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INDUSTRIAL DEVELOPMENT ORGANIZATION



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independent
evaluation

Generating energy capacity from geothermal power generation and its related technologies for sustainable development

Office of Evaluation and Internal Oversight

**OFFICE OF EVALUATION AND INTERNAL OVERSIGHT
INDEPENDENT EVALUATION UNIT**

Independent Evaluation of UNIDO programme:

**Generating energy capacity from geothermal power generation and
its related technologies for sustainable development**

UNIDO Project ID: 170046



**UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION**

Vienna, April 2024

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Abstract

The UNIDO programme 'Generating energy capacity from geothermal power generation and its related technologies for sustainable development' focuses on geothermal power generation and energy management systems in Africa, with a particular emphasis on the Eastern Great Rift Valley region. The programme aims to increase access to stable electricity, improve the operations of an existing geothermal plant in Kenya, and enhance human and institutional capacities.

The programme was divided into two parts, with the Internet of Things (IoT) sub-project being separated due to its technical nature and having its budget. The overall budget for the program – starting in March 2017 and completed at the end of 2023- is USD 12.733 million.

The Terminal Evaluation assesses the program's achievements in terms of technology demonstration projects, removing barriers to accessing technical information, capacity building, knowledge management, identifying sustainable business models, and strengthening market conditions for investment. The evaluation also examines the program's progress toward its impact, which includes catalysing market development for geothermal power projects and improving energy access in African countries.

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Evaluation team:

Mr. Simon TAYLOR, international evaluation consultant and team leader
Mr. Laban MacOPIYO, national evaluation consultant

Abbreviations and Acronyms

Abbreviation	Meaning
APR	Annual Progress Report
COVID-19	Coronavirus Disease 2019
EACREEE	East African Centre for Renewable Energy and Energy Efficiency
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ESIA	Environmental and Social Impact Assessment
ESSPP	Environmental and Social Safeguards Policy and Procedures
FiT	Feed in Tariff
FO	Field Office
GDC	Geothermal Development Company
GEEW	gender equality and empowerment of women
IED	Independent Evaluation Division
IoT	Internet of Things
IPP	Independent Power Producer
JICA	Japanese International Cooperation Agency
JOGMEC	Japan Oil, Gas and Metals National Corporation
KenGen	Kenya Electricity Generating Company
LogFrame	Logical Framework
M&E	Monitoring and Evaluation
MTR	Mid-Term Review
MW	Mega Watt (1,000,000 Watts)
NCCAP	National Climate Change Action Plan
NEC	National Evaluation Consultant
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
ODDEG	L'Office Djiboutien de Développement de l'Energie Géothermique
ProDoc	Programme Document
PCC	Programme Coordination Committee
PM	Project Manager
PMU	Project Management Unit
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSC	Project Steering Committee
RBM	Results-Based Management
RE	Renewable Energy
TE	Terminal Evaluation
TGDC	Tanzania Geothermal Development Company
TICAD	Tokyo International Conference on African Development

TL	Team Leader
ToC	Theory of Change
ToR	Terms of Reference
ToT	Training of Trainers
TNA	Training Needs Assessment
UNIDO	United Nations Industrial Development Organisation
USD	United States Dollars
WJEC	West Japan Engineering Consultants

Glossary of Evaluation-Related Terms

Term	Definition
Baseline	The situation, prior to an intervention, against which progress can be assessed.
Effect	Intended or unintended change due directly or indirectly to an intervention.
Effectiveness	The extent to which the objectives of a development intervention were or are expected to be achieved.
External evaluation/review	The evaluation/review of a development intervention conducted by entities and/or individuals outside the donor and implementing organizations.
Formative evaluation/review	Evaluation/review intended to improve performance, most often conducted during the implementation phase of projects or programs.
Impact	Positive and negative, primary and secondary, intended and non-intended, directly and indirectly, long-term effects produced by a development intervention.
Indicator	Quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess the performance of a development actor. Means by which a change will be measured.
Intervention	An external action to assist a national effort to achieve specific development goals.
Lessons learned	Generalizations based on evaluation experiences that abstract from specific to broader circumstances.
Logframe (logical framework approach)	Management tool used to guide the planning, implementation, and evaluation of an intervention. System based on MBO (management by objectives) also called RBM (results-based management) principles.
Outcome	The achieved or likely short-term and medium-term effects of an intervention's outputs.
Outputs	The products, capital goods, and services that result from a development intervention; may also include changes resulting from the intervention that are relevant to the achievement of outcomes.
Recommendations	Proposals aimed at enhancing the effectiveness, quality, or objectives; and/or at the reallocation of resources.

Relevance	The extent to which the objectives of a development intervention are consistent with beneficiaries' requirements, country needs, global priorities, and partners' and donor's policies. Note: Retrospectively, the question of relevance often becomes a question as to whether the objectives of an intervention or its design are still appropriate given changed circumstances.
Results-Based Management (RBM)	A management strategy focusing on performance and achievement of outputs, outcomes and impacts.
Review	A systematic and evidence-based self-assessment of the performance of a programme or project, aiming at determining performance against established criteria. It can be conducted internally, i.e. by personnel directly involved in a programme or project, or externally, i.e. by personnel hired specifically for the purpose of conducting the review, whereby the overall responsibility for the review rests with the programme or project management. Reviews can be carried out at different stages of the programme or project life cycle, i.e. for programmes and projects with start and end dates as mid-term reviews (MTRs) and terminal self-evaluations.
Risks	Factors, normally outside the scope of an intervention, which may affect the achievement of an intervention's objectives.
Sustainability	The continuation of benefits from an intervention, after the development assistance has been completed. The probability of continued long-term benefits. The resilience to risk of the net benefit flows over time.
Target group	The specific individuals or organizations for whose benefit an intervention is undertaken.
Theory of change	Theory of change or programme theory is similar to a logic model but includes key assumptions behind the causal relationships and sometimes the major factors (internal and external to the intervention) likely to influence the outcomes.

Executive Summary

The UNIDO programme '*Generating energy capacity from geothermal power generation and its related technologies for sustainable development*' (UNIDO ID 170046) focuses on geothermal power generation and energy management systems in Africa, particularly in the Eastern Great Rift Valley region. Its main objectives are to increase access to stable electricity, improve the operations of an existing geothermal plant in Kenya, and enhance human and institutional capacities

At the inception phase, it was decided to separate the programme into two due to the highly technical nature of what subsequently became known as the Internet of Things (IoT) sub-project (ID 190036) which was assigned its budget and has been completed with its own Terminal Evaluation (TE) in July 2022.

The overall budget for the programme accounts for USD 12.733 million, with a split between the IoT project of USD 5.311 million and the remainder of USD 7.422 million for the other activities. Adjustments were made as the programme progressed and the actual expenditure is about USD 1 million less than originally planned.

This TE assesses the extent to which the geothermal programme has achieved its expected results in Kenya and other participating African countries. These results include technology demonstration projects, removing barriers to accessing technical information, capacity building and knowledge management, identifying sustainable business models, and strengthening market conditions for investment. The evaluation also examines the program's progress toward its impact, which is measured by catalyzing market development for new geothermal power projects and improving energy access in African countries.

Key Findings

Relevance

The choice of Kenya as the host country is highly relevant because of its leadership in African geothermal development and the programme has strong relevance to the five other African nations' resource assessments, although, in Djibouti, Rwanda, and Tanzania, proper laws and regulations are not yet in place. The programme was designed to contribute to the SDGs and in line with many international efforts on renewable energy and sustainable development while aligning with the participating countries' institutions' requirements.

Design

Although the Programme Document clearly presents the background and a well-thought-out plan to achieve the objectives, the LogFrame is too fluid and does not capture all of the proposed activities and indicators, and many of the outcomes are replicated through the LogFrame table. Also, there was not a detailed risk management matrix prepared and the risk assessment only looked at post-implementation aspects.

Progress towards Impact

The TE prepared a comprehensive Theory of Change diagram (Annex 3) and conducted a barrier analysis to thoroughly understand how the activities may have driven progress. The programme had a reasonable impact in the promotion of advances in geothermal power and improving existing operations (for Kenya Electricity Generating Company - KenGen)

while enhancing capacities in the beneficiary African countries, but it is too early to say whether it will help to achieve the ultimate impact.

Effectiveness

Overall the programme has successfully achieved the stated objectives, with a boost in geothermal generation in Kenya and a notable increase in knowledge due to the training and exposure events.

Efficiency

The programme was delivered for USD 1 million less than the originally published budget and the resources were stretched over 6.5 years as opposed to the original 2.5-year plan. The trainings were executed efficiently with good management by UNIDO and KenGen and the programme adapted well to the COVID-19 challenges.

Sustainability

Both the capacity developed within the beneficiary staff and the technology already disseminated at KenGen point toward the sustainability of impacts into the future. The training institute supported by the Kenyan government and the development of Training of Trainers within KenGen mean that there could be follow-up capacity building between the participating countries.

Coherence

Within KenGen there has been good co-ordination with JICA in-country and that relationship is highly likely to continue to flourish in the future. Good coordination was also found between the Kenyan and other African countries' stakeholders and Japanese technology providers and those with experience in appropriate business models. UNIDO initiated a partnership with AfDB which resulted in a useful study on PPP approaches. Compatibility was also seen between the programme and other initiatives in the sector, especially in Kenya, and the presence of the UNIDO regional office in Nairobi helped to forge these.

Gender Mainstreaming

The programme document (ProDoc) had a strong emphasis on Gender Equality and Empowerment of Women, although the ideal 50/50 gender balance was not achieved in the training and other events, even keeping into account the specificities of the energy sector. Overall, the efforts made in gender mainstreaming are highly commendable although the Completion Report did not provide any quantitative analysis of this, only reporting the pure numbers of men and women attending events.

Monitoring & Evaluation

Although the ProDoc has a comprehensive monitoring and evaluation plan, this has not been translated into the programme management well enough, as evidenced by the documentation seen, particularly due to the poorly defined performance indicators in the LogFrame. There is a lack of continuous progress reporting and the Annual Progress Reports do not have written comprehensive assessments as the programme progresses.

Partners' performance

The feedback from the evaluation has been overwhelmingly positive for UNIDO staff's management of the programme. The Programme Steering Committee showed a sufficient level of engagement and all the partners were fairly represented. UNIDO maintained good relationships with the Kenyan stakeholders such as KenGen, MITI, MoEP and MoICT and continuously collaborated and engaged the main national counterparts to implement the

targeted objectives. The donor, JICA, was well represented and proved to be a solid partner throughout the programme's implementation.

Environmental & Social Safeguards

UNIDO carried out its assessment of Environmental and Social Safeguards Policy and Procedures in 2019 which identified the need for an Environmental and Social impact Assessment for the IoT technologies. This was conducted comprehensively in June 2022 which allowed the programme to comply with UNIDO's own environmental and social sustainability policies as well as Kenya's National Environmental Management and Coordination Act.

Each criterion has been rated according to the standard six-point scale and overall the programme achieves a score of Satisfactory (5). High scores were achieved for effectiveness, coherence, gender mainstreaming, and environmental & social safeguards while there were found to be concerns in the areas of programme design, monitoring & evaluation, and Results Based Management.

Key Recommendations

1. There should be a continual development and roll-out of the IoT technology, which has allowed better collection of data and made operations much easier with the system enabling predictive maintenance. The IoT can help with KenGen's internal Enterprise Resource Plan and the system can be integrated into relevant staff daily work plans. KenGen has budgeted for this, but there is a need for software service providers to understand that the purchasing model of KenGen is different from that under the UNIDO project, which paid for the technology upfront. Although it is known that all the Olkaria data can be contained in one platform, KenGen now needs to learn how to fully analyse the data particularly to do the predictive maintenance.

2. The financing of renewable energy technology is always seen as the most difficult focus, therefore UNIDO should help further with identifying appropriate funding models for the exploration and engineering of geothermal sites with good potential (i.e. Ethiopia, Djibouti, and Tanzania). However, before embarking on new suggested modalities for geothermal power plant investments, UNIDO can help widely disseminate the lessons learned in the context of KenGen

3. The links already forged with the six countries in this programme should be further encouraged and maintained. A network for continual communication would be useful. There are already bilateral partnerships with KenGen emerging from the programme which may help address funding constraints (e.g. at ODDEG). The concerned Ministries of Energy in each country could also be included to maintain links with the Government of Kenya and other Kenyan geothermal institutions.

4. UNIDO should adopt more of a decentralized management structure. Empowering the field office in Kenya for local-national coordination is crucial to ensuring that decision-making processes are more inclusive and responsive to the local context. This approach will foster a deeper connection with the operational locations, allowing for more effective local management, quicker responses to challenges, and improved adaptability to the unique nuances of the project environment.

5. UNIDO should foster a collaborative and integrated approach which would help to break down silos between different departments/teams and will facilitate more seamless

communication and information sharing. Opportunities for advocacy should also be enhanced. Improved communication channels would have ensured that information was disseminated efficiently from within the programme to external stakeholders. Additionally, enhancing advocacy and awareness creation initiatives would contribute to a broader understanding of the significance of the programme, garnering support and collaboration from key stakeholders across the East African region.

Evaluation Rating Table

#	Evaluation Criteria	Mandatory rating	Rating
A	Progress to impact	Yes	5 – Satisfactory
B	Project design	Yes	4 – Moderately Satisfactory
1	1. Overall design	Yes	4 – Moderately Satisfactory
2	2. Logframe	Yes	4 – Moderately Satisfactory
C	Project performance		
1	3. Relevance	Yes	5 – Satisfactory
2	4. Effectiveness	Yes	6 – Highly Satisfactory
3	5. Coherence	Yes	6 – Highly Satisfactory
4	6. Efficiency	Yes	5 – Satisfactory
5	7. Sustainability of benefits	Yes	5 – Satisfactory
6	8. Progress toward impact	No	5 – Satisfactory
D	Cross-cutting performance criteria		
1	9. Gender mainstreaming	Yes	5- Satisfactory
2	10. M&E: 1. M&E design 2. M&E implementation	Yes Yes	4 – Moderately Satisfactory
3	11. Results-based Management (RBM)	Yes	4 – Moderately Satisfactory
E	Performance of partners		
1	12. UNIDO	Yes	5 – Satisfactory
2	13. National counterparts	Yes	5 – Satisfactory
3	14. Donor	Yes	5 – Satisfactory
F	Overall assessment	Yes	5 – Satisfactory

Evaluation Rating Scale

Score	Definition	Category
6	Highly satisfactory	SATISFACTORY
5	Satisfactory	
4	Moderately satisfactory	
3	Moderately unsatisfactory	UNSATISFACTORY
2	Unsatisfactory	
1	Highly unsatisfactory	

1. Introduction

This Terminal Evaluation assesses the performance of the UNIDO programme ‘Generating energy capacity from geothermal power generation and its related technologies for sustainable development’. The programme’s main objective is to promote geothermal power generation and energy management systems within Africa (particularly in the Eastern Great Rift Valley region) to i) increase access to stable supplies of electricity; ii) improve operations of an existing geothermal plant in Kenya; and iii) enhance human and institutional capacities.

The programme’s intervention logic is driven by two outcomes, targeting African countries:

1. Demonstration, deployment and transfer of geothermal technology.
2. Increasing favourable market conditions for strengthening investment in geothermal energy.

There are five outputs under these outcomes:

- i. Geothermal demonstration projects designed and implemented.
- ii. Training activities conducted.
- iii. Public and private sector partnerships for scaling up the demonstrated technology.
- iv. Best practice implementations identified and showcased.
- v. Policy recommendations and knowledge management on best practice of technology and services.

The Programme Document (ProDoc) does not mention components specifically, but the intervention was broken up into five components for convenience of managing the programme and clarifying the type of activities to be carried out. Component 1 , strengthening capacity for operation and maintenance with Internet of Things technologies for Olkaria Geothermal Power Station in Kenya was designed as a separate ‘sub-project’ with its own assigned budget of USD 4.7m and has been completed with a Terminal Evaluation in July 2022, therefore this TE will focus primarily on the other activities.

The ProDoc was developed after the The Sixth Tokyo International Conference on African Development (TICAD VI) held in Nairobi in August 2016, when Prime Minister Shinzo Abe announced Japan’s intention to invest in geothermal power generation projects in Africa. The ProDoc was approved by UNIDO in April 2017 and official start date was 30 May 2017. The kick-off then took until April 2019 but the work properly started only in March 2020, 3 years after the originally planned start date. With a planned duration of 2.5 years, it was completed at the end of December 2023 so although the programme was live for 6.5 years, the work was actually completed in just over 3.5 years. The programme did have to be extended twice, firstly from October 2019 to December 2022 (revision approved 19 Aug 2022) and then by another year to end of Dec 2023 (revision approved 24 Jan 2022).

The TE analyses to what extent the geothermal programme has achieved the expected results for Kenya and other participating African countries. According to the ProDoc, these are:

- technology demonstration projects
- removal of existing barriers to accessing technical information
- capacity building/knowledge management to better absorb and domestically replicate such technologies

- identification of viable, sustainable and suitable business models
- strengthening market conditions for scaling up investment (particularly through public private partnerships)

The TE also looks at whether the programme activities have contributed to the main progress to impact, which has been assessed within the Theory of Change as ‘catalysing market development for new geothermal power projects’ and ultimately to improve access to energy in African countries. This will be done through understanding the programme’s design, its relevance, effectiveness, efficiency, coherence and sustainability, and ultimately its ‘progress to impact’. The evaluation aims to develop a series of project specific findings and recommendations, as well as transferable lessons learned for enhancing the design of new and on-going UNIDO projects (which are similar in nature) and their implementation in the field.

1.1 Evaluation Methodology

The Terminal Evaluation is conducted in accordance with the latest UNIDO Evaluation Policy (2021) and UNIDO Guidelines for Technological Co-operation and Project Cycle (2006), and particularly referencing the latest version of UNIDO’s Evaluation Manual (2023). The internationally agreed evaluation criteria are used, which are based on the Organization for Economic Cooperation and Development / Development Assistance Committee (OECD/DAC) Network on Development Evaluation revised Evaluation Criteria and Results Based Management, wherein the whole assessment of the project draws from the analysis made in ‘project performance’ and ‘project impact’ criteria. An extra criterion is added under Project Performance using the suggestion from the OECD/DAC Network on Development Evaluation’s ‘Better Criteria for Better Evaluation’ (2019), which is coherence – to better capture project linkages, systems thinking and partnership dynamics.

Table 1 – List of evaluation criteria used

EVALUATION CRITERIA	DEFINITION
<ul style="list-style-type: none"> • 1. Progress to Impact 	<ul style="list-style-type: none"> • Positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended, including redirecting trajectories of transformational process and the extent to which conditions for trajectory change are being put into place.
<ul style="list-style-type: none"> • 2. Project Design 	
<ul style="list-style-type: none"> • Overall Design 	<ul style="list-style-type: none"> • Assessment of design in general.
<ul style="list-style-type: none"> • LogFrame 	<ul style="list-style-type: none"> • Assessment of the Logical Framework.
<ul style="list-style-type: none"> • Project Performance 	
<ul style="list-style-type: none"> • 3. Relevance 	<ul style="list-style-type: none"> • The extent to which the activity is suited to the priorities and policies of the target group, recipients and donor.
<ul style="list-style-type: none"> • 4. Effectiveness 	<ul style="list-style-type: none"> • The extent to which the intervention achieved, or is expected to achieve, its objectives, and its results, including any differential results across groups.
<ul style="list-style-type: none"> • 5. Efficiency 	<ul style="list-style-type: none"> • The extent to which the intervention delivers, or is likely to deliver, results in an economic and timely way.

EVALUATION CRITERIA	DEFINITION
<ul style="list-style-type: none"> 6. Sustainability 	<ul style="list-style-type: none"> The extent to which the net benefits of the intervention continue, or are likely to continue.
<ul style="list-style-type: none"> 7. Coherence 	<ul style="list-style-type: none"> The extent to which other interventions and policies support or undermine the intervention and vice-versa at global, country, sector or institutional level. Coherence can be measured at both internal and external level.
<ul style="list-style-type: none"> Cross cutting issues 	
<ul style="list-style-type: none"> 8. Gender mainstreaming 	<ul style="list-style-type: none"> The extent to which UNIDO interventions have contributed to better gender equality and gender related dimensions were considered in an intervention.
<ul style="list-style-type: none"> 9. Monitoring & Evaluation 	<ul style="list-style-type: none"> Refers to management's continuous examination of progress achieved during the implementation of a project or a programme in order to track progress of the plan and to take necessary decisions to improve performance (monitoring), how they are recorded and communicated to stakeholders (reporting), and whether desired results are being achieved and tracked.
<ul style="list-style-type: none"> 10. Results-based management 	<ul style="list-style-type: none"> Assessment of issues related to results-based work planning, results-based M&E and whether decision-making on project/programme management are based on results.
<ul style="list-style-type: none"> 11. Partners Performance 	
<ul style="list-style-type: none"> - UNIDO - National Counterparts - Donors 	<ul style="list-style-type: none"> Assessment of the contribution of partners to project design, implementation, monitoring and reporting, supervision and backstopping and evaluation.
<ul style="list-style-type: none"> 12. Environmental & Social Safeguards, disability & human rights 	
<ul style="list-style-type: none"> Environmental safeguards 	<ul style="list-style-type: none"> How UNIDO avoided or minimized/mitigated potential adverse impacts and risks.
<ul style="list-style-type: none"> Social safeguards, disability and human rights 	<ul style="list-style-type: none"> Assessment of social inclusiveness and human rights aspects, such as indigenous peoples' rights, land rights or other social and economic rights. Includes the assessment of disability-related vulnerabilities.

UNIDO's standard rating system has been used to quantify the performance of the programme against the criteria listed above and using the methodology described in the UNIDO Evaluation Manual¹.

Table 2 - UNIDO Project Evaluation Rating

Score	Rating	Definition	Category
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¹ Evaluation Manual - Office of Evaluation and Internal Oversight, Independent Evaluation Unit (UNIDO), July 2023

6	Highly satisfactory	Level of achievement presents no shortcomings (90% - 100% achievement rate of planned expectations and targets).	SATISFACTORY
5	Satisfactory	Level of achievement presents minor shortcomings (70% - 89% achievement rate of planned expectations and targets).	
4	Moderately satisfactory	Level of achievement presents moderate shortcomings (50% - 69% achievement rate of planned expectations and targets).	
3	Moderately unsatisfactory	Level of achievement presents some significant shortcomings (30% - 49% achievement rate of planned expectations and targets).	UNSATISFACTORY
2	Unsatisfactory	Level of achievement presents major shortcomings (10% - 29% achievement rate of planned expectations and targets).	
1	Highly unsatisfactory	Level of achievement presents severe shortcomings (0% - 9% achievement rate of planned expectations and targets).	

The methods deployed during the Terminal Evaluation assignment included:

Desk review of all UNIDO documents and background information relating to the programme as well as notes and minutes from project meetings.

Semi-structured interviews (using the proposed questionnaire in Annex 5 as a guide) with stakeholders at UNIDO (Vienna HQ and Japan Office by virtual means), with Kenyan stakeholders (in person) and other African country beneficiaries/stakeholders (virtually).

Field visits to stakeholder premises and the project site in Kenya to observe and take note of all relevant results achieved within the programme.

Tabulate the initial findings from information reviews, meetings and interviews and observations made – for quick reporting.

The evaluation checks that the programme design has given rise to measurable development impact against the objectives and targets laid down in the LogFrame and that the relevance, effectiveness, efficiency, sustainability and coherence have been understood and honestly reported on. Analysis is made of the cross-cutting issues (gender, monitoring and evaluation, results-based management and environmental & social safeguards) and on the performance of partners.

The evaluation presents a series of findings, lessons and recommendations to improve UNIDO services and effectiveness as well as guide management decisions/innovations and for enhancing the design of new and on-going UNIDO (similar) projects and their implementation in the field. The evaluation will assist UNIDO in reporting to governing bodies, partner governments and donors for accountability; supporting management by providing clear recommendations to project managers and team leaders; and enhancing in design of new and on-going projects by taking the lessons particular to this evaluation.

Table 3 - Division of work by the consultants

<ul style="list-style-type: none"> International Evaluation Consultant / Team Leader (TL) 	<ul style="list-style-type: none"> Prepare and submit the Inception Report Lead on design of interviews Undertake interviews with the NEC (in-country) Draft initial finding with NEC while in-country Lead on writing the draft report Make presentation to UNIDO HQ Liaise with UNIDO PM and IED and UNIDO Japan Office
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<ul style="list-style-type: none">• National Evaluation Consultant (NEC)	<ul style="list-style-type: none">• Contribute to the Inception Report• Set up meetings for interviews with UNIDO assistance• Plan and carry out the in-country visits• Undertake interviews with the TL• Draft initial findings with the TL while in-country• Support the TL in providing the draft report• Co-ordinate with UNIDO PM and IED and UNIDO Japan Office
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2. Project Background and Context

2.1 Country Background

Kenya is a country located in East Africa with a population of approximately 54 million people². The country has a total area of 580,367 square kilometres. Kenya has made significant political and economic reforms that have contributed to sustained economic growth, social development, and political stability gains over the past decade. However, its key development challenges still include poverty, inequality, youth unemployment, transparency and accountability, climate change, continued weak private sector investment, and the vulnerability of the economy to internal and external shocks.

