External Final Evaluation of the Geothermal Exploration Project

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Disclaimer:

This report is the solely responsibility of the authors and in no way necessarily reflect the views of the Icelandic International Development Cooperation Agency, the Ministry for Foreign Affairs, Iceland or the Nordic Development Fund.

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TABLE OF CONTENT

TABLE OF FIGURES

LIST OF TABLES

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This evaluation was implemented climate neutrally. All carbon emissions generated through flights were subject of compensation in the Gold Standard climate protection project "Improved Kitchen Regimes – Boreholes, Malawi" (FC-Reg-Cert-No. 702779).


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External evaluation on Geothermal Exploration Project GEP, Ministry for Foreign Affairs of Iceland

Flights from October 28th, 2018 to April 4th, 2019 will generate

24 tonnes of CO_2e emissions

This certificate confirms that these emissions were offset by emission reductions in the Gold Standard climate protection project

Improved Kitchen Regimes – Boreholes, Malawi

The consultant is responsible for any misunderstandings or misinterpretations that may be present within the report.

ABBREVIATIONS

AFESD	Arab Fund for Economic and Social Development
AGCE	African Geothermal Centre of Excellence
ARGeo	African Rift Geothermal Development Facility
ARGeo7	7th African Rift Geothermal Conference (in Kigali)
AU (C)	African Union (Commission)
CB	Capacity Building
EARS	East Africa Rift System
EEP	Ethiopian Electric Power
EIA	Environmental Impact Assessment
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
ESSP	Malawi Energy Sector Support Project
EWSA	Energy, Water and Sanitation Authority (in Rwanda)
GDC	Geothermal Development Company (in Kenya)
GEP	Geothermal Exploration Project (of ICEIDA)
GGDP	Global Geothermal Development Plan
GRMF	Geothermal Risk Mitigation Facility
GSE	Geological Survey of Ethiopia
ICB	International Competitive Bidding
ICEIDA	Icelandic International Development Agency (since 2017 merged with MFA)
ISOR	Iceland GeoSurvey (self-financing, state-owned, non-profit institution)
JICA	Japanese International Cooperation Agency
KenGen	Kenya Electricity Generating Company
MDBs	Multilateral Development Banks
MFA	Ministry of Foreign Affairs (of Iceland)
MoNREM	Ministry of Natural Resources, Energy and Mining (in Malawi)
NDF	Nordic Development Fund
NZAID	New Zealand Agency for International Development
ODDEG	Djiboutian Office for Development of Geothermal Energy
OECD DAC	Organisation for Economic Co-operation and Development - Development Assistance Committee
PO	Programme Officer
PPA	Power Purchase Agreement
TA	Technical Assistance
TGDC	Tanzania Geothermal Development Company
ToC	Theory of Change
ToR	Terms of Reference
ToT	Training of Trainers
UNEP	UN Environment Programme
UNU-GTP	United Nations University – Geothermal Training Programme
USAID	United States Agency for International Development
WB	World Bank

EXECUTIVE SUMMARY

The evaluation took place over an effective six month period, commencing with attendance at the ARGeo7 Conference in Kigali (end of October), followed by an Inception Meeting in Reykjavik in December 2018. Field work in four countries (Djibouti, Ethiopia, Kenya and Tanzania) was carried out in February 2019.

The project's design is demonstrably relevant to the needs of the geothermal sub-sector across the region. It is also in line with Iceland's Development Act and reflects MFA-ICEIDA's commitment to addressing climate change and promoting resilience. It also matches the NDF's priorities.

The logframe is beset by weaknesses that emerged from the need to implement a framework project through demand-led national projects undermining the initially identified Outputs and the indicators. Nonetheless, the individual country projects promote the achievement of overall project's Outcome and Goal.

The divergence between the overall logframe and the individual country ones could have been addressed, had the overall logframe been amended. The individual national projects resulted in a necessary focus change towards a demand-led emphasis on capacity building (training and technical assistance) and organisational development to deliver better surface exploration results.

The actual experience of the MFA-ICEIDA Geothermal Exploration Programme (GEP) as a whole approaches a bell curve. Resource management, centrally, has been efficient. Because of the International Competitive Bidding (ICB) process the utilisation of resources represented value for money and was within reasonable bounds. The 'framework agreement' with ISOR and meeting UNU-GTP fees appears a value for money response.

The GEP's activities have clearly lead to an advancement in the partner countries' stage of geothermal development and their capabilities to take further action. Although surface exploration will continue to be an important field of work, many have now shifted the focus towards exploratory drilling. Apart from broadening and deepening the knowledge transferred so far, future support should focus largely on the following links of the geothermal value chain.

The total potential power generating capacity which could result at the sites studied through the GEP totals over 550 MW. If, *circa*, one third of this potential capacity is eventually implemented, the intended Impact of Geothermal Compact (the joint overall program with the World Bank, to which the GEP contributes) will have been achieved. The GEP has made relevant contributions both towards individual countries achieving the overall Goal of the Compact and in strengthening their organisational and human resource capacities in order to achieve this progress.

There are both positives and challenges surrounding sustainability. On the one hand, the considerable skills transfers that have taken place have increased organisational capacity in partner countries to a considerable degree. On the other, there are unquestioned risks linked to the achievement of medium-term sustainability. On balance, the evaluation finds that there is potential for sustainability in the long-term but short- and medium-term considerations are capable of undermining these.

Recommendations

At the outset, the evaluation recommends that there should be a second-phase follow-up programme, which should consider the following:

Overall

- Further support for geothermal development in the region is desirable.

Relevance / Design

- Any future programme should pursue actively the standard MFA-ICEIDA stakeholder approach in order to ensure achieving widespread ownership of the demand-driven project design.
- Adjust the overall project logframe to reflect realities that emerge through experience in order to maintain and enhance its relevance.

Efficiency

- In the event of future support to regional geothermal development, maintain the demand-led approach.

Effectiveness

- Provide further guidance and mentoring to countries who are still not capable of doing things fully on their own for further surface explorations.
- “More of the same” is still needed, even in advanced countries like Ethiopia and Kenya! Particularly, there is a need to strengthen knowledge for interpretation, processing and management of data from surface studies (including also more sophisticated software solutions than Excel).
- Additional equipment is needed together with training in proper use (for instance, GDC requested new technology tools for well logging and reservoir operations).
- “Refresher courses” as well as further coaching and mentoring in the trained topics in order to ensure that the acquired knowledge is correctly applied and not lost over time, and to broaden the knowledge base within partner institutions.
- Transfer of more advanced and more specialized training to deepen the expertise (likely best transmitted through on-the-job training and mentoring). In this context, it is worth also pursuing the possibility of placements with geothermal institutions in other African countries, like GDC in Kenya.
- Focus on the „next steps“, such as supervision and management of exploratory drilling (so that partners “are not just observers”, as was formulated by ISOR, but understand what is happening and are able to monitor and supervise).
- Future training should also look already at power plant operation to avoid cases like Langano which is out of operation for several years now and to ensure sustainable operation (steam field management and power plant operation, maintenance, etc.).
- Improve matching of training needs and contents, in capacity building measures such as the training attachments for GDC in Iceland.
- Intensify train-the-trainer approaches, so that knowledge and capacities acquired through the GEP can be more effectively spread within the partner institutions.
- There is a need for further short courses (particularly on project management, where often a lack of skills is still observed) which could be implemented through the AGCE.
- In case the GRMF continues into further rounds, support in writing funding applications will still be needed.

- However, support should be provided to obtaining funding also from other sources, such as World Bank and Agence Francaise du Dévelopement (problem is that GRMF covers only 40% of drilling costs).
- More pro-actively push Partner Countries to apply for drill funding from the GRMF (or other grant sources), since the initiative is not always taken by the countries themselves.
- Support a cost-benefit study to enable decision making and possibly pave the way for a direct use pilots elsewhere.
- Continue support the AGCE, for instance in the following:
  - Curriculum verification
  - Competence testing of teachers and filling of their knowledge gaps (in order to ensure high quality)
  - Bring in direct use expertise
  - Bringing in the Icelandic expertise from institutions like ISOR, Verkis, etc., through corresponding linkages and partnerships

Impact

- Focus additional TA and capacity building further along the geothermal development value chain to support the renewable energy source's further development.

Sustainability

- Consider supporting mentorships intended to promote skills transfers within and between the national partner organisations, such as GDC.
- Develop linkages and partnerships between Icelandic expertise and the AGCE.
- Explore the introduction of compensation of greenhouse gas emissions caused by airplane travel carried out within the project.
- "Refresher courses" as well as further coaching and mentoring in the trained topics in order to ensure that the acquired knowledge is correctly applied and not lost over time, and to broaden the knowledge base within partner institutions.

Inclusiveness/Gender

- For any potential future short courses, more pro-actively encourage the participation of women and form part of the selection process in order to guarantee a fair representation of women.

1 BACKGROUND

The GEP is jointly funded by the Ministry for Foreign Affairs Iceland (MFA-ICEIDA) and the Nordic Development Fund (NDF) with a total budget of € 10 million (approximately US$ 13 million). Implementation started in 2013; at the time the evaluation commenced in 2018 the final remaining activities were under implementation. The project was implemented in collaboration with several partners including UN Environment and the World Bank and included collaboration with the African Union, whose Commission is responsible for donor coordination and manages the Geothermal Risk Mitigation Facility (GRMF).

The main objective of the GEP was to assist countries in the East Africa Rift System (EARS) to increase their knowledge of geothermal potential by conducting reconnaissance and surface exploration studies and to build capacity and expertise in the field of geothermal development and utilization. The project aimed to assist countries to have:

- a realistic assessment of potential geothermal sites;
- plans for further action where applicable with drilling targets identified; and
- capacity to move forward based on those plans and submit exploration drilling projects into funding pipelines.

The specific objective (outcome) of the project was:

- Enhanced geothermal knowledge and capacity that enables further actions on geothermal utilization in EARS countries. (Completing the exploratory phase of geothermal development)

This would be achieved through three main outputs expected from the project, which were

- (1) the necessary scientific data, (2) reports and human resources required to enable governments to take further actions on geothermal utilization, and (3) strengthened policy and legal frameworks incl. processes and capacity available.

The TOR note that output value also exists where reconnaissance or explorations may have eliminated fields and, ultimately, countries, previously thought to have potential.

This required an objective understanding of the geothermal potential established in participating countries that creates the necessary foundations for informed decisions regarding energy production.

In detail, the expected results (outputs) according to the logframe matrix of the project were:

1) Scientific data and reports on geothermal resources produced:
    a) Reconnaissance studies conducted in respective EARS countries with recommendations for further action;
    b) Geothermal explorations conducted and reported.
2) Improved and increased level of knowledge and capacity on geothermal utilization:
    a) Strengthened policy and legal framework for geothermal utilization in respective countries;
    b) Capacity building in the participating countries, including UNU-GTP training;
    c) Strengthened ability of development and financial institutions to engage and support the geothermal development process.
3) Preparations for exploratory drilling are in place:
    a) Environmental and Social Impact Assessment conducted for exploratory drill sites where applicable;
    b) Applications in place for exploration drillings.

In preparation of the GEP, the following potential participating countries were identified, albeit at different stages of exploration and implementation of their geothermal resources: Burundi, Comoros, Djibouti, Democratic Republic of the Congo, Eritrea, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Tanzania, Uganda and Zambia. This was reflected in the demand-based design approach. As a result, activities in individual countries were not pre-designed in advance, but emerged in consultation with individual governments and agencies, based on requests made in the course of project implementation.

A mid-term review (MTR) of the project carried out in 2016 found the project to be relevant and responding to needs in the countries. The MTR came up with specific recommendation for the project and the evaluation should assess if the recommendation were successfully incorporated into the project. These recommendations are listed in Annex 5 of this Report. The MTR noted that there had been limited emphasis on output 2.1, as several other donor agencies, such as NZAID, USAID and the World Bank were already focusing on this aspect. In addition, there was considerably more emphasis placed on capacity building in the implementation of the project than initially anticipated.

1.1 STAKEHOLDERS AND TARGET GROUPS / BENEFICIARIES

The project identified both, international and national level stakeholders and beneficiaries.

International donors and stakeholders:

- UN Environment (ARGeo Project)
- World Bank
- African Union (Regional Geothermal Coordination Unit and GRMF)
- MFA-ICEIDA
- NDF
- Iceland GeoSurvey (ISOR)
- UNU-GTP

National Stakeholders in the main partner countries:

- Djibouti: Djibouti Office for Geothermal Energy Development (ODDEG)
- Ethiopia: Geological Survey of Ethiopia (GSE); Ethiopian Electric Power (EEP)
- Kenya: Geothermal Development Company (GDC); African Geothermal Center of Excellence (AGCE)
- Tanzania: Tanzania Geothermal Development Company (TGDC)

1.2 METHODOLOGICAL APPROACH

The final evaluation pursued in order to provide well-founded answers to the main evaluation question, which were identified as follows:

To what extent has the project contributed to increased knowledge of geothermal areas in East Africa and to capacity building to develop geothermal projects in the respective countries?

The evaluation oriented itself along the lines of the five OECD-DAC criteria: relevance, efficiency, effectiveness, impact, sustainability. Furthermore, it considered to what extent the project has implemented MFA-ICEIDA policies regarding cross cutting issues such as environment and gender.

The evaluation pursued these aims through a three-phased approach:

- Inception phase
- Desk-research phase
- Fieldwork phase

Specifically, in the course of these, the evaluation team carried out the following:

- Documentary review (A list of consulted documents is presented in Annex 2).
- Interviews with key stakeholders – ICEIDA-MFA, the NDF, the AU Commission, the AGCE, UNEP, and other donors, including the World Bank, field trips to Djibouti (ODDEG), Ethiopia (GSE, EEP, field trip to the Aluto Langano field), Kenya (GDC and KenGen) and Tanzania (TGDC) in order to: pursue consultation and validation with a representative sample of primary project stakeholders and carry out field visits
- Quantitative and qualitative analysis of the project's fulfilment of the success indicators on the output and outcome level as described in the project's log frame matrix.
- Elaboration of Final Report

Risks

The major risk, which confronted the achievement of the ToR related to the availability of key stakeholders in the course of the country field work. The consultants successfully mitigated this through a combination of early electronic contact, building on initial meetings in the course of the ARGeo 7 conference in Kigali, to establish dates and times for meetings[1]. Most of the meetings with African stakeholders took place during the evaluation mission to East Africa in February 2019. Meetings with Icelandic institutions such as UNU-GTP and ISOR were held during the Inception Mission to Reykjavik in December 2018. Wherever meetings in person were not be possible, the consultants aimed to carry out interviews via Skype or phone[2]. The only institution which did not respond at all to various requests for a meeting or phone call, and therefore no input was obtained from, is the Kenyan Ministry of Energy.

[1] The exceptions to this successful mitigation were the failure to meet with the members of the AGCE's Interim Project Coordinating Unit (which meeting was offered to be arranged by UNEP) and the lack of response from Kenya's Ministry of Energy's representative.

[2] This was the case with representatives from NDF and the AUC (although an initial meeting with the AUC took place at the ARGeo7 Conference in Kigali).

1.3 METHODOLOGY

In accordance with the TOR's implicit intent, the team pursued the implicitly envisaged three-phase approach.

1) Inception phase

   An inception report outlining:

   a) The proposed Methodology: to the extent possible, the team adopted participatory approaches,

   b) The envisaged Activities,

   c) The respective Responsibilities of the team

   d) The Work plan and milestones produced and discussed,

   …was prepared and approved in December 2018.

2) Desk study phase

   During this desk phase, the evaluation team

   a) reviewed and analysed all relevant documents (Annex 2),

   b) summarised the information already gathered and limitations, and identified issues still to be covered including preparation of interview questions,

   c) developed the (participatory) tools (semi-structured interviews, focus groups, etc.) to be applied in the field phase, together with all preparatory steps already taken,

   d) developed a detailed work plan for the field phase (details under chapter 3) below).

   This was largely completed in advance of the departure on the field phase on 2 February 2019.

3) Field phase

   The evaluation team developed and discussed

   a) an indicative list of projects to be visited,

   b) people to be interviewed,

   c) itinerary and schedule of visits, and name of the responsible team member,

   d) carried out stakeholder interviews in Djibouti, Ethiopia, Kenya and Tanzania.

   After the conclusion of the Field Phase on 14 February, the evaluation team prepared the draft final report, addressed comments received and participated in a de-briefing meeting in Reykjavik at the beginning of April. Final version of the report was submitted in April 2019.

Geographical coverage

Geographical coverage was in the identified four countries (Djibouti, Ethiopia, Kenya, Tanzania) and at locations determined by the physical presence of stakeholders and interlocutors (Rwanda and Iceland).

Semi-structured interviews and Focus Groups

Interviews were conducted with relevant stakeholders, at national level and locally.

The evaluation focussed on the 2013 – 2018/19 implementation period.

Key areas of enquiry addressed the following:

Relevance	Was the strategy appropriate to the context of Rift Valley countries' alternative energy priorities?
Efficiency	Were the resources utilised as projected? Was the overall management and supervision of the project in line with the expected outputs? Did the resources complement those available from other sources? Was there any doubling of efforts with other donors? Were there potential alternative uses of the available resources?
Effectiveness	Were the envisaged outputs achieved? Did the outputs contribute to an overall improved understanding of the regional and national geothermal potential? Was geothermal capacity built through the project activities?
Impact	Did the strategy affect Rift Valley countries' alternative energy sources development? Which were its main benefits / shortcomings? Is the Outcome on track for achievement?
Sustainability	How has the strategy contributed to identification of geothermal as an alternative energy source? Has it contributed to an improved understanding of geothermal potential in each of the Rift Valley countries? Are individual countries' capacities to manage geothermal as an alternative source of renewable energy greater as a result of the project? Are these capacities sufficient to take the utilisation of geothermal energy forward with or without further external support? Have capacities which were built in the course of the project been retained? Are appropriate policies and regulations in place to manage geothermal as an energy source? In countries where geothermal projects are already being operated or will soon be operated: are capacities and structures in place for sustainable operation and maintenance of the facilities?
Gender	Did the project actively seek to engage women in the course of implementation and subsequently? What were the main constraints it experienced in this regard?
Environment	Did the project respond adequately to environmental issues? Were the ESIA's supported reflective of environmental and social concerns and where the relevant national and international guidelines followed?