According to the World Bank, Kenya's economy achieved broad-based GDP growth averaging 4.8% per year between 2015-2019, significantly reducing poverty (from 36.5% in 2005 to 27.2% in 2019 (USD 2.15/day poverty line)). In 2020, the COVID-19 pandemic shock hit the economy hard, disrupting international trade and transport, tourism, and urban services activity. Fortunately, the agricultural sector, a cornerstone of the economy, remained resilient, helping to limit the contraction in GDP to only 0.3%. In 2021, the economy staged a strong recovery, with the economy growing at 7.5% although some sectors, such as tourism, remained under pressure. GDP growth however declined to 4.8% in 2022 and is projected to grow at 5.0% in 2023. The poverty rate has resumed its trend decline after rising earlier in the pandemic.

Kenya government's Vision 2030 development strategy aims to accelerate sustainable growth, reduce inequality, and manage resource scarcity. The government's bottom-up economic model prioritizes agriculture, healthcare, affordable housing, micro and small enterprises, and the digital and creative economy. The country has also set a target of achieving 100% renewable energy in its power mix by 2030³. As of 2021, the country's electrification rate stands at 77%. The majority of the population has access to electricity through the grid, which is the principal least-cost solution for the majority of the population⁴. The country has also set a greenhouse gas emissions reduction target of 32% by 2030.

2.1.1. Kenya's Power Sector

Kenya's power sector has experienced steady growth over the last two decades. Moreover, Kenya has remarkable renewable resources as evidenced by its track record as one of the lowest cost developers of geothermal power in the world. Kenya has also aggressively tried to increase access to the power grid, having more than doubled electricity access from 32% in 2013 to 75% of households in 2022.

Kenya's installed electricity capacity as of 2022 stood at 3,300 MW, a significant growth from 1,800 MW in 2014. Of this, more than 80% came from the low carbon sources of geothermal, hydro, wind, and solar power. Over half of this low carbon electricity came from geothermal energy, which Kenya has in abundance. So much in fact, that excess geothermal energy is

² Kenya Overview: Development news, research, data | World Bank. <https://www.worldbank.org/en/country/kenya/overview>.

³ Highlights of The Socio-Economic Atlas of Kenya. <https://www.knbs.or.ke/highlights-of-the-socio-economic-atlas-of-kenya/>.

⁴ Kenya - The Heritage Foundation. <https://www.heritage.org/index/country/kenya>.

released during the night when electricity demand is low. Installed geothermal capacity in Kenya could be increased by at least eightfold, which could open opportunities for scaling up green manufacturing capacity or exporting excess electricity to neighbouring countries.

It is expected that overall generation will reach 5,000 MW by the year 2030, with the bulk of it coming from geothermal, natural gas (imports), wind, and solar. Kenya has long-term goals of developing nuclear power with the first project expected to start in 2035.

Around a third of Kenya's installed capacity is owned and operated by IPPs across several plants, including small-scale hydro plants, geothermal, biomass, wind, solar, and heavy fuel oil plants. The remaining capacity is owned and operated by Kenya Electricity Generating Company (KenGen), which is 70% government-owned.

2.1.1. Renewable Sources

As already mentioned, over 80% of Kenya's electricity is generated from renewable/clean energy sources. Of these, geothermal remains the most significant source with an estimated potential of 10,000 MW, but it remains relatively unexploited with a current installed capacity of 963 MW. This vast potential indicates significant room for growth in the geothermal sector. This notwithstanding, Kenya is the eighth largest geothermal producer in the world and is home to the single largest geothermal power plant, the 280 MW Olkaria IV plant. Most generation is being carried out by the government with only one IPP operating in the sector, the U.S. firm Ormat, producing 140 MW, and the rest produced by KenGen.

The Government of Kenya efforts in geothermal production seem to be paying off with various projects currently underway by both the public and private sector that should realize over 1,100 MW capacity. Already, has established a 10-year USD 2.6 billion geothermal exploration plan that will involve sinking 566 wells in the Rift Valley. KenGen plans to add 560 MW of geothermal power to the grid through joint ventures, in addition to 80 MW of wind, and various solar installations at their existing hydro sites. The Government owned Geothermal Development Company (GDC) plans to develop 2000 MW from the Bogoria-Silali geothermal block and has received a USD 89 million in concessional loans from the German Development Bank for this development, part of which will be applied to drilling of exploration wells. Numerous other exploration activities are underway in ten other blocks.

Wind energy is another key growth area. Kenya is estimated to have a wind power potential of 3,000 MW. The Lake Turkana Wind Power Plant is the single largest wind power generation plant in Africa supplying 310 MW to the grid. Additionally, GE Energy is the technology supplier for the 100 MW in Kipeto wind power plant, a DFC-funded project that was commissioned in late 2021. KenGen's 80 MW wind project in Meru has been put on hold owing to permit and land rights issues. It will be important for future investors to engage early with communities to ensure acceptance and ownership at the community level.

Kenya has a high potential for solar power given the high irradiation levels available throughout the year. Kenya added 120 MW of solar power to the grid in 2021, raising the total generation to 172 MW. There are various other solar projects in different stages that are envisioned to come online from 2023. There is huge untapped demand for off-grid solar that will connect communities located far from existing transmission infrastructure. Plans are also underway to convert off-grid diesel stations to solar hybrids to lower power cost

2.1.2. Policy Context Alignment

Kenya is a leader in addressing climate change and is one of the first countries in Africa to enact a comprehensive law and policy to guide national and subnational climate action. The

Climate Change Act and the National Climate Change Policy Framework of 2016 provide guidance for low-carbon and climate- resilient development.

The country's institutional framework for climate change is developed and the national political commitment towards climate change mitigation issues is evident. The Climate Change Directorate housed within the Ministry of Environment, Climate Change and Forestry is the lead agency of the government on national climate change policy. The country can also access climate financing through the National Environment Management Authority, a National Implementing Entity for the Adaptation Fund and accredited by the UNFCCC Green Climate Fund.

Institutional structures have been established around the National Climate Change Action Plan (NCCAP 2013-2017) and NCCAP 2018 – 2022 which presents Kenya's low-carbon development pathway options for mitigating increasing national emissions. The plan also addresses the enabling aspects of finance, policy and legislation, knowledge management, capacity development, technology requirements and monitoring and reporting for pathway options. The NCCAP support the integration of climate change into policy and programming, as well as promote coordinated action among ministries (Government of Kenya, 2013).

The activities that have been supported under the current programme being evaluated are consistent with Kenya's national development priorities around climate change mitigation and adaptation. They will increase the use of Renewable Energy (RE) and decrease the consumption of fossil. They further aim to support the following Government policies and strategies targeted to increase the percentage of RE in overall energy mix and rural electrification in the country.

- **The Electric Power Act, 1997:** This act facilitated the private sector participation in the generation and distribution of electricity and encouraged rural electrification using RE technologies.
- **First National Communication of Kenya to UNFCCC, 2002:** This policy identified the need for economic incentives, intensified R&D activities, access to appropriate technologies, capacity building and policy formulation in RE.
- **Technology Needs Assessment (TNA), 2005:** This assessment suggested carrying out of inventory on GHG reduction potential, capacity and awareness building on GHG emission reduction as well as promotion of technology transfer of less GHG emitting technology.
- **Energy Act, 2006 and Vision 2030 (announced in 2008):** This act aimed at promotion of development and use of RE technologies, strengthening of operation and maintenance (O&M) capacity, reduction of country reliance on imported fossil fuels, increase of electrification access, provision of affordable and reliable energy and mobilization of private sector capital for generation of electricity from RE.

The Electricity and Petroleum Regulatory Authority ('The Energy Regulator'), created under the Electricity Act (2019), replacing the former Energy Regulatory Commission, is responsible for regulating is an independent regulatory authority responsible for technical and economic regulation of electricity, petroleum (upstream, midstream and downstream) and renewable energy subsectors in Kenya.

The Ministry of Energy and Petroleum is responsible for policy, planning and oversight in Kenya's energy sector. The Ministry's Rural Energy Directorate is responsible for renewable electricity policy formulation, review, planning, promotion, development, M&E and Feed-in-Tariff (FiT) formulation and review. The electricity sector was liberalized and restructured during the 1990s. Kenya Power is the power off-taker from all power generators, including

geothermal electricity generating companies (IPPs – independent power producers), on the basis of negotiated Power Purchase Agreements (PPAs) for Kenya Power to supply to consumers.

Kenya has finally been able to ramp up energy generation at every scale, from utility scale wind and solar farms, to rural microgrids. The range of technologies and business models mean that there is an energy solution to match every need.

2.1.3. Geothermal Sectoral Background

Kenya has been making significant strides in the geothermal energy sector, positioning itself as a global leader in this domain. As of recent years, Kenya has witnessed a substantial increase in its geothermal power output. In the first quarter of 2023, the country reported a 46% increase in geothermal power output, reaching 1,506.33 GWh. This was a notable improvement from the previous year and played a key role in mitigating the impact of a reduction in hydropower output, which had declined due to water level issues associated with prolonged droughts. This puts Kenya at the 8th position globally in terms of geothermal power utilization, a remarkable feat for a developing nation.

The geothermal sector accounts for nearly 30% of the country's total electricity generation. The majority of this capacity stems from the Olkaria geothermal complex in the Great Rift Valley, a region blessed with abundant geothermal resources. Several plants, including Olkaria I, IV, and V, contribute significantly to the national grid, powering homes, industries, and businesses across the country.





Figure 1: GEG Pilot and Wellhead plants of British Green Energy Geothermal (GEG) at Olkaria, Kenya (source: GEG/Lydur Skulason - <https://www.thinkgeoenergy.com/10-years-in-kenya-the-geothermal-success-story-of-geg/>)

2.1.4. Regulatory context of the geothermal sector

Kenya's legislative and regulatory framework pertaining to the geothermal and energy sector is as follows:

Energy Act, 2019:

The Energy Act, 2019, is a comprehensive piece of legislation that consolidates various laws and regulations related to the energy sector in Kenya. It establishes the legal framework for the development, regulation, and promotion of all forms of energy, including geothermal energy. The Act emphasizes the importance of renewable energy sources, energy efficiency, and conservation.

Geothermal Resources Act, 1982 (Revised in 2016):

The Geothermal Resources Act governs the exploration, development, and utilization of geothermal resources in Kenya. It establishes the procedures for geothermal resource assessment, exploration, drilling, and licensing. The revised Act of 2016 introduced updated provisions to enhance the regulation of geothermal activities and protect the environment.

The Energy (Geothermal Development) Regulations, 2019:

These regulations provide specific guidelines for geothermal development in Kenya. They cover aspects such as licensing requirements, geothermal data access and sharing, environmental impact assessments, and revenue-sharing mechanisms between the government and project developers. The regulations aim to streamline the geothermal development process.

Renewable Energy Feed-in Tariff (REFiT) Policy:

The REFiT policy in Kenya sets tariff rates for electricity generated from renewable energy sources, including geothermal. It is designed to encourage investment in renewable energy projects by ensuring that developers receive a fair and predictable return on their investments. Tariff rates are periodically reviewed and updated.

Electricity Act, 2019:

The Electricity Act, 2019, regulates the generation, transmission, distribution, and supply of electricity in Kenya. It includes provisions related to power generation licenses, power

purchase agreements, and grid access for geothermal projects. The Act also encourages competition and private sector participation in the energy sector.

Energy Regulatory Commission (ERC):

The Energy Regulatory Commission is the primary regulatory authority overseeing the energy sector in Kenya. It is responsible for issuing licenses, setting tariffs, monitoring compliance with energy regulations, and ensuring the efficient functioning of the energy market. The ERC plays a pivotal role in regulating geothermal energy projects.

National Energy Policy:

Kenya's National Energy Policy outlines the government's long-term vision and strategy for the energy sector. It emphasizes the importance of diversifying the energy mix with a focus on renewables like geothermal. The policy promotes sustainable energy development, energy security, and affordable electricity for all Kenyans.

Environmental Impact Assessment (EIA) Regulations:

Any geothermal project in Kenya is subject to rigorous environmental impact assessment processes as per the Environmental Management and Coordination Act (EMCA). EIAs evaluate potential environmental and social impacts, and mitigation measures must be implemented to minimize adverse effects.

Public-Private Partnerships (PPP) Act, 2013:

The PPP Act facilitates partnerships between the government and private sector entities for the development of infrastructure projects, including those in the energy sector. It provides a legal framework for structuring and implementing public-private partnerships in geothermal projects, attracting private investment and expertise.

Contracts and Agreements:

Geothermal projects often involve contracts and agreements between the government, geothermal developers, and other stakeholders. These agreements define the terms and conditions for exploration, development, operation, and revenue-sharing. Transparency and compliance with Kenya's regulatory framework are essential components of these agreements.

In summary, Kenya has renewable-friendly policy landscape. Kenya has launched a range of policy interventions to garner activity and investment within the renewable energy sector, combined under the long-term strategy of Kenya Vision 2030.

Kenya's ambitions for geothermal energy extend far beyond its current achievements. The government has set a bold target of 5,530 MW of geothermal power by 2030, representing over 50% of the nation's total electricity generation capacity. This ambitious goal is enshrined in Kenya's Vision 2030 and the National Climate Change Action Plan, reflecting the nation's unwavering commitment to clean and sustainable energy.

The country's geothermal development has had a broader impact beyond its borders. Kenyan engineers and project managers have gained global recognition for their expertise in the geothermal sector, leading projects from site surveys to environmental impact assessments and plant design. This expertise has been extended to neighbouring countries such as Ethiopia and Djibouti, both of which lie along the East African Rift and are beginning to develop their geothermal sources with guidance from Kenyan experts.

Kenya's efforts in geothermal energy are supported by initiatives like the Geothermal Centre of Excellence, set to open soon with the assistance of the World Bank. This centre aims to

train professionals in the region on various aspects of geothermal energy, including exploration, development, and management.

Several factors have contributed to Kenya's remarkable success in the geothermal sector:

- Favourable geology: The Great Rift Valley's active tectonic plates provide readily accessible geothermal resources, minimizing exploration and drilling costs.
- Government support: The Kenyan government has actively promoted geothermal development through policy initiatives, financial incentives, and institutional support.
- Private sector involvement: IPPs have played a crucial role in financing and developing geothermal projects, bringing additional expertise and resources to the sector.
- Technological advancements: Kenya has embraced cutting-edge technologies in geothermal exploration, drilling, and plant operation, optimizing efficiency and output.

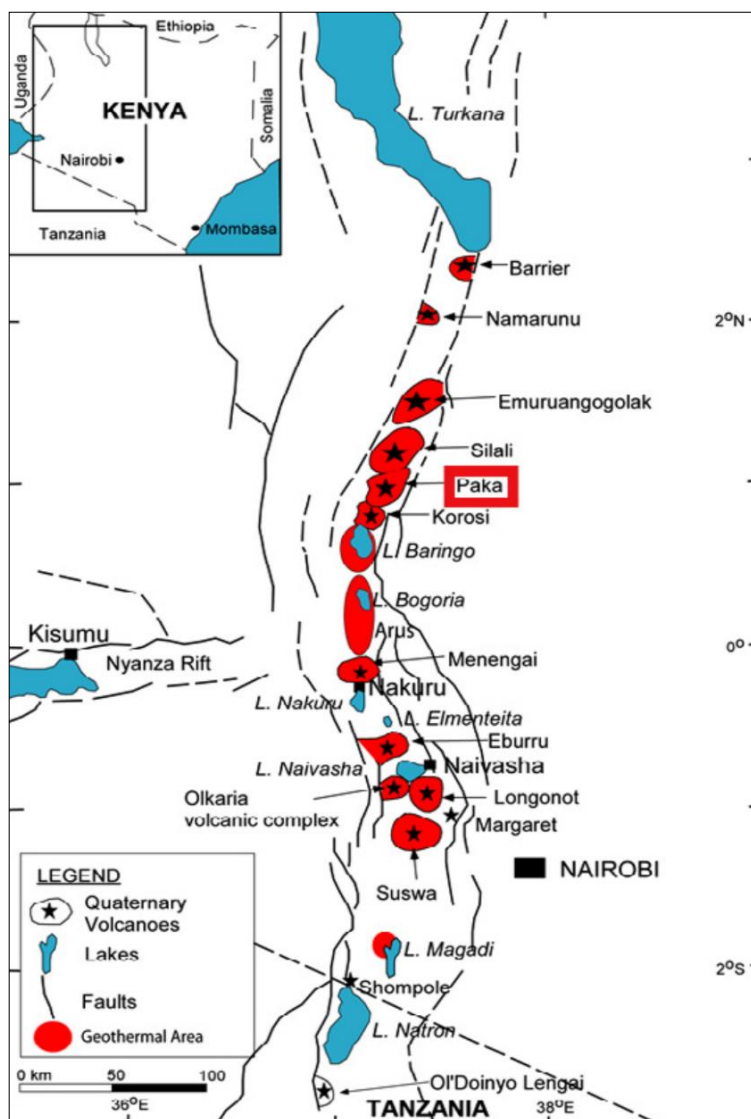


Figure 2: Map showing location of geothermal area along the Kenyan Rift Valley (source: Mwangi S.M 2013. "Application of geochemical methods in geothermal exploration in Kenya." *Procedia Earth and Planetary Science* 7 (2013) 602 – 606)

Despite its impressive progress, Kenya's geothermal journey is not without its challenges. Land acquisition for new projects, environmental concerns related to brine disposal, and the

high upfront costs of exploration remain hurdles that need to be addressed. However, the opportunities outweigh the challenges. The vast untapped geothermal potential in the Rift Valley, to the tune of 10,000 MW, holds immense promise for future development. Additionally, Kenya's expertise in geothermal development is being recognized globally, opening doors for exports of knowledge and services to other African countries.

2.1 Programme Background

2.2.1. Programme Objectives and Outcomes and LogFrame

The programme under evaluation is entitled “Generating energy capacity from geothermal power generation and its related technologies for sustainable development”. The main objective of this programme was to promote geothermal power generation and energy management systems within Africa (particularly within the Eastern Great Rift Valley region) to; i) increase access to stable supplies of electricity; ii) improve operations of an existing geothermal plant in Kenya; and iii) enhance human and institutional capacities. This is to be achieved through five key strands:

- demonstration projects
- removal of barriers to accessing technical information
- capacity building/knowledge management
- identification of Business Models
- strengthening market conditions for investment (particularly through PPP)

The programme’s intervention was broken up into five Components as follows:

1. Component 1: Implementation of the project “Strengthening capacity for operation and maintenance with Internet of Things technologies for Olkaria Geothermal Power Station in Kenya” (the IoT project).
2. Component 2: Research and analysis study with the scope of identifying technology and capacity building needs for uptake of geothermal power generation for effectively addressing challenges of climate change, energy poverty and sustainable industrialization in six countries in Africa.
3. Component 3: Technical training targeting geoscientists, engineers and environmental experts.
4. Component 4: Capacity building programme for policy makers to increase awareness and understanding of geothermal development through familiarizing with advanced practices in Japan.
5. Component 5: Study on public and private partnership for the Targeted Countries.

The details of the programme are given in **Error! Reference source not found.** below and the programme’s LogFrame is presented in Annex 1.

Project title	Generating energy capacity from geothermal power generation and its related technologies for sustainable development
UNIDO ID	170046
Country(ies)	Kenya with participating countries Djibouti, Ethiopia, Rwanda, Tanzania, Uganda,
Project donor(s)	Government of Japan
Project approval date/GEF CEO endorsement date	April 2017

Planned project completion date (as indicated in project document/or GEF CEO endorsement document)	October 2019 (30 months)
Actual project completion date (as indicated in UNIDO ERP system)	December 2023
Project duration: Planned: Actual:	2.5 yrs 6.5 yrs
Implementing agency(ies)	UNIDO
Government coordinating agency	Ministries of Energy, Industry and Environment in participating countries
Donor funding	USD 11,268,536.74
Total project cost (USD), excluding support costs	USD 12,733,446.52

The capacity building component in Kenya was formulated as the result of UNIDO's ToR '*Development and implementation of capacity building programme for geothermal power utilization for sustainable climate resilient development in Africa*'. This was subcontracted to KenGen, aiming at creating a pool of geothermal experts in Djibouti, Ethiopia, Rwanda, Tanzania and Uganda by delivering technical trainings so as to fulfil the following objectives: Improve awareness, knowledge and capacity on technical matters related to geothermal development; Develop technical capacity and expertise in geothermal technology; and Create networks among geothermal experts within and across the targeted countries. Three foundation courses were provided in 1) geoscience, 2) geothermal engineering and 3) environmental and social analysis in two phases (Part A: 15 – 19 May 2023, Part B: 17 July to 7 August 2023).

2.2.2. Programme Budget Analysis

The overall budget of the programme was stated as USD 12.733 million out of which Component 1 was assigned USD 5.311 million leaving USD 7.422 million within this TE. An analysis has been done on the financial management of the programme from 2020 to 2022 based on the budget tables in section 4. of the Annual Progress Reports (APR) and supported by Project Delivery Reports generated within UNIDO HQ and appended to each report. For 2023, figures were taken from Annex 1 of the End of Programme Report (Programme Completion Report, see Annex 7).

The summary of analysis is given in Table 4. The overall budget for 170046 of USD 6,568,537 includes the Programme Support Costs (PSC), and these seem to be paid from the 'total funds still available' in 2023, but the PSC figure calculated of USD 854,928 does not equal that reported in the End of Programme Report of USD 744,688, and the actual PSC is reported in the next column as USD 755,318. The report states that the latest revised total UNIDO budget (excl.PSC) was in the end USD 11,268,537 and USD 4,587,599 of that was for the IoT 190036, giving a remainder USD 6,680,938, the difference between that and the overall budget for 170046 of USD 6,569,537 being between the final 'funds available' and the actual support cost.

Table 4: Calculations done for budget expenditures on the Programme (2020 - 2023)

UNIDO Geothermal Programme Budget															
in USD															
October to October	2020			2021				2022				2023			
Description	Expenditure	Total funds	Amount	Spend in Year	Expenditure	Total funds	Amount	Spend in Year	Expenditure	Total funds	Amount	Spend in Year	Expenditure	Total funds	Amount
	(30 Sep. 2020, excl. psc.)	still available	of Budget		(30 Sep. 2021, excl. psc.)	still available	of Budget		(30 Sep. 2022, excl. psc.)	still available	of Budget		(30 Sep. 2023, excl. psc.)	still available	of Budget
Staff & Intern Consultants	1,131,557.28	1,006,942.72	52.9%	232,865.99	1,364,423.27	774,076.73	10.9%	264,980.14	1,629,403.41	424,340.83	12.9%	454,666.03	2,084,069.44	-30,325.20	22.1%
Local travel	126,485.28	120,635.40	51.2%	0.00	126,485.28	120,635.40	0.0%	17,205.52	143,690.80	153,902.06	5.8%	43,909.45	187,600.25	109,992.61	14.8%
Staff Travel	29,698.63	5,660.66	84.0%	-1,327.81	28,370.82	6,968.47	-3.8%	7,793.22	36,164.04	39,194.78	10.3%	27380.28	63,544.32	11,814.50	36.3%
National Consultants	402,994.25	207,592.10	66.0%	34,510.33	437,504.58	173,081.77	5.7%	114,464.11	551,968.69	380,930.05	12.3%	211,205.53	763,174.22	169,724.52	22.6%
Contractual Services	1,232,822.81	1,081,009.43	53.3%	4,094.22	1,236,917.03	1,076,915.21	0.2%	571,041.69	1,807,958.72	985,873.31	20.4%	363,038.31	2,170,997.03	622,835.00	13.0%
Train/Fellowship/Study	481.4	44,767.55	1.1%	0.00	481.4	44,767.55	0.0%	0.00	481.4	84,768.00	0.0%	299,941.74	300,423.14	-215,173.74	351.8%
International Meetings	19,320.44	40,679.56	32.2%	0.00	19,320.44	40,679.56	0.0%	-2,555.01	16,765.43	90,940.01	-2.4%	4,069.79	20,835.22	86,870.22	3.8%
Premises	3,176.80	48,323.75	6.2%	0.00	3,176.80	48,323.75	0.0%	9,789.18	12,965.98	38,534.82	19.0%	14,460.65	27,426.63	24,074.17	28.1%
Equipment	2,868.56	998,060.57	0.3%	1,572.27	4,440.83	996,488.30	0.2%	124.58	4,565.41	98,692.68	0.1%	96.49	4,661.90	98,596.19	0.1%
Other Direct Costs	29,448.88	36,010.93	45.0%	7,632.98	37,081.86	28,377.95	11.7%	18,072.00	55,153.86	12,242.72	26.8%	35,723.21	90,877.07	-23,480.49	53.0%
Total	2,978,854.33	3,589,682.67	45.4%	279,347.98	3,258,202.31	3,310,314.69	4.3%	1,000,915.43	4,259,117.74	2,309,419.26	15.2%	1,454,491.48	5,713,609.22	854,927.78	22.1%
Overall Budget	6,568,537.00			6,568,517.00				6,568,537.00				6,568,537.00			

The summary of year-to-year activity is:

- 2020 – The major expenses were for various contractual services and for payments to staff and consultants. There was quite a large expense on local and staff travel and also for international meetings.
- 2021 – The bulk of major expenses were for payments to staff and consultants but the amounts for contractual services was considerably decreased, and overall the expenditure for 2021 was small (4.3%) because of the COVID-19 pandemic. There was a change in the estimated expenditure into 2022 which took into account the proposed extension towards the end of April 2022.
- 2022 – The major expenses were again for various contractual services and for payments to staff and consultants with a decrease in travel expenditures due to COVID-19 restrictions. The changes proposed in 2021 for expenditures were increases for travel, national consultants & contractual services and trainings & meetings, while the budgets for equipment was decreased by USD 900,000 to cover those. The report said that budget allocation among the various lines would be adjusted as per the applicable UNIDO guidelines, which was done in 2023.
- 2023 – The figures for expenditure in the year were derived from the Completion Report which was made available during the drafting of this TE. The report only presents tables of Project Delivery in Annex 1 and does not give any detail as to the financial implementation, which would be usually expected.

The profile of spending year on year is shown in Figure 3, and comparison of cumulative budget spent against reported progress in the APRs shows:

- 2020 – 45.4% against 20% reported progress
- 2021 – 49.6% against 40% reported progress
- 2022 – 64.8% against 70% reported progress
- 2023 – 87.0% at the end of programme

These percentages add up to 87% because the analysis is done including the ‘funds still available’, which were used at the end for Project Support Costs, so the remaining 13% is the assumed ‘overhead’. The other thing to note is how the expenditure in 2021 was affected by the pandemic.

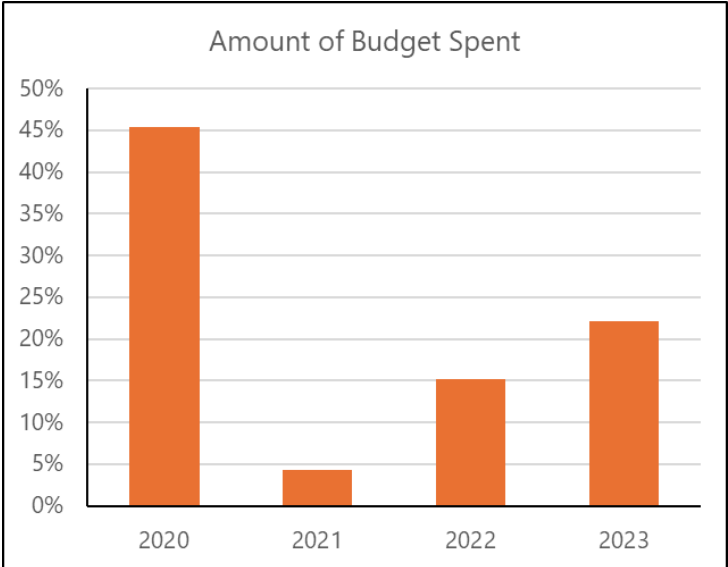


Figure 3: Year in year budget expenditure by percentages

Overall the financial management as presented in the APRs is comprehensive and well-presented and the figures pass a basic audit for accuracy and transparency. What is lacking from the APR for 2022 is an explanation of the where the adjustments in line budgets proposed in 2021 actually resulted in changes in amounts, as shown in the Table 5 below, and whether the decrease in the amount spent on equipment had a consequence to the overall programme delivery. More analysis on the amounts used for each line is done in the section on efficiency.

Table 5: Adjustments calculated made in 2022 (USD)

2022	Adjusted by
Staff & International Consultants	-84,755.76
Local travel	50,472.18
Staff Travel	39,999.53
National Consultants	322,312.39
Contractual Services	479,999.79
Train/Fellowship/Study	40,000.45
International Meetings	47,705.44

Premises	0.25
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2.2.3. Programme Implementation and Governance

The programme was overseen by a Project Management Unit (PMU) based at UNIDO's HQ and in Japan and managed locally through a Project Steering Committee (PSC). A Programme Coordination Committee (PCC) consisting of representatives from UNIDO and the donor was organised every year since 2017 (except in 2023) and was attended in person except during COVID-19 (2020 - 2022). There is no detail in the Annual Progress Reports or Completion Report of a Project Execution Unit (PEU) as was envisaged in the ProDoc.

The PMU had the responsibility for the comprehensive operational management and implementation, as well as the monitoring of the project. It was led by a Project Manager, who was in charge of overall coordination, budgeting, contracting, results measurement, and ensuring the project's sustainability. Moreover, Project Officers were tasked with carrying out the relevant implementation activities, while administrative staff provided support for the overall programme management. Some project development experts reported to the PMU to lead specific technical activities and support project implementation.

The PMU reviewed and reported on the project's performance to the PSC and functioned as the secretariat of both committees. Additionally, the PMU was responsible for coordinating project oversight activities, providing technical expertise, and ensuring the implementation of all monitoring and self-evaluation requirements according to best practices. This encompassed ensuring the quality of products, outputs, and deliverables, preparing and submitting progress and financial reports, as well as major budget revisions and managing staff and consultants. The PMU also engaged in consultations with project partners and stakeholders, including the Government of Kenya, through the PSC meetings.

2.2.4. Stakeholders, engagement and communication

Stakeholder engagement and communication were key aspects of the Project Steering Committee's (PSC) mandate. The PSC was established to oversee the project's direction and provide the necessary guidance and support to attain project objectives. This committee was composed of distinguished individuals from pertinent ministries, namely the MoITED, which chaired the meetings, the Ministry of Energy, the National Treasury and Planning, and the MoICT. Additionally, the PSC included representation from three primary project stakeholders: UNIDO, JICA, and KenGen.

The inaugural PSC meeting took place in November 2020, with subsequent sessions scheduled for March 2021 and June 2021. These meetings served as the appropriate venues and opportunities to establish and maintain stakeholder engagement and facilitate effective communication.

Table 6: List of stakeholders

UNIDO	Kenyan stakeholders	Other African stakeholders
UNIDO Vienna HQ (PM)	KenGen	Djibouti Office for Geothermal Energy Development
UNIDO IED (EIO)	Ministry of Industry, Trade and Investment	Ethiopia Ministry of Mines and Petroleum
UNIDO DSE Division (TCS)	Ministry of Energy and Petroleum	Ethiopia Mineral Industry Development Institute

UNIDO Kenya	Dept. for Industry	Ethiopia Geological Institute
UNIDO Country Offices	Olkaria Geothermal Plant	Rwanda Ministry of Infrastructure
UNIDO Japan		Tanzania Ministry of Energy
		Tanzania Geothermal Development Company
		Uganda Ministry of Energy and Mineral Development
		Uganda Attorney General Chambers

2.2.5. Programme Risks

The Programme Document identifies risk factors that are stated to be technical, financial, implementational, market-based and institutional in nature. However, the subsequent table does not then delineate between these categories and instead rates as 'medium' the risks of local skills for maintenance not developed, difficulty with technology deployment/dissemination, lack of private sector investors and lack of funds for business models. A more comprehensive risk assessment including the implementational and institutional risks is therefore absent from the programme's initiation phase, resulting in the failure to identify those pertaining to delays, a common occurrence during project commencement. It is imperative that the documentation undergoes a formal risk analysis to address this critical aspect. Notably, the absence of any reference to risks in the three Annual Progress Reports and the Completion Report is glaring, with the exception of the technical and investment risks associated with the geothermal development in the event of insufficient steam in the well.

During the course of the interviews, the following factors have been identified as potential risk elements that have surfaced during the execution of the programme. It is noteworthy that the majority of these factors resulted in delays and, significantly, were not anticipated during the programme's initial phase, despite being foreseeable:

Financial Risks

The financial management of the programme was under the purview of UNIDO headquarters. The initiation of contracts and disbursements rested solely with the Project Manager and necessitates approval through the hierarchical management structure at UNIDO headquarters. It should have been however acknowledged that the programme would incorporate several activities and expenditures, which would incur certain expenses for KenGen, in terms of maintenance at the programme's conclusion. This is an issue that appears to have not been thoroughly addressed to secure budgetary (typically high costs) commitments from KenGen for the continuous operation and maintenance of activities, and there is a lack of documented evidence regarding their resource-related commitments in this regard.

Socio-political Risks

At present, there are no identifiable political risks that pose a threat to the sustainability of the programme's outcomes. However, there exists bureaucracy at national and county levels that could potentially disrupt the normal course of activities related to the programme's future expansion. Additionally, the benefits need to be matched by benefit-sharing with local communities, conservation and local development.

Institutional Framework and Governance Risks

While there are currently no legal frameworks, policies, or governance structures and processes that are perceived as detrimental to the long-term viability of the programme's benefits, it is essential to note that some of the African partners plan to receive training

support from KenGen going forward. This support entails establishing connections between the beneficiary institutions and the local electricity authority, as well as any other relevant entities, as mandated by local rules and regulations.

Environmental and Socioeconomic Risks

There are no discernible risks associated with the exacerbation of social inequalities or the undermining of gender equality within the programme. Furthermore, any environmental risks that might jeopardize the sustainability of the outcomes are not readily apparent.

3. Findings

3.1 Project Design

The design of a project should formulate a plan for the intervention to achieve the specific purpose as discovered in the preparatory phase and the evaluation looks at overall design and interrogates the Logical Framework (LogFrame).

The Programme Document (ProDoc) recognises the importance of reliable, secure, and cost-effective energy for all countries' economic growth and sustainable development and notes that many African nations suffer energy poverty due to a mixture of complex, often interlinking factors. There is increasing evidence that the continent is at high risk to the adverse impacts of climate change and coupled with by rising populations, urbanization, limited infrastructure and inadequate electricity supplies, this is putting a burden on the livelihoods of millions of people, mainly the poor.

At the same time Africa has substantial energy resources, particularly in the renewable field, and many economies are now growing quickly with a corresponding increase in demand for energy. There is a need for this economic growth to provide access to modern energy to the 600 million people in Africa that do not have access to electricity, particularly in rural areas. In this century the growth of renewable energy development globally has led to huge cost reductions and performance improvements and can now provide relatively cheap, reliable and clean electricity.

In Eastern and Southern Africa along the Rift Valley, geothermal energy has a considerable potential for development which could help meet the growing demand for stable electricity, as has been demonstrated in Kenya. The development of indigenous renewables such as geothermal power will help balance the supply and demand sides. But the uptake of renewable energy technologies (RETs) together with good energy management systems face barriers such as verification of the resource potential in order to attract investment.

Given this background and the announcement in Nairobi in August 2016 by Prime Minister Shinzo Abe of Japan's intention to invest in geothermal power generation projects in African countries, this geothermal programme was conceptualised by UNIDO. The main objective is to promote geothermal power generation and its related technologies in African countries through Japanese technology. This is achieved through demonstration projects, capacity building and knowledge management activities, identification of suitable business models and strengthening market conditions for investment in the developing nations of Africa. Six countries along the Great Rift Valley were identified as target countries to develop demonstration projects; Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda.

The above provides the backdrop to the preparatory phase of the programme, whereby these elements were drawn into the Programme Document, which has a clear and well thought out plan to achieve the objectives. This plan recognises that although RETs can provide modern energy services there are a number of barriers related to innovation of some technologies and the broader market environment.

Reference was made in the design to how RETs typically follow development stages along the 'innovation chain', which both the public and private sector participate in at different stages:

- Research and development to overcome technical barriers and thereby reduce costs of new technology.

- Demonstration of the technology in practice, while costs are still high compared to mature technology solutions in place.
- Deployment of the technology whereby it is operated successfully but may still need support to overcome cost or non-cost barriers.
- The diffusion or commercialization stage, when the technology becomes cost competitive in its own terms, but sometimes with the support of government interventions.

The most critical stage of the innovation chain is when the deployed 'product/technology push' needs to become a 'market/demand pull' and may require outside intervention. The programme therefore focused on interventions to help establish the connection between these two dynamics in geothermal power generation and its related technology transfer. The public sector plays a critical role in tandem with private financial institutions, to hedge investment risks and facilitate a sound investment environment. This was planned to be realized through the establishment of Public Private Partnerships within the programme.

To meet these two criteria (technology transfer through demonstration and linking public and private institutions), the programme was designed with the following structure:

- Demonstration projects implemented with capacity building activities (Outcome 1; Output 1.1 and 1.2).
- PPPs established for scaling-up of the demonstrated technologies and identification of best practices to be showcased with the development of supportive business models for replication (Outcome 2; Output 2.1).

The programme also targeted cross-cutting components and activities (Outcome 2; Output 2.2 and 2.3):

- Capacity building activities for innovative management system solutions, local maintenance, adoption and dissemination to specific local conditions for widespread dissemination of clean and renewable baseload energy sources.
- Knowledge management including institutional partnership, know-how, standards and best practices showcasing to mainstream incentive mechanism and replication actions.
- New business development in the targeted regions in collaboration with training institutions.
- Policy-related analysis to develop a mechanism for replication and market development towards dissemination. Policy recommendation documents included roadmaps prepared to promote best practice technologies together with promotion events.

The programme has an approach to try and maximize the outcomes through identified technology demonstrations together with capacity development activities and ultimately innovation diffusion in a sustainable industrial development sector. Results were planned on the topics such as mainstreaming the technological lessons-learnt; know-how sharing and institutional networking; strategies for market deployment; gender mainstreaming; adaptive policy/regulatory issues and alternative financing/business options.

Although the design addresses the needs for improvements within the geothermal sector in Africa, analysis of the LogFrame designed to capture the logic behind the intervention and manage the activities shows some weaknesses and does not capture all of the possible indicators. For example within the ProDoc there is a detailed explanation of the outcomes

expected (pages 11 - 13) of which many are not carried forward into the LogFrame and the actual Indicators do not pick up the extent of the narrative, as shown in Table 7, leaving gaps within the LogFrame, as seen in the left hand column.

Table 7: Analysis of ProDoc narrative against LogFrame

Reference	Outcomes as derived from ProDoc	Indicators as per LogFrame
Outcome 1 Technology Transfer	<ul style="list-style-type: none"> • Development of geothermal demonstration projects under different country specific conditions • Technology transfer to recipients • Showcase Best Practice • Technology to improve access to energy • Market development strategies assessed • Business development models that are economically stable and sustainable • Social acceptance and gender aspects considered through ESIA. 	# demos formulated # demos completed # geothermal technologies transferred # technologies – socio-economic needs, gender and FS conducted
Outcome 1 Capacity Building	<ul style="list-style-type: none"> • Enhanced human and institutional capacities for: <ul style="list-style-type: none"> ○ O&M ○ Adoption & Dissemination ○ Local manufacturing ○ Local supply chain ○ After sale service and retailing • New business oriented management and services practices • Stimulation of local adoptive R&D • Capacity building for: <ul style="list-style-type: none"> ○ Policy makers ○ Technician ○ Engineers ○ SMEs • Gender equity training • Institutional partnerships with educational establishments • Civil society involvement (e.g. local business) • # people trained and deployed for geothermal systems, O&M, management and manufacturing 	# international and national CB programmes # experts trained <i>(gender aspects run through 4 of the indicators)</i> # partner educational institutions # company staff trained # training courses
Outcome 2	<ul style="list-style-type: none"> • Successful demos showcased with supporting Business Models • Incentives for enabling market development • Policy support, cost reduction and supply chain • Individual demos in different countries to show links between market and policy • Review policy, legal and socio-economics • For demos, review of existing policy framework together with financing options for further technology development • Partnerships: JV, FDI, Licensing to reduce costs • For technology showcasing: Results, lesson Learned, Next Actions to help other countries with replication 	# best practice cases # best practice guides with BMs <i>[# people trained] – not covered in ProDoc</i> <i>[# of local organisations, associations and NGOs] – not covered in ProDoc</i> # policy recoms. & strategy docs. # events for partner match-making # business partnerships # best practice promotion events

Reference	Outcomes as derived from ProDoc	Indicators as per LogFrame
	<ul style="list-style-type: none"> • Cross-cutting: <ul style="list-style-type: none"> ○ Incentive replication ○ Awareness raising ○ Broaden networks ○ Scaling up (rapid) ○ Market environment development • Extent to which policy instruments adopted • Extent to which local capacity to develop prosecution chains are strengthened. 	<ul style="list-style-type: none"> # roadmaps for scaling up # relevant policy instruments and recoms. adopted # options for cost reduction & local production chain development

The reason that there seem to be indicators missing in the LogFrame (e.g. aspects of R&D, link to civil society and broadening networks) is that many of the outcomes targeted in the ProDoc are replicated across the two Outcomes (e.g. showcasing best practice, development of business models and enhancing local supply chains) and the LogFrame has too many generalised indicators. There should have been a much clearer delineation between the two outcomes with Outcome 1 focussing on the concrete activities (demonstrations and capacity building) while Outcome 2 dealing with the supportive actions (policy, strengthening of the market, partnerships building).

As such the LogFrame is too fluid and difficult to interrogate for verification of indicators. Knowing this, the project team organised the overlapping outcomes and outputs into five components, as is normal in UNIDO project design, but this was just for convenience and they did not have official status. The use of components did help frame the activities more clearly and guide its implementation (for example, the IoT project was able to be packaged wholly within component 1) but this delineation did not extend to tracking of outputs and finances.

As has been noted in the background section above, there was only a basic risk management matrix prepared in the design, which looked at post-implementation aspects (development of local skills, technical dissemination, mobilisation of private investors, lack of funding for innovative business models). It would have been better for the ProDoc to zero in on the risk to smooth implementation with consideration of the capacity of the five African countries to actually fulfil the programme goals and the factors that might cause delay in delivery, which the programme did suffer from, completing 3 years later than planned. The COVID-19 pandemic (which was a risk difficult to predict) was not wholly to blame for the two extensions; the delays in starting the programme in 2019 – 2020 had more of a factor.

On gender equality and empowerment of women, the design is strong on the macro-level how access to sustainable energy may have positive impacts on women in Africa, and on the micro-level how equal participation should be fostered in the capacity building, staff recruitment, decision making processes and gathering gender-disaggregated data.

Considering all of these assessments (including the weaknesses in risk assessment, and particularly of the LogFrame and ‘unofficial’ use of components) the design is regarded as a score of Moderately Satisfactory (4).

3.2 Progress to impact

The definition of the ‘Progress to Impact’ evaluation criterion is to assess any long-term effects (direct or indirect, intended or unintended) of the intervention whether positive or negative that have redirected the transformation process, which in this programme is “to

promote geothermal power generation and its related technologies in African countries”. The impact of a project is a wide-ranging assessment point and runs through the design and performance, and also covers barrier analysis.

Theory of Change

In order to assess whether the programme has initiated the progress to impact, the reconstructed theory of change (ToC) approach was used whereby the intervention is checked against the results, tracking causal and transformational pathways to change using the theory of change diagram generated by the evaluators in Annex 5.

At the base of the ToC are the five outputs as designed in the ProDoc, which are presented above in the Programme Design section. These outputs feed directly into their associated two outcomes which are; i) Successful demonstration, deployment and transfer of geothermal technology in targeted African countries and; ii) Favourable market conditions and strengthening geothermal energy investment. However, there is an identified link between two of the outputs being how the demonstration projects designed and implemented (Output 1.1) should give rise to best practice identified and showcased (Output 2.2). As presented on in the Deloitte report made as part of Component 2 (Research and analysis study with the scope of identifying technology and capacity building needs), this was able to be proved through identification of case studies for best practice.

Seven case studies for potential projects using the PPP approach were analysed (see Table 8) including the financing structure, potential risks and the mitigation solutions to attract private investors. The technical support requirements were provided to give clear information for the private sector regarding what kind of contribution they can provide to accelerate the identified projects’ development.

Table 8: Case studies presented in Deloitte report

	Case Study 1	Case Study 2	Case Study 3	Case Study 4	Case Study 5	Case Study 7
Project Name	Menengai	Baringo-Silali	Tulu Moye	Buranga	Bugarama	Ngozi
Location	Kenya	Kenya	Ethiopia	Uganda	Rwanda	Tanzania
Ownership	PPP	Public	Private	Private	Public	Public
Main Developer	GDC & IPPs	GDC	TMGO	Gids Consult, GRD	REG	TGDC
Development Model	Separated Model	Separated Model	Vertical Integration Model	Not identified	Not identified	Separated Model

In addition, within Component 5 (Study of PPP Models), the Consultant report presented the phases of geothermal power project development in Chapter 5. By following systematic steps, risk exposure is minimized and results in the lowest cost of development. A well-planned geothermal project also creates opportunity for private investment directly or through a PPP scheme. A very useful figure from this report (Phases of geothermal power project development - ESMAP, 2012) shows eight phases with indicative period of implementation as a best practice for geothermal development which also gives rise to realistic project costing. These are; 1) Preliminary Survey; 2) Exploration; 3) Test Drilling; 4) Project Review and Planning; 5) Field Development; 6) Construction; 7) Commissioning and 8) Operation & Maintenance.

Three other outcomes have been identified within the ToC which the programme has been able to foster to a greater or lesser degree, namely:

- Strengthen international/regional/local networks – this was achieved between Japanese companies and participating African institutions and linkages between Kenya and some of the other African countries.
- Enhance local/regional training centres through Training of Trainers (ToT) – this has been started within KenGen.
- Dissemination strategies (i.e. local business development, Public-Private Partnerships, adoption of financing & policy instruments) – although there were activities conducted to foster dissemination, there has not yet been progress seen.

These various outputs and outcomes should give rise to elements that are part of the Progress to Impact through a complex set of interlinkages (see the ToC in Annex 3). The main elements of progress have been identified as:

- Transfer of geothermal technology and building technical capacities (O&M, adoption & dissemination, local manufacturing and supply chains) within the targeted African countries.
- Local innovation of geothermal technology development and investment in local supply chains.
- Improved management of geothermal installations built.
- Capacity built on business intuition (after-sales & retailing, service management).
- Understanding how ESIA's properly cover social acceptance and gender aspects in project development.
- Showcasing of best practice examples.

These should then give rise to the strengthening of renewable energy capacity within the UNIDO targeted areas of Africa, as shown by the convergence of progress to impacts in the Figure 4 below.

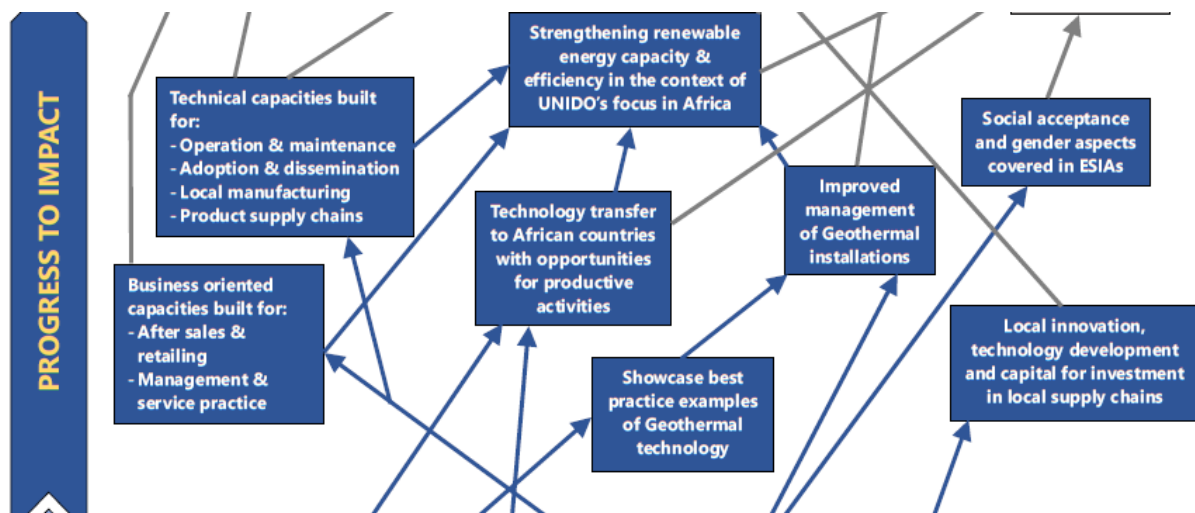


Figure 4: Progress to Impact part of the ToC

At the top of the ToC are several key impacts that should result as part of the flow of progress. These have been identified as the market deployment of well-designed, cost-effective and sustainable new geothermal plants, realised through operation of good business models and Public-Private partnership and access to innovative financing and investment, considering donor funds where possible. This should give rise to reduced production costs and investment risk in geothermal power and therefore reduced energy

costs for consumers with positive impacts on local natural resources, society and the wider economy in relevant African countries.

This should in turn catalyse market development for new geothermal power generation in Africa, with the ultimate programme goal of “Improved energy access in African countries” as shown at the pinnacle of the theory of change. Whether can be achieved as a result of UNIDO’s intervention is too early to say because progress to impact can take many years, but it is likely that the various activities have contributed to the participating countries getting on the correct path. Indeed one interviewee thought that the impact of the programme will produce long term results, i.e. job creation, economic boost, sustainable investment, deployment of an energy source which is locally produced with a small footprint and near zero carbon emissions, and above all a reliable energy mix with future energy security.

In the shorter term and as assessed by the interviewees, the programme has had undoubted impact in the areas targeted, particularly in the capacity building which has had a significant impact on various aspects of geothermal power generation such as:

- **Local On-site Training:** This has significantly improved individual capacity which should lead to improved efficiency in geothermal production processes.
- **Regional Training Support:** The programme provided improved training support to Eastern African countries within the region. This has saved time, resources and money, making the programme a cost-effective capacity building solution.
- **Policy Awareness:** Awareness and sensitization have been improved about geothermal power among some policy makers. This has had a knock-on potential effect of accelerated power generation initiative.
- **Improved Reservoir Management:** The programme has led to better reservoir management, especially in terms of improved re-injection strategies resulting in enhanced geothermal power generation.
- **Data Acquisition:** The programme has enabled the acquisition of quality data for better data handling and inter-laboratory comparison of results.

For recipients of the trainings in Kenya, the KenGen geothermal team was highly respected as an internationally recognized institution for innovative, robust geoscientific research, expertise and consultancy advice. One of the main impacts was how the training explained the key point of how to move from the drilling to the development phase with in-situ and hands on learning. This was noted as being particularly important for TGDC who are starting drilling at an exploration stage and moving soon to production drilling.