Interview informants

The informants interviewed were informed by the ToR and developed in the course of the desk study phase and communicated to facilitate appointments in advance of the team's arrival in country. The team's field visit schedule was communicated to ICEIDA in advance of departure on the mission.

1.4 Structure of the Report

The report is structured in accordance with standard OECD DAC criteria. In Section 2, it discusses the programme's design and relevance including an assessment of the logframe. This is followed in Section 3 by a discussion of Efficiency and, in Section 4, of Effectiveness. Section 5 makes a preliminary assessment of Impact, followed by consideration of programme Sustainability in Section 6. Section 7 outlines the consultant's recommendations arising from the foregoing. Cross-cutting issues are addressed in the course of discussions of the different sections.

2 DESIGN AND RELEVANCE

2.1 INTRODUCTION

Implementation of the Geothermal Exploration Project (GEP), jointly funded by the Ministry for Foreign Affairs - Icelandic International Development Agency (MFA-ICEIDA) and the Nordic Development Fund (NDF), started in January 2013; during 2018 the last remaining activities were reported to be under way, although the final evaluation noted that some activities (e.g. completion of the Eritrean surface exploration, the accreditation of the geochemical laboratory and the installation of a geothermal grain-dryer at GDC in Kenya (for direct use demonstration) remained incomplete in February 2019. The project was implemented in collaboration with several partners including UN Environment and the World Bank and included collaboration with the African Union Commission. The total budget of the project was 10 million EUR or approx. US $13 million (including administration costs) divided to equal shares between MFA-ICEIDA and NDF.

Design predated the possibility of implementation. Because of the nature of the project – a regional focus implemented at national levels – the design approach saw the development of an overall framework, the implementation of which was achieved through individual national projects. Their respective content was negotiated bilaterally between the MFA-ICEIDA team and the national counterparts. This process saw a change of emphasis away from surface exploration towards organisational and individual capacity building and specific technical assistance as these emerged as individual countries' priorities. Partner countries and institutions in the African Rift Valley countries expressed substantial appreciation of MFA-ICEIDA's and the NDF's adaptability and flexibility in this regard. The evaluation underlines this, noting that in its absence the design would not have responded to identified needs.

2.2 CONSISTENCY WITH REGIONAL AND NATIONAL GOVERNMENT POLICIES

The African Union Commission plays a central role for geothermal energy development through its hosting of the Geothermal Risk Mitigating Facility (GRMF) and by coordinating donor support. According to the former Head of the Energy Division, Mr. Atef Marzouk, there is continuing importance of geothermal energy in East Africa in the short and long-term, and the need to mobilize more financial and technical resources to boost geothermal energy development in Africa to expand energy access for meeting basic needs as well as productive activities. In this respect, the Geothermal Risk Mitigation Facility (GRMF) successfully supports early stage development of 30 geothermal energy projects in East Africa; available GRMF grants of USD 140 million are expected to leverage investments estimated at USD 9.2 billion.

While there is no 'regional policy' per se, a general agreement amongst Rift Valley member countries exists around the importance of geothermal energy as a source of diversification of their national energy mix and as a means of reducing dependence on carbon-based generation. Thus, Ethiopia, for example, emphasizes a Climate-resilient Green Economic Strategy, which places renewables, including geothermal energy, as the sole source of electricity generation. Similarly, in Kenya, the President announced (CapitalFM, 4 December 2018) that universal access to electricity is to be reached by 2030, the total supply being from renewable sources, in the achievement of which, geothermal energy will play a major role. Similarly, Tanzania and Djibouti are actively pursuing geothermal energy amongst other renewable energy generation sources in pursuit of climate resilient strategies intended to address the challenges posed by climate change, while ensuring reliable sources of power supply.

Some countries (e.g. Ethiopia, Kenya) are more advanced in policy terms than others (e.g. Malawi, Tanzania). However, all are actively pursuing green energy, including geothermal, and developing policies to support the process. The Geothermal Exploration Project has supported African Rift Valley countries to identify (through surface exploration support, training, organisational capacity building, equipment procurement and technical assistance) to advance their understanding of their individual geothermal

potential and inform policy-making as a result. As such, the project is highly relevant to their shared goal of a more climate resilient and sustainable energy sector.

2.3 Alignment with MFA-ICEIDA Policy and Strategy

In 2008, the Althingi, the Icelandic Parliament, enacted the Act on Development Cooperation (21/2008). In terms of this, the country's development cooperation was to build on Iceland's national expertise, applying this to add value to development cooperation partnerships. In the light of the substantial national expertise in geothermal development and utilisation, the Geothermal Exploration Project is fully in line with this requirement.

The Strategy for Iceland's Development Cooperation, 2013-16, adopted in 2013, identifies three priority areas for the country's development cooperation: natural resources (reflecting Iceland's specific experience in energy and fisheries), social infrastructure and peace building; the Geothermal Exploration Project responds directly to the first of these priorities and, therefore, is fully aligned with this aspect of the strategy.

The strategy also identifies four multilateral donors as key institutions; of which two are key partners of the Geothermal Exploration Project:

- the World Bank, with which MFA-ICEIDA created the Geothermal Compact Program, and Iceland also provides significant support to the Energy Sector Management Assistance Program (ESMAP)
- the United Nations University: The Geothermal Training Programme (UNU-GTP) was established in 1979 and, being hosted in Iceland, has played an important role in the project.

The Geothermal Exploration Project clearly responds to Iceland's national development cooperation priorities and, as such, is highly relevant to the country's development cooperation commitments. MFA-ICEIDA's country project identification approach was to engage transparently with national stakeholders in pursuit of the development of demand-driven projects. Based on the evaluation's observations, this was broadly speaking the case; having noted this, in Kenya the identified partner, the Geothermal Development Company (GDC), while an important actor in national geothermal development, is only one actor[3]. The other, the 70% state-owned enterprise (SOE), KenGen, was reportedly not party to the design discussions and, despite being responsible for the entire value chain of geothermal development (including surface exploration) for its nine well sites, did not benefit from the project. This is regrettable since it is evident that KenGen could also have benefitted from capacity building across all its areas of responsibility. Any future programme should pursue actively the standard MFA-ICEIDA stakeholder approach in order to ensure achieving widespread ownership of the demand-driven project design.

Furthermore, the projects' design has reflected a further important MFA-ICEIDA characteristic, which is its flexibility. This is evident from the shift away from the initial focus on support to surface exploration (towards training and capacity building) and was emphasised approvingly in the course of engagement with project partners. Lastly, the project has drawn extensively on sector expertise within Iceland (e.g. ISOR) as a source of critical technical expertise, further underlining its relevance.

[3] According to the GDC website, 'The Geothermal Development Company (GDC) is domiciled in the Ministry of Energy and Petroleum (MoEP). GDC was created following the unbundling of the energy sector into entities that are focused on the various stages of the energy value chain as provided for by the Energy Act of 2006. All players are assigned clearly defined roles. Other agencies within the MOEP include: The Energy Regulatory Commission (ERC), Kenya Electricity Generating Company (KenGen), Kenya Power and Lighting Company, the Rural Electrification Authority (REA), Kenya Electricity Transmission Company (KETRACO), Kenya Nuclear Electricity Board (KNEB), Kenya Pipeline Company (KPC), National Oil Corporation of Kenya (NOCK) and the Kenya Petroleum Refinery Limited.

2.4 Alignment with NDF Policy and Approach

The Nordic Development Fund (NDF) is the joint development finance institution of the five Nordic countries - Denmark, Finland, Iceland, Norway and Sweden. Established in November 1988, operations commenced in February 1989. The objective of NDF's operations is to facilitate climate change investments, primarily in low-income countries.

NDF finances projects usually in cooperation with bilateral, multilateral and other development institutions. The operations mirror the Nordic countries' priorities in the areas of climate change and development. NDF flexibly uses grants, loans, equity and any combination of these as financing instruments.

ICEIDA was a new NDF partner (although Iceland is a co-owner of NDF); earlier main partners had been multilateral development banks (MDBs). NDF needed to find new partners as the number of 'good' partners had declined probably due to the expansion of the scale of climate and climate-resilience finance availability. Focus on climate and climate resilience financing post-2004 arose because as cost of closing down was greater than new focus post-Brundtland. The new emphasis became operational in 2009.

ICEIDA approached the NDF for co-financing. From NDF's perspective, there was a clear advantage due to the member country's thematic expertise, which allowed NDF to expand into a new thematic area - renewable energy development. This complemented the existing financing portfolio, with its link to a sustainable energy focus. NDF was not actively seeking to enter the sub-sector; was just a background financier, but its co-financing has added value to its portfolio, as has the partnership with ICEIDA. As such, the Geothermal Exploration Project has relevance to the NDF and its wider goal of promoting and supporting climate resilience and addressing and mitigating climate change issues.

2.5 The Logframe(s)

The Narrative and Theory of Change (ToC)

The overall project's narrative represents a logically coherent flow from the following three Outputs:

- Scientific data and reports on geothermal resources;
- Improved and increased level of knowledge and capacity on geothermal utilisation; and
- Preparations for exploratory drilling in place where applicable, including EIA, potential projects have entered funding pipelines.

to the defined specific objective (Outcome) of the project:

Enhanced geothermal knowledge and capacity that enables further action on geothermal utilisation in EARS countries.

In its turn, this represents a necessary condition for the Overall Objective (goal) of the Geothermal Compact Program which is:

Increased access to renewable energy through low emission geothermal energy development in East African Rift Valley countries.

For their part, the narrative summary of the individual country project logframes are equally logically coherent and demonstrate evident contribution to the achievement of the overall project outcomes and goals. Thus, Djibouti's project aims, for example, to assist the government in achieving increased access to renewable energy through geothermal energy, while Ethiopia's and Rwanda's have the same goal. Kenya's Overall Project Objective is worded differently:

[…] assist […] Kenya to enhance […] geothermal energy development for the social and economic benefit of the country by further enhancing their knowledge of geothermal resources and build[ing] capacity for geothermal development.

In essence, however, this represents essentially the same goal as the other three, although specifying it is for national social and economic benefit, which, logically, may be assumed the case in the other projects.

The four national level projects' outcomes focus on the means to achieve their respective goals but, in all cases, these are essentially to build capacity to achieve these. To this end, building national capacity in respect of geothermal exploitation and understanding is a necessary condition to deliver the overall project's outcome. In the absence of capacity at national level, it is unlikely that '….further action on geothermal utilisation….' is possible.

At this point, Outputs in the national projects diverge quite sharply from those of the overall project and focus on capacity building (and not on works for surface exploration as was intended according to the original resource allocation).

This is an effective reworking of the Theory of Change (ToC): as originally envisaged this envisaged delivery of Outcome and Goal was predicated upon completion and expansion of surface exploration, complemented by a pro-geothermal policy and regulatory environment and completion of the necessary preparatory steps (ESIAs and drilling licenses).

While entirely logical and coherent, this ToC did not survive a consultative, demand-driven country design strategy. This saw national programmes emerge that responded to identified gaps. According to this ToC, the achievement of Outcome and Goal would be promoted through organisational strengthening and capacitation, individual skills development and, critically, Technical Assistance (TA) support to review jointly nationally produced data for well siting. Sub-outputs (e.g. support to mobilise finance (essentially GMRF application development support) and UNU-GTP course participation) were retained but subsumed within individual skills development and TA.

Notwithstanding these shifts of focus at Output level, the underlying ToC remained consistent with Outcomes and Goal at all levels – national and overall.

Indicators

The revised approach impacted on the defined indicators. Essentially, the national projects scrapped those identified in the overall project. For example, the indicator for the measurement of the project's Overall Objective (Impact) was the quantity (200 MW) of geothermal capacity installed in the EARS countries over a 10 – 15 year timeframe. The national projects abandoned the numerical target for installed geothermal capacity. This rendered the indicator irrelevant: even if one MW of geothermal capacity was installed in Kenya, for example, (today, 685 MW, corresponding to 29% of Kenya's total capacity is geothermal), then the project had achieved its goal, which is patently absurd.

Much the same can be said in respect of the divergence between the overall project's Outcome indicators and those of the individual countries' projects. For example, the overall project identifies preparation of drilling permits and funding applications, while Djibouti emphasizes a revised conceptual model and drilling targets for Lake Abhe, as well as improved ODDEG management capacity. Kenya's indicators are a conceptual model (Suswa), the number of GDC experts trained and plans for the geothermal drying facility. In other words: since the individual countries' Outcome indicators are not in line with those of the overall project, they do not contribute to achieving the intended Outcome of the overall Geothermal Exploration Project.

Given the major shift in focus of the identified Outputs, it is unsurprising that their indicators too are very different. What this points to is the failure to update the overall project's logframe in the light of the detail of the individual national projects.

This is unfortunate as it effectively renders the overall project logframe ineffective as a project management tool. Best practice views the logframe as a living document subject to continual updating in the light of experience. While this has clearly happened at national level (e.g. the revisions to the projects), it did not at the overall level. [The negative effect of this appears to have been mitigated through regular discussion between the two donors (MFA-ICEIDA and NDF) in the course of which shifts in project focus

were discussed and agreed. This does not detract, however, from the effective undermining of the logframe as an effective project management tool.]

More positively, the Assumptions and Risks are well thought through and relevant across all logframes reviewed. Similarly, although a number of Assumptions are critical, none (exception political commitment and political stability) can really be termed 'killer assumptions'. Furthermore, most are capable of mitigation through appropriate action to address issues as they arise or might arise.

Conclusions

Therefore, the initial overall project logframe was superseded by those supporting the individual country projects. Progress measurement from the time of national project identification was done against the individual country project logframes and their individual and collective contribution to the overall Goal and Outcome inferred. Given the nature of the overall project – essentially a framework through which to pursue national outcomes and goals – this was probably inevitable. However, it is advisable to adjust the overall project logframe to reflect realities that emerge through experience in order to maintain and enhance its relevance.

2.6 Conclusions

The project's design is demonstrably relevant to the needs of the geothermal sub-sector across the region. It supports the emphasis on the development of renewable energy development as espoused on behalf of its member states by the AU Commission. Furthermore, it supports the achievement of East African Rift Valley (EARS) countries national policies in this respect, many of which have had such policies in place for a lengthy period. The project has reinvigorated geothermal development in a variety of countries, including Ethiopia, and promoted it in others, e.g. Malawi.

The project is also in line with Iceland's Development Act, building on sharing the country's expertise in the area. Furthermore, it is fully in line with the Development Cooperation strategy, 2013-16 and reflects MFA-ICEIDA's commitment to addressing climate change and promoting resilience in partner countries. Equally, the project matches the NDF's priorities, adding a further aspect to the Fund's loan portfolio and deepening its ability to respond to climate change, which successfully contributes to the portfolio of development partners. As such, the design is relevant to the identified needs.

The logframe is beset by weaknesses that emerged from the need to implement a framework project through demand-led national projects. This also undermined the initially identified Outputs and the indicators across all levels of the logframe. Having noted this, the national projects clearly seek to contribute to the common Goal and Outcome and reporting has demonstrated contributions to the achievement of Outcome and Goal. As such, the individual country projects promote the achievement of overall project's Outcome and Goal, despite the inevitable reality that the country-level logframe indicators bear no relation to those in the overall project logframe.

The divergence between the overall logframe and the individual country ones could have been addressed had the overall logframe been regarded as a living document and amended in the light of experience. This would have addressed the shortcomings that developed over time, which undermined any efficacy in the overall documents role as a project management tool. Having noted this, it is important to emphasise that the evaluation does not believe that this has negatively impacted on progress towards Outcome and Goal. As such, the critique is valuable in underlining the logframe's project management function but, despite the shortcomings in this respect, there appears evidence of progress towards Outcome and Goal.

3 EFFICIENCY

According to the DAC, efficiency is a measure of how economically resources/ inputs (funds, expertise, time, etc.) are converted to results. Issues to be explored include:

- Were the objectives achieved in a cost-efficient manner by the development intervention?
- Is the relationship between input of resources and results achieved appropriate and justifiable? What is the cost-benefit ratio?
- To what extent have individual resources been used economically?
- Are there any alternatives for achieving the same results with less inputs/funds?

This section explores the answers to these and other questions.

3.1 INTRODUCTION

The Geothermal Exploration Project (ICE23066-1301) was approved as a sub-project of the Geothermal Compact in East Africa between Iceland and the World Bank. The Geothermal Compact program that was formed includes a staged approach to research and investments, combined with parallel activities for institutional strengthening and capacity building in the respective countries and supporting institutions. The Overall Objective of Geothermal Compact is defined as follows:

Increased access to renewable energy through low emissions geothermal energy development in East African Rift Valley countries

In 2012, The World Bank started to explore with other donors the possibility of mobilizing additional concessional resources to fund test-drilling programs, after the activities of the Geothermal Exploration Project GEP are successfully completed. This initiative, the Global Geothermal Development Plan (GGDP) is led by ESMAP. Iceland supports the GGDP.

The GEP aims at assisting all EARS countries in completing the exploratory phase of geothermal development and build capacity and expertise in the field of geothermal utilization and related policy. The project will thus contribute to the overall objective of the Geothermal Compact. At the end of the project it is expected that all participating countries will have:

- A realistic assessment of potential geothermal sites,
- Plans for further action where applicable, and
- Capacity to move forward on the basis of those plans and submit drilling projects into funding pipelines.

The Geothermal Exploration Project GEP is the initial phase of the Geothermal Compact partnership program, initiated jointly by Iceland and the World Bank. ICEIDA acts as the Lead Agency with joint co-financing from the NDF and participation of others, as the case may be. The implementation of the project is demand-driven, responding to requests by governments and appropriate authorities. In addition to supporting and funding reconnaissance and geothermal exploration the project also covers technical assistance and capacity building, as needed and requested within the scope of the project, including training through the UNU-Geothermal Training Programme.

3.2 RESOURCE ALLOCATION

The GEP's Project Documents establishes an upper limit of available financing for the 13 EARS countries. Table 1 (Annex 4) provides details of this by stage and activity.

Fig. 1 clearly shows the early emphasis on support for exploration.