As well as the trainings in Kenya, the site visits in Japan allowed the start of a good depth of technical knowledge for all participants as the trips allowed the operation of geothermal plants to be seen first-hand. The trip to Japan also forged links between Japanese technology providers and some of the African governments, e.g. Kenya and Rwanda, while official communication is now set up between the Kenyan Ministry of Energy and its equivalent in Ethiopia. For the Djibouti representatives, it was the first chance that they had been able to benefit from a programme of training through Japanese assistance, and the trip to Japan was particularly welcome because it allowed them to meet the private sector directly.

Barrier Analysis

The theory of change is useful as a complementary tool to the LogFrame because it can include extra context regarding barriers and drivers of change. The analysis of barriers is

done on two levels; firstly seeing whether there are high-level barriers that may prevent achievement of the goal and recommendations on how to overcome such challenges; and secondly whether there were any programme-related barriers encountered that impeded its implementation.

The programme did a thorough analysis of the barriers faced in trying to follow the pathway to change outlined in the theory of change, the most comprehensive of which is in the Deloitte report cited above which identified technology, capacity building and outreach needs for uptake of geothermal power generation. A summary of four main challenges is given below and the report proposes a substantial number of practical recommendations to address the issues.

1. Lack of clarity on regulations governing geothermal development and pricing of power

This barrier is due to unclear definitions and national laws/regulations regarding ownership of geothermal resources, types of development licenses and delineation of development areas. The process of pricing electricity generated by geothermal resources is also often not standardized or transparent.

2. Poor institutional framework and capacity for the implementation of laws and regulations and the technical capacity of local workforce

There is a need for improved human resource capacity to implement laws and regulations, and ability to negotiate and coordinate with local and foreign stakeholders. Because of the importance of PPP in geothermal development, it is necessary to create clear PPP procedures and frameworks and have sufficient ability within PPP units to manage and operate such projects.

3. Risks to private developers and undeveloped capabilities to coordinate the sharing of these risks between the public and private sectors

Includes exploration risk (low steam productivity) and credit risk (not receiving timely payment from electricity off-takers). While government agencies can take on risk at the initial stages and public and private sectors can share the risk and cost associated with geothermal resource development, the policy and institutional frameworks are not fully capable to make such arrangements.

4. Financial support for private developers

Geothermal development involves large expenditures at each stage with the entailed risks, so support is needed through appropriate financial incentives (e.g. tax exemptions) but these are often not clearly defined in regulations. In order to increase the investment predictability and profitability for the entry of private developers, it is important to set the purchase price of generated electricity at level above the development cost.

Overall, it is recommended that a good balance is struck between risk and cost sharing between public and private sector and that capacity development for both government officials and developers are indispensable for promoting the PPP model. As can be seen, the above synopsis gives an excellent overview of the main barriers to growth of the geothermal sector in the relevant countries and the detail is available for all programme participants to read.

With the exception of Kenya, despite the great potential, most East African countries haven't properly started exploiting their geothermal resources. Most of the geothermal development sites in the targeted countries are in phase of exploration and appraisal drilling. So clearly there are barriers that are being faced in the more widespread development of this useful energy source. However, the programme will enhance efforts to

reduce technical and institutional barriers and ensure that there are professional people with skills and competence to drive geothermal development.

In respect of barriers to the implementation of the programme itself, the interviews conducted gave some insight. One of the main challenges and often mentioned was the COVID-19 pandemic which meant a slow progress of activities in 2020 and hindered travel by consultants to Kenya, which caused delay to the programme and meant that it had to be extended. Often the challenges were overcome (more meetings were held virtually) but the resolutions required extra time.

Within Kenya, the permissions required from the local counterpart office (MITI) took time. The IoT sub-project kick-off was in April 2019 (already 2 years after the official start date of March 2017) but the Programme Document was not approved until March 2020, just as COVID-19 was starting. The Steering Committee did not start functioning until June 2020, after which time the project could commence in earnest. Finally, the Treasury of Kenya wanted to have management over the programme budget which required some legal aspects and took time to resolve.

In terms of how participants from other African countries perceived challenges within the programme, one major concern is cost of the technology. It was seen through the exposure trip to Kenya that it is a good investment to develop a geothermal wellhead and then build a power plant, but the financing of that is difficult in other African countries, often requiring the central government to be more involved. Then there are the risks already highlighted above in developing new geothermal because of the cost of developing new wells that may not produce enough steam volume or the energy required. The other African countries also have highlighted the problems of regulation of the sector, for example Tanzania needs a Geothermal Law because regulation is presently done through the Mining Law, which is not the correct tool.

For the trainings that participants attended, these were generally very well received with only a small observation on the training sessions was that sometimes the KenGen trainers were not available due to internal HR issues and this affected the delivery of trainings. The emphasis on training is crucial not only because geothermal is still a new technology and continuous training is definitely needed, but also because there is presently a dependence on consultants and if staff are untrained, they have difficulty processing experts' different views.

Finally, there were some challenges noted in the delivery of the programme from the UNIDO Kenya Office. There is a perceived alienation of the field office in Kenya from the HQ in Vienna resulting in a minimized and less empowered role, hindering staff ability to actively contribute to project management and decision-making processes. The local national coordination, situated on the ground and possessing contextual insights, felt underutilized and detached from the core project activities. More efficiency and a holistic understanding of the local nuances could have been achieved had the local coordination been proactively engaged in project management responsibilities.

Assessment of the impact of the programme has many facets (including the associated IoT project) and given the objectives were 'to promote advanced renewable energy technologies to increase access to stable supply of electricity and improve operations of existing renewable energy installations while enhancing local human and institutional capacities in the African continent', there has been measurable impact, although against the long-term effect of 'Improved energy access in African countries' it is too early to say whether the

interventions would help achieve this. Therefore, progress to impact is rated with a score of Satisfactory (5).

3.3 Relevance

The relevance of an intervention is the extent to which the activity is suited to the priorities and policies of both the target beneficiaries and the funding partner(s).

The structure of the programme was designed around a Note Verbale, signed between UNIDO and the Government of Japan in Vienna on 22 November 2016, which stated that a project will be executed assisting African countries to enhance their energy sector through Japanese geothermal power generation and its related technology. The Government of Japan then committed to fund the programme, designed to conform to this Note Verbale, and therefore the focus on geothermal power generation to increase access to stable supply of electricity in the African continent is directly relevant to the donor's priorities.

The choice of Kenya, from where the original announcement was made on Japanese assistance to the African geothermal sector and as the keystone country in the programme is highly relevant because since 2000 Kenya has steadily increased its geothermal capacity which now accounts for over 40% of the country's generating capacity. There are future plans to raise the number of geothermal establishments in Eastern Africa by over 4,000 MW through the next decade, and Rwanda, Ethiopia, Djibouti, and Tanzania are making progress in harvesting their untapped resources of geothermal energy.

The selection of the partner countries for project implementation was made with consideration of the potential for strong political ownership of geothermal power development, a policy environment that is favourable and UNIDO's past experience in the country. As a result, five extra countries were chosen in addition to Kenya (Djibouti, Ethiopia, Rwanda, Tanzania and Uganda) and are regarded as very relevant choices, although the participation and interaction was not as strong from Rwanda.

Looking at each participating country's geothermal resource, the programme has strong relevance to those countries' studied resource assessments:

- With the significant seismic activity seen in the Rift Valley, Djibouti may have a huge geothermal potential (see Figure 5). There are 21 geothermal sites being worked on totaling a near-term potential of 1,000 MW.

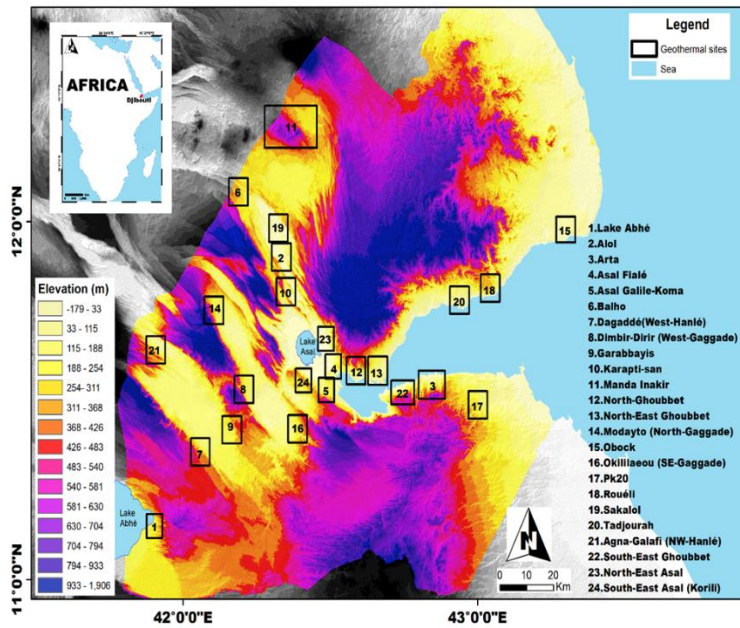


Figure 5: Map of Djibouti's geothermal resources (source: ODDEG, 2023)

- Ethiopia made a Geothermal Declaration in 2016, under which the Second Growth and Transformation Plan estimates the geothermal potential of the country to be within the range of 4,200 MW to 11,000 MW (see Figure 6).



Figure 6: Map of Ethiopia's geothermal resources (source: Solomon Kebede, 2019, cited by Deloitte)

- Rwanda has a plan reach 60% by 2030 including 31% from hydro and 24% from solar PV. Geothermal could be part of the mix but because no proper study has been done the potential is not known and more exploration is needed.

- Tanzania's geothermal potential is estimated at 5,000 MW and the country is looking to exploit its geothermal resources with a target of 200 MW by 2025.
- Uganda's geothermal resources are estimated at about 1,500 MW with its resource mainly in the southern corner (see Figure 7). With 24 geothermal sites identified and several private players working on projects, the government of Uganda is optimistic on reaching 100 MW of geothermal power generation capacity target by 2025.

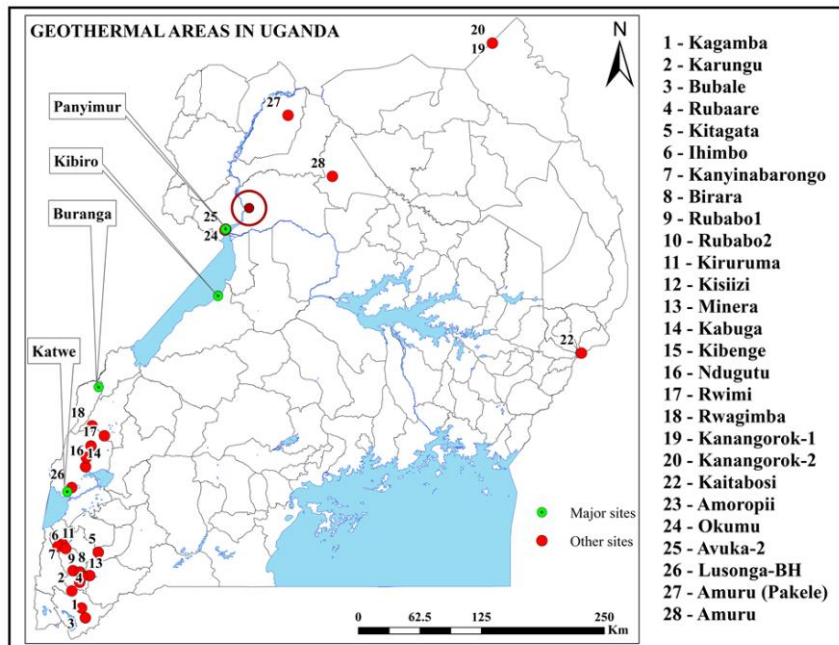


Figure 7: Map of Uganda's geothermal resources (source: Hanson, 2020, cited in Deloitte report)

The relevance to Rwanda is judged as lower because of the unknown and probably smaller geothermal potential resource than in the larger countries, its population being much lower (13.5 million⁵) and therefore less pressure to develop large power projects. Also, Rwanda already has a reasonably high penetration of renewable energy (51% from hydro and solar with an active programme to increase these sustainably with small distributed projects), whereas in Uganda and Ethiopia their dependence on large hydropower has put them at risk from when there are prolonged dry periods. Kenya has already recognised this and is prioritising geothermal development over hydropower with dams, which has helped the electricity supply as Kenya has suffered extreme lack of rainfall in the last few years. Djibouti is a special case because of its much smaller size (1.1 million) and high dependence on imported electricity from Ethiopia and subsequent need to develop its own renewable resources, which primarily are solar and geothermal.

With regard to international relevance, the programme was designed to contribute directly to the following SDGs:

- SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all;
- SDG 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation;
- SDG 13: Take urgent action to combat climate change and its impacts.

⁵ Ethiopia= 120 million, Kenya = 53 million, Tanzania = 64 million, Uganda = 46 million

It has been checked that the programme is compliant with the outcomes, activities and responsibilities specified in the United Nations Development Assistance Framework (UNDAF)⁶ with contribution to ensuring sustainability and resilience and with particular relevance to the following:

- Promoting public-private partnerships to achieve the SDGs;
- Supporting technical and scientific cooperation and North-South and international cooperation on and access to science, technology, innovation and knowledge-sharing in order to achieve SDGs; and
- Encouraging the engagement and participation of relevant stakeholders and the broader population in national actions to achieve the SDGs.

The programme is also in line with the following international efforts (amongst many others) on renewable energy and sustainable development:

- UN's partner international organization '**Sustainable Energy for All**' (**SE4All**) clean energy transition, which targets achieving universal energy access by 2030 and up-scaling the contributions of renewable energy globally.
- **Renewable Energy Policy Network for the 21st Century (REN21)**, the only global renewable energy community of actors from science, governments, NGOs and industry with the goal of enabling decision-makers to urgently shift to renewable energy .
- **International Energy Agency (IEA)** which works with governments and industry to shape a secure and sustainable energy future for all. The IEA recommends policies that enhance the reliability, affordability and sustainability of all energy, including renewables.
- **International Renewable Energy Agency (IRENA)**, an intergovernmental organization mandated to facilitate cooperation, advance knowledge, and promote the adoption and sustainable use of renewable energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.
- **World Energy Council (WEC)** which has a network of over 3,000 member organisations and a presence in nearly 100 countries, from governments, private and state corporations, academia and civil society, as well as current and future energy leaders.
- **Frankfurt School – UNEP Collaborating Centre for Climate and Sustainable Energy Finance** which since 2009 has been promoting public and private sector investment in greenhouse gas mitigation and climate adaptation in developing and emerging countries, as well as in industrialized countries.
- UNIDO's mandate on promotion of **Inclusive and Sustainable Industrial Development (ISID)** in developing countries and economies in transition which is a key driver for the successful integration of the economic, social and environmental dimensions, required to fully realize sustainable development for the benefit of our future generations.

In terms of replies from those interviewed, there was unanimous agreement that the programme has a high degree of relevance to their institutions, and inter-alia, their country's needs.

For KenGen, the programme was deemed highly relevant due to the strategic importance of geothermal production in Kenya where geothermal power generation is a key priority, as

⁶ UNDAF provides a system-wide overview of key UN activities and functions at country level, in support of national policies, priorities and plans of programme countries, while ensuring coordination, coherence, effectiveness and efficiency for maximum impact.

evidenced by the development of the six power stations in Olkaria, significantly contributing to national energy security. Moreover, the programme holds the potential to extend its benefits beyond national borders, as indicated by Memoranda of Understanding (MoUs) signed with countries in the Eastern Africa region. This expansion aligns with the broader goal of regional collaboration, sharing expertise, and fostering energy security in the Eastern Africa region.

The Kenyan Government's plan to increase geothermal energy production to over 5,000 MW by 2030 is part of Kenya Vision 2030, which highlights the country's ambition to become a middle-income country by 2030. To emphasize this relevance, the Government has further established the state-owned Geothermal Development Company (GDC), that develops and sells steam to generate electricity. Apart from Olkaria, GDC's geothermal ambitions include:

- Baringo-Silali project: Estimated potential of 3,000 MW.
- Menengai Steam field: Building a 35 MW geothermal power plant.
- Paka Well 8A: Adding 20 MW of power to the national grid.
- Plans to add 1,065 MW to the national grid over the next ten years.

The Kenyan Ministry of Energy regards the relevance in terms of expansion of the scope and capacity for energy generation by broadening the range of energy sources and improving the overall national energy situation through:

- Diversification of energy sources through expansion of renewable energy: increasing the share of renewable energy sources through geothermal power.
- Technological advancements: improved efficiency in output through technological advances that has enhanced supply side management.
- Decentralizing energy systems: decentralizing electricity generation away from single sources, i.e. large hydropower stations along a single source, the Tana River that periodically suffers from low water inflows.

The programme is relevant to the Kenyan nation as a whole and is in-line with policies such as reducing the cost of power for the Kenyan population, reducing the wastage of power, benefiting industrial users who can receive reliable electricity and enabling the sharing of new technologies.

In Tanzania it is recognised that geothermal energy is one of the strategies to transform the country into a competitive and inclusive economy, and the programme is in tune with efforts to improve access to energy across the country, be that from solar, wind or geothermal. The programme has relevance to Uganda's priorities and strategies because the country is working hard to develop its geothermal resources by establishing a Geothermal Resources Department as a stand-alone institution to oversee the development of geothermal resources in an accelerated manner. The same is true of the Office for Geothermal Energy Development in Djibouti and the Geothermal Resource Directorate under the Ministry of Mines and Petroleum in Ethiopia.

The programme is highly relevant to Kenya and shows good institutional coherence with the five other African countries, although in Rwanda the relevance is judged as lower and its lack of proper laws and regulations for geothermal development are a reflection of that, so relevance attains a score of Satisfactory (5).

3.4 Effectiveness

Effectiveness measures the extent to which the intervention's objectives were achieved and is therefore fairly wide-ranging because it also can look at the achievement of outputs and their outcomes in the LogFrame. Within the interviews held, questions were asked about benefits that have arisen, how those benefits would continue in the short and medium term and the key drivers in achieving the project goal.

Achievement of intervention's objectives

The intervention's objectives were to i) promote geothermal power generation and energy management systems within the Eastern Great Rift Valley region; ii) increase access to stable supplies of electricity; iii) improve operations of an existing geothermal plant in Kenya; and iv) enhance human and institutional capacities.

Overall the programme has successfully achieved its objectives, although some to lesser degree than others. There is now a significant boost in the geothermal power generation most notably in Kenya, and the renewable energy mix in the country continues to see improvement, contributing to enhanced energy security. Additionally, there could be a notable increase in investment and financing facilitated through the successful business matching with Japanese companies. Technical staff and policymakers experienced heightened exposure, and there was an increased interest in geothermal power generation from regional countries such as Ethiopia, Tanzania, and Uganda. But there is a lot more work to do in the participating countries to bring them up to the status in Kenya.

Achievement of outputs and their outcomes in the LogFrame

Within Outcome 1 (Geothermal technology successfully demonstrated, deployed and transferred in the targeted countries) included the IoT project but also covered trainings. The Kenyan demonstration should have the ability to be developed in the other five targeted countries, but their ability for deployment of a demonstration project is hampered by the lack of existing projects and lack of skills. This is why the UNIDO assistance has a high degree of concentration on trainings and capacity building and was supported by three major reports by Kyushu & Honeywell and West Japan Engineering Consultants (both of which dealt with only the IoT sub-project) and Deloitte, which had relevance to the wider programme.

For Outcome 2 (Favourable market conditions for geothermal energy investment strengthened in targeted countries) a geothermal business matching event was organized in Tokyo for the six African countries to promote partnerships between the public and private sector. Furthermore, the below studies were conducted for the purpose of identifying tangible options and windows of opportunities for attracting private sector finance:

- **PPP Study** – this was done by a local Consultant who also covered Business Models (noted in the Development Goal as a requirement for replication). The scaling-up of demonstrations was also covered by the study of the needs in Kenya and addressed through the training in July 2023 (see Report '*Geothermal Projects Development in East African Countries of Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda and Opportunities for Private Investments and Public Private Partnerships*').
- **Best practice implementations showcased** – these were covered in the PPP Study as already mentioned in the section on Progress to Impact (see Deloitte Report '*Provision of Services Related to Development of a Report and Execution of a Workshop towards Market Expansion and Finance Mobilization of Geothermal Industry in Africa*').

- **Policy recommendations** – the IoT project results can be drawn from which is regarded as a best practice which are also covered in the Capacity Building Study (see Deloitte Report ‘*Conduct Research and Analysis towards Establishing Work Program on Geothermal Power Utilization for Sustainable Climate Resilient Development in Africa*’).

Interview responses from the trainees were that increasing knowledge on geothermal is really important and there was full a full range of people able to benefit from trainings, in topics of engineering (which were particularly well-received), geo-science and environmental/social aspects. The training topics covered on-line in September and October 2023 on drilling, maintenance and safety were a good follow up to the in-situ trainings. The IoT demonstration project was operational for trainees to witness at the KenGen geothermal facility and exposure to this new technology highly enriched the trainings. Many of the people who were trained are of senior level, so they can train new and working staff as means of internal knowledge transfer.

KenGen viewed the capacity building as instrumental in addressing the pressing need for capacity enhancement, particularly in the areas of geothermal reservoir management and modernization. This has enabled KenGen to be in line with international standards for managing geothermal power generation, thereby ensuring the company is equipped with the necessary skills and knowledge to operate efficiently and effectively. The programme has not only filled a critical gap but also positioned KenGen at the forefront of geothermal power generation, setting a benchmark for others in the industry.

The effectiveness of the programme was further underscored by the proactive and responsive approach taken by KenGen in addressing issues that arose during implementation. The company's commitment to excellence was evident in its swift and effective resolution of any challenges. The issues that emerged were not only addressed promptly but also with a high degree of effectiveness. This efficient problem-solving approach allowed for a streamlined execution of tasks and contributed significantly to the programme's overall success. The unique operating structure of KenGen, combining government oversight with private-sector efficiency, emerged as a key enabler, fostering an environment where responsiveness and effectiveness thrived.

A small challenge to the effectiveness of the programme stemmed from UNIDO's centralized management structure, particularly in terms of budget oversight and decision-making. The responsibility for project management, including detailed budget considerations, was primarily concentrated under the Project Manager situated at UNIDO's HQ in Vienna or in Japan. This centralized approach, while ensuring direct oversight, inadvertently marginalized the role of the field office in Kenya, although it is geographically closer to the operational locations.

The programme generated many reports which can be drawn on for future scaling-up of geothermal energy across the participating countries and most of the outputs were met as per the LogFrame. Despite some findings about the centralisation of UNIDO's operations at HQ, overall the programme has been effective so the evaluation rates this criterion with a score of Highly Satisfactory (6).

3.5 Efficiency

The efficiency is a measure of how economically the resources and inputs are converted to results and within the expected timeframe. The inputs are usually cash, funding, loans,

services given (in-kind), expertise (paid or unpaid) and people’s time. Each interviewee was asked what inputs they gave, and all responded that they had given time rather than any cash or funding, and some gave in-kind inputs such as provision of local transport at their cost.

Although the IoT project was developed under the main programme, its budget was separated after it was approved. If the previously reported USD 5.311 million for IoT is taken out of the total of USD 12.733 million, the balance of USD 7.422 million for the main programme can be evaluated for efficiency of conversion of financial resources and inputs into results within the expected timeframe.

As presented in the Background section, the financial performance as reported in the APRs (2020 – 2022) does not reflect the final budget analysis as given in Annex I of the Completion Report (USD 6.568 million versus USD 6.579 million including the support cost) although the difference is small. The same goes for the IoT project which in the end had a total cost of USD 5.184 million not USD 5.311 million, including the support cost. The final analysis of both projects is presented in Table 9.

Table 9: Financial analysis for the two geothermal projects (in USD million)

	Released funds (a)	Disbursements (b)	Remaining funds (c)	Support cost (d)	Total (b + d) (e)
IoT (190036)	4.700	4.588	0.112	0.596	5.184
Prog (170046)	6.568	5.824	0.745	0.755	6.579
Total	11.268	10.412	0.857	1.351	11.763

Therefore the final expenditure of USD 11.763 million is almost USD 1 million less than what was expected at the drafting of the ProDoc although that USD 12.733 million was not disaggregated between the two projects so cannot be commented on further.

For the IoT project, 82% of the budget was used for equipment, as expected, with 11% for support cost and 7% for staff, consultants and travel. This is clearly effective use of budget because it resulted in the visible and useful technology demonstration for KenGen. Analysis of the use of funds in the main programme (170046) across the budget line items shows the following.

Table 10: Budget line items expenditure in 170046 (USD million)

Budget line item	Amount	Perc.
Staff/Consultants	2.949	45%
Contractual services	2.171	33%
Travel	0.254	4%
Train/Study and Meetings	0.322	5%
Premises/Equipment and Others	0.129	2%
Support	0.755	11%
Total	6.579	100%

Therefore 78% was spent on staff, consultants and company contracts for various reports, with 11% on travel and the same 11% for UNIDO support cost. Again, due to the soft nature of the services provided (capacity building, exposure trips, policy, PPP and investment analysis etc.), the use of the disbursed budget would seem appropriate,

working out at an average cost over the 3.5 years of implementation of USD 1.88 million per year.

There is a caveat in that analysis of the estimated 0.49 million (USD 0.3 million for Train/Study and USD 0.19 million for travel) for capacity building and exposure trips for the beneficiaries (numbering 94 as given in the Table 11 below) gives cost per capita of over USD 5,000 for inputs over a period of only 4 months. While this is a rough estimate it gives the quantum of what the capacity building may have cost per beneficiary and is regarded as quite high for the trainings delivered. Another analysis, based on the training hours delivered in Kenya⁷ (380 hours in total for 25 participants) means that if less than the USD 0.3 million was used (say 75% = USD 0.226) the cost per hour of training works out at about USD 600.