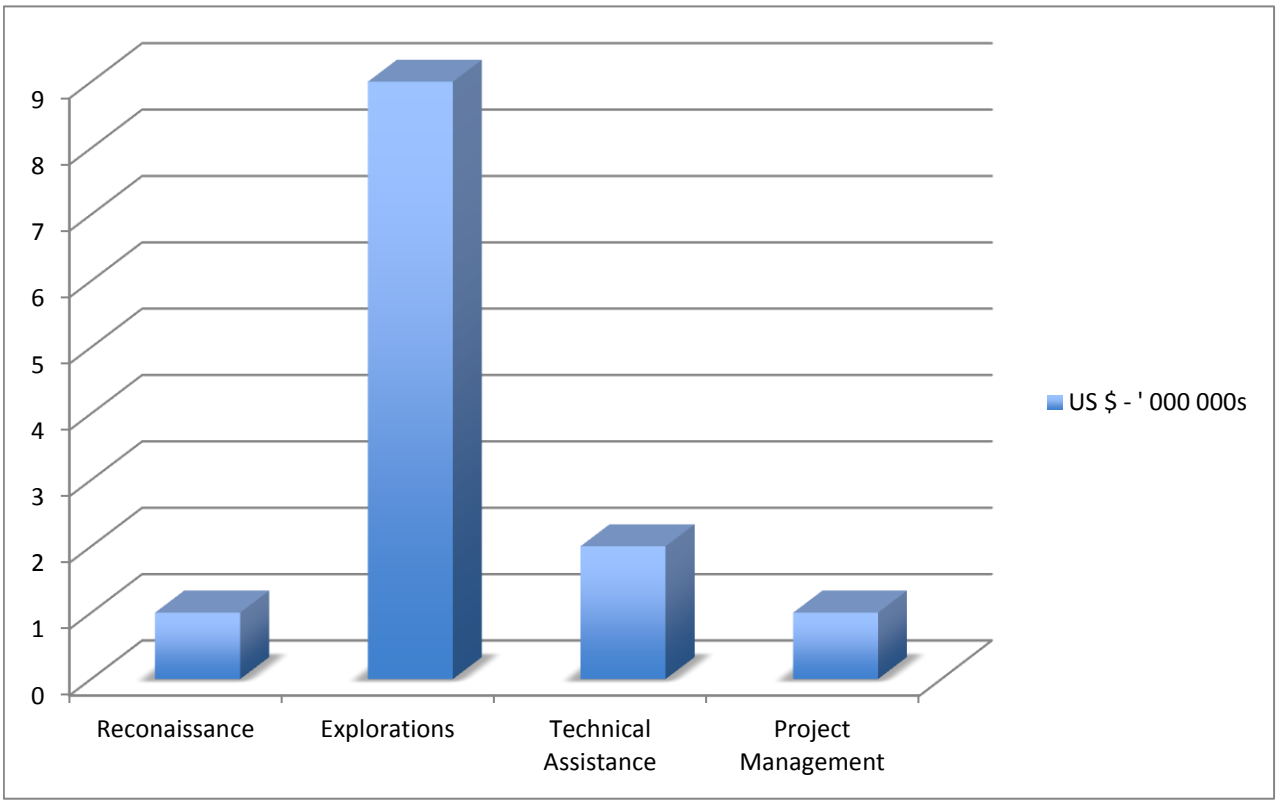

Figure 1: Funding Envelope By Activity Area

Source: ibid

ICEIDA and NDF each contributed up to US$ 6.5 million (€5 million). ICEIDA's approved funding for the project was subject to the customary reservations regarding annual budgetary allocations for the agency. The NDF Board approved €5 million funding for the project.

As the project document established a financial envelope, it was necessary to develop individual country level projects to actualize project activities. MFA-ICEIDA entered into bilateral negotiations with UNEP (ARGeo, Phase 2, and Djibouti), Ethiopia, Eritrea, Kenya, Rwanda, Tanzania and Malawi. The allocation of the Geothermal Exploration Project resources to each country is discussed below.

Resource Allocation by Country

In order to give effect to the GEP concept, it was necessary to negotiate country level projects that responded to the identified programme project's goal and outcomes. MFA-ICEIDA sought to do this in a transparent, demand-led approach, based on individual national priorities.

Djibouti

Djibouti Project Description

MFA-ICEIDA and the Government of Djibouti agreed a Capacity Building and Technical Assistance for Geothermal Development in Djibouti project to be implemented by the Djiboutian Office for Geothermal Energy Development (ODDEG) under the Office of the Presidency in 2014. The overall objective of this project is to assist the Government of Djibouti to increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country.

The immediate objective of the project is improved knowledge and skills for ODDEG staff on geothermal surface exploration and management of geothermal projects, in order to enable further actions on geothermal energy development in Djibouti.

The project results were, according to the project document:

- Improved project management and planning capacity for geothermal project management.
- Two-week geothermal project management training course, organized by the UNU-GTP.
- IPMA accreditation for ODDEG staff in project management.
- Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders), through a training program designed at UNU-GTP in Iceland.
- Increased capacity for monitoring and supervision of geothermal drilling established at ODDEG
- Two-week short course *Well Design and Geothermal Drilling Technology* conducted in Djibouti. The project will aim to develop opportunities for Djibouti experts to learn from on-going drilling operations in Kenya. The aim is that this would include hands-on training in Kenya for up to 8 ODDEG staff in various aspects of geothermal drilling. This training would be carried out by GDC in Kenya, and is thus subject to an arrangement with GDC. At the time of preparing the project document this option has been discussed with GDC, but no arrangements have been finalized.
- Improved knowledge of geothermal surface exploration methods and conceptual modelling.
- Training programme for ODDEG in surface exploration methods and modelling. It is expected that this training programme will include the following main components:
    - Preparations and review of existing data from the area 3 day workshop in Djibouti on surface exploration methods with a review of geophysics, geology and geochemistry data for Lake Abhe and to present the work as to be done on the field.
    - Six weeks on-site training in geophysics to cover required soundings in Lake Abhe (MT, TEM, Gravity)
    - One week field training (if required) for geologist and geochemist to cover additional studies as may be required in Lake Abhe (geologist and geochemist).
    - One month training of two ODDEG geophysicists and 1 geologist in Iceland for analyzing geophysical data and modelling.Finalize work in geology and geochemistry as may be requiredJoint revision of the conceptual model for Lake Abhe by ODDEG and ISOR
    - One candidate from Djibouti undertakes 6 months training at the UNU-GTP in Iceland on geothermal surface exploration in relation to the Lake Abhe training programme.
    - One expert trained in Iceland for a period of 4-8 weeks in reservoir engineering modelling.
- Short term technical assistance provided to ODDEG in relation to this project, to address imminent needs and gap-filling in geothermal development.

The Budget and Revisions

Table 2 (Annex 4) sets out the budget as agreed in the project document. Fig. 2 outlines the focal areas of MFA-ICEIDA support to the (effective) city state's geothermal development.

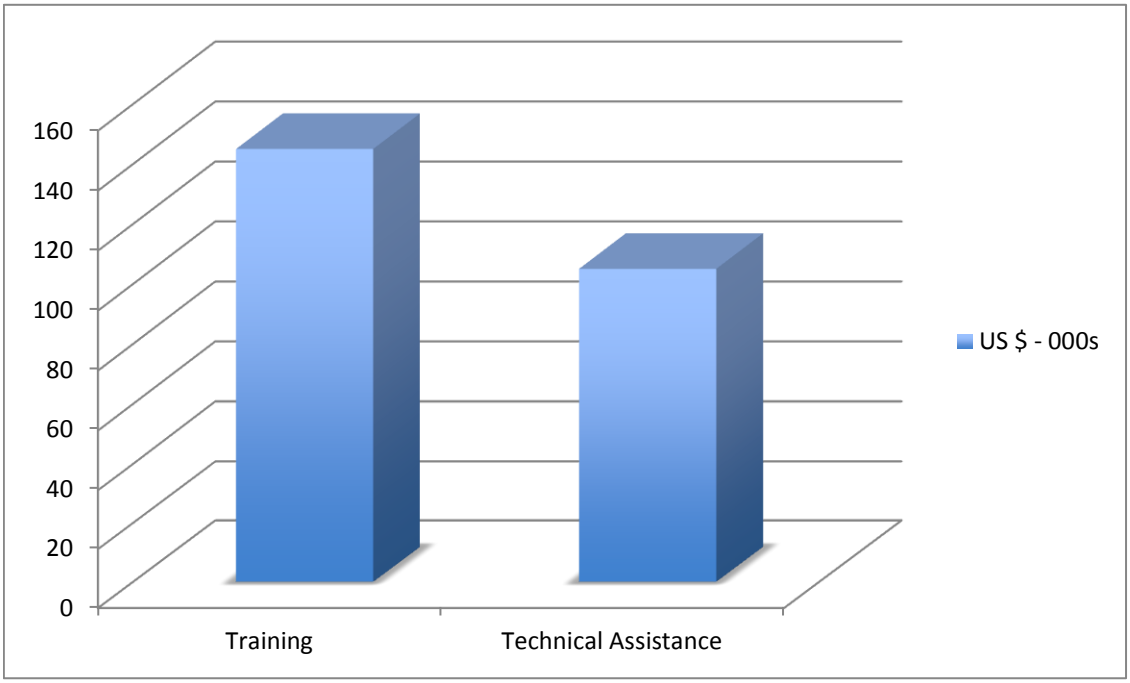

Figure 2: Djibouti Geothermal Support Budget

Source: Djibouti Project Document

In August 2017, MFA-ICEIDA proposed revisions to the budget set out in Table 3 (Annex 4). Fig. 3 shows the effect of these revisions.

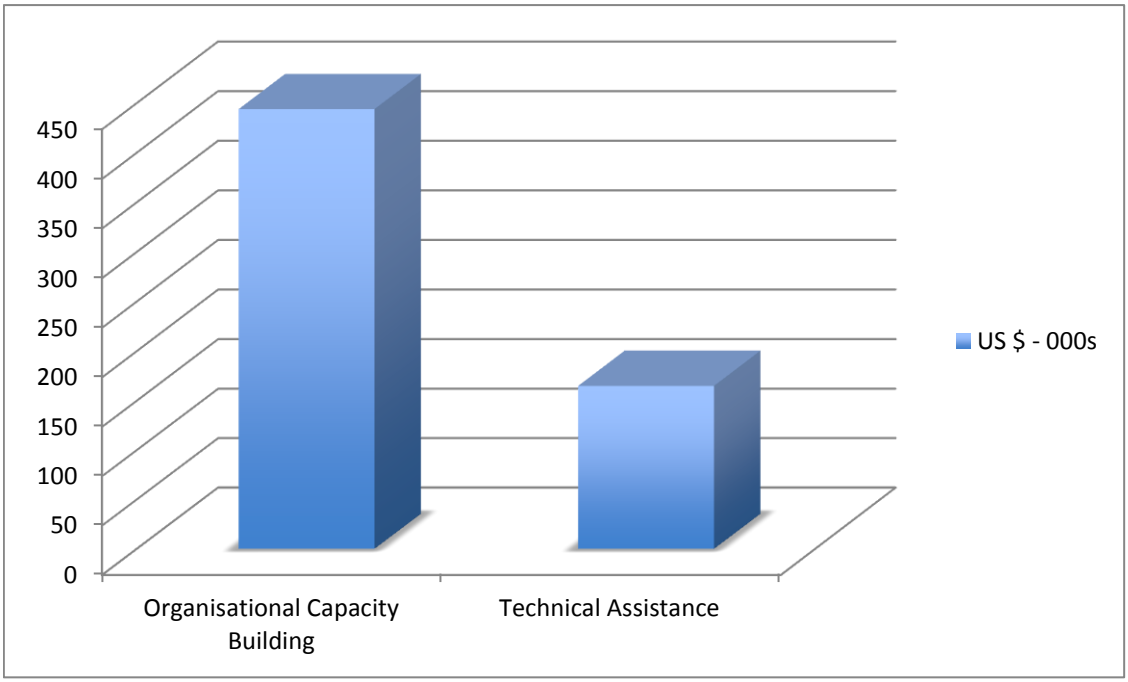

Figure 3: Revised Budget – Distribution of Resources

Source: MFA-ICEIDA Project Manager, 18 August 2017

Eritrea

The Eritrean Project

ARGeo submitted the revised Proposal for Technical Assistance by ARGeo, UNEP-ROA, for the Prefeasibility Study of the Alid Geothermal Prospect in May 2014, a total value of US $1 113 000, to MFA-ICEIDA, of which MFA-ICEIDA's share was US $553 500 (49.7%), for funding. The project document is unusual in that it specifies neither overall, nor specific, objectives. However, close reading leads to the deduction that the overall objective of the project is to perform ongoing preparatory work so that two questions can be answered:

- Where and at what depth is the probable reservoir located? and,
- Is the geothermal resource renewable, i.e., is there sufficient reservoir recharge by ground water to assure sustained resource production over the long term?

In pursuit of these answers the project proposes its specific objective. The risk of failure to discover the reservoir is reduced by carrying out surface exploration for discerning the subsurface conditions and to determine suitable drilling sites and estimated drilling depths.

It aims to achieve this through the following outputs over two phases:

Phase 1

Geologic survey

- The mapping of areas of hydrothermal alteration and secondary mineral deposition and the determination of whether any such mapped features are attributable to a currently active geothermal system.

Geochemical surveys

- The detection and measurement, in the field, of CO2 fluxing across the surface.
- A Radon emanation survey for identifying structures along which thermal gradients may exist and host geothermal fluid circulation.
- Laboratory determination of Mercury concentrations in soil samples, as a way for discerning the longevity of upward fluxes of volatile hydrothermal fluid components.

Geophysical Surveys

- A gravimetric survey centred on Alid massif and covering its peripheral graben floor areas as a tool for defining any Bouguer gravity anomaly that may indicate the lateral extension and depth range of the pluton that is supposed to be the heat source.
- Micro seismic monitoring survey for recording and analysing any subsurface deformation that may be attributable to the activity by a magma body or geothermal fluid circulation.

Supplementary work

- Preparation of a topographic base-map of the Alid area and its environs for use in accurately plotting the exploration data and interpretations.

Phase 2

MFA-ICEIDA also supported Phase 2 of the UNEP-implemented ARGeo support. Table 4 (Annex 4) identifies the extent of this. This support built on MFA-ICEIDA support to ARGeo that had persisted from the early 2000s and, initially, was characterised by sponsored short courses at the bi-annual conferences. The support to Phase 2 expanded MFA-ICEIDA's focus to support for core activities, including the establishment of the African Centre of Excellence.

- A combined transient electromagnetics (TEM) and magnetotellurics (MT) survey to be carried out in the area that is expected to be indicated by the results of the Phase 1 surveys to be underlain by a probable geothermal reservoir. This is expected to outline the probable reservoir and its depth estimate.

A successful conclusion of the above surveys should be followed by the execution of:

- a hydrogeological survey to determine the existence and provenance of ground water recharge to the reservoir, including the establishment of a meteorological station; and,
- the study of the possible social and environmental impact of geothermal development at Alid and to recommend the impact management scheme.

The Budget

As noted, the total budget for the project was US $1 113 000; MFA-ICEIDA's share was US $553 500, 49.7% of the total. Table 4 (Annex 4) provides a breakdown of the project budget as proposed. Fig. 4 shows the distribution of resources by investment area and partner organisation.

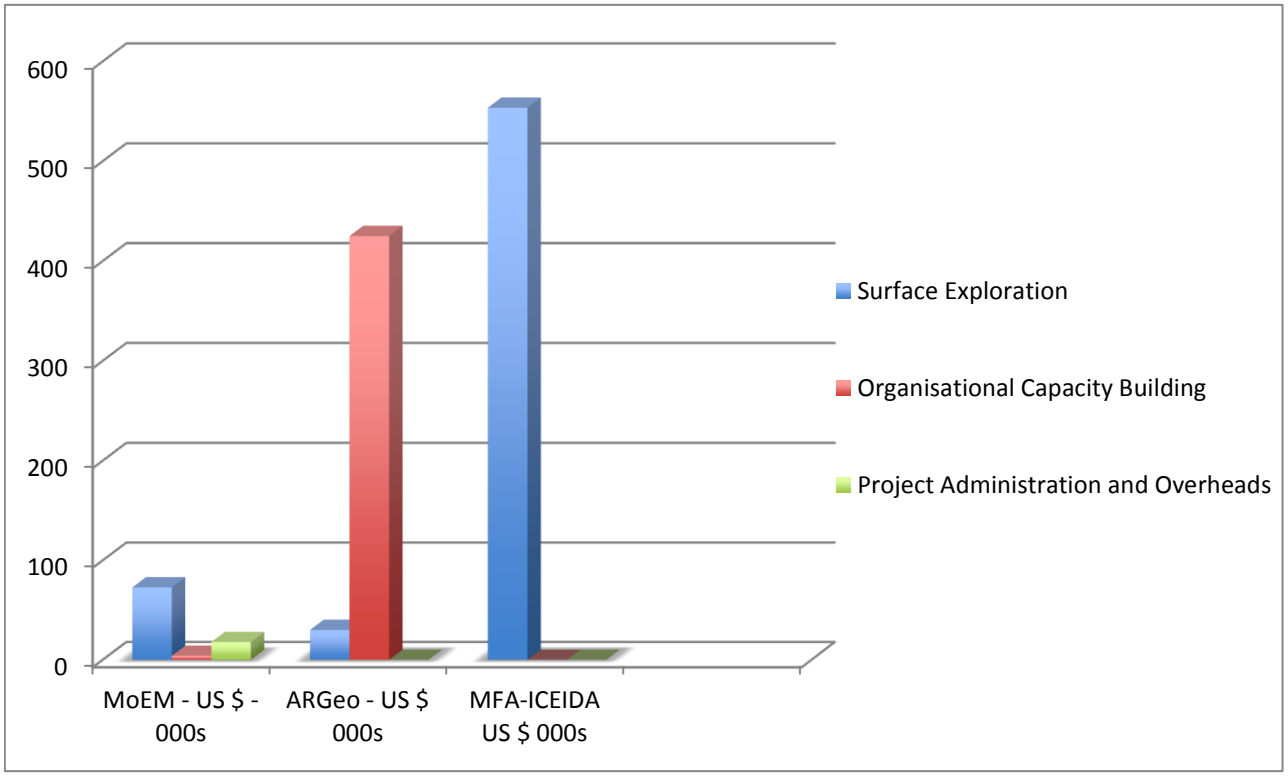

Figure 4: Distribution of Resources by Partner and Investment Area

Source: Project Document, May 2014

Fig. 5 shows the total resources by partner.

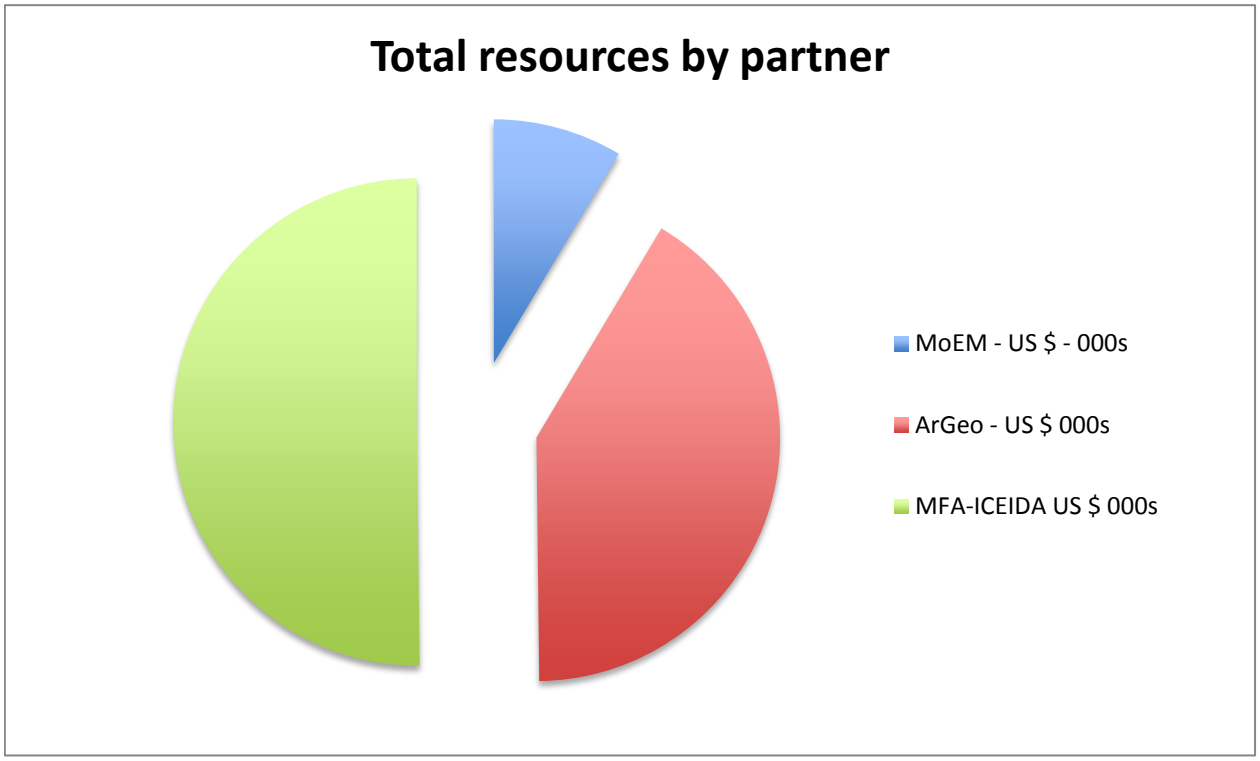

Figure 5: Distribution of Resources by Partner

Source: ibid

Ethiopia

The Ethiopia Project

This project aims to contribute to the efforts of the Government of Ethiopia to further the development of geothermal energy in the country, by addressing two main challenges which are considered of key importance to move forward:

a) Lack of detailed surface exploration studies in key geothermal sites, and identification of potential exploration drill sites within those areas.

b) Need for increased capacity and human resources in Ethiopia to take on the growing work in scientific and managerial aspects of geothermal development

Due to the uncertainty associated with geothermal energy development, in particular in the early stages, public resources are required for resource identification, including research on geochemistry, geophysics through surface exploration studies and subsequent test drilling. In light of the vast potential for the development of geothermal energy in the country, investment in local capacity building and knowledge transfer to advance geothermal development is further considered of great importance.

The focus of this project addresses the needs for Geological Survey of Ethiopia (GSE) and Ethiopian Electric Power (EEP) to

- build capacity to handle further growth and development in geothermal energy production, as well as
- assist with finalizing geothermal surface explorations and associated geophysical and geochemical studies in order to identify locations for drilling of exploration and production wells in target sites.

The project's **overall objective** is to

- assist the Government of Ethiopia to increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country.

The **immediate objective** is to

- identify potential sites for exploration drilling in the target areas and develop capacity in Ethiopia to advance geothermal energy production in the country.

At the end of the project it is expected that Ethiopia will have defined drill sites in 3 potential geothermal areas, which could potentially yield 100-150 MW of energy, as well as enhanced capacity in exploration, drilling, and geothermal project management to advance projects to further stages of development as laid out in future energy development plans of the country. Environmental and Social Impact Assessments will be in place for areas where potential exploration drill sites have been identified.

The project specifically addresses MFA-ICEIDA's Cross cutting issues (Gender and Environment). To this end, an Environmental and Social Impact Assessment will be carried where potential sites have been identified for exploration drilling. As part of the social impact analysis of these studies, gender aspects will be addressed. The gender ratio of trainees was to be addressed; in addition, the participation of both encouraged, including applications from female trainees for the UNU-GTP six-month programme.

The Budget

ICEIDA/NDF support to Ethiopia's Geological Survey and the Electric Power Corporation was approved in August 2013. Table 6 (Annex 4) details the budgeted provisions by investment area. Fig. 6 shows this graphically.

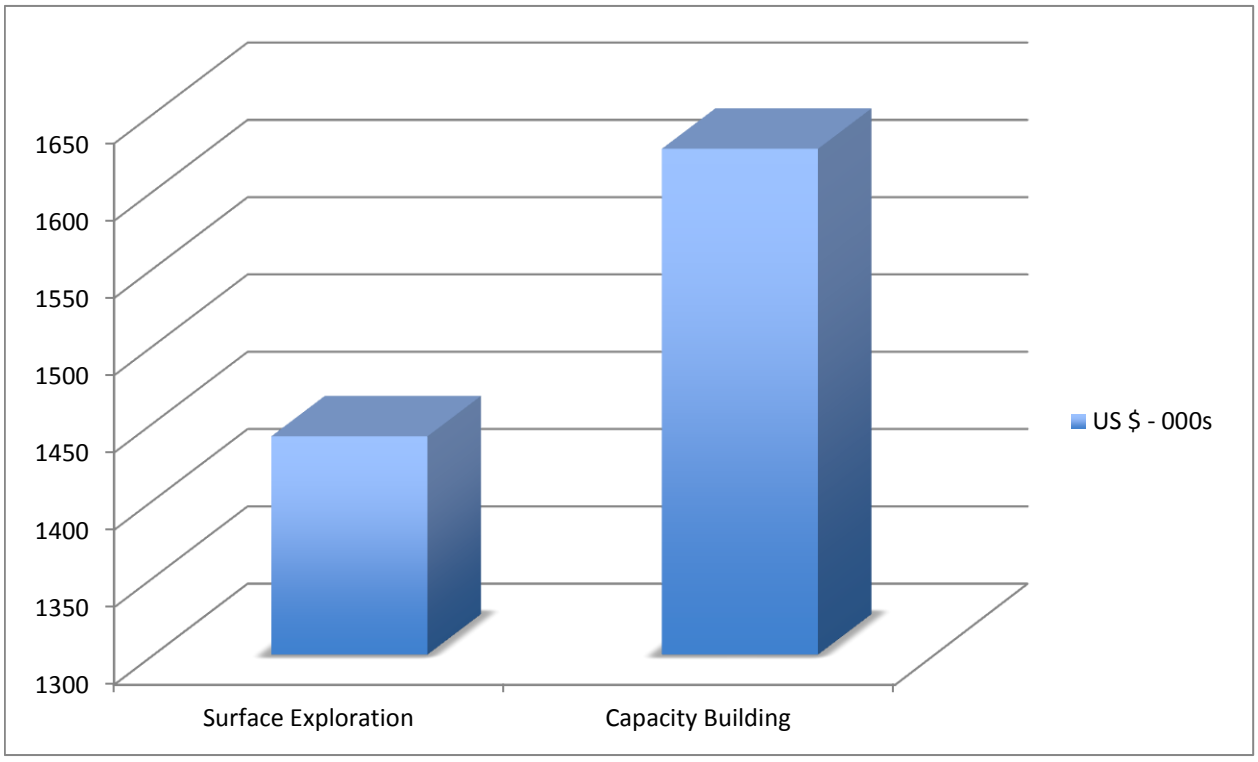

Figure 6: Budget by Investment Areas

Source: Project Document, Ethiopia - Iceland Cooperation in Geothermal Development Initiated under the Iceland - World Bank Compact on Geothermal Energy

Subsequently, based on advice from ISOR, the project budget was revised to reflect changed targets and progress to date (2015). Table 7 (Annex 4) identifies the proposed changes. Fig. 7 provides a graphic overview of the proposed changes.

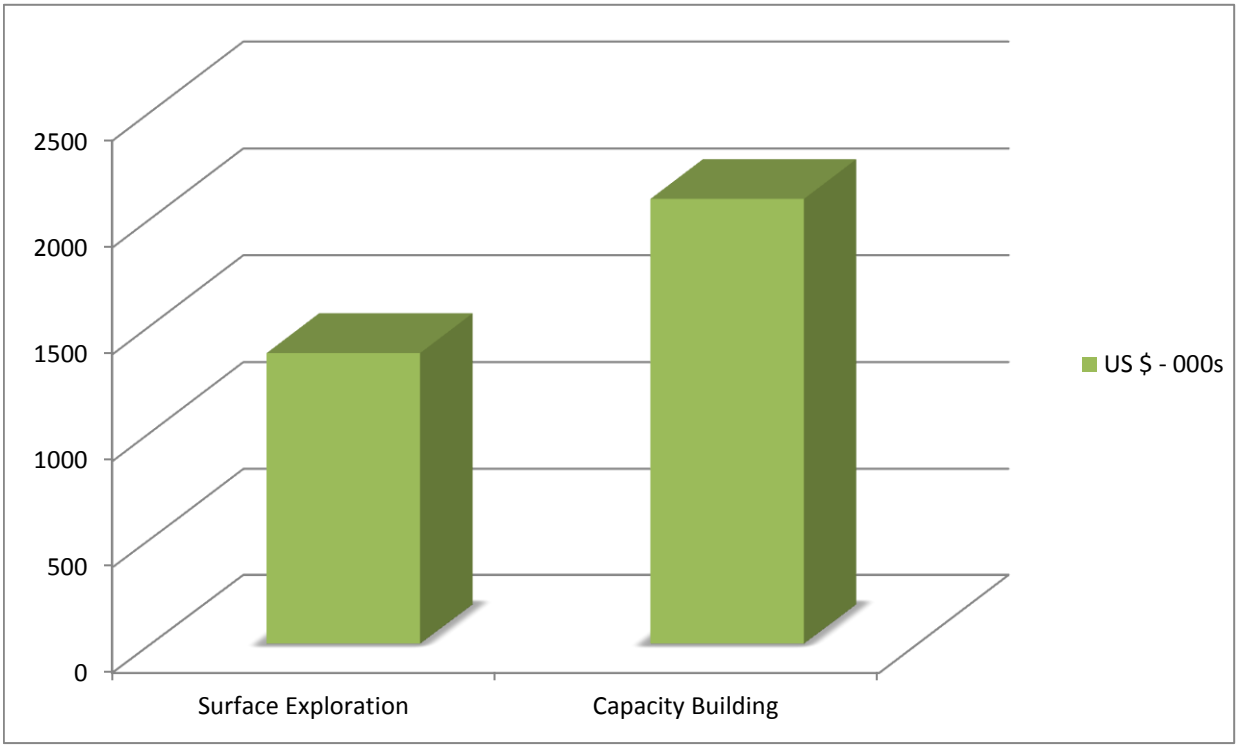

Figure 7: Revised budget by Investment Focus

Source: Memo, Revision of Project Document and Budget, Ethiopia, 17 September 2015.

Kenya

The Project Description

In October 2014, MFA-ICEIDA signed a capacity building support agreement with Kenya's Geothermal Development Company (GDC). The **overall objective** of this collaborative project is to assist the Government of Kenya to enhance their geothermal energy development for the social and economic benefit of the country by further enhancing their knowledge of geothermal resources and build capacity for geothermal development in the country.

The **immediate objective** of the project is

…to contribute to enhanced capacity of GDC in geothermal development and further reduce the risk of planned exploration drilling with technical review studies.

GDC identified the following as areas of collaboration within the scope of the ICEIDA/NDF programme:

- Capacity building for 15 GDC staff: attend training internships at geothermal institutions and companies in Iceland.
- 20 GDC staff attend two-week training course in Kenya on Geothermal Project Management, carried out by the UNU-GTP.
- Feasibility for geothermal drying pilot project established.
- Technical review of the surface exploration studies for the Suswa prospect conducted with revised conceptual model a drilling targets, including capacity building for GDC staff during the review process.
- GDC Chemical Laboratory accredited in accordance with ISO-17025 standard.

Furthermore, the cooperation between GDC and the ICEIDA/NDF geothermal exploration project was also expected to entail further elements of capacity building for GDC staff through the establishment of the African Geothermal Centre of Excellence (AGCE).

The Budget

Table 8 (Annex 4) sets out the identified budget of the Kenya project. Fig. 8 shows the resource distribution by investment focus.

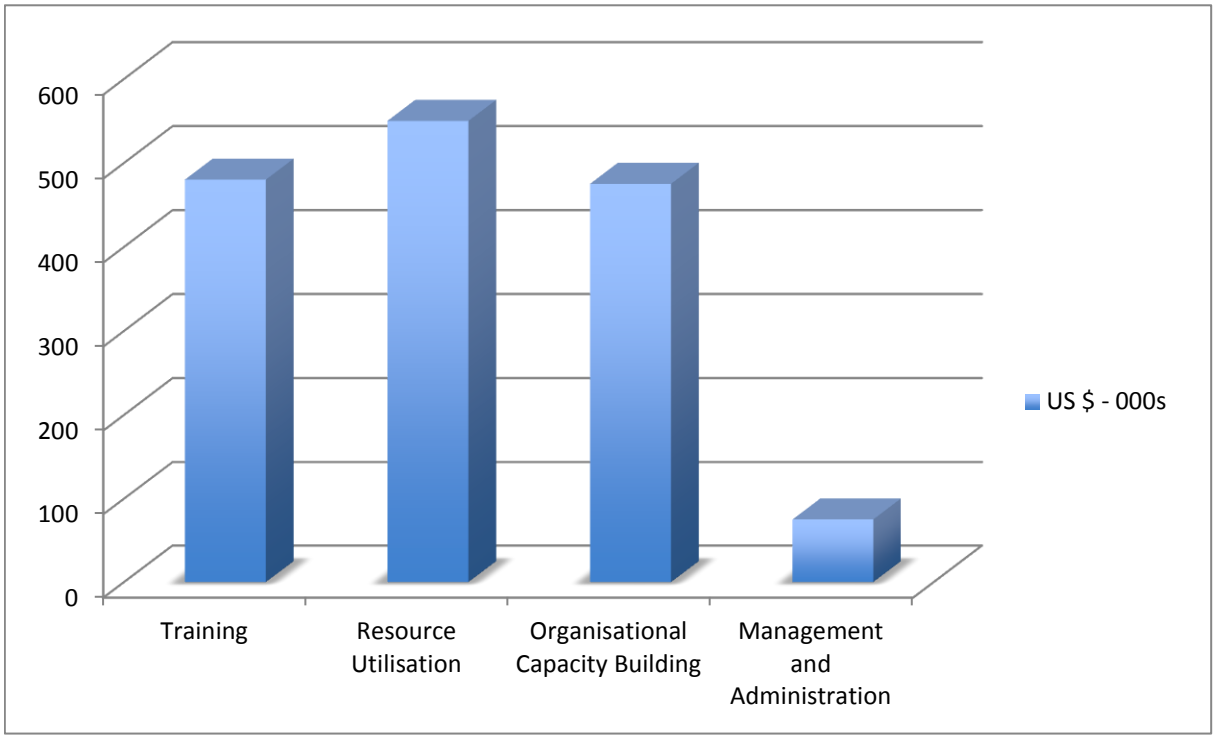

Figure 8: Investment in Capacity Building by Sub-Sector

Source: Project Document: Capacity Building GDC –ICEIDA/NDF Cooperation

Rwanda

The Rwanda Project's Description

The project signed an agreement with the Energy, Water and Sanitation Authority (EWSA) in Rwanda to support Capacity Building and Technical Assistance for Geothermal Drilling. The **overall objective** of this project is to assist the Government of Rwanda to

…increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country.

The **immediate objective** of this project is to

…equip EWSA with resources, knowledge, skills and equipment to effectively administer and monitor geothermal drilling.

At the end of the project it is expected that the targeted staff of EWSA will have gained knowledge and practical skills to effectively administer and monitor relevant scientific and practical aspects of geothermal drilling.

The three expected outputs were:

a) Increased capacity for monitoring and supervision for geothermal drilling at EWSA
   - Short Course conducted in Kigali for EWSA staff with evaluation of participants' performance.
   - EWSA borehole geologist trained and evaluated.
   - EWSA drilling engineer trained and evaluated.
   - EWSA chemist trained and evaluated.
   - EWSA environmental scientist trained and evaluated.
   - Equipment for geothermal monitoring and analysis purchased based on needs assessment.
   - All trainees have received certificates in line with the training they have received.
   - Training report with assessments of trainees and main challenges identified.

b) Support for technical assistance in drilling supervision
   - Experienced drilling supervisor contracted by EWSA for a period of 9 weeks.

c) Gender and Environment
   - Gender ratio of trainees will be observed, an application from a female trainee for the UNU-GTP 6 months program will be encouraged.

An Environmental and Social Impact Assessment has been conducted for the Karisimbi Geothermal Project. The project will adhere to environmental and safety instructions which have been prepared.

Budget

Table 9 (Annex 4) details the agreed budget for the Rwanda Project. Fig. 9 demonstrates MFA-ICEIDA support for Rwanda's geothermal capacity development by investment sub-sector.