Table 11: Numbers of beneficiaries for various activities

Activity	Date	Number of beneficiaries
Inception and PSC meetings	April 2019 – April 2022	167
Inauguration Workshop	May 2023	41
PPP Workshop in Japan	18 July 2023	47
CB in Japan	July 2023	22
CB in Kenya	Sept/Oct 2023	25
Total		302

In terms of contributions from each institution towards the programme (inputs), KenGen has played a pivotal role in bolstering the success of the capacity building through its dedicated resources to manage training logistics. Furthermore, KenGen's commitment to staff development is seen in the provision of study leaves for the trainers.

For the beneficiaries from other countries, their inputs were limited to incidental support, such as time the training participants were away from their workplace which is valued by most institutions because training employees increases knowledge and results in efficient work performance. On returning from the capacity building activities, most staff had to continue to give time to integrate what had been learnt within their institutions. Other inputs were covering the visa cost of trainees, travel insurance and sometimes a small allowance for out-of-pocket expenses.

In terms of the delivery of the trainings, they were executed efficiently with good management arrangements for accommodation, transport, lectures, refreshments and field excursions. The adaptability of the programme during the challenging times of the COVID-19 pandemic showcased its resilience. The swift transition to a hybrid instruction model, incorporating both in-person and online elements, underscored the programme's commitment to continuous learning despite external challenges. This hybrid approach was not only considered sufficient but also efficient, allowing participants to engage with the material regardless of geographical constraints. Although there were instances of lower online attendance, the programme's flexibility ensured that learning opportunities were not compromised.

The implementation of the capacity building programme demonstrated a commendable level of efficiency; firstly, the clarity of the objectives was evident from the outset; secondly, planning and identification of the appropriate courses not only streamlined

⁷ Geoscience = 147.5 hours, Geothermal engineering = 127 hours, Environmental & Social = 105.5 hours

the training process but also facilitated a focused and targeted approach, ensuring that the participants gained precisely the skills and knowledge required.

Furthermore, the strategic decision to conduct follow-up training upon the return of trainees to Kenya exemplified a proactive approach to addressing time constraints. While the initial duration in Japan might not have allowed for the completion of all desired courses, the post-return training sessions ensured that participants could consolidate their learning and finalize any outstanding components. This pragmatic approach not only demonstrated flexibility but also contributed to the overall efficiency of the capacity-building initiative.

In essence, the success of the programme was not only attributed to the initial planning and clarity but also to the programme's adaptability in the face of unforeseen challenges. The combination of well-defined objectives, a flexible hybrid instruction model during the pandemic, and post-return follow-up training collectively contributed to an efficient and impactful implementation of the capacity-building programme.

With regards to efficiency, the financial resources can be accounted for but there is a concern that the capacity building seems to have come at a high cost, although the programme was delivered at USD 1 million less than estimated in the ProDoc and the resources were stretched over 3.5 years as opposed to the original 2.5 years plan. Therefore the efficiency criterion achieves a score of Satisfactory (5).

3.6 Sustainability

There are two aspects to the sustainability criterion, its environmental credentials (which are clear in this case being the promotion of renewable energy) and the continuation of the benefits after the assistance with the probability of continued long-term resilience to the rise of benefit flow over time. For the latter, interviewees were asked whether the benefits seen would continue to be ensured in the short, medium or long-term.

The sustainability of the programme is evident through the capacity developed in beneficiary staff and the establishment of IoT at the six geothermal stations. The government, specifically the Kenyan Ministry of Energy and Petroleum (MoEP), has committed to ongoing support for the continuous improvement of these stations. Additionally, there is a training institute supported by the government through KenGen, which could build capacity for other participating institutions as the trained staff take on educational roles. This suggests a high level of sustainability as KenGen has committed to make sure these efforts persist.

The sustainability of the capacity building programme is firmly anchored in the creation of a core team of extensively trained personnel within KenGen. This cadre of professionals, having acquired advanced skills and expertise, will assume roles as Trainers of Trainers. Not only are they entrusted with the responsibility of cascading their knowledge to fellow staff members but also trainees from outside. This method not only secures the long-term impact of the capacity building programme but also positions KenGen as a leader in maintaining and advancing industry standards in geothermal power generation.

There was also a reasonably rigorous procedure for monitoring at KenGen and an appreciation of evaluation points which tended to reside at individual staff level. What is needed to underpin this is a more formal procedure for taking learnings and disseminate these across the institution.

Although the IoT part of the programme is not being evaluated directly, there are some sustainability aspects which point to the good results in the overall evaluation. The IoT software has an ability to manage technical risks into the future and it has an excellent reporting function that that will be continually utilised by KenGen. However, not all of the wellheads are connected to the IoT system (14 – 15 yet to be), so this needs to be done in order to have the programme benefits sustained across all geothermal sites.

From responses to interviews, the programme has achieved a good level of sustainability to carry results into the future. In the medium to long-term, geothermal development in Kenya looks set to be sustained particularly because the country is the leading developer in Africa and has a global ranking. But for other African countries, the expertise is still at a rudimentary level but is improving, therefore the UNIDO training and capacity building activities undertaken have been essential in working for sustainability. For those spearheading geothermal power in the participating African countries, having the knowledge on how to identify, monitor and mitigate environmental and social impacts during geothermal project development is very important in project sustainability.

In terms of the trainings the programme enhanced beneficiaries’ technical capacity and professional competence in the field of geothermal exploration. They were exposed to modern techniques and technology and had the benefit of being a hands-on training, which will tend to have a deeper and longer-lasting impact. The participants developed networks and linkages with KenGen staff which can be essential for future collaboration. Future attachments and secondments can be arranged. Some of the participants involved are policy makers so they can influence supportive policy direction for geothermal exploration and development.

Table 12 gives the replies from the beneficiaries of the two capacity building events (trip to Japan and trainings in Kenya) and shows that although internal monitoring was done at a rudimentary level, this generally consisted of feedback so that colleagues would be aware of the activities.

Table 12: Feedback on monitoring and evaluation by participants

Country	Institution	M&E done
Kenya	MITI	Japanese trip was evaluated giving feedback within the Department of Industry.
Djibouti	ODDEG	Monitoring report to Supervisor for the truthful involvement in the trainings and presentation made back to colleagues on Japanese trip.
Ethiopia	MoMP	Presentation made to the Directorate after return from trainings. Videos taken of some of the sessions and shared internally.
Rwanda	Mol	No M&E was reported.
Tanzania	TGDC	Training report written by participants describing the programme lessons learned, challenges and mitigations and conclusions and recommendations.
Uganda	MEMD	Technical report written to Ministry detailing what was gained at training programme and recommendations to be acted on by managers to accelerate geothermal exploration and development in Uganda.

A clear and well-defined roadmap for sustainability, complete with allocated budgets is integral to maintaining the programme's impact and ensuring the enduring success of capacity-building initiatives.

More exposure of these types of training should be done for more staff to improve sustainability. This was discussed during the PSC meetings, that Japanese assistance should continue to be channelled through KenGen and that scaling-up is required. In the meantime it is understood that KenGen is already engaged in geothermal development in Ethiopia as a result of the visit to Japan and interactions during the trainings in Kenya and this points to continuity that the programme has been able to foster.

It is evaluated that there has been a good degree of sustainability built into the intervention, particularly for Kenya and KenGen as an institution. There is a concern that the level of expertise is still at a rudimentary level in the other targeted countries but the programme has at least started the journey towards sustainable development of geothermal along the Rift valley. Therefore the score for Sustainability is Satisfactory (5).

3.7 Coherence

This criterion measures the compatibility of the intervention with other initiatives in the respective sector/s and tries to capture project linkages, systems thinking and partnership dynamics. This was assessed through the interviews with questions on the extent to which other interventions and policies support or undermine the programme and vice-versa at global, country, sector or institutional level.

Firstly, because of the high profile of the announcement made at TICAD VI in Kenya in 2016 and the subsequent Japanese support, it was important to see that the Kenyan counterparts (KenGen and government bodies) have been receptive to the Japanese counterparts (donor and Japanese companies). In the various meetings with KenGen and other Kenyan stakeholders it was clear that there has been good co-ordination between the main recipient of programme benefits (i.e. KenGen) and JICA in-country and that relationship will continue to flourish in the future.

There was evidence of similar good co-ordination between KenGen and the Japanese technology providers such as West Japan Engineering Consultants (WJEC), Kyushu Electric Power and Yokogawa. It is good to see that WJEC is also active in Ethiopia, Rwanda and Tanzania. There was co-ordination with many other Japanese institutions; specifically on the topics of technology, know-how and business models, a series of interviews were conducted with geothermal experts including Kyushu University, Japan Geothermal Association, Geo-Heat Promotion Association of Japan, JOGMEC and the National Agriculture and Food Research Organization.

UNIDO initiated a partnership with AfDB whereby both organizations recognized that synergy exists in cooperation towards enhanced clean energy access in African region especially through market expansion and mobilization of private sector financing in geothermal industry. A study report on PPP resulted from this liaison which elaborated on tangible options and windows of opportunities for attracting private sector finance and for promoting non-sovereign projects in the field of geothermal industry in Africa.

Within Kenya, the installed geothermal capacity is expected to be 891.8 MW by the end of 2023 placing it well within the top ten producers in the world. Kenya has a strong policy context for this source of power as has been covered in the section on relevance so by making the country the centre of the programme and hosting the training for other countries made good sense and contributed to its success.

For coherence between each participating country's policies and initiatives in the geothermal sector, the following Table 13 gives a synopsis of how the programme harmonised with the relevant areas of Africa. Extensive study was made on this aspect in the two Deloitte Reports (Chapter 3 – Baseline Review) which describes in detail the energy and electricity capacity and generation trends, geothermal potential, development status, and status of the current policies, regulations and institutional framework.

Table 13: Summary of electricity and geothermal prospects

Country	Peak Demand	Geothermal Power	Geothermal Resource	Policy and Regulation
Kenya	1,926 MW in 2020 (93.5% from renewables)	863 MW, (30%)	7,000 MW to 10,000 MW	Kenya has a comprehensive policy framework for geothermal development, such as a clear plan, FiT (Feed-in Tariff) policy, tax and other financial incentives for geothermal power plant.
Ethiopia	2,491 MW in 2018 (98% from renewables mainly hydropower)	7.3 MW (1,900 MW planned)	Over 10,000 MW	Ethiopia has a clear geothermal development target, but no fiscal incentives for geothermal developers. In term of regulation, Ethiopia has a geothermal law, namely Geothermal Resources Development Proclamation which regulates definition of geothermal, ownership, exploration license and authority, and royalty.
Rwanda	155 MW in 2020 (57% from renewables)	0 MW (four potential geothermal prospects)	170 MW to 300 MW	Rwanda currently has no clear geothermal development plan and fiscal incentives for geothermal. In term of regulation, it has no clear regulation to regulate geothermal ownership, exploration license procedure and authority, and royalty.
Uganda	600 MW in 2018 (98% from renewables mainly hydropower)	0 MW (three potential geothermal prospects)	1,500 MW	Uganda has a clear geothermal development target and FiT policy, but has no tax and other financial incentives for geothermal developers. Uganda has no clear regulation for geothermal ownership, geothermal exploration license procedure and authority, and royalty.
Djibouti	130 MW in 2019 (100% renewables by 2035 - solar & wind)	0 MW (50 MW planned)	1,000 MW	Djibouti has a clear target for geothermal development, but has no fiscal incentives for geothermal developers. In terms of regulation, Djibouti doesn't have clear laws to regulate geothermal exploration, but has decree for the creation and management of geothermal development projects.
Tanzania	1,120 MW in 2019 (33% from renewables mainly hydropower)	0 MW (200 MW target by 2025)	5,000 MW	Tanzania has a clear geothermal development plan, tax and other financial incentives for geothermal developers. Tanzania also has FiT Policy, but not for geothermal energy. In term of regulation, Tanzania doesn't have a clear law to regulate geothermal exploration.

As can be seen in the Table 13, there is a huge potential for geothermal exploration with 28,000 MW in the 6 countries yet only 3% of this has been tapped, nearly all of it in Kenya. There is clearly a huge amount of work that needs to be done to realise this geothermal potential and most of the countries have the requisite policy and regulations to allow this to happen (although some are still in development, especially the issues surrounding PPAs). Therefore the focus on these six countries shows the coherence within the programme to country focus and as such support and good participation from the countries involved was ensured, with the exception perhaps of Rwanda.

Within Ethiopia, the MoMP felt that the programme may assist in bringing in financing for 25 prospective sites and as such a separate entity has been formed under government for development, which is a very positive step. This institution also felt that by encouraging technical and human capacity, extra expertise could be brought into the legal and policy arenas.

What is also notable in the reporting within the programme is that the clean and renewable nature of geothermal power is not missed because the development of the resource has coherence with policy in the whole renewable energy arena. As one interviewee said “the programme coordinates well with other geothermal / renewable energy work as we work a clean energy transition for all.” As such an annual conference and expo called Renewable Energy Conference and Expo has been organised in which geothermal is actively involved.

It was proposed in the ProDoc that UNIDO could synergize the activity in Tanzania, Uganda and Rwanda through the East African Centre for Renewable Energy and Energy Efficiency (EACREEE) which was established with technical assistance from UNIDO. The Centre would be well placed to facilitate South-South and North-South knowledge and technology transfer, but in the end it is not reported that this partnership was used. Instead, the trip to Japan in July 2023 was used to forge North-South partnerships through a geothermal business matching event organized for partner-matchmaking between African and Japanese organizations wherein several potential business partnerships could be established between the 12 organizations attending from Africa and the 7 Japanese companies attending.

Finally, it is important to note that UNIDO’s team helped ensure complementarity, harmonisation and co-ordination through having a regional office in Nairobi, Kenya headed by a UNIDO Representative and a number of technical officers who focus on the implementation of similar on-going country programmes. This set up allowed the programme to benefit from some of the administrative structures established for other UNIDO projects. UNIDO was also able to draw from its extensive experience from a large portfolio on the climate change mitigation focal area. The programme was found to be in line with other renewable energy projects in the past and on-going in various countries including within the targeted African countries.

It is clear that the intervention has a high degree of compatibility with other initiatives in the geothermal/renewable energy sector which is demonstrated in coherence across the participating countries, particularly in Kenya. Partnerships were developed within Japan and UNIDO was also able to leverage in the AfDB for a PPP Study. Therefore the Coherence criterion scores Highly Satisfactory (6).

3.8 Gender Mainstreaming

UNIDO evaluations ensure that the evaluation complies with policies on gender equality, the empowerment of women and gender parity with such questions as:

- Were gender issues identified in the design stage and were gender dimensions integrated into the project?
- Was gender equality reflected in the objective/s and to what extent are the output/outcome indicators gender disaggregated?
- Did project monitoring and assessment collect and analyse gender disaggregated data?
- How gender balanced was the composition of the PMU, the Steering Committee, experts and consultants and beneficiaries?

The evaluation ascertains the extent to which the intervention has contributed to better gender equality and parity and whether it has empowered women.

The capacity-building programme demonstrated a commendable commitment to gender balance. A concerted effort was made to ensure inclusivity to the selection of trainers, where deliberate steps were taken to maintain a gender balance among those imparting knowledge. Moreover, the programme was dedicated to addressing gender-specific concerns related to safety procedures. Recognizing the unique needs and perspectives of women, safety protocols were thoughtfully designed and implemented to create a secure and supportive learning environment.

Those who attended the trainings both in Japan and Kenya felt that there had been efforts to integrate gender issues and that there was reasonable representation of women albeit not uniform across the trainings. For example within the geo-science topic, only one of the trainees was a woman and only one woman attended from Ethiopia. Within the environmental topics there was a high degree of involvement from women but not enough in the drilling discipline. It was also observed of the KenGen trainers that only 2 out of 30 were women.

During the Kenyan trainings, there were site visits made within the Olkaria geothermal plants complex, and no prior information was given by KenGen that a certain dress requirement would be required by women, i.e. that a long dress and high heels might interfere with the PPE. Ultimately this is simply about preparedness by trainers and good communication that includes all from whichever gender or culture.

Of course the goal should always be a 50/50 gender balance, and one comment was made that women are often more skilled to reach out and share information with their colleagues after trainings, but it was seen that UNIDO made efforts to encourage women forward in this programme. The Programme Document was written with a strong emphasis on gender equality and empowerment of women (GEEW) but the Completion Report did not have a specific chapter on this aspect and only listed the following trainings with male and female representation (Table 14) which overall shows an overall percentage of 30% (100/335).

Table 14: Deliverables as per the Completion Report showing women’s participation in events

Deliverables as per Programme LogFrame	Observed deliverables as per programme indicator
Outcome 1	
1.2: Training activities conducted	<ul style="list-style-type: none"> 1 local capacity building training (IoT Project) and 2 international trainings (Capacity Building in Kenya, Capacity Building in Japan) 99 experts (75 men, 24 women) trained (IoT Project) 25 experts (19 men, 6 women) trained (Capacity Building in Kenya) 22 experts (15 men, 7 women) trained (Capacity Building in Japan) 2 training courses provided for local O&M (Yokogawa technology and Honeywell technology for IoT Project) 1 company trained (IoT Project) 4 organizations trained (Capacity Building in Kenya) 11 organizations trained (Capacity Building in Japan)
Outcome 2	
Favourable market conditions for geothermal energy investment strengthened in targeted countries	<ul style="list-style-type: none"> 22 experts (15 men, 7 women) trained (Geothermal PPP Workshop in conjunction with Capacity Building in Japan) 2 policy recommendations made (IoT project, Geothermal PPP Study) Several business partnerships to be established potentially between Africa’s 12 organizations and Japan’s 7 organizations (Geothermal business matching event)
2.3: Policy recommendations and knowledge management with key stakeholders on best practice and available technologies and services	<ul style="list-style-type: none"> 2 policy recommendations made (IoT project, Geothermal PPP Study) 7 events organized to raise awareness about IoT solutions in Kenya (111 men, 56 women; IoT Project) 7 promotional materials created and 1 promotional event organized

The analysis within Output 2.3 showing 7 events were not in fact organized only for the IoT sub-project, the events were for the inception, inauguration, site visits and PSC meetings which were associated with the whole programme.

In addition to the tabulated figures there were other activities that were tracked for women’s attendance which are summarised in the Table 15 below. The calculation of these extra events means that the overall gender balance in the programme is actually about 28% (123/445).

Table 15: Number of women attending extra events associated with the programme

Event	Date	Male		Female		Total
		No.	%	No.	%	
Inauguration ceremony (Kenya)	12 May 2023	31	76%	10	24%	41
Capacity building in Japan	July 2023	15	68%	7	22%	22
PPP Workshop (Japan)	18 July 2023	41	87%	6	13%	47
	TOTAL	87	79%	23	21%	110

It would have been better for the programme to strive to have a women’s representation figure closer to the ideal 50% although it is recognised that the average number of female staff in the participating organisations, as shown in the Table 16 below, is about the same as achieved in the programme at 33%.

Table 16: Number of women in participating organizations gained from interviews

Country	Institution	Perc. of female staff	Notes
Kenya	KenGen @ Olkaria	20%	KenGen target is 25-30%
Djibouti	ODDEG	35%	
Ethiopia	MoMP	30%	25% attended Japan trip
Rwanda	Ministry of Infrastructure	Unknown	25% attended Japan trip
Tanzania	TGDC	50%	
Uganda	MEMD	Estimated 30% ⁸	The 4 last top executives have been women (since 2011)

Even though the ideal 50/50 gender balance was not achieved in the capacity building programme, it is understood this is difficult to achieve in the energy sector. Meanwhile the ProDoc had a strong emphasis on GEEW and there is a strong culture of women's involvement within KenGen and the other participating institutions, so the Gender Mainstreaming scores Satisfactory (5).

3.9 Monitoring and Evaluation

The monitoring and evaluation of the intervention refers to the indicators made in the LogFrame (its design) and the tools used by the UNIDO project team to measure whether a project has been implemented according to the plan (monitoring) and whether it is having the desired results (evaluation). This process should be happening externally to any formal independent evaluations such as the MTR or this TE. It includes the LogFrame, baseline reports, periodic reports, minutes of meetings and documentation of activities.

Within the ProDoc, there is a comprehensive attention to what is required in monitoring of the programme according to UNIDO standard procedures. It commits to a short report every six months on the progress and expected results against and the work plan, the monitoring plan and the Logical Framework, but this changes to every three months in the monitoring plan table (page 35), and these short reports are not apparent, so it is unsure if they were made for the overall programme (they may have been submitted for the IoT element).

This lack of continuous progress reporting is a weakness and may be a result of the poorly defined performance indicators defined in the LogFrame in the first place. Further, it means that the following issues were not given enough attention:

- lessons-learned for potential new geothermal power market creation, environmental impact, and overall socio-economic improvement such as increased energy access and productivity;
- achievement of the new business development activities directly and indirectly such as business model promoted, new jobs created etc.;
- level of awareness and technical capacity built from the demonstrated technology within the African institutions and within their relevant private sector players.

A review of the documentation made available shows that a reasonable amount of other reporting was done with a good capture of information in the Completion Report. What is also evident is that some continuous monitoring is captured (as Outcome 3) in the APRs (2020 – 2022) but there does not seem to be any written comprehensive assessment as the

⁸ https://www.energia.org/assets/2021/02/Country-brief-Uganda_Nov2020_final.pdf (Page 9)

programme progressed even though each APR report that ‘analysis of performance indicators will be conducted to feed into project management unit and Annual Project Review / regularly’. What would be expected is the tracking of outputs against the LogFrame and assessment of whether the programme was being delivered directly against the targets. This is necessary to highlight insufficiencies or challenges and to come up with a plan to address any challenges faced at that time. The COVID-19 pandemic is one important example which is only mentioned once (in APR 2021) due to the restrictions it posed to travel not to the delivery of the programme overall.

Finally it was found that the lack of empowerment at the UNIDO field office level hindered regular monitoring and real-time participation in programme activities. A more decentralized approach, with enhanced involvement of the local national coordination, would have facilitated quicker response times to challenges and a more nuanced understanding of the local context. This challenge underscores the importance of fostering a collaborative and inclusive approach to project management, ensuring that field offices are not only geographically closer but actively engaged in decision-making processes, thereby optimizing the overall effectiveness of the programme.

Because of the APRs not including evaluation points against monitoring done, especially for analysis of how delays occurred during the start-up and during the COVID period and the basic M&E carried out by the participating institutions, the score for this criterion would be Moderately Satisfactory (4).

3.10 Results Based Management

The definition of this evaluation criterion is an assessment of issues relating to results-based planning of the work, the M&E and reporting back, which would usually, but not exclusively, fall into UNIDO’s responsibility. Results-Based Management (RBM) is sometimes called Management by Objectives (MBO) and the tool used is the LogFrame which guides the planning, implementation and evaluation of an intervention, using the principles of objectives, indicators, baselines, targets and sources of verification as well as risks and assumptions.

The LogFrame was assessed together with the Completion Report, which lists how the activities were reported on and checked against results expected. The other formal tool to manage results is the Annual Progress Reports, which have also been reviewed, although they are found to be too brief.

The first issue to note is that at the beginning of the programme there was a 2 year gap between UNIDO approval (April 2017) and kick-off (April 2019); then a further year to March 2020 for approvals from the Kenyan government, by which time the COVID-19 pandemic was restricting movement. This of course required extensions to be requested from the Government of Japan, but the factors involved were not fully analysed within the suite of documents provided to the evaluators. This does not mean that the issues were ignored, they were most likely to have been discussed between UNIDO HQ and the FO, but there is not a sufficient formal tracking of the factors that caused delay.

Also there is not enough cross-referencing of delays and other challenges faced to the risk analysis provided in the ProDoc (even though this did not look at enough implementation risk) or to the list of assumptions noted in the LogFrame, nor is there a proper evaluation of how those risks manifested themselves within the period of programme delivery and how lessons learned from managing them could be applied in the future.

The LogFrame was used to track results and reported on clearly in the Completion Report, however, due to the cross-cutting nature of many of the outputs in the LogFrame, this reporting was not specific enough with regards to whether the indicators had been met. There is also no evidence of UNIDO cross-referencing result tracking with the African country stakeholders, with the exception perhaps of KenGen. UNIDO consistently pointed to the range of reports as evidence of the targets being meant but this resulted in too generic reporting of results which were not quantifiable against the plan, with the exception of counting the number of people that benefited from the training and other events.

Although the Completion Report mentions three demonstration projects were developed and implemented according to the Table 17 below, it is not correct to include the two capacity building programmes as ‘demonstration’. According to the LogFrame ‘geothermal technology should be demonstrated through design and implementation’ as one output with a separate output on ‘training activities’. More relevant to demonstration is the Wellhead Study done at the start of the programme, but this only covered Kenya and Ethiopia.

Table 17: Demonstration projects claimed in UNIDO’s reporting

Year	Country	Title of the project	Vendor	Reference
2019 to 2022	Kenya	Strengthening capacity for operations and maintenance with Internet of Things technologies for Olkaria geothermal power station complex in Kenya (“IoT Project”)	Yokogawa and Honeywell	Attachment 5_End of Project Report for IoT
2022 to 2023	Djibouti, Ethiopia, Rwanda, Tanzania, Uganda	Capacity building programme, targeting geoscientists, engineers and environmental experts in geothermal development from Djibouti, Ethiopia, Rwanda, Tanzania and Uganda (“Capacity Building in Kenya”)	KenGen	Attachment 6_Capacity Building Report
2023	Djibouti, Ethiopia, Kenya, Rwanda, Tanzania, Uganda	Capacity building programme, targeting policy makers from Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda (“Capacity Building in Japan”)	WJEC	Attachment 7_WJEC Final Report

An explanation for this discrepancy between ‘demonstration’ and ‘capacity building’ has been provided by the UNIDO PM, wherein numbers of "demo projects" is an indicator to track the progress of Output 1.1 but it is also an indicator to track the overall development goal of *"To promote geothermal power generation and its related technologies in African countries through demonstration projects, capacity building, and business models for replication."* UNIDO therefore took a flexible approach in the definition of demonstration project considering the nature of the logical framework which is inherently cross cutting. For example, the technology focused activities (e.g. the IoT project) had capacity building elements and the capacity building activities also included technology demonstration elements.

This programme was assessed within the FY 2021 UNIDO audit of projects in the report ‘PBC.38_03_E_Report of the External Auditor on the accounts of the United Nations Industrial Development Organization for the financial year 1 January to 31 December 2021_2201843E’ which included an audit on Financials, Performance and IT & Innovation. The report made specific reference to this programme firstly on budget, noting that budget amounts

represented 'rough estimates without detailed calculations or documented assumptions, for example estimated costs of experts do not include information about the required number, duration of their engagement, range of monthly fee and additional related costs'. Secondly, on project implementation, the MTR was conducted at a time which did not allow for timely correction of PMs actions and may have impaired the value of this evaluation.

For the TE on the IoT part, this was performed before the end when there were no results to be assessed. Because TEs are often performed too early, while it is possible to assess the achievement of outputs, the longer term impacts are missed because these take time to become evident. As seen in this programme (and other projects), UNIDO currently does not have sufficient appropriate mechanisms for long-term impact assessment, so it is difficult to assess real benefits, support a learning loop and drive the sustainability of project/programme results. This means that important lessons learned that would be relevant for future projects could be lost. The timely conduct of Mid Term Reviews and Terminal Evaluations as well as longer term assessments is therefore required.

The audit also noticed that Field Offices (FOs) do not always perform functions as stipulated in the Technical Cooperation ToRs on a constant basis. Even though FOs are supposed to be involved in the full cycle of project delivery, in practice local staff are mostly involved in the project planning stage, and their involvement in project delivery is limited to communication with local governments and partners, formal participation in PSCs and project site visits. This was found to be true for this programme in that the UNIDO Kenya staff were quite dependent on HQ in programme delivery and should have been given more specific assigned roles and responsibilities within implementation.

The management of results generally ends up in the domain of UNIDO which can be burdened by the amount of reporting against planned results, whereas all stakeholders have a responsibility to contribute to RBM. As described above, this seems to have been the case in this programme and in addition the RBM was not deep enough in analysis of risk, using the assumptions in the LogFrame. Therefore, the assessment of RBM is evaluated as Moderately Satisfactory (4).

3.11 Partners' Performance

This section assesses the contribution of partners to a project design, implementation, monitoring, reporting, supervision, backstopping and evaluation and concentrates on UNIDO, the National Counterparts and the Donor.

UNIDO

The feedback from the evaluation has been overwhelmingly positive for UNIDO staff's management of the programme, both from HQ and the Kenyan Field Office. The UNIDO inputs were highly regarded, noted as cooperative and proactive, with good coordination and support to beneficiaries of the trainings. The following are highlights from the findings:

- UNIDO staff attended and helped co-ordinate the Japanese trip and gave guidance where it was required from the African participants.
- UNIDO Kenya and HQ staff attended the trainings and led in the on-line sessions, e.g. for the drilling component held in September/October 2023.
- UNIDO were helpful in resolving any in-country issues, particularly for local travel.
- However, one criticism is that the certificates for the training took a lot of effort to be issued through KenGen (sometime being re-issued), needing follow up with UNIDO.

- For KenGen, UNIDO were available to help facilitate the technical input from Japanese sub-contractors and the Japanese Embassy. KenGen staff have also been working closely with a representative at JICA and will continue to in the near term to fully integrate the IoT sub-project.

National Counterparts

UNIDO has good relationships with the Kenyan stakeholders and continuously collaborated and engaged the main national counterparts to implement the targeted objectives:

- **KenGen** - the overall effectiveness of the programme can be attributed to the seamless coordination of key stakeholders, with KenGen playing a pivotal role. The programme was executed with a high degree of efficiency, owing in large part to KenGen's good management and operational practices. KenGen, despite being majority-owned and heavily regulated by the Government of Kenya through the Ministry of Energy and Petroleum and the National Treasury, demonstrated a remarkable ability to operate with the agility of a private company.
- **Ministry of Industry, Trade and Investment (MITI)** – The State Department for Industry was a key stakeholder and provided UNIDO with a Liaison Officer. This officer has dealt with 3 or 4 UNIDO projects so is well-appraised of a range of UNIDO initiatives, not just in the energy sector. MITI served as co-chair on the PSC and meetings were attended by MITI's Industrial Secretary (a senior role) and two separate Principal Secretaries. Although this may not have been perfect for continuity, and also the original Industrial Secretary, retired during the programme, he did hand over full responsibility to the new Secretary. MITI staff attended the Japanese trip and witnessed the usefulness to all participating countries. The Liaison Officer also attended the official launch of the KenGen trainings in Olkaria.
- **Ministry of Energy and Petroleum (MoEP)** – The Directorate involved in the programme has about 30 technical staff and has capacity within the geothermal sector, as well as in the coal and nuclear areas (for their geo-exploration). The MoEP was a member of the PSC and the Principal Secretary acted as co-chair with MITI, and the representatives kept themselves well-appraised of the activities of the programme.
- **Ministry of Information, Communications and Technology (MoICT)** – Since October 2022 this Ministry's name has been changed to the Ministry of Information, Communications and the Digital Economy (MICDE), but at the time of the PSC meetings it still had responsibility for formulating, administering, managing and developing the policies around information, broadcasting and communication policy with a vision of making Kenya a competitive knowledge-based economy and mission to facilitate universal access to ICT infrastructure and services all over the country.
- **The National Treasury** – Unfortunately the planned interviews with Treasury representatives could not be scheduled in time for this TE, but it was ascertained from interviews with other stakeholders that their representatives had sufficient engagement with the programme but caused delay at the beginning of the project due to some procedural intricacies within government bureaucracy, i.e. the approving of the financials and then having management over the programme budget.

One of the most important project management tools is the PSC, which consisted of high-level representatives from the relevant ministries (at the time, MoITED, MoEP and MoICT) and exhibited a sufficient level of engagement, conducting two visits to the Olkaria geothermal sites. On average the PSC had meetings every half-year (although and these were held on-line because of COVID-19 restrictions in 2020 – 2021), but more recently the PSC has met more often as restrictions reduced. In the face of various challenges, the committee demonstrated effectiveness by promptly identifying and addressing emerging

issues. The responsive nature of the PSC was particularly commendable, as they took swift and decisive actions to resolve obstacles encountered during the inception phase. The role of government support from MITI and MoEP was crucial in emphasizing that robust backing, including official endorsements and letters of support, played a pivotal role in initiating and sustaining the programme from the outset. The collaborative nature of the PSC underscored the seamless coordination that contributed significantly to the overall success of the programme, ensuring it was resilient and well-supported.

However, there was a view expressed that although the PSC members were fully engaged, the frequency of meetings was insufficient, and that the PSC should have convened more regularly to enhance coordination and effectiveness. The Completion Report mentions that there were only three PSC meetings held (one every year), in November 2020, June 2021 and April 2022, with none scheduled in 2023 despite all of the capacity building activities taking place in that year. It would be expected that an 'End of Project' PSC meeting is held just before the programme closed at the end of December 2023, but in fact this took place on 28 April 2022. Also, the delegation of responsibilities by core members to other staff members within their offices occasionally impeded the smooth continuity of tasks.

Funding partner

The funding partner was officially the Japanese Government (Ministry of Economy, Trade and Industry), the implementation was in collaboration with the Japan International Cooperation Agency (JICA). JICA has a strong presence in Kenya and there was good coordination between JICA and KenGen. At least 5 Japanese experts joined the PSC meetings and programme events, from the Operations Office and Energy and Mining Group as well as two Kenyans representing JICA in the energy sector.

During PSC meetings and other events in Kenya, UNIDO had contracted representatives from the partner companies, namely Yokogawa Electric Corporation, Kyushu Electric Power Company and West Japan Engineering Consultants. Their participation by joining on-line gave good support to the programme, particularly for the demonstration project part.

Overall the partners performance and their contributions into the project are rated as Satisfactory (5).

3.12 Environmental & Social Safeguards

For assessment of these points, reference has been made to the comprehensive report by GIBB International in June 2022 '*Environmental and Social Impact Assessment (ESIA) for The Strengthening Capacity for Operation and Maintenance with Internet of Things (IoT) Technologies for Olkaria Geothermal Power Station Complex in Kenya*' (attachment 18 in the End of Project Report for IoT). This answers to UNIDO's commitment to environmental and social sustainability as enshrined in the Environmental and Social Safeguards Policy and Procedures (ESSPP) as well as in Kenya's legal requirement of section 58 of the Environmental Management and Coordination Act (EMCA). The report only considers the KenGen IoT technologies for the Olkaria plant complex because it falls in the category of medium risk projects (telecommunication infrastructure) for which EIA should be undertaken by NEMA (National Environment Management Authority) licensed expert(s).

The detailed document describes the scope (IoT installations around the site and the route of proposed fibre-optic cables), the works required, site that may be environmentally

affected, the environmental and social baseline, public consultations had and list of impacts and their mitigation. It concludes that the IoT project will have positive impacts that significantly outweigh the negative impacts, enhancing KenGen’s O&M capabilities through knowledge transfer as well as increasing the reliability of geothermal power supply in Kenya.

In addition, UNIDO did its own ESSPP assessment as described in ‘Attachment 16_UNIDO ESIA screening’ which is a thorough document and signed off by the Chief of Climate Technology and Innovations on 19 July 2019, and from which the requirement for the GIBB report originated.

Given the comprehensive and detailed work within UNIDO’s ESSPP and the subsequent ESIA, the Environmental and Social Safeguards element is rated Highly Satisfactory (6).

Project Ratings

#	Evaluation Criteria	Mandatory rating	Rating
A	Progress to impact	Yes	5 – Satisfactory
B	Project design	Yes	4 – Moderately Satisfactory
1	Overall design	Yes	4 – Moderately Satisfactory
2	Logframe	Yes	4 – Moderately Satisfactory
C	Project performance		
1	Relevance	Yes	5 – Satisfactory
2	Effectiveness	Yes	6 – Highly Satisfactory
3	Coherence	Yes	6 – Highly Satisfactory
4	Efficiency	Yes	5 – Satisfactory
5	Sustainability of benefits	Yes	5 – Satisfactory
6	Progress toward impact	No	5 – Satisfactory
D	Cross-cutting performance criteria		
1	Gender mainstreaming	Yes	5- Satisfactory
2	M&E: M&E design M&E implementation	Yes Yes	4 – Moderately Satisfactory
3	Results-based Management (RBM)	Yes	4 – Moderately Satisfactory
E	Performance of partners		
1	UNIDO	Yes	5 – Satisfactory
2	National counterparts	Yes	5 – Satisfactory
3	Donor	Yes	5 – Satisfactory
F	Overall assessment	Yes	5 – Satisfactory

4. Conclusions, Recommendations and Lessons Learned

4.1 Conclusions

Overall, the programme is regarded as a success and is leaving a good legacy through the conduct of well-received trainings, although with a relatively low number of beneficiaries. From the discussions held with interviewees from UNIDO, KenGen, Kenyan partner agencies and all participating counties, the following is a summary of the main findings:

- The geothermal programme is highly relevant to Kenya and shows good institutional coherence with the five other African countries; the synergies are clear with the government departments responsible and policies in each country, although in Djibouti, Rwanda and Tanzania the laws and regulations are not yet in place for geothermal ownership, exploration and license procedures.
- The participation of Japan as leader on the technology in the programme was highly respected and gave the participating African countries the chance to directly experience how the focussed technical culture in Japan achieves results in this renewable energy field.
- The capacity building has been well received (generally training will always solicit positive response) and been generally successful although there are some important lessons learned from the trainings, both in Kenya and Japan.
- The programme, like many other UNIDO initiatives, started late and was slow to pick up momentum, became delayed and therefore required extensions, then most of the work was actually completed in the last two years. This is a common finding in UNIDO renewable energy projects/programmes and cannot be blamed purely on external factors such as the COVID-19 pandemic.
- This particular programme arrangement (as guided by the Programme Document and LogFrame) is confusing due to the use of Outcomes/Outputs driving the activities and then later adding five Components that were not really understood by the participants.
- A concern is that participants and especially beneficiaries tend to say that there needs to be continuation of programme activities and scaling-up after the programme close and that UNIDO should lead on this. This indicates that building sustainability into the programme design is required to ensure that UNIDO can step away on completion and be confident that the benefits can be continued by local institutions into the future.

4.2 Recommendations

<p>1. There should be a continual development and roll-out of the IoT technology, which has allowed better collection of data and made operations much easier with the system enabling predictive maintenance. The IoT can help with KenGen’s internal Enterprise Resource Plan and the system can be integrated into relevant staff daily work plans. KenGen have budgeted for this, but there is a need for software service providers to understand that the purchasing model of KenGen is different to that under the UNIDO project, which paid for the technology upfront. Although it is known that all the Olkaria data can be contained in one platform, KenGen now needs to learn how to fully analyse the data particularly to do the predictive maintenance.</p>	<p><u>Fully accepted.</u></p> <p>UNIDO will maintain a close monitoring of the ongoing implementation of the capacity development program by JICA. This program focuses on training KenGen staff in utilizing the installed IoT system for predictive maintenance.</p> <p>Based on the latest information from JICA in February 2024, the capacity-building program has been extended into 2024. UNIDO will closely monitor the implementation of the training activities at KenGen and, if necessary, intervene accordingly.</p>	<p>UNIDO</p>	<p>December 2024</p>
<p>2. The financing of renewable energy technology is always seen as the most difficult focus, therefore UNIDO should help further with identifying appropriate funding models for the exploration and engineering of geothermal sites with good potential (i.e. Ethiopia, Djibouti and Tanzania). However, before embarking on new suggested modalities for geothermal power plant investments, UNIDO can help widely disseminate the lessons learned in the context of KenGen,</p>	<p><u>Partially accepted.</u></p> <p>Under the programme a comprehensive study was done on modalities to finance the geothermal projects in the targeted countries. The study findings were disseminated among policymakers from the Eastern African region (targeted countries) at the workshop held in Tokyo in July 2023. Therefore, the mentioned policymakers are provided with the essential knowledge to identify the modalities and mechanisms required for financing the development of geothermal resources in their countries.</p> <p>As for disseminating the findings from studies conducted at KenGen, it is worth noting that all trainees from the target countries who participated in the technical training program at KenGen were provided with knowledge materials intended for sharing with a broader audience (policymakers and experts at the national level dealing with aspects related to the development of geothermal resources.).</p>	<p>UNIDO</p>	<p>December 2025</p>

	In terms of disseminating knowledge to “other participating countries”, it is not applicable as the program has encompassed all the countries located on the East African Rift, which have the intention to pursue geothermal development.		
3. The links already forged with the six countries in this programme should be further encouraged and maintained. A network for continual communication would be useful. There are already bi-lateral partnerships with KenGen emerging from the programme which may help address funding constraints (e.g. at ODDEG). The concerned Ministries of Energy in each country could also be included to maintain links with the Government of Kenya and other Kenyan geothermal institutions.	<u>Partially accepted.</u> This is subject to budgetary and time constraints. To the best of our ability, we will maintain ongoing communication with program stakeholders, ensuring that when the time comes, we can capitalize on this network. As for the cooperation between KenGen/GoK with relevant ministries from the targeted countries, this collaboration already exists, given that KenGen has been providing various services in geothermal development (geological analysis, resource exploration, etc.) to those ministries/countries.	UNIDO	December 2025
4. UNIDO should adopt more of a decentralized management structure. Empowering the field office in Kenya for local national coordination is crucial to ensuring that decision-making processes are more inclusive and responsive to the local context. This approach will foster a deeper connection with the operational locations, allowing for more effective local management, quicker responses to challenges and improved adaptability to the unique nuances of the project environment.	<u>Fully accepted.</u> We will adhere to the internal guidelines when planning activities at the country level.	UNIDO	Continuously
5. UNIDO should foster a collaborative and integrated approach which would help to break down silos between different departments/teams and will facilitate more seamless communication and information sharing. Opportunities for advocacy should also be enhanced. Improved communication channels would have ensured that information was disseminated efficiently from within the programme to external stakeholders. Additionally, enhancing advocacy and awareness creation initiatives would contribute to a broader understanding of the significance of the	<u>Partially accepted.</u> We will implement appropriate measures to facilitate information sharing with various departments within UNIDO. As for disseminating information about the program to external stakeholders, this was achieved through various channels, including training sessions, workshops, study visits, etc. The programme's promotion and the dissemination of its implementation	UNIDO	Continuously

programme, garnering support and collaboration from key stakeholders across the East African region.	results to a broader audience were accomplished through social media channels and the UNIDO website.		
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4.3 Lessons learned

Lessons learned are firstly analysed across the five targeted results, which are listed in the Introduction before considering delivery of the programme.

1. Technology demonstration

It is considered that the only demonstration part of the programme is the IoT project at KenGen’s Olkaria plant; it is not the case that three demonstration projects were developed and implemented because capacity building cannot be included as ‘demonstration’. The development of demonstration or pilot projects requires more effort (and funding) than envisaged in the programme design. The design should also foresee an initial screening for development of individual geothermal power technology demonstration projects in the other potential recipient countries which would have been assessed as not possible because they are at a much lower level of ability compared to Kenya.

2. Capacity building/knowledge management to better absorb and domestically replicate technologies

In order to build a skilled and professional personnel to drive and accelerate geothermal exploration and development, trainings always should be conducted across as wide a range of people as possible with a different mix of skills and with a 50/50 gender balance, although it is always difficult to have equal participation in the energy sector. Hands-on-training was noted as being particularly effective as well as the trainers’ approach to make participants feel comfortable and those attending being receptive to the topics.

3. Identification of viable, sustainable and suitable business models

Financing of renewable energy is always a challenging area, even for established technologies and especially those that may be new to a country, but the programme gave good guidance to assist in strengthening market conditions for scaling up investment in geothermal technology and there was sufficient study on the viable, sustainable and suitable business models that could be used to help in the investment arena. Although the programme gave exposure of the African country representatives to the public and private sector stakeholders in Japan, stronger emphasis is required on the importance of the legal and regulatory frameworks and policy interventions required in each participating country.

4. Strengthening market conditions for scaling up investment (particularly through public private partnerships)

Having participated closely in this programme, KenGen is now also able to generate additional revenue to further improve its efficiency and productivity from consultancies by delivering high-quality services and expertise in geothermal niche areas where there is a demand for consultancy services in the eastern African region. This was made possible by the pivotal role of partnership, notably, the exchange of knowledge between Japanese and Kenyan counterparts from collaborative efforts in fostering comprehensive learning experiences. For investment in other African nations, there needs to be a recognition that government led financing for exploration will need to be more prominent than from the private sector.

5. Programme Delivery

There are some lessons learned to do with programme delivery, particularly around the reasons for delay and then management of these. Firstly, at the start of the programme intervention was required from UNIDO for the ProDoc and budget signing of protocols which were lengthy and bureaucratic, and secondly; although the COVID-19 pandemic was an unexpected occurrence and definitely slowed down the programme in 2020 – 2021, such a delay had not been planned for in the risk matrix and it was not properly analysed in UNIDO's programme monitoring.

There were also challenges in programme delivery associated with UNIDO's centralized management structure between HQ and the Kenyan Field Office, which underscores the need for a more decentralized approach. There was a perception of a siloed approach observed in current UNIDO's operations in Kenya and to address this there is a pressing need for a more integrated and collaborative framework. The relative success of the programme gifted a great opportunity for UNIDO to maximise its impact through a higher degree of advocacy, communication and awareness creation but it is felt that this opportunity was lost. UNIDO should have invested in robust advocacy efforts to highlight the achievements and lessons learned from the programme.

6. Annexes

Annex 1: Evaluation Terms of Reference

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

TERMS OF REFERENCE

Independent terminal evaluation of the project:

Generating energy capacity from geothermal power generation and its related technologies for sustainable development

UNIDO Project ID: 170046

JULY 2023

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Programme background and overview

1. Programme factsheet

Programme title	Generating energy capacity from geothermal power generation and its related technologies for sustainable development
UNIDO programme No. and/or ID	170046
GEF project ID	N/A
Region	Global (with special focus on Africa)
Country(ies)	Kenya, Ethiopia, Rwanda, United Republic of Tanzania, Djibouti, Uganda
Planned implementation start date	April 2017
Planned implementation end date	September 2019
Actual implementation start date	May 2017
Actual implementation end date	December 2023
GEF Focal Areas and Operational Project (in addition, also indicate whether the project is linked to a GEF programme)	N/A
Implementing agency(ies)	United Nations Industrial Development Organization
Executing partner(s)/entity(ies)	Local governments, national institutions, agencies and state-owned companies in participating countries
Donor(s):	Government of Japan
Total programme allotment	USD 12,733,446.52
Total co-financing at design (in cash and in-kind)	N/A
Materialized co-financing at programme completion (in cash and in-kind)	N/A
Mid-term review date	The programme did not envisage a mid-term review

(Source: Programme document)⁹

2. Programme context

The Sixth Tokyo International Conference on African Development (TICAD VI) was held from 27 to 28 August 2016 in Nairobi, Kenya. Prime Minister Shinzo Abe of Japan announced during his address at the Opening Session of TICAD VI on 27 August 2016 Japan's intention to invest in energy infrastructure

⁹ Project information data throughout these TOR are to be verified during the inception phase.

projects, in particular geothermal power generation projects in African countries. Aa Note Verbale for this programme was exchanged and signed between UNIDO and the Government of Japan in Vienna on 22 November 2016 for the execution of a project assisting African countries to enhance their energy sector through Japanese geothermal power generation and its related technology.

Countries in the African continent are characterized by a rising population, urbanization, inadequate infrastructure and relatively unstable electricity supply. Africa has seen rapid economic growth this century, with a corresponding increase in demand for energy. Keeping pace with rising energy needs is at the top of the agenda for policy makers to enable economic growth and extend access to modern energy to those lacking it now. About 600 million people in Africa do not have access to electricity, and approximately 730 million people rely on traditional uses of biomass. About three quarters of people in East Africa lack access to electricity. While unstable supply of electricity challenges the sustainable industrialization in the urban setting, rural areas are heavily affected by the lack of electricity supply that severely hampers rural development. Africa's current energy needs are met through a mix of biomass and fossil fuels: biomass accounts for approximately half of Africa's total primary energy supply. Coal and natural gas account for about 14 % each, and oil approximately 22%. Hydropower represents about 1% of the total primary energy supply in Africa. The total primary energy supply of Africa has been increasing at an annual rate of about 3%, the highest among all continents.

At the same time, massive global deployment of renewable energy has led to cost reductions and performance improvements. Along with helping to meet energy needs in a cost-effective, secure and environmentally sustainable manner, renewable energy can strengthen socio-economic development. The African continent is endowed with large renewable energy potential varying in type across diverse geographic areas. Geothermal energy is a resource of considerable importance in East and Southern Africa. It is estimated that the continent has a potential of 15 GW, all of it found along the Rift Valley, which runs from Mozambique to Djibouti. Clear policy signals and an enabling framework can produce accelerated renewable energy deployment in this region.

There is a need to meet the growing demand for stable electricity and to meet the need to create reliable and accessible energy production and distribution system. In this regard, each country within the continent can meet sustainable development goals as well as allow rural socio-economic development of the region in a strategic manner. Primary focus needs to be made on developing locally available renewable energy resources by taking advantage of available technologies and services that will enhance the supply and demand equation. With the fluctuated price of fossil fuels, lack of large capacity power infrastructure and funding as well as transmission losses that can be expected from expanding grids, it is imperative that the region deploys high quality technologies and services to ensure to maximize the energy supply resources.

The uptake of renewable energy technologies and energy management for sustainable energy systems face several barriers. Among the limiting factors to the uptake of renewable energy resources is that the resource potential needs to be verified in order to attract investments into these areas. Africa has vast opportunities for improvements of energy management and renewable energy technology applications.

The Great Rift Valley in the African Continent has been identified as having large potential in geothermal power generation. It is estimated that the continent has a potential of 15 GW, all of it found along the Rift Valley. It is one of the major tectonic structures of the earth and extends for about 6,000 km from north to south being seismically and tectonically active today.

The programme “Generating energy capacity from geothermal power generation and its related technologies for sustainable development” (hereinafter referred to as - programme) focuses on the geothermal power generation and seeks to promote advanced renewable energy technologies and energy management systems to increase access to stable supply of electricity, improve operations of existing renewable energy installations while enhancing local human and institutional capacities in the African continent.

Programme implementation started in March 2017 and the initial end date was in August 2019. Actual implementation end date is December 2023.

The programme document foresees regular monitoring, and a terminal evaluation (TE).