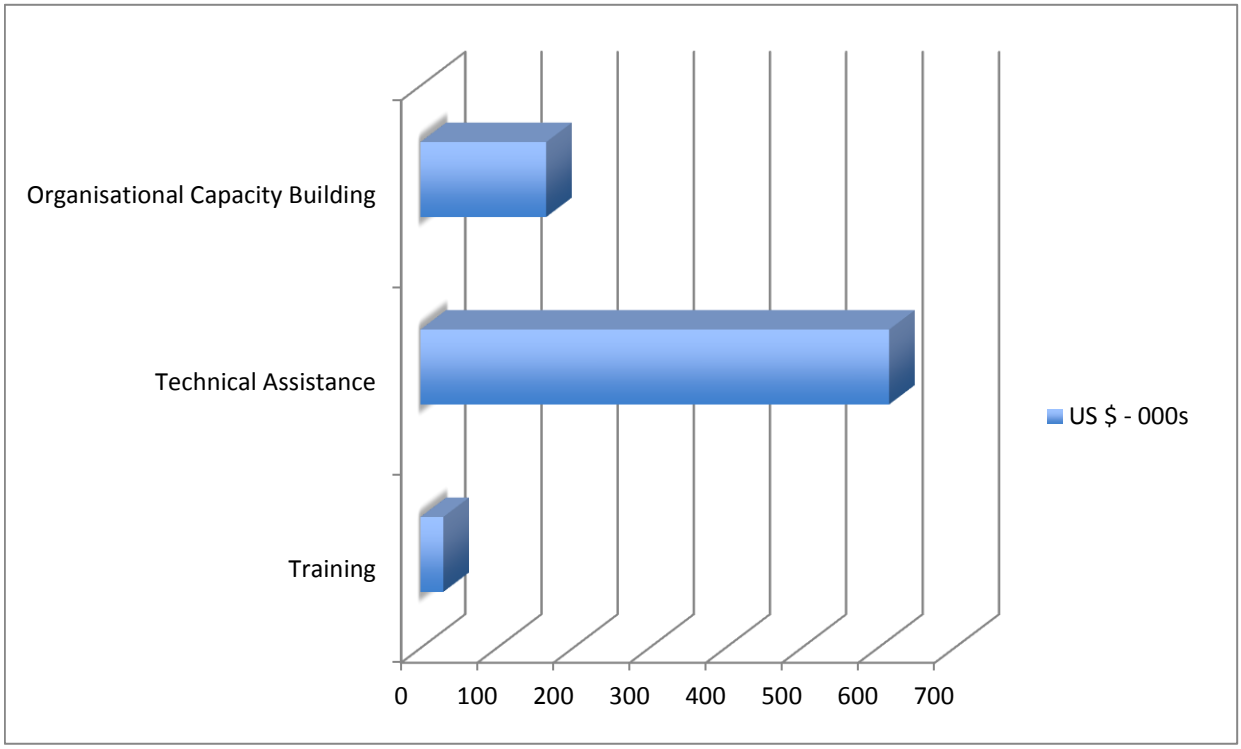

Figure 9: Capacity Development Investment by Sub-Sector

Source: Capacity Building and Technical Assistance for Geothermal Drilling in Rwanda, Project Document

Tanzania

The Project Description

Tanzania, through the Tanzania Geothermal Development Company Limited (TGDC) (under the Ministry of Energy and Minerals), and MFA-ICEIDA agreed the Surface Exploration and Capacity Building for Geothermal Development in Tanzania project document with a total value of US $1 565 000. The **overall objective** of this project is to assist the Government of Tanzania to increase their renewable energy access through low emissions geothermal energy development for the social and economic benefit of the country.

The **immediate objective** of this project is enhanced knowledge of selected geothermal areas in Tanzania with identification of potential sites for exploration drilling if applicable and improved capacity in Tanzania to advance geothermal energy production in the country. To this end, with the project's conclusion, Tanzania will have detailed knowledge of potential geothermal areas and, if viable, defined drill sites. Equipment for geophysical and geochemical surveys will be in place, and knowledge to operate this equipment in subsequent studies. The experts at TGDC will further have gained knowledge on management and planning of geothermal projects, which will enhance their capacity to plan and implement subsequent activities.

The project's envisaged results were:

- Surface exploration conducted and up to 3 drilling targets identified, if geothermal potential allows, in the Luhoi geothermal prospect and training in surface exploration in Kiejo-Mbaka geothermal area, involving increased involvement and responsibility of TGDC staff, under the supervision of experienced experts to be hired under the ICEIDA/NDF project: including the following components:
  - Geology/hydrogeology,
  - Geochemical studies,
  - Soil Gas study,
  - TEM-MT survey,
  - Gravity survey,
  - Conceptual modelling,
  - Elaboration of well design and drilling program if applicable.
- Preliminary social and environmental impact assessment (ESIA) in relation to proposed drilling targets, if applicable
  - transfer of knowledge and techniques for geothermal surveys and modelling to TGDC.
- Quality monitoring of surface studies and follow up
- Support to quality monitoring and supervision of surface studies under output 1 and 2.
- Review of final reports under output 1 and 2, by external reviewers and technical meeting held.
- Technical Assistance for TGDC to support the advancement of the development of the Ngozi geothermal prospect *inter alia* through addressing
  - imminent needs and gap-filling related to studies in the area,
  - review and advice on existing studies,
  - assistance with drill plans,
  - reviews and training related to analysis and
  - monitoring of drilling.
- Equipment to conduct field surveys provided and relevant training for operations and maintenance implemented (in relation with other donor funding). Together with equipment purchased under the UNEP/ARGeo programme it is expected that TGDC will have available a set of equipment, which can be deployed for multiple surface exploration studies.
- Improved capacity of TGDC staff for management and planning of geothermal projects
- Training provided for TGDC staff (10 – 15 on two courses each) through regional training courses in Kenya or elsewhere. This training will be aligned to the extent possible with the proposed African Geothermal Centre of Excellence, planned for the region.
- Cross cutting issues – Gender and Environment
  - Where potential sites are identified for exploration drilling, a preliminary ESIA will be commissioned, ensuring addressing necessary environmental and social aspects; gender aspects will be addressed in the social impact analysis. Trainees' gender ratio will be observed and with both encouraged to participate in all training conducted.

The Budget

The project document identifies a total US $1 565 000 funding envelope. Table breaks this down by output area. Table 10 (Annex 4) details the planned budget. Fig. 10 shows the distribution of resources by area of planned investment.

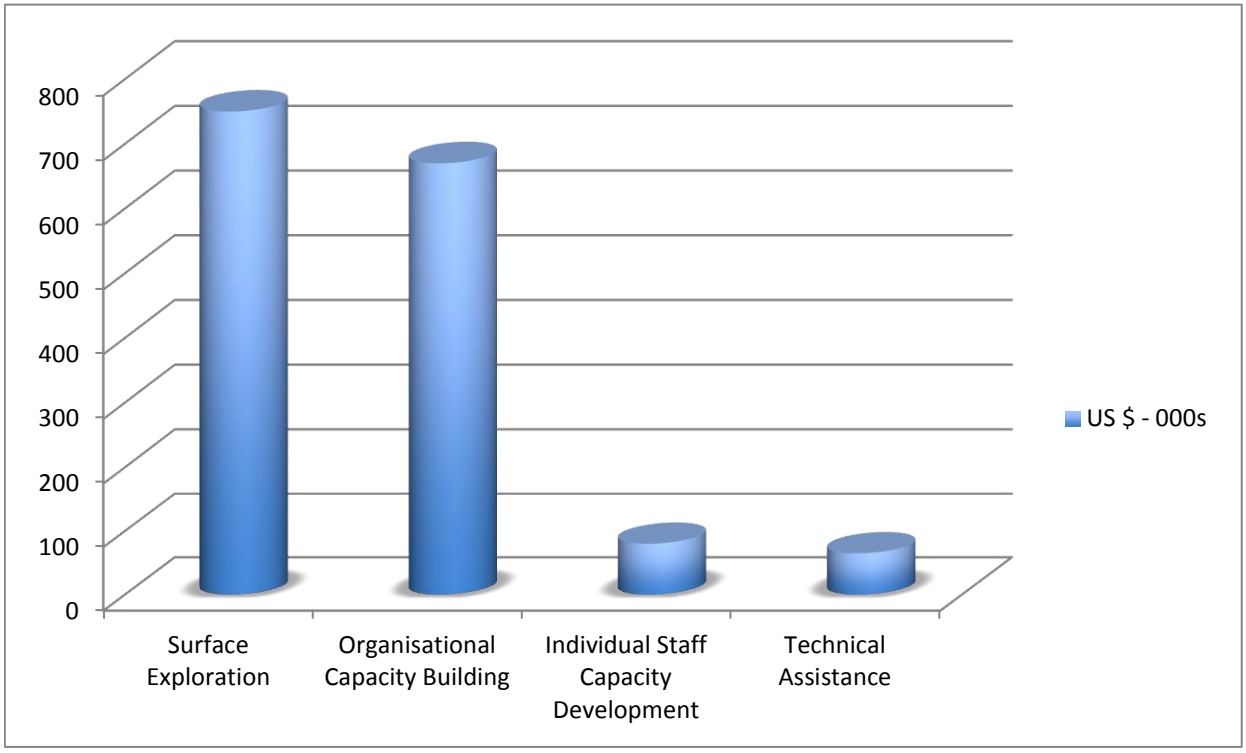

Figure 10: Resource distribution of Investment Area

Source: Tanzania Project Document

Malawi

Project Description

The Ministry of Natural Resources, Energy and Mining (MoNREM), Malawi launched a geothermal reconnaissance and exploration project, under the World Bank supported Malawi Energy Sector Support Project (ESSP). To enhance its capacity in project implementation unit with monitoring and review of the project, the MoNREM requested technical assistance from the ICEIDA/NDF Geothermal Exploration Project. This request was in line with the MFA-ICEIDA – World Bank compact. As a part of the cooperation with MoNREM, MFA will provide support for technical assistance to MoNREM in the monitoring and reviews of the geothermal studies. This support will also involve capacity building elements for the project implementation unit and geothermal experts in Malawi in relation to the project.

The objective aimed to provide MoNREM with highly qualified consultants within the field of geothermal research and development, thereby ensuring high quality of all work undertaken within Assessment of Geothermal Resources in Malawi: A Reconnaissance and Pre-feasibility Study. This technical support assisted MoNREM to ensure relevance, solid scientific foundations and high quality of all work undertaken. Iceland GeoSurvey (ISOR) provided the technical assistance to MoNREM and the project implementation unit during the implementation of the project from March 2016 to June 2017.

The outputs of the technical assistance were as follows:

- Assist the project implementation unit in evaluating reports from contractors as defined in the Terms of Reference for the contractor. Assuming that previous steps lead to further exploration the following reports will be reviewed:
  - Inception report,
  - Five quarterly reports,
  - Preliminary Appraisal Report,
  - Resource Assessment Report of Two First Priority Prospects,
  - Engineering Pre-feasibility Study Report,
  - Preliminary Environmental Social Impact Assessment,
  - Final Pre-feasibility Study Report.
- Provide written reviews of reports from contractors and recommendations for approval or actions to be addressed by the contractor. The reports will be evaluated based on technical and scientific merit and used to assess whether the contractor has conducted the work in accord with the contract.
- Provide the project implementation unit with advice as applicable.
- Presence at meetings which may include:
  - At the end of Stage 2 of the project, when the Consultants present their findings of the four - seven geothermal areas, select two for more detailed study.
  - At the end of Stage 3 of the project, when the Consultants present the Pre-feasibility Study Report.
- Conduct a two-day workshop, after Stage 2, for Malawian scientists involved in the project, to
  - review methods, findings and the learning process from the project.
- Conduct a two-day workshop/briefing session with the project implementation unit and Malawian experts to
  - outline key findings related to the final report,
  - discuss implications and,
  - subsequent possibilities for geothermal development.
- Depending on the results of the Final Pre-feasibility Study Report, provide MoNREM with advice and assistance to develop a geothermal project further, as applicable with reference to the recommendations of the final report.

The ToR provide no details of the cost of ISOR's technical assistance support but it formed part of the overall framework contract agreed with ISOR at the start of the Geothermal Exploration Project, with individual call-downs dependent on the development and approval of individual ToR.

3.3 RESOURCE UTILISATION

Total Disbursement, 2013 – 17 is clearly demonstrated in Fig. 11.

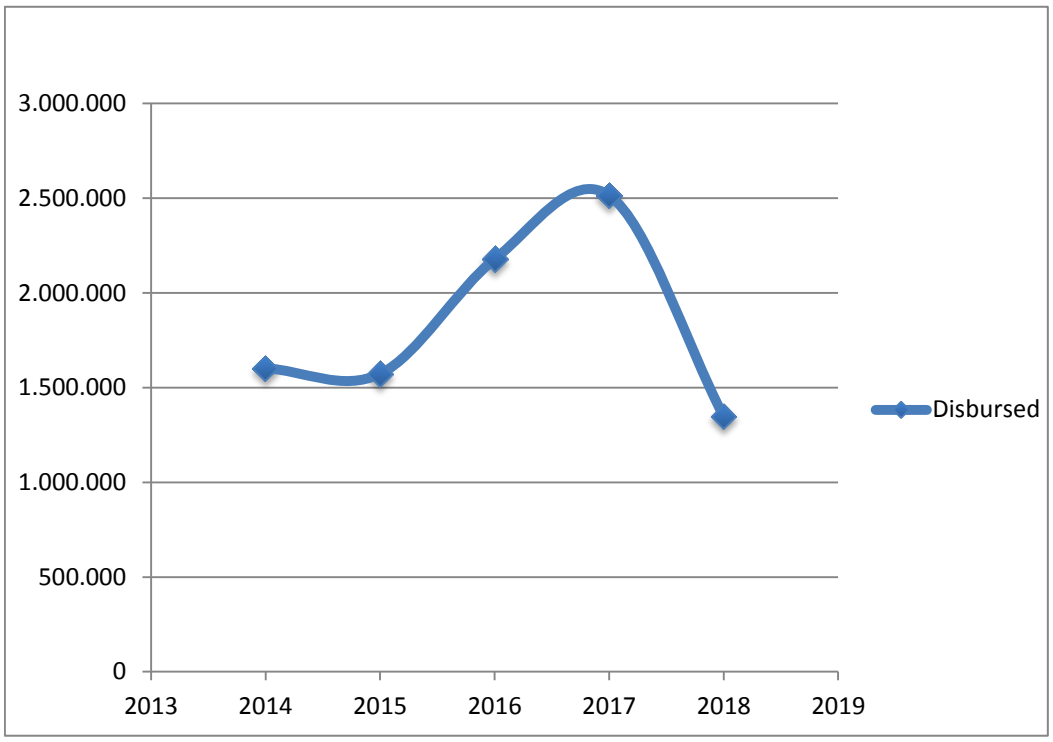

Figure 11: Total Disbursement by Year

Source: Overview by Country, MFA-ICEIDA

Fig. 12 shows the utilisation of total support (including that to Eritrea) by ARGeo.

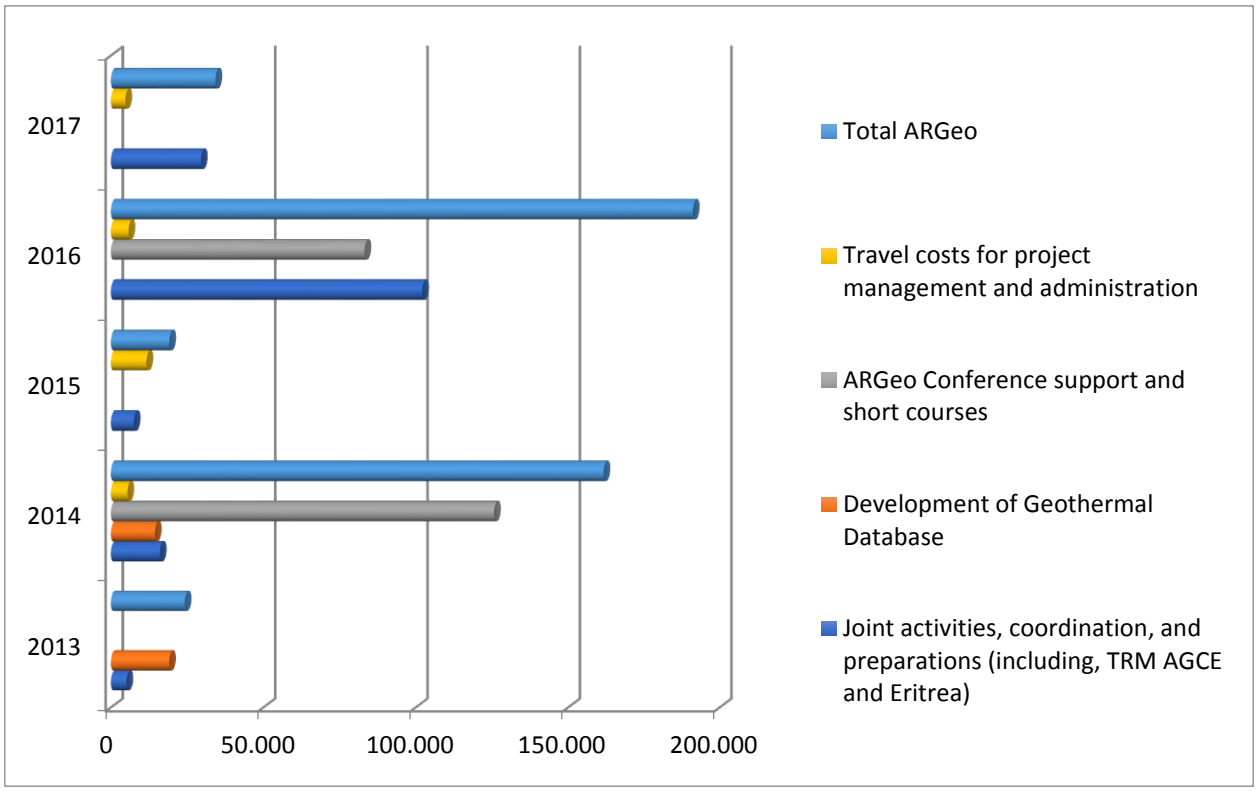

Figure 12: Support to ARGeo, 2013 - 17

Source: ibid

The dominance (in terms of value) of the Eritrean surface exploration support is clearly evident[4] in Fig. 12.

[4] It is important to note that the Eritrean surface exploration remained incomplete at the time of the evaluation. For reasons that remain unclear to the evaluation (but appear linked to the ongoing tensions between the country and Ethiopia and the Government's associated increase in suspicion of external actors), it was out on hold. The evaluation was informed at the Kigali ARGeo conference that the Eritrean authorities had written to request that work to complete the exploration restart and complete as early as possible. MFA-ICEIDA had already committed all planned and identified resources for the Eritrean project's completion at the time.

Fig. 13 excludes support to the Eritrean surface exploration project.