3. Programme objective and expected outcomes

The overall objective of the programme is to promote geothermal power generation and its related technologies in African countries. It was assumed this would be achieved through demonstration projects, capacity building and knowledge management activities, identification of suitable business models and strengthening market conditions for investment in developing countries in Africa.

The following **programme components** was implemented to achieve the objectives:

Programme component 1:

“Strengthening capacity for operation and maintenance with Internet of Things technologies for Olkaria Geothermal Power Station in Kenya” was implemented. The main objective of the project was to enhance Kenya Electricity Generating Company (KenGen)’s power generating capabilities at Olkaria Geothermal Power Station through capacity strengthening of O&M using Internet of Things (IoT) technologies. The project accomplished its objectives of installing a state-of-the art data center with IoT technologies for centralization and accumulation of various geothermal data as well as organized various capacity building and knowledge management activities.

Programme component 2:

A research and analysis study with the scope of identifying technology and capacity building and outreach needs for uptake of geothermal power generation and its relevant technologies for effectively addressing challenges of climate change, energy poverty and sustainable industrialization in Africa was conducted. The targeted countries included Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda considering the existence of strong political ownership to utilize geothermal energy development. As part of the analysis, a concept note was prepared based on the study to realize a program for operationalization of capacity building and outreach activities to address the needs of the targeted countries towards further uptake of geothermal power generation and its relevant technologies.

Programme component 3:

A capacity building programme, targeting geoscientists, engineers and environmental experts in geothermal development from Djibouti, Ethiopia, Rwanda, Tanzania and Uganda, has been developed as a result of the programme component 2, and is being implemented as of the date of this ToR. The capacity building programme will be held in Kenya in two steps: in May 2023 and toward the end of this year in order to:

Improve awareness, knowledge and capacity on technical matters related to geothermal development;

Develop technical capacity and expertise in geothermal technology; and

Create networks among geothermal experts within and across the Targeted Countries.

Under the capacity building programme, three foundation courses in geoscience, geothermal engineering and environmental and social analysis will be provided to create a pool of geothermal experts in the field of geoscience, geothermal engineering and environmental and social analysis in those countries.

Programme component 4:

A capacity building programme, targeting policy makers from Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda, has been developed as a result of the programme component 2, and is being implemented as of the date of this ToR. The capacity building programme will be held in Japan in July 2023 in order to increase awareness and understanding of geothermal development for the policy makers through familiarizing with advanced practices in Japan.

Programme component 5:

A study on public and private partnership focusing on Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda is being implemented, and a workshop to showcase the result of the study and a matching event to provide Japanese public and private stakeholders with opportunities to meet with the policy makers from Djibouti, Ethiopia, Kenya, Rwanda, Tanzania and Uganda are being developed as of the date of this ToR. The workshop and the matching event will be held in July 2023 in Japan.

4. Programme implementation arrangements

The programme is managed by the Programme Coordination Committee (PCC) and Programme Management Unit (PMU).

The PCC consist of representatives from UNIDO and from the donor government and it guides the overall programme co-ordination and implementation and approves key steps and outcomes as well as annual plans and budgets. It acts as the decision-making body of the programme and it operates on the basis of consensus, and makes any necessary decisions about programme management and oversight.

The PMU is responsible for the overall operational management and implementation of the programme and of individual programme component. The PMU is led by a Senior Programme Manager responsible for overall coordination, budget, contracting and results measurement issues, and sustainability of the programme.

On top of PCC and PMU, local governmental organizations and agencies as stakeholders guided and supported programme implementation through provision of local context and expertise.

5. Budget information

Table 1. Financing plan summary

Description	Programme (in USD)	Total (in USD)
Financing (Government of Japan)	6,568,537.00	6,568,537.00

Source: Programme document

Table 2. Financing plan summary – programme component breakdown

Programme outcomes	Total (in USD)
1. Geothermal technology successfully demonstrated, deployed and transferred in the targeted countries	4,940,000.00
2. Favorable market conditions for geothermal energy investment strengthened in targeted countries	607,000.00
Programme Management	971,537.00
Monitoring and Evaluation	50,000.00
Total (in USD)	6,568,537.00

Source: Programme document

Table 3. UNIDO budget execution¹⁰ (Grant No.: 2000003662: All figures are in USD)

Items of expenditure	2017	2018	2019	2020	2021	2022	2023	Total	%/total
Staff & Intern Consultants	83,055.42	351,885.83	414,050.99	283,820.53	259,411.08	292,975.92	368,544.47	2,053,744.24	31.27%
Local travel	392.73	83,152.98	42,939.56	0.01	553.78	18,969.18	151,584.62	297,592.86	4.53%
Staff Travel	3,995.43	4,863.97	19,619.81	1,269.29	-1,377.68	7,795.41	39,192.59	75,358.82	1.15%
Nat.Consult./Staff	24,189.57	99,455.14	156,696.39	122,375.83	48,140.24	147,011.75	335,029.82	932,898.74	14.20%
Contractual Services	208,416.96	285,671.33	739,106.86	-292.54	314.42	574,350.20	986,264.80	2,793,832.03	42.53%
Train/Fellowship/Study	0.00	0.00	481.40	0.00	0.00	708.63	84,059.37	85,249.40	1.30%
International Meetings	0.00	14,580.69	4,739.75	0.00	-2,555.01		90,940.01	107,705.44	1.64%
Premises	0.00	753.86	2,422.94	0.00	0.00	9,795.48	38,528.52	51,500.80	0.78%
Equipment	0.00	0.00	1,428.53	1,767.91	1,301.32	105.69	98,654.64	103,258.09	1.57%
Other Direct Costs	557.15	4,296.16	20,551.41	7,935.21	8,821.25	18,853.97	6,381.43	67,396.58	1.03%
Grand total	320,607.26	844,659.96	1,402,037.64	416,876.24	314,609.40	1,070,566.23	2,199,180.27	6,568,537.00	100%

Source: UNIDO. ERP database as of May 2023

¹⁰ Disbursement: Expenditure, incl. commitment

Scope and purpose of the evaluation

The terminal evaluation (TE) will cover the whole duration of the programme from its starting date up to the date of the evaluation. It will assess programme performance against the evaluation criteria: relevance, effectiveness, coherence, efficiency, effectiveness, sustainability and impact.

The TE has an additional purpose of drawing lessons and developing recommendations for UNIDO, the Government, Donors, and the programme stakeholders and partners that may help improving the selection, enhancing the design and implementation of similar future programme/projects and activities in the country and on a global scale upon project completion. The TE report should include examples of good practices for other projects in the focal area, country, or region.

The TE should provide an analysis of the attainment of the programme objective and the corresponding outputs and outcomes. Through its assessments, the Evaluation Team (ET) should enable the Government, counterparts, UNIDO and other stakeholders and donors to verify prospects for development impact and sustainability, providing an analysis of the attainment of global environmental objectives, programme objectives, delivery and completion of programme outputs/activities, and outcomes/impacts based on indicators. The assessment shall include reexamination of the relevance of the objectives and other elements of programme design according to the project evaluation parameters defined in chapter III below.

The overall purpose of the TE is to assess whether the programme has achieved or is likely to achieve its main objective, i.e. to promote geothermal power generation and its related technologies in African countries and to what extent the programme has also considered sustainability and scaling-up factors for long term impact.

The evaluation has three specific objectives:

- (i) Assess the programme performance in terms of relevance, coherence, effectiveness, efficiency, sustainability and progress to impact;
- (ii) Identify key learning to feed into the design and implementation of the forthcoming programmes/projects; and
- (iii) Develop a series of findings, lessons and recommendations for enhancing the design of new and implementation of ongoing programmes/projects by UNIDO.

Evaluation approach and methodology

The TE will be conducted in accordance with the UNIDO Evaluation Policy¹¹, UNEG Norms and Standards for evaluation and the UNIDO Guidelines for the Technical Cooperation Project and Project Cycle¹².

The evaluation will be carried out as an independent in-depth evaluation using a participatory approach whereby all key parties associated with the programme will be informed and consulted throughout the evaluation. The evaluation team leader will liaise with the UNIDO Independent Evaluation Division on the conduct of the evaluation and methodological issues.

¹¹ UNIDO. (2018). Director General's Bulletin: Evaluation Policy (DGB/2018/08, dated 1 June 2018)

¹² UNIDO. (2006). Director-General's Administrative Instruction No. 17/Rev.1: Guidelines for the Technical Cooperation Programme and Project Cycle (DGAI.17/Rev.1, 24 August 2006)

In line with its objectives, the evaluation will have two main components. The first component focuses on an overall **assessment of performance** of the programme, whereas the second one focuses on the **learning** from the successful and unsuccessful practices in programme design and implementation.

The evaluation will use quantitative and qualitative methods, including an analysis of the theory of change and will collect data and information from a range of sources and informants. It will pay attention to triangulating the data and information collected before forming its assessment. This is essential to ensure an evidence-based and credible evaluation, with robust analytical underpinning.

The theory of change of the project – in case no explicit TOC exists in the project the evaluation team will re-construct it based on evidence - will be analyzed, reviewing the soundness of causal and transformational pathways from the programme outputs to outcomes and longer-term impacts, and drivers as well as barriers to achieve them. The learning from this analysis will be useful to feed into the design of the future programmes/projects so that the management team can effectively manage them based on results.

In those cases where baseline information for relevant indicators is not available, the evaluation team will aim at establishing a proxy-baseline through recall and secondary information.

Data collection methods

The ET will be required to use different methods to ensure that data gathering and analysis deliver evidence-based qualitative and quantitative information, based on diverse sources, as necessary: desk studies and literature review, statistical analysis, individual interviews, focus group meetings/discussions, surveys and, if possible, direct observation. This approach will not only enable the evaluation to assess causality through quantitative means but also to provide reasons for why certain results were achieved or not and to triangulate information for higher reliability of findings. The specific mixed methodological approach will be described in the inception report.

Following are the main instruments for data collection:

Desk and literature review of documents related to the programme, including but not limited to:

The original programme document, monitoring reports (such as progress and financial reports), mid-term review report, output reports, back-to-office mission report(s), end-of-contract report(s) and relevant correspondence

Notes from meetings of committees involved in the programme

Stakeholder consultations will be conducted through structured and semi-structured interviews and focus group discussion. Key stakeholders to be interviewed include:

UNIDO Management and staff involved in the programme; and

Representatives of donors and counterparts

Data collection from Kenya

Interviews with the relevant UNIDO Country Office(s) representative to the extent that he/she was involved in the programme, and the project's management members and the various national [and sub-regional] authorities dealing with project activities as necessary

Other interviews, surveys or document reviews as deemed necessary by the evaluation team and/or by the Independent Evaluation Division for triangulation purposes

Key evaluation questions and criteria

The evaluation team will develop interview guidelines. Field interviews can take place either in the form of focus-group discussions or one-to-one consultations.

The key evaluation questions are the following:

Relevance: Is the intervention doing the right things? To what extent do the project/programme’s objectives respond to beneficiaries, global, country, and partner/institution needs, policies, and priorities, and continue to do so if circumstances change?

Coherence: How well does the intervention fit? How compatible is the project/programme with other interventions in the country, sector or institution?

Effectiveness: Is the project/programme achieving its objectives?

Efficiency: How well are resources being used? Has the project/programme delivered results in an economic and timely manner?

Impact: What difference does the intervention make? To what extent has the project/programme generated significant positive or negative, intended or unintended, higher-level effects? Has the project/programme had transformative effects?

Sustainability: Will the benefits last? To what extent will the net benefits of the project/programme continue, or are likely to continue?

The evaluation will assess the likelihood of sustainability of the programme results after the programme completion. The assessment will identify key risks (e.g. in terms of financial, socio-political, institutional and environmental risks) and explain how these risks may affect the continuation of results after the programme ends. Table 5 below provides the key evaluation criteria to be assessed by the evaluation. The detailed questions to assess each evaluation criterion are in annex 2. The **rating criteria** and table to be used is presented in annex 7.

Table 5. Summary of Programme evaluation criteria

#	Evaluation criteria	Mandatory rating
A	Progress to Impact	Yes
B	Project design	Yes
1	Overall design	Yes
2	Project results framework/log frame	Yes
C	Project performance and progress towards results	Yes
1	Relevance	Yes
2	Coherence	Yes
3	Effectiveness	Yes
4	Efficiency	Yes
5	Sustainability of benefits	Yes
D	Gender mainstreaming	Yes
E	Project implementation management	Yes
1	Results-based management (RBM)	Yes
2	Monitoring and Evaluation, Reporting	Yes
F	Performance of partners	
1	UNIDO	Yes

2	National counterparts	Yes
3	Implementing partner (if applicable)	Yes
4	Donor	Yes
G	Environmental and Social Safeguards (ESS), Disability and Human Rights	Yes
1	Environmental Safeguards	Yes
2	Social Safeguards, Disability and Human Rights	Yes
H	Overall Assessment	Yes

These topics should be covered as applicable:

The terminal evaluation will assess the following topics, for which ***ratings are not required:***

Need for follow-up: e.g. in instances of financial mismanagement, unintended negative impacts or risks.

Materialization of co-financing: e.g. the extent to which the expected co-financing materialized, whether co-financing was administered by the project management or by some other organization; whether and how shortfall or excess in co-financing affected project results.

Environmental and Social Safeguards: appropriate environmental and social safeguards were addressed in the project’s design and implementation, e.g. preventive or mitigation measures for any foreseeable adverse effects and/or harm to environment or to any stakeholder.

Rating system

In line with the practice adopted by many development agencies, the UNIDO Independent Evaluation Unit uses a six-point rating system, where 6 is the highest score (highly satisfactory) and 1 is the lowest (highly unsatisfactory) as per the table below.

Table 6. Project rating criteria

Score	Definition
6	Highly satisfactory Level of achievement presents no shortcomings (90% - 100% achievement rate of planned expectations and targets).
5	Satisfactory Level of achievement presents minor shortcomings (70% - 89% achievement rate of planned expectations and targets).
4	Moderately satisfactory Level of achievement presents moderate shortcomings (50% - 69% achievement rate of planned expectations and targets).
3	Moderately unsatisfactory Level of achievement presents some significant shortcomings (30% - 49% achievement rate of planned expectations and targets).
2	Unsatisfactory Level of achievement presents major shortcomings (10% - 29% achievement rate of planned expectations and targets).
1	Highly unsatisfactory Level of achievement presents severe shortcomings (0% - 9% achievement rate of planned expectations and targets).

Evaluation process

The evaluation will be conducted from September 2023 to November 2023. The evaluation will be implemented in five phases, which are not strictly sequential, but in many cases iterative, conducted in parallel and partly overlapping:

Inception phase: The evaluation team will prepare the inception report providing details on the evaluation methodology and include an evaluation matrix with specific issues for the evaluation to address; the specific site visits will be determined during the inception phase, taking into consideration the findings and recommendations of the mid-term review.

Desk review and data analysis;

Interviews, survey and literature review;

Country visits (whenever possible) and debriefing to key relevant stakeholders in the field;

Data analysis, report writing and debriefing to UNIDO staff at the Headquarters; and

Final report issuance and distribution with management response sheet, and publication of the final evaluation report in UNIDO website.

Evaluation team composition

A staff from the UNIDO Independent Evaluation Division will be assigned as Evaluation Manager and will coordinate and provide evaluation backstopping to the evaluation team and ensure the quality of the evaluation. The UNIDO Project Manager and national project teams will act as resourced persons and provide support to the evaluation team and the IEU evaluation manager.

The evaluation team will be composed of one international evaluation consultant acting as the team leader and one national consultant. The evaluation team members will possess relevant strong experience and skills on evaluation and evaluation management, including social safeguards and gender. Expertise and experience in the related technical subject of the programme is desirable. The evaluation consultants will be contracted by UNIDO.

In some specific cases (e.g. complex projects, regional projects, projects at risk), an IEU evaluation officer could be also assigned to be part of the evaluation team and hence participate in the whole conduct as such.

The tasks of each team member are specified in the job descriptions in annex 3 to these terms of reference.

According to UNIDO Evaluation Policy, members of the evaluation team must not have been directly involved in the design and/or implementation of the programme under evaluation.

Time schedule and evaluation deliverables

The evaluation is scheduled to take place from September 2023 to November 2023. The evaluation field mission is tentatively planned for end of October 2023. At the end of the field mission, the evaluation team will present the preliminary findings for key relevant stakeholders involved in this project in the country. The tentative timelines are provided in the table below.

After the evaluation field mission, the evaluation team leader will arrange a virtual debriefing and presentation of the preliminary findings of the terminal evaluation with UNIDO Headquarters. The draft TE report will be submitted 4 to 6 weeks after the end of the mission. The draft TE report is to be shared with the UNIDO Project Manager (PM), UNIDO Independent Evaluation Unit, and other stakeholders for comments. The Evaluation team leader is expected to revise the draft TE report based on the comments received, edit the language and submit the final version of the TE report in accordance with UNIDO EIO/IEU standards.

Table 7. Tentative timelines

Timelines	Tasks
Mid-September 2023	Desk review and writing of inception report
End of September 2023	Online briefing with UNIDO project manager and the project team based in Vienna.
October 2023	Field visit to Kenya or other sites to be identified at Inception Stage.
End of October 2023	Debriefing in Vienna (or online/hybrid) Preparation of first draft evaluation report
November 2023	Internal peer review of the report by UNIDO’s Independent Evaluation Unit and other stakeholder comments to draft evaluation report
End of November 2023	Final evaluation report

Evaluation report format and review procedures

The draft report will be delivered to UNIDO Independent Evaluation Unit (with a suggested report outline) and circulated to UNIDO staff and key stakeholders associated with the project for factual validation and comments. Any comments or responses, or feedback on any errors of fact to the draft report will be sent to UNIDO’s Independent Evaluation Unit for collation and onward transmission to the evaluation team who will be advised of any necessary revisions. On the basis of this feedback, and taking into consideration the comments received, the evaluation team will prepare the final version of the terminal evaluation report.

The evaluation team will present its preliminary findings to the local stakeholders at the end of the field visit and take into account their feedback in preparing the evaluation report. A presentation of preliminary findings will take place at UNIDO HQ afterwards.

The evaluation report should be brief, to the point and easy to understand. It must explain the purpose of the evaluation, what was evaluated, and the methods used. The report must highlight any methodological limitations, identify key concerns and present evidence-based findings, consequent conclusions, recommendations and lessons. The report should provide information on when the evaluation took place, the places visited, who was involved and be presented in a way that makes the information accessible and comprehensible. The report should include an executive summary that encapsulates the essence of the information contained in the report to facilitate dissemination and distillation of lessons.

Findings, conclusions and recommendations should be presented in a complete, logical and balanced manner. The evaluation report shall be written in English and follow the outline given by UNIDO Independent Evaluation Unit.

Quality assurance

All UNIDO evaluations are subject to quality assessments by UNIDO Independent Evaluation Unit. Quality assurance and control is exercised in different ways throughout the evaluation process (briefing of consultants on methodology and process of UNIDO Independent Evaluation Unit, providing inputs regarding findings, lessons learned and recommendations from other UNIDO evaluations, review of inception report and evaluation report by UNIDO's Independent Evaluation Unit).

The quality of the evaluation report will be assessed and rated against the criteria set forth in the Checklist on evaluation report quality. The applied evaluation quality assessment criteria are used as a tool to provide structured feedback. UNIDO Independent Evaluation Unit should ensure that the evaluation report is useful for UNIDO in terms of organizational learning (recommendations and lessons learned) and is compliant with UNIDO's evaluation policy and these terms of reference. The draft and final evaluation report are reviewed by UNIDO Independent Evaluation Unit, which will circulate it within UNIDO together with a management response sheet.

Annex 1: Programme results framework

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
DEVELOPMENT GOAL			
To promote geothermal power generation and its related technologies in African countries through demonstration projects, capacity building, and business models for replication.	Number of demonstration projects successfully demonstrated, transferred and deployed including capacity building activities undertaken.		
OUTCOME 1			
1. Geothermal technology successfully demonstrated, deployed and transferred in the targeted countries.	Number of geothermal and its related technologies successfully transferred;	<ul style="list-style-type: none"> • Surveys of participating companies/facilities; • Baseline study; • Inception report • Feedback from key local stakeholders; • Programme progress report; • Visits to project sites. 	<ul style="list-style-type: none"> • Criteria for best practice defined and data collected for transparent and objective evaluation; • Geothermal and related technologies successfully demonstrated as best practice; • Projects under this programme maintained and completed on time; • Appropriate coordination and inputs by partners for training collected;
OUTPUT			
Output 1.1: Demonstration projects on geothermal designed and implemented for identified countries/regions.	<ul style="list-style-type: none"> • # of technology-socioeconomic needs, gender dimensions when possible and relevant, and feasibility studies conducted; • # of demonstration projects formulated; • # of demonstration projects implemented; 	<ul style="list-style-type: none"> • Feasibility study reports; • Inception Report; • Annual lessons-learned project report; 	<ul style="list-style-type: none"> • Sustained commitment of local stakeholders; • Active involvement of participating countries and institutions; • Project endorsed by the participating government;

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
Output 1.2: Training activities conducted	<ul style="list-style-type: none"> • # of international/national capacity building programmes incl. gender responsive training materials on geothermal and its related technologies conducted; • # of experts trained (with certificate) (sex-disaggregated data on participants and trainers); • # of training courses for local operation, maintenance, management and manufacturing (sex-disaggregated data on participants and trainers); • # of partner educational institutions incl. women's groups and associations concerned with gender when possible and relevant for local R&D and adaptation; • # of companies' staff trained (sex-disaggregated data on participants and trainers) 	<ul style="list-style-type: none"> • Programme progress report • Course plan/material used; • Course certificates; • Programme progress report • Course plan/material used; • Training plans by local institution; • Course certificates; 	<ul style="list-style-type: none"> • Activities are coherent with the thematic area of demonstration projects and local training activities; • Appropriate local institutions identified for collaborative work and partnership agreed;
OUTCOME 2			
2. Favorable market conditions for geothermal energy investment strengthened in targeted countries	<ul style="list-style-type: none"> • Number of people trained (sex-disaggregated data on participants and trainers); • Number of local organizations associated to geothermal and its related technologies and associations/NGOs that promote GEEW; • Number of relevant policy instruments and recommendations adopted; • Number of business partnerships established incl. female led businesses when possible. 	<ul style="list-style-type: none"> • Public records • Feedback from key local stakeholders; • Surveys of participating companies/facilities • Baseline study • Inception report 	<ul style="list-style-type: none"> • Policy instruments or plans are developed in a coherent manner to create a favorable market environment; • Results and lessons-learned from all activities analyzed collectively;

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
OUTPUT			
Output 2.1: Public and private sector partnership established for scaling-up of the demonstrated technology solutions	<ul style="list-style-type: none"> • # of events organized for partner match-making of demonstrated geothermal and its related technologies (sex-disaggregated data on participants); • # of options for cost reduction and local production chain development identified; 	<ul style="list-style-type: none"> • Programme progress report; • Proceedings of events; • Statements by local organizations. 	<ul style="list-style-type: none"> • Existence of mutual interest between technology provider and local manufacturer; • Private-public-policy linkage is outlined; • Effective promotion of geothermal programme among stakeholders; • Successful implementation of scheduled activities.
2.2: Best practice implementations identified and showcased	<ul style="list-style-type: none"> • # of best practice cases identified along with the preset selection criteria; • # of best practice guide with developed business models published; 	<ul style="list-style-type: none"> • Evaluation document of geothermal and its related technologies demonstration (e.g. System benchmarking review; Impact and co-benefit assessment; Self-sustaining management; deployment potential); • Cross-cutting result review report; 	<ul style="list-style-type: none"> • Best practice technology and market potential are assessed in an integrated manner; • Indicators for the selection criteria of best practice geothermal and its related technologies are objectively identified and coherent with baseline data per demonstration project;
2.3: Policy recommendations and knowledge management with key stakeholders on best practice and available technologies and services	<ul style="list-style-type: none"> • # of policy recommendation and strategy documents made available; • # of roadmaps for scaling-up; • # of best practices promotion events and seminars/workshops organized (sex-disaggregated data on participants); 	<ul style="list-style-type: none"> • Policy documents; • Documents and information materials for best practices prepared; 	<ul style="list-style-type: none"> • Information collected properly to analyze the linkage between policy instruments and market development; • Business models are available from demonstration projects; • Strong support of key stakeholders available;

Annex 2: Job descriptions

TERMS OF REFERENCE FOR PERSONNEL UNDER INDIVIDUAL SERVICE AGREEMENT (ISA)

Title:	International evaluation consultant, team leader
Main Duty Station and Location:	Home-based
Missions:	As required
Start of Contract (EOD):	15 September 2023
End of Contract (COB):	15 November 2023
Number of Working Days:	35 working days spread over 3 months

ORGANIZATIONAL CONTEXT

The UNIDO Independent Evaluation Unit (ODG/EIO/IEU) is responsible for the independent evaluation function of UNIDO. It supports learning, continuous improvement and accountability, and provides factual information about result and practices that feed into the programmatic and strategic decision-making processes. Evaluation is an assessment, as systematic and impartial as possible, of a programme, a project or a theme. Independent evaluations provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons learned into the decision-making processes at organization-wide, programme and project level. ODG/EIO/IEU is guided by the UNIDO Evaluation Policy, which is aligned to the norms and standards for evaluation in the UN system.

PROGRAMME CONTEXT

Detailed background information of the programme can be found in the terms of reference (TOR) for the terminal evaluation.

The international evaluation consultant/team leader will evaluate the programme in accordance with the evaluation-related terms of reference (TOR). He/she will perform, inter alia, the following main tasks:

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
1. Undertake a desk review of programme documentation and relevant country background information (national policies and strategies, UN strategies and general economic data); determine key data to collect in the field and adjust the key data collection instruments accordingly (if needed). Assess the adequacy of legislative and regulatory framework relevant to the programme's activities and analyze other background info.	Division of evaluation tasks with the National Consultant; Adjusted table of evaluation questions, depending on country specific context; Draft list of stakeholders to be interviewed during the evaluation field mission; Brief assessment of the adequacy of the countries' legislative and regulatory framework;	6 days	Home-based

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
2. Prepare an inception report which streamlines the specific questions to address the key issues in the TOR, specific methods that will be used and data to collect in the field visits, detailed evaluation methodology confirmed, draft theory of change, and tentative agenda for field work.	Draft theory of change and Evaluation framework to submit to the Project Manager for clearance.	4 days	Home-based
3. Briefing with the UNIDO Independent Evaluation Division, project manager and other key stakeholders at UNIDO HQ.	Detailed evaluation schedule with tentative mission agenda (incl. list of stakeholders to be interviewed and planned site visits) submitted to evaluation and project manager.	1 day	Online
4. Plan and supervise evaluation field mission ¹³ to consult field project stakeholders, partners and beneficiaries to verify and complete preliminary evaluation findings from desk review and assess the institutional capacities of the recipient country.	Field mission conducted; Evaluation/debriefing presentation of the evaluation's preliminary findings prepared, draft conclusions, recommendations and lessons learnt to stakeholders in the country, at the end of the mission; Agreement with the National Consultant on the structure and content of the evaluation report and the distribution of writing tasks.	7 days	Homebased, Online & Kenya as required
5. Debriefing: Present preliminary findings, recommendations and lessons learnt to project stakeholders at UNIDO HQ for factual validation and comments Hold additional meetings and obtain additional data from evaluation/project manager and other stakeholders as required.	Power point presentation; Feedback from stakeholders obtained and discussed; Additional meetings held as required.	2 days	Online
6. Prepare the draft evaluation report, with inputs from the National Consultant, and in accordance with the evaluation TOR. Submit draft evaluation report to the evaluation manager for feedback and comments.	Draft evaluation report submitted to evaluation manager for review and comments.	8 days	Home-based

¹³ The exact mission dates and necessity for the consultant to visit Kenya will be decided in agreement with the Consultant, UNIDO HQ, and the country counterparts.

MAIN DUTIES	Concrete/ Measurable Outputs to be achieved	Working Days	Location
7. Revise the draft evaluation report based on comments and suggestions received through the evaluation manager and edit the language and finalize the evaluation report according to UNIDO Independent Evaluation Division standards. Prepare a two pages summary of a take-away message from the evaluation.	Final evaluation report submitted to evaluation manager. Two pages summary take-away message from the evaluation submitted to the evaluation manager.	7 days	Home-based
	TOTAL	35 days	

MINIMUM ORGANIZATIONAL REQUIREMENTS

Education:

Advanced degree in environment, energy, engineering, development studies or related areas.

Technical and functional experience:

Minimum of 10 years' experience in environmental/energy project management and/or evaluation (of development projects), including social safeguard and gender

Experience in conducting and managing reviews or evaluations (of development projects), preferably in the field of energy, clean technologies, climate change, and/or entrepreneurship.

Sound qualitative and quantitative methodological skills incl. data collection, management and analysis skills.

Knowledge about energy, clean technologies, climate change, and/or entrepreneurship.

Working experience in developing countries, ideally in countries on the African continent.

Very good communication, interpretation and writing skills, as well as interpersonal skills.

Proven leadership capacity.

Experience in the evaluation of projects related to waste to energy/bioenergy is an asset.

Knowledge about multilateral technical cooperation and the UN, international development priorities and frameworks.

Languages:

Fluency in written and spoken English is required.

Reporting and deliverables

1) At the beginning of the assignment the Consultant will submit a concise Inception Report that will outline the general methodology and presents a concept Table of Contents

2) The country assignment will have the following deliverables:

Presentation of initial findings of the mission to key national stakeholders;

Draft report;

Final report, comprising of executive summary, findings regarding design, implementation and results, conclusions and recommendations.

3) Debriefing to UNIDO HQ:

Presentation and discussion of findings;

Concise summary and comparative analysis of the main results of the evaluation report.

All reports and related documents must be in English and presented in electronic format.

Absence of conflict of interest:

According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the programme before the completion of her/his contract with the UNIDO Independent Evaluation Division.

TERMS OF REFERENCE FOR PERSONNEL UNDER INDIVIDUAL SERVICE AGREEMENT (ISA)

Title:	National evaluation consultant
Main Duty Station and Location:	Home-based
Mission/s to:	Travel to potential sites in Kenya
Start of Contract:	15 September 2023
End of Contract:	15 November 2023
Number of Working Days:	25 days spread over 3 months

ORGANIZATIONAL CONTEXT

The UNIDO Independent Evaluation Division (ODG/EIO/IEU) is responsible for the independent evaluation function of UNIDO. It supports learning, continuous improvement and accountability, and provides factual information about result and practices that feed into the programmatic and strategic decision-making processes. Evaluation is an assessment, as systematic and impartial as possible, of a programme, a project or a theme. Independent evaluations provide evidence-based information that is credible, reliable and useful, enabling the timely incorporation of findings, recommendations and lessons learned into the decision-making processes at organization-wide, programme and project level. The UNIDO Independent Evaluation Division is guided by the UNIDO Evaluation Policy, which is aligned to the norms and standards for evaluation in the UN system.

PROGRAMME CONTEXT

Detailed background information of the programme can be found the terms of reference (TOR) for the terminal evaluation.

As evaluation team member, the national evaluation consultant will evaluate the programme according to the terms of reference (TOR) under the leadership of the team leader (international evaluation consultant). S/he will perform, inter alia, the following main tasks:

<u>MAIN DUTIES</u>	Concrete/measurable outputs to be achieved	Expected duration	Location
<p>Desk review</p> <p>1. Desk review</p> <p>Review and analyze programme documentation and relevant country background information; in cooperation with the team leader, determine key data to collect in the field and prepare key instruments (questionnaires, logic models) as required;</p> <p>If need be, recommend adjustments to the evaluation framework and Theory of Change in order to ensure their understanding in the local context.</p> <p>Analyze and assess the adequacy of legislative and regulatory framework,</p>	<p>A list of evaluation questions, questionnaires/interview guide, logic models adjusted to ensure understanding in the national context;</p> <p>A list of key data available; and to be collected;</p> <p>A stakeholder mapping, in coordination with the project team;</p> <p>A brief assessment of the adequacy of the country's legislative and regulatory framework in the context of the project;</p> <p>Input to Inception Report</p>	8 days	Home-based

<u>MAIN DUTIES</u>	Concrete/measurable outputs to be achieved	Expected duration	Location
specifically in the context of the programme's objectives and targets.			
2. Coordinate and conduct the field mission with the team leader in cooperation with the Project Management Unit, where required and if possible. Consult with the Team Leader on the structure and content of the evaluation report and the distribution of writing tasks.	Presentations of the evaluation's initial findings, draft conclusions and recommendations to stakeholders; Detailed evaluation schedule; List of stakeholders to be interviewed during the field mission.	10 days	Home-based & potential sites in Kenya
3. Prepare inputs and analysis to the evaluation report according to TOR and as agreed with the Team Leader. Revise the draft programme evaluation report based on comments from UNIDO and stakeholders and proof read the final version.	Draft evaluation report prepared.	7 days	Home-based
TOTAL		25 days	

REQUIRED COMPETENCIES

Core values:

1. Integrity
2. Professionalism
3. Respect for diversity

Core competencies:

1. Results orientation and accountability
2. Planning and organizing
3. Communication and trust
4. Team orientation
5. Client orientation
6. Organizational development and innovation

Managerial competencies (as applicable):

1. Strategy and direction
2. Managing people and performance
3. Judgement and decision making
4. Conflict resolution

MINIMUM ORGANIZATIONAL REQUIREMENTS

Education:

Advanced university degree in environmental science, engineering or other relevant discipline like developmental studies with a specialization in industrial energy efficiency and/or climate change.

Technical and functional experience:

Minimum of 10 years' experience in environmental/energy project management and/or evaluation (of development projects).

Exposure to the needs, conditions and problems in developing countries.

Familiarity with the institutional context of the programme is desirable.

Experience in the field of environment and energy, including evaluation of development cooperation in developing countries and social safeguard and gender is an asset.

Experience in the evaluation of UNIDO activities is an asset.

Languages:

Fluency in written and spoken English required.

Absence of conflict of interest:

According to UNIDO rules, the consultant must not have been involved in the design and/or implementation, supervision and coordination of and/or have benefited from the programme/project (or theme) under evaluation. The consultant will be requested to sign a declaration that none of the above situations exists and that the consultants will not seek assignments with the manager/s in charge of the programme before the completion of her/his contract with the UNIDO Independent Evaluation Division.

Annex 3: Outline of an in-depth project evaluation report

Abstract

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3.4 Efficiency

3.5 Sustainability

3.6 Progress to Impact

3.7 Gender Mainstreaming

3.8 Environmental Impacts

3.9 Social Impact

3.10 Performance of Partners

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Annex 1: Evaluation Terms of Reference

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Annex 8: Statistical Data from Evaluation Survey / Questionnaire Analysis

Annex 2: Programme`s Logical Framework

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
DEVELOPMENT GOAL			
To promote geothermal power generation and its related technologies in African countries through demonstration projects, capacity building, and business models for replication.	Number of demonstration projects successfully demonstrated, transferred and deployed including capacity building activities undertaken.		
OUTCOME 1			
1. Geothermal technology successfully demonstrated, deployed and transferred in the targeted countries.	Number of geothermal and its related technologies successfully transferred.	<ul style="list-style-type: none"> • Surveys of participating companies/facilities. • Baseline study. • Inception report • Feedback from key local stakeholders. • Programme progress report. • Visits to project sites. 	<ul style="list-style-type: none"> • Criteria for best practice defined and data collected for transparent and objective evaluation. • Geothermal and related technologies successfully demonstrated as best practice. • Projects under this programme maintained and completed on time. • Appropriate coordination and inputs by partners for training collected.
OUTPUTS			
Output 1.1: Demonstration projects on geothermal designed and implemented for identified countries/regions.	<ul style="list-style-type: none"> • # of technology-socioeconomic needs, gender dimensions when possible and relevant, and feasibility studies conducted. • # of demonstration projects formulated. • # of demonstration projects implemented. 	<ul style="list-style-type: none"> • Feasibility study reports. • Inception Report. • Annual lessons-learned project report. 	<ul style="list-style-type: none"> • Sustained commitment of local stakeholders. • Active involvement of participating countries and institutions. • Project endorsed by the participating government.
Output 1.2: Training activities conducted	<ul style="list-style-type: none"> • # of international/national capacity building programmes incl. gender responsive training materials on geothermal and its related technologies conducted. • # of experts trained (with certificate) (sex-disaggregated data on participants and trainers). 	<ul style="list-style-type: none"> • Programme progress report • Course plan/material used; • Course certificates. • Programme progress report • Course plan/material used. 	<ul style="list-style-type: none"> • Activities are coherent with the thematic area of demonstration projects and local training activities. • Appropriate local institutions identified for collaborative work and partnership agreed.

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
	<ul style="list-style-type: none"> • # of training courses for local operation, maintenance, management and manufacturing (sex-disaggregated data on participants and trainers). • # of partner educational institutions incl. women's groups and associations concerned with gender when possible and relevant for local R&D and adaptation. • # of companies' staff trained (sex-disaggregated data on participants and trainers). 	<ul style="list-style-type: none"> • Training plans by local institution. • Course certificates. 	
OUTCOME 2			
2. Favorable market conditions for geothermal energy investment strengthened in targeted countries	<ul style="list-style-type: none"> • Number of people trained (sex-disaggregated data on participants and trainers); • Number of local organizations associated to geothermal and its related technologies and associations/NGOs that promote GEEW; • Number of relevant policy instruments and recommendations adopted; • Number of business partnerships established incl. female led businesses when possible. 	<ul style="list-style-type: none"> • Public records • Feedback from key local stakeholders; • Surveys of participating companies/facilities • Baseline study • Inception report 	<ul style="list-style-type: none"> • Policy instruments or plans are developed in a coherent manner to create a favorable market environment; • Results and lessons-learned from all activities analyzed collectively
OUTPUTS			
Output 2.1: Public and private sector partnership established for scaling-up of the demonstrated technology solutions	<ul style="list-style-type: none"> • # of events organized for partner match-making of demonstrated geothermal and its related technologies (sex-disaggregated data on participants). • # of options for cost reduction and local production chain development identified. 	<ul style="list-style-type: none"> • Programme progress report. • Proceedings of events. • Statements by local organizations. 	<ul style="list-style-type: none"> • Existence of mutual interest between technology provider and local manufacturer. • Private-public-policy linkage is outlined. • Effective promotion of geothermal programme among stakeholders. • Successful implementation of scheduled activities.
Output 2.2: Best practice implementations identified and showcased	<ul style="list-style-type: none"> • # of best practice cases identified along with the preset selection criteria. • # of best practice guide with developed business models published. 	<ul style="list-style-type: none"> • Evaluation document of geothermal and its related technologies demonstration (e.g. System benchmarking review; Impact and co-benefit assessment; Self-sustaining 	<ul style="list-style-type: none"> • Best practice technology and market potential are assessed in an integrated manner. • Indicators for the selection criteria of best practice geothermal and its related technologies are objectively identified and coherent with baseline data per demonstration project.

INTERVENTION LOGIC	INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
		management; deployment potential). • Cross-cutting result review report.	
Output 2.3: Policy recommendations and knowledge management with key stakeholders on best practice and available technologies and services	<ul style="list-style-type: none"> • # of policy recommendation and strategy documents made available. • # of roadmaps for scaling-up. • # of best practices promotion events and seminars/workshops organized (sex-disaggregated data on participants). 	<ul style="list-style-type: none"> • Policy documents. • Documents and information materials for best practices prepared. 	<ul style="list-style-type: none"> • Information collected properly to analyze the linkage between policy instruments and market development. • Business models are available from demonstration projects. • Strong support of key stakeholders available.

Annex 3: List of Documentation Reviewed

Title	Date	Author	Sharepoint
Programme Document	April 2017	UNIDO	In Folder 01_Programme Document
Annual Progress Report_2020	4 Nov 2020	UNIDO	In Folder 02_Annual Progress Report for Programme
Annual Progress Report_2021	11 Nov 2021		
Annual Progress Report_2022	23 Nov 2022		
Programme Completion Report	27 Nov 2023	UNIDO	10 attachments and 32 sub- attachments
Project Document (IoT)	Aug 2020	UNDO	In Folder 04_Component 1_IoT Project (190036)
Midterm Review Report	Feb 2021		
End of Project Report	July 2022		
Final Report - Provision of Services Related to Development of a Report and Execution of a Workshop towards Market Expansion and Finance Mobilization of Geothermal Industry in Africa	28 Feb 2023	Deloitte	In Folder 05_Component 2_Capacity Building Study
ToR - Development and implementation of capacity building programme for geothermal power utilization for sustainable climate resilient development in Africa	Dec 2022	UNIDO	In Folder 06_Component 3_Capacity Building in Kenya
Midterm Progress Report	Feb 2021	KenGen	
Final Report – On training materials, presentations, list of participants, pictures	1 Aug 2023	WJEC	In Folder 07_Component 4_Capacity Building in Japan
Final report - Services related to the planning and implementation of networking and partnership building activities in Japan under the project entitled "Generating energy	31 July 2023	SEK	
Final Report - Conduct Research and Analysis towards Establishing Work Program on Geothermal Power Utilization for Sustainable Climate Resilient Development in Africa	20 April 2023	Deloitte	In Folder 08_Component 5_PPP Study

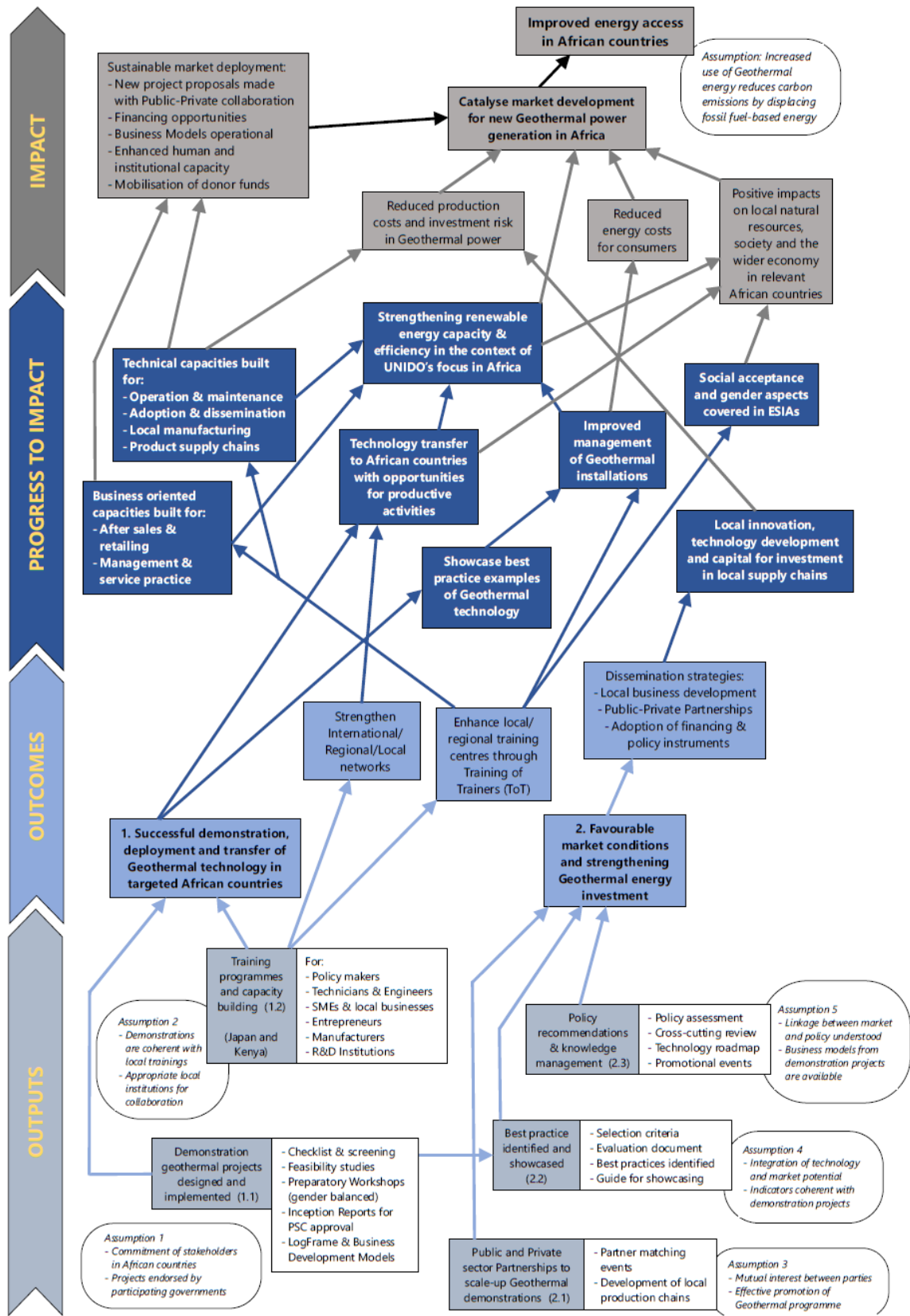
Final Report - Geothermal Projects Development in East African Countries and Opportunities for Private Investments and Public Private Partnerships	17 Aug 2023	Peter Omenda (for AfDB)	
Workshop Report - Promoting Geothermal Development in Africa	27 July 2023	Deloitte	

Annex 4: List of Stakeholders Consulted

	Date	Interviewee	Position	Interviewer (ST/LM)
1	Monday 6 November 2023	UNIDO Programme Team	Project Manager and support team - UNIDO	ST (Zoom)
2	Thursday 9 November 2023	Esther Mtimbaru RANGE	Environmental Engineer - TGDC – Tanzania	ST (Zoom)
3	Thursday 9 November 2023	Fathia ABDI	Electrical Engineer – Office for Geothermal Energy Development (ODDEG) Djibouti	ST (Zoom)
4	Thursday 9 November 2023	Tesfaye KASSA	Senior Expert - Ministry of Mines and Petroleum - Ethiopia	ST (Zoom)
5	Thursday 9 November 2023	Cesar NIYONZIMA	Fossil Fuels Senior Engineer - Ministry of Infrastructure - Rwanda	ST (Zoom)
6	Monday 13 November 2023	Richard MAVISI	Senior Principal Geologist - Ministry of Energy and Petroleum – Kenya	ST/LM
7	Monday 13 November 2023	Vincent KATO	Assistant Commissioner - Ministry of Energy and Mineral Development – Uganda	Filled in questionnaire (pg. 16 - 18)
8	Tuesday 14 November 2023	KenGen staff Olkaria Geothermal Plant	Rose KUBAI – Principal Geologist Ruth WAMALA – Reservoir Chemical Engineer David IMAIDI – Principal Engineer Diana MUTHONI – Electrical Engineer	ST/LM
9	Tuesday 14 November 2023	Lynette LUVAL	Deputy Representative - UNIDO	ST/LM
10	Thursday 16 November 2023	Chebet MUTAI	ICT Officer – KenGen Geothermal Plant	ST/LM (Zoom)

11	Thursday November 2023	16	Lydia MWENGA	UNIDO Desk Officer - Ministry of Investments, Trade and Industry – Kenya	ST (Zoom)
12	Monday November 2023	20	Abdirasak Omar MOUMIN	Head of Engineering Department and Drilling Projects Manager - Djiboutian Office for Geothermal Energy Development	ST (Zoom)
13	Monday November 2023	27	Sofiya Abdulkadir AYANO	Chief Executive Officer Ministry of Mines and Petroleum (Ethiopia)	Exchanged e-mails
14	TBA		Julius Namusanga WAMALA	Assistant Commissioner (Electrical Generation, Electrical Power Department) - Ministry of Energy and Mineral Development - Uganda	Exchanged e-mails

Annex 5: Project Theory of Change



Annex 6: Evaluation Questionnaire

It is proposed to use semi-structured interviews with key informants with both the Team Leader and National Consultant present. The majority of meetings are planned to be in person, but for those to be conducted virtually, the same process will be used. The differences between these techniques are highlighted below:

- Structured interviews - Uses a standard list of questions following a pre-determined order – easily conducted and compared to other interviews BUT does not allow for flexibility in answering and sometimes fails to solicit depth in the answers.
- Semi-Structured interviews – Uses a standard list of questions but the interviewer can determine the order depending on the flow of the conversation – creates a good balance between formal responses and spontaneity BUT makes comparability with other interviews more difficult.

Generating energy capacity from geothermal power generation and its related technologies for sustainable development

UNIDO ID: 170046

Interviewee details:

Name _____

Institution / Employer _____

Place _____ of _____ work
address _____

Length of employment _____

Questions:

1. Please describe how have you been involved in the geothermal programme and for how long?

2. What specific activities in the programme you have been involved with?

*[Component 1: O&M using the Internet of Things for Olkaria Power Station in Kenya.
Component 2: Research & Analysis Studies for Djibouti, Ethiopia, Kenya, Rwanda, Tanzania, Uganda.
Component 3: Capacity Building targeting geoscientists, engineers and environmental experts.
Component 4: Capacity Building targeting policy makers from the 6 African countries.
Component 5: Study on Public and Private Partnerships focusing on the 6 African countries.]*

3. Would you say that the programme is **IN LINE WITH THE PRIORITIES AND POLICIES** of your institution?

4. Did the programme have **RELEVANCE** to your country's national priorities and strategies?

5. How did the programme **CO-ORDINATE** with other geothermal / renewable energy work in your country?

6. How **EFFICIENT** was the programme delivery (e.g. in terms of having a clear plan, good management arrangements and whether delivery was cost and time efficient)?

7. Did the programme **ACHIEVE** its planned outputs (i.e. in technical development, research & development, capacity building and on forging public-private partnerships)?

8. How would you describe the **IMPACT** for any long-term results produced (i.e. Outcomes)?

9. Would you say that the programme results will **BE SUSTAINED** in the short, medium or long-term?

10. What have been the **KEY DRIVERS** to achieve the development goal (i.e. *“To promote geothermal power generation and its related technologies in African countries through demonstration projects, capacity building, and business models for replication”*).

11. Have there been any **BARRIERS** encountered in the programme delivery?

12. What **INPUTS** did your institution commit to in the delivery of the programme (i.e. funding, time, services etc.)?

13. Have there been any **RISKS** (technical, financial, institutional or environmental) in the programme implementation, and will they affect the continuation of results?

14. How were **GENDER** issues integrated into the programme (i.e. involvement of women in decision making etc.)?

15. Did you/your institution **MONITOR** the activities in any way? Have you/your institution formally **ASSESSED** or **EVALUATED** whether the programme is having the desired results? How was this done?

16. Do you have any comments about how **UNIDO and the donor (JICA)** managed the design, implementation, monitoring, reporting, supervision, backstopping and evaluation of the programme?

17. Overall, what **LESSONS** do you draw from this geothermal programme intervention?

18. Do you have any **RECOMMENDATIONS** you would make to improve this UNIDO/JICA programme?

Date of interview:

Name and signature of interviewer:



Vienna International Centre
Wagramerstr. 5, P.O. Box 300,
A-1400 Vienna, Austria



+43 1 26026-0



www.unido.org



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