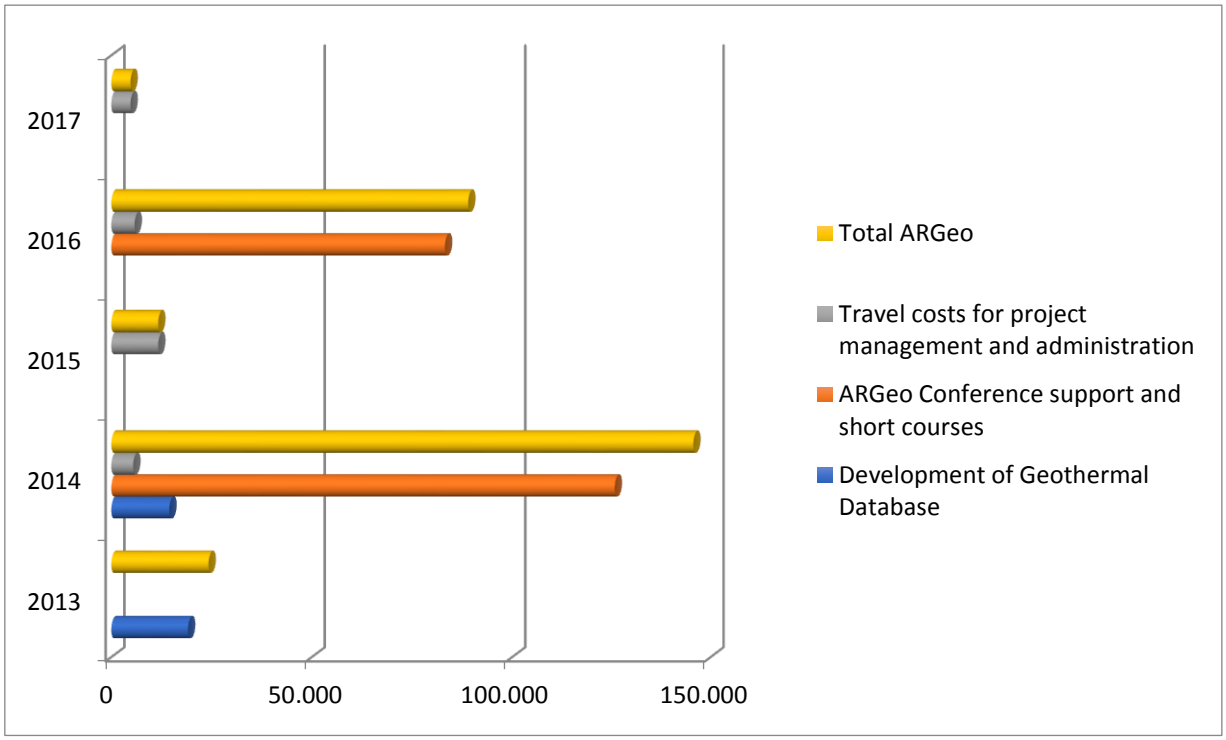

Figure 13: ARGeo Support, 2013 – 17 (excluding Eritrean support)

Source: op cit

Once the Eritrean project support is extracted, it is evident that the most important area of MFA-ICEIDA support was to the bi-annual ARGeo conferences, a utilitarian meeting point of African Rift Valley countries pursuing geothermal energy, financiers (including donors) and private sector actors.

Djibouti

Fig. 14 describes the Djibouti project's utilisation of resources.

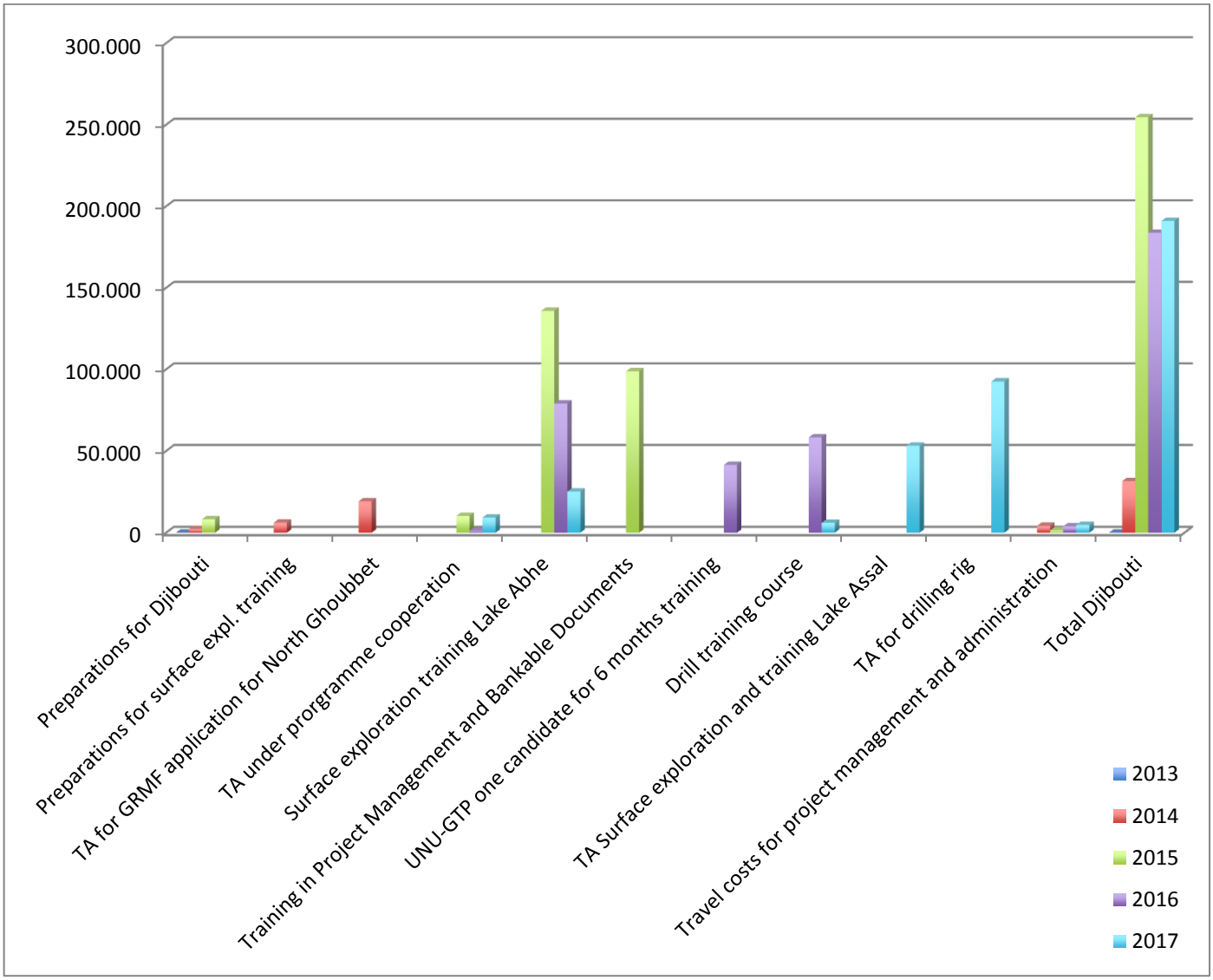

Figure 14: Utilisation of Resources, 2013 – 17 (steps of 50.000)

Source: Op cit

Figure 14 clearly identifies the three major investment areas, viz. surface exploration training, Project Management and bankable proposal development training, and training in the use of the drilling rig, particularly when the drill training course is included. Interlocutors emphasised the value added they gained from the project as a whole but particularly from these interventions as they advanced geothermal development activities further along the value chain.

Ethiopia

Fig. 15 describes the utilisation of resources in the Ethiopian project.

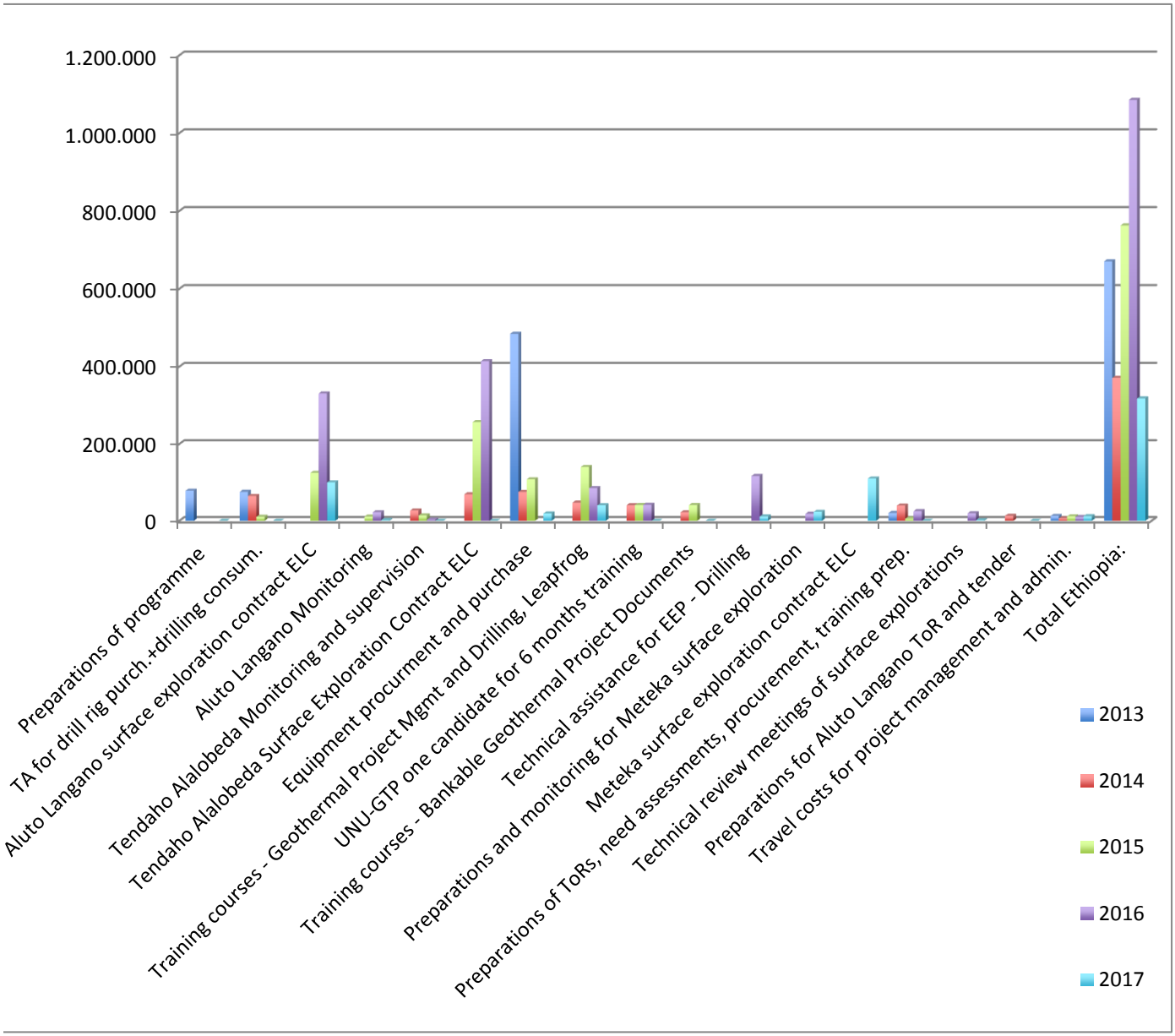

Figure 15: Resource Utilisation by Investment Area, 2013 – 17

Source: Op cit

Fig. 15 clearly shows that the major areas of utilized investment were in respect of surface exploration (two sites) and the procurement of equipment. While these were the major investment areas, interlocutors emphasised the value added accrued through training (e.g. in the correct use of the procured equipment) and technical assistance (e.g. in interpretation of the surface exploration data) support that the project provided. Furthermore, over the five year, c. US $3.3 million investment, the project had supported successful access to Geothermal Risk Mitigating Facility (GRMF) support totalling US $6 million. In addition, interlocutors informed the evaluation that the country had secured a US $212 million loan to finance drilling 20 wells in the Aluto Langano prospect area; in their view, a major contributory factor to this was the improved surface exploration data interpretation achieved as a result of the TA support in this area.

Based on this, it is evident that the investment has been efficiently utilized and has resulted in significant gains for geothermal development in Ethiopia.

A picture of the geothermal field at Aluto Langano in Ethiopia (with an existing 7 MW power plant which is currently out of operation). MFA-ICEIDA support has identified drilling targets for power plants. This picture was taken during the field mission by our evaluators.

Kenya

Fig. 16 shows the Kenya project's utilized investment by areas of investment.

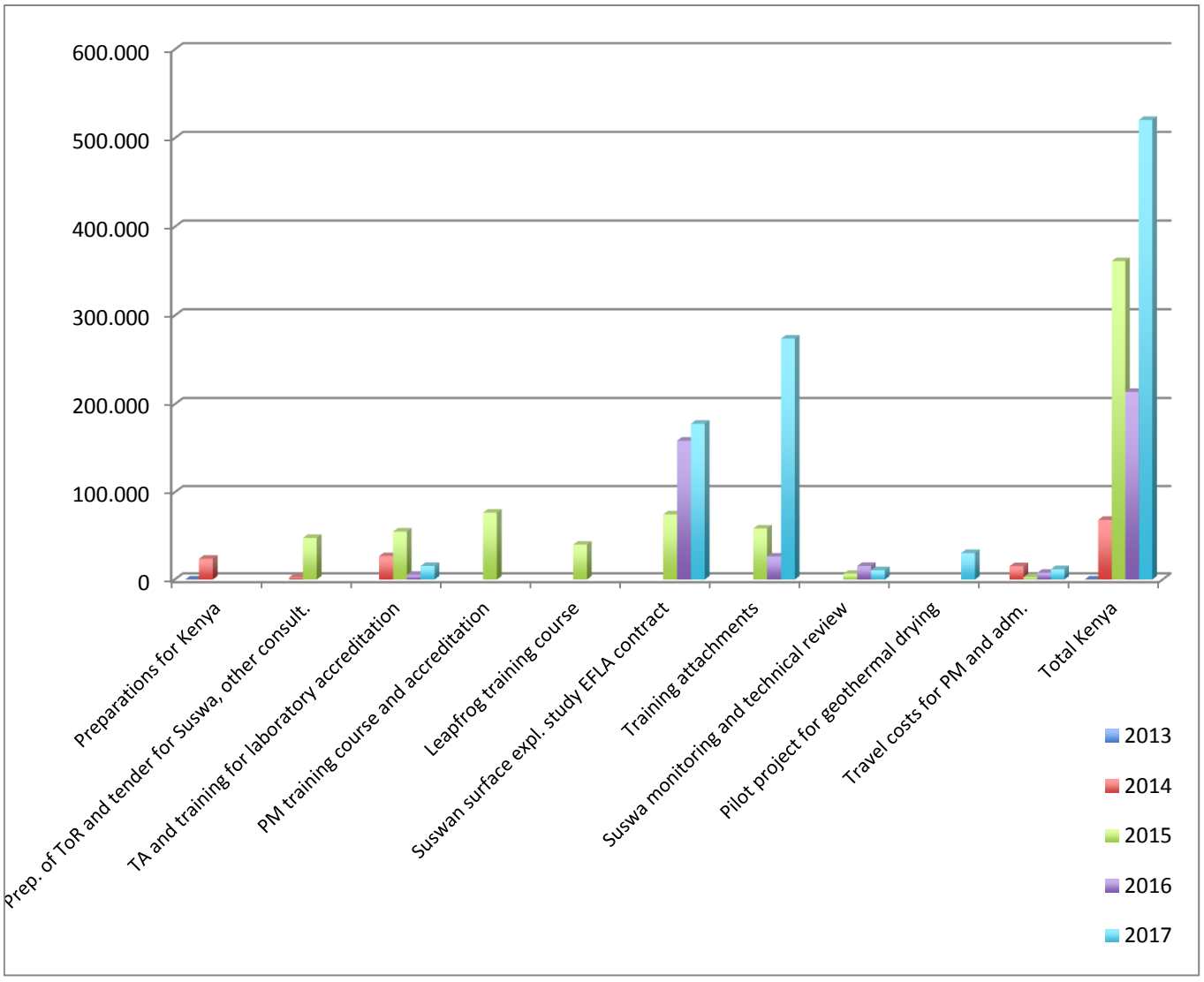

Figure 16: Resource Utilisation by Investment Area, 2013 – 17 (steps of 100.000)

Source: Op cit

Fig. 16 clearly shows that the major resource utilisation areas were in respect of training attachments and surface exploration support (in the Suswa prospect). GDC interlocutors in the Geothermal Resource Assessment (GRA), Geothermal Resource Monitoring (GRM) and Direct Use departments who participated in the training attachments, emphasised the personal and organisational value added achieved through this support.

Malawi

Fig. 17 clearly shows the areas of support to the World Bank-supported programme through the MFA-ICEIDA – World Bank Compact.

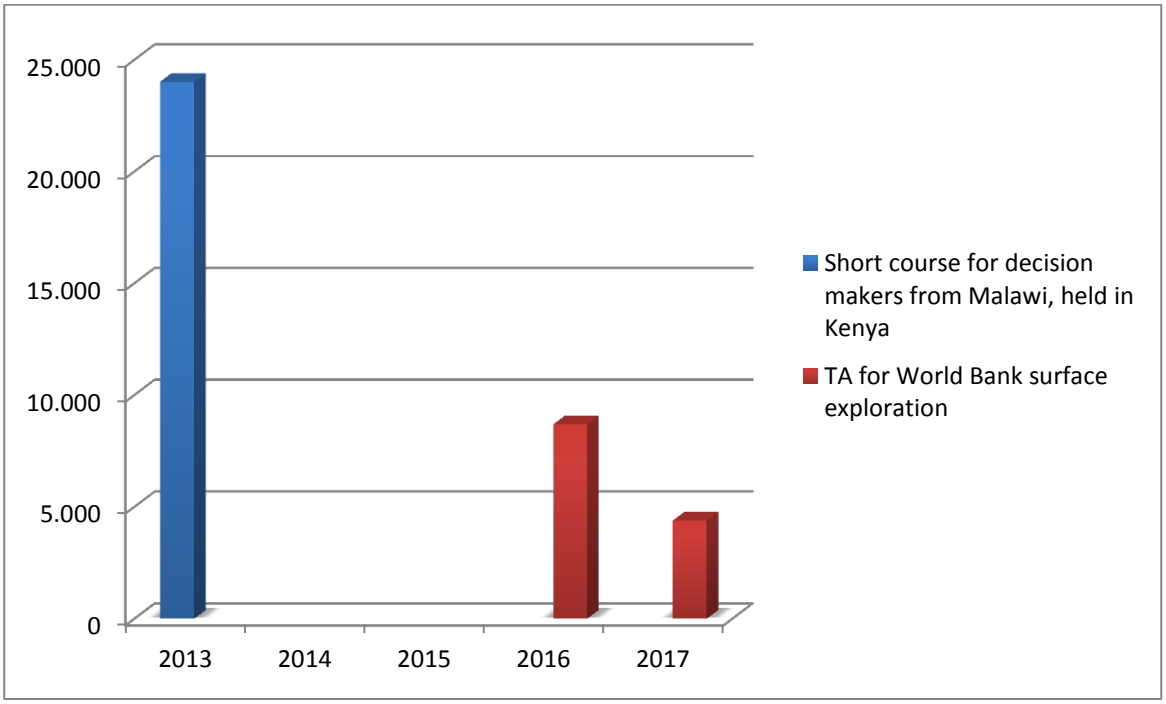

Figure 17: Support to Geothermal Capacity Building, 2013 – 17

Source: Op cit

ESMAP interlocutors supported the value-added through the project's support for ISOR TA for the identified purposes.

Fig. 18 outlines the utilisation of resources allocated for MFA-ICEIDA's limited support to Rwanda's geothermal programme.

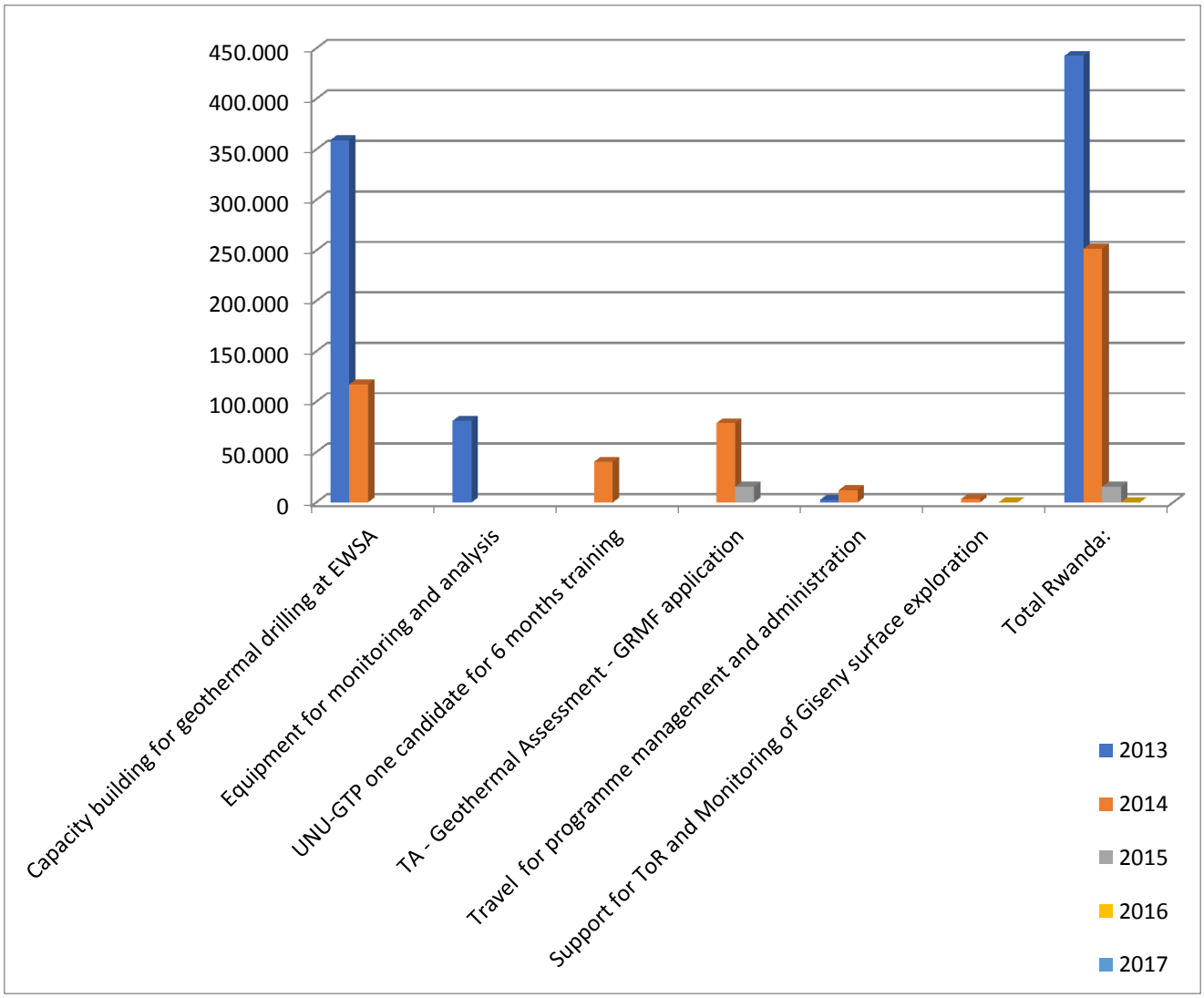

Figure 18: Utilisation of Resources, 2013 – 17

Source: Op cit

Rwandan interlocutors indicated that the MFA-ICEIDA geothermal project's support had enabled the country to identify future priorities for Rwanda's geothermal development strategic approach.

Fig. 19 identifies the priority resource utilisation focal areas in the Tanzanian country project.

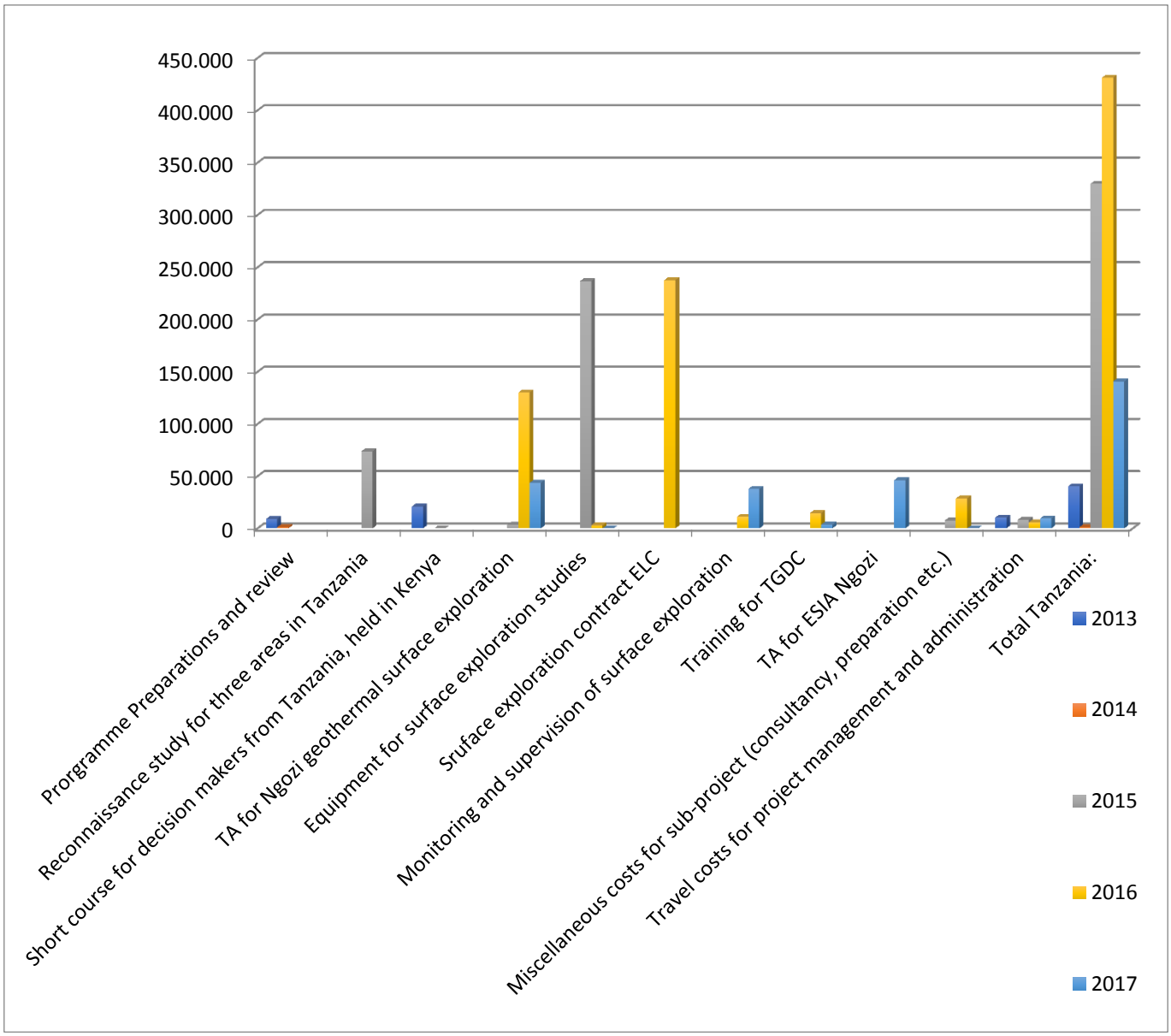

Figure 19: Resource Utilisation by Activity Area, 2013 – 17

Source: Op cit

As Fig. 19 shows, the three most important areas of the MFA-ICEIDA project's investment were support to contracting for the surface exploration, the provision of equipment and the provision of TA.

3.4 CONCLUSION

The figure 20 below depicts the total disbursement in US$, from 2013-2018, as well as the total approved expenditures, (incl. actual in completed sub-projects).

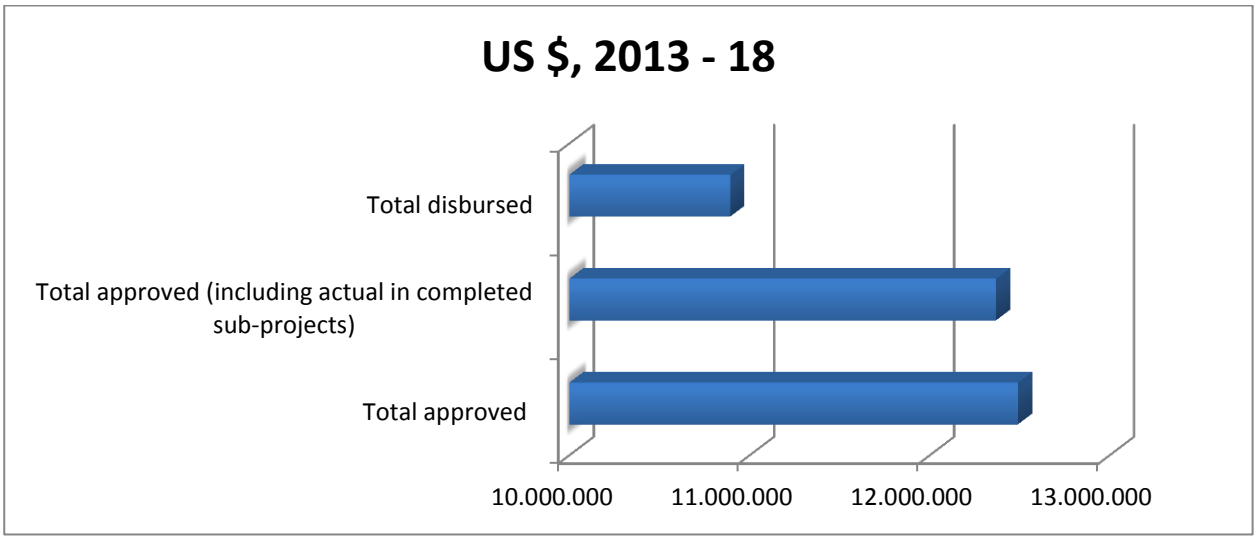

Figure 20: Overall Disbursement, 2013 – 18 inclusive

Source: Annual Report, 2018

Figure 21 below, shows the overall percentage disbursement over the entire project period. [As of the end of 2018, some disbursements (e.g. in respect of invoices that had still to be submitted) were still awaiting payment.]

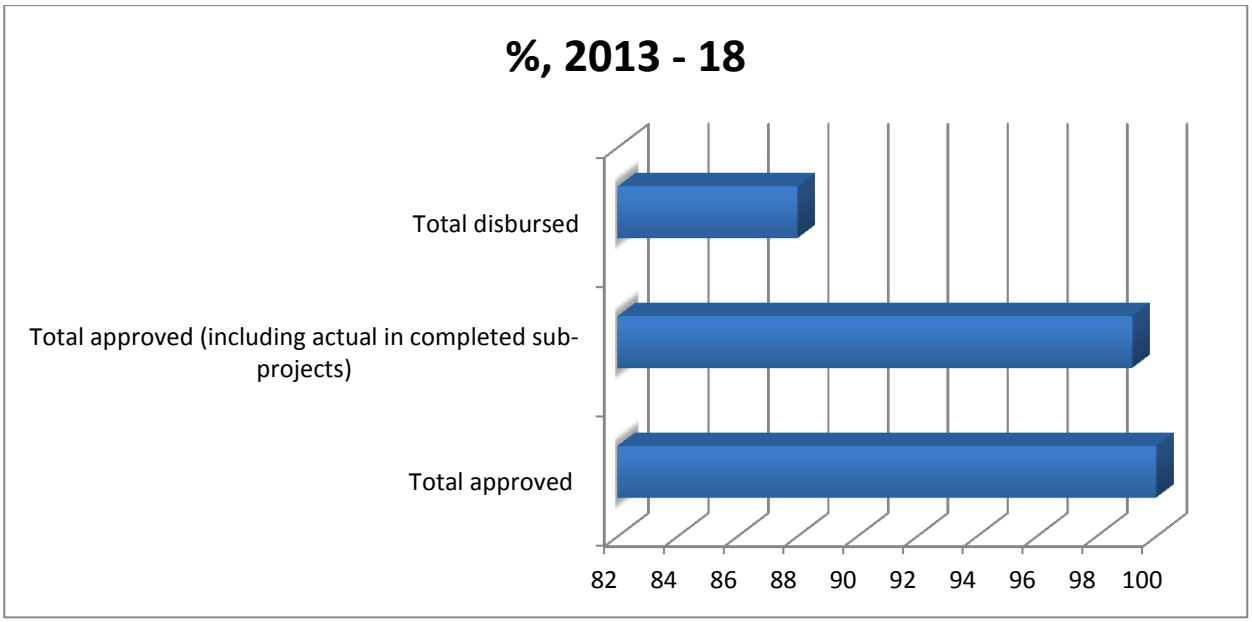

Figure 21: Overall Disbursement in percentage, 2013 – 18 inclusive

Source: ibid

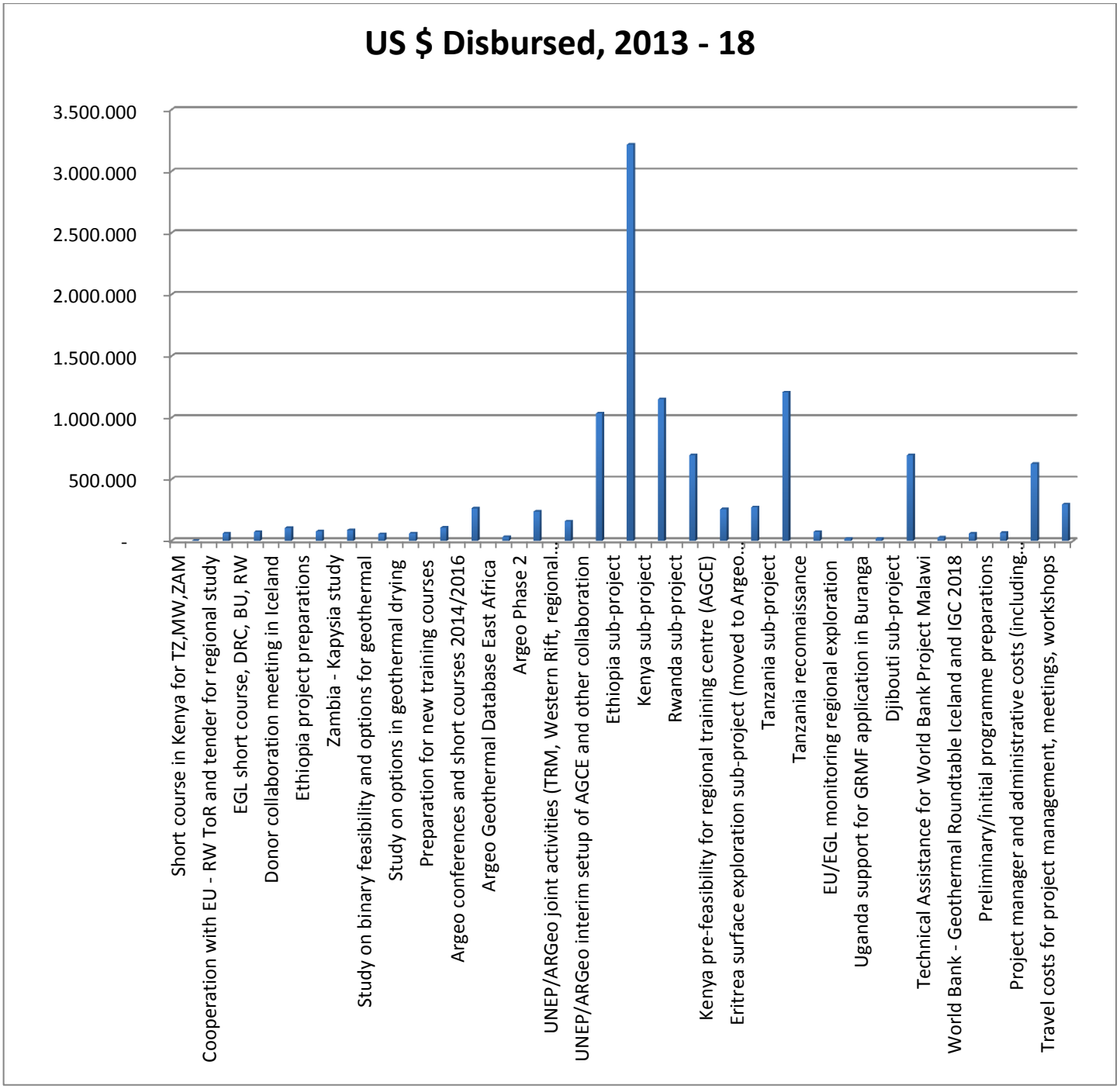

Figure 22: Overall Disbursement by sub-component, 2013 – 18 inclusive

Source: op cit

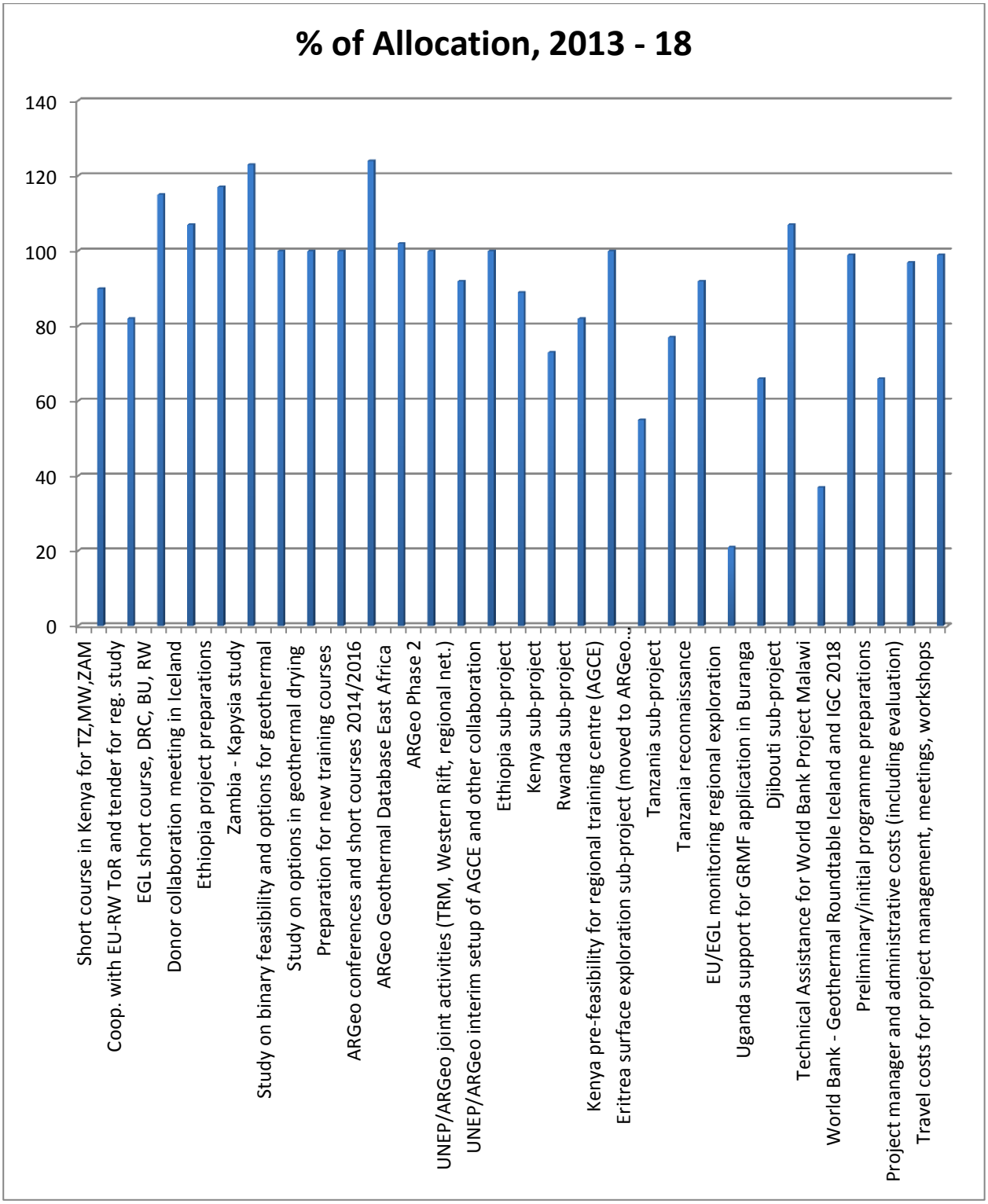

Figure 23: Overall Disbursement by sub-component in percentage, 2013 – 18 inclusive

Source: op cit

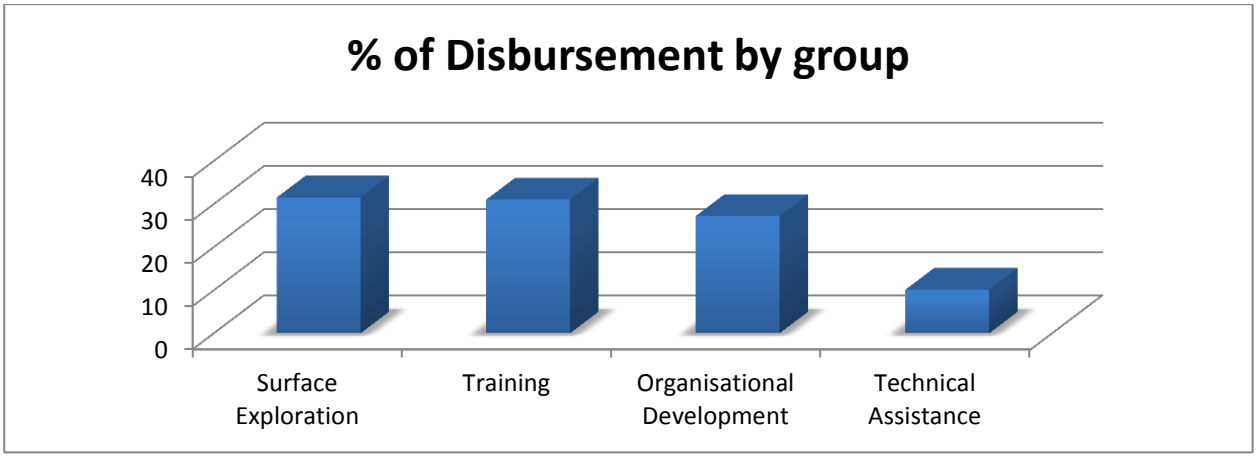

Figure 24: Percentage of Disbursement by sub-component, 2013 – 18 inclusive

Source: op cit

The figure above clearly shows the actual turn out by expenditure category. This reflects the shift away from surface exploration towards training and organisational development that occurred in the course of individual country project identification.

Fig. 11, reproduced below in another format as Fig. 25, shows the overall Geothermal Programme disbursement over the five year period, 2013 – 2017 inclusive.

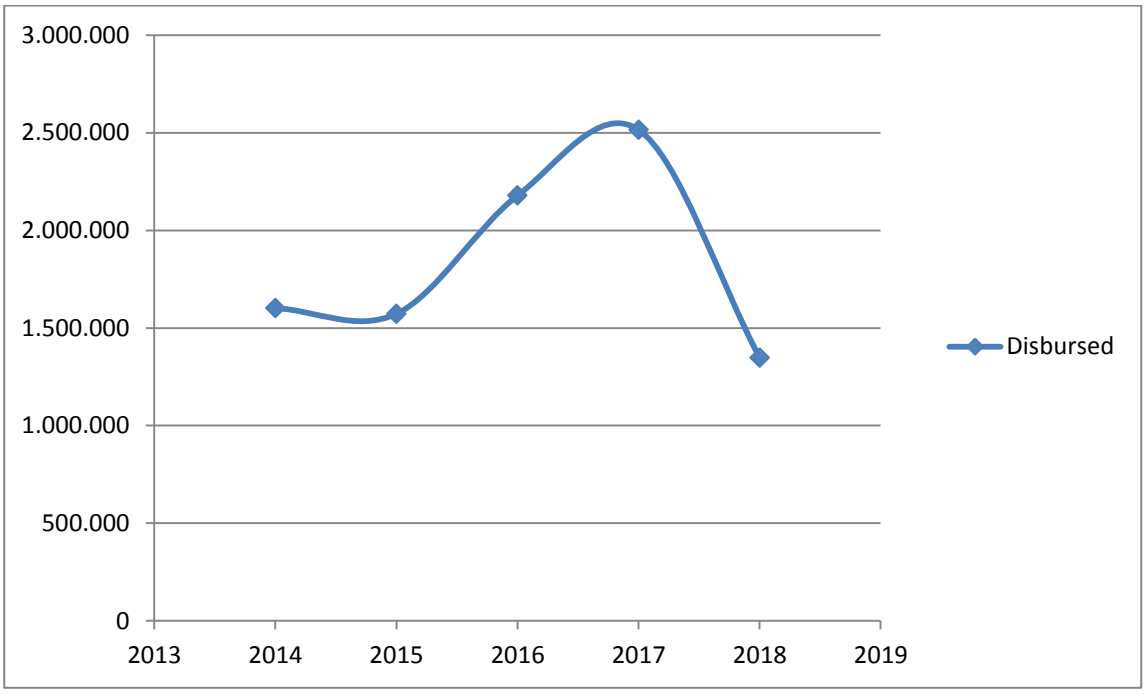

Figure 25: Overall Resource Disbursement, 2013 – 17 inclusive

Source: op cit

Classically, resource utilisation over a project cycle is ideally in the form of a bell curve; it reflects a slow start, followed by a rapid rise and, as the project approaches completion, a graduated fall. In broad terms, as Figs. 11 and 25 show, this is in line with the actual experience of the MFA-ICEIDA GEP as a whole. Expenditure in the first two years was flat (although significant); this was followed by a sharp rise and then an equally steep fall off in 2017. Disbursements in 2018 were largely (c. 80%) in respect of ongoing support to ARGeo; the balance principally presents the support to the Interim Project Management Unit of the

AGCE. Outstanding disbursements related to the stalled support to Eritrean surface exploration, as well as some invoices that had still to be submitted for payment. Resource management, centrally, therefore has been efficient.

The question remains whether this could have been achieved at a lower cost. The evaluation notes that MFA-ICEIDA utilized the NDF procurement modality, International Competitive Bidding (ICB). In line with this, the NDF follows internationally recognised practice[5], and include

1) ensuring economy and efficiency in the procurement of goods, works, and services;
2) giving eligible bidders from developed and developing countries a fair opportunity to compete in providing goods, works, and services financed by NDF;
3) encouraging the development of domestic industries NDF's countries of operations; and
4) providing for transparency in the procurement process.

The, generally successful, purpose of ICB is to ensure that value for money is achieved and that the tender process is transparent and open to competition. Because of the transparent and competitive nature of the bidding process, the evaluation is satisfied that the utilisation of resources represented value for money and was within reasonable bounds.

If there are any questions to be raised in this connection it is in respect of the supplier relationship with ISOR and the UNU-GTP. However, in the evaluation's opinion, the unquestioned advantage both demonstrate in terms of the level of technical expertise arising out of Iceland's extensive experience in geothermal power (both generation and direct use) suggests that in both instances a 'natural monopoly' is present. In this situation a 'framework agreement' with ISOR and meeting UNU-GTP fees appears a value for money response.

Fig. 26 shows resource utilisation by individual country or partner (in the case of ARGeo).

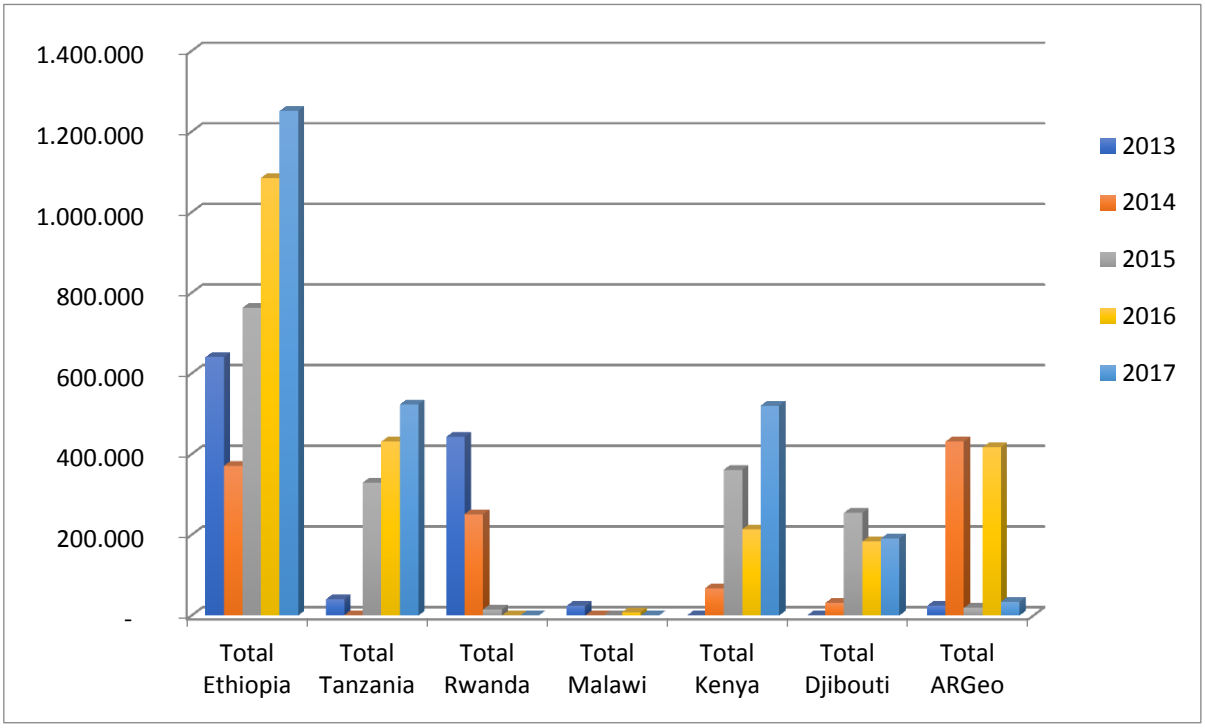

Figure 26: Resource Utilisation by Country/Partner[6], 2013 – 17

[5] Such as used by the World Bank and the Regional Development Banks.
[6] ARGeo is an outlier in so far as it implements the stalled Eritrean surface exploration project.

Source: op cit

Inevitably, given the different times at which individual country projects were approved, the utilisation of resources over the period differs. In general, what Fig. 21 demonstrates is that utilisation ramped up following implementation commencement. It is also likely, given that there are activities still to be implemented (e.g. the installation of the dryer for the direct use trial), 2017 reflected disbursed resources that remain unutilized. Having noted this, MFA-ICEIDA informed the evaluation team that there is not a big change in the country by country financial breakdown from the foregoing overview. The largest bulk of disbursements in 2018 were for the UN Environment cooperation agreement[7]. Overall, however, read together with Fig. 25, the evaluation concludes that resource use has been efficient in view of the nature of the programme.

[7] The agreement with UN Environment has been extended until the end of year 2019, to allow for the finalization of activities planned under the agreement.

4 EFFECTIVENESS

According to the DAC, Effectiveness is a measure of the extent to which an aid activity achieves its objectives. In evaluating the effectiveness of a programme or a project, it is useful to consider the following questions:

- To what extent were the objectives achieved / are likely to be achieved?
- What were the major factors influencing the achievement or non-achievement of the objectives?

The **Specific Objective** of the Geothermal Exploration Project (GEP) was:

Enhanced geothermal knowledge and capacity enables further actions on geothermal utilization in EARS countries.

Specifically, the project initially focussed on the phase of reconnaissance and surface exploration of geothermal fields and aimed to put the implementing agencies in the partner countries in a position where they could proceed from the identification of drilling targets to the next step, viz. exploratory drilling.

The framework project's logframe identified the achievement of this objective through the following indicators:

- Plans in place (drill permits prepared) for exploratory drilling in (4-7) respective countries
- Funding proposals submitted to relevant financial institutions for exploratory drilling in (4-7) countries

4.1 SURFACE EXPLORATION

In brief, surface exploratory work carried out through the GEP's ambit led to the identification of drilling targets, and consecutive drill permits and funding applications in four countries, thereby the Outcome indicators were achieved:

1) In **Djibouti** the GEP carried out surface explorations and training in the areas of Lake Assal and Lake Abhé which led to the identification of drilling sites.

   The evaluation team was informed that at the site of Lake Assal, a drilling permit has been obtained for three boreholes and everything is ready for the drilling phase. For Lake Abhé no requests for drilling permits have yet been made by ODDEG, however obtaining these should not be a problem, since the land is property of the state of Djibouti and ODDEG is a government institution.

   According to ODDEG, the GEP initially supported GRMF applications for two sites (Lake Assal and North Ghoubet) by assisting the elaboration of Expressions of Interest which resulted in both projects being selected by the fund in the prequalification phase. However, ODDEG states that (for reasons unknown to them) support from ISOR „did not continue for the next phase" so that no full applications were ever submitted. Asked about this, ISOR replied that they actually supported only the EoI for Lake Assal (and not for North Ghoubet), and that they had „very little time to complete the document". The actual application would have required more work, but ISOR had not been assigned to do that. In hindsight, ISOR states that they „could (or should) have pushed ODDEG to seek funding for that process and maybe we would have done so if the field was more promising than it appears to be."

   In any case, ODDEG informed the evaluation team that a major constraint is the fact that the GRMF only meets 40% of the drilling cost and that it is difficult for them to obtain the remaining 60% from the Government. Eventually, for Lake Assal, ODDEG obtained drill funding from the Arab Fund for Economic and Social Development (AFESD). For Lake Abbhé, no funding has yet been obtained for the drilling phase.

2) The GEP's surface exploration work in **Ethiopia** led to identifying eight drilling targets in Aluto Langano and four in Tendaho Alalobeda. Drilling permits have been obtained and funding for drilling has been secured from the World Bank (for Aluto Langano) and the GRMF (for Tendaho Alalobeda). Drilling in Aluto Langano is scheduled to start in 2019; the Contract for Rigs Supply and Drilling Services was signed on 23 February 2019 between EEP and a Consortium of three companies (Two Chinese companies together with GDC from Kenya).

3) In **Kenya**, support provided by the GEP focused on capacity building. Additionally, some TA was provided for the revision of the conceptual model for Suswa, leading to the identification of drilling targets. Despite repeated inquiries by e-mail in the aftermath of the evaluation mission, GDC did not respond to the evaluation's enquiry whether drilling permits have been obtained and funding applications submitted in respect of Suswa. However, numerous online-sources indicate that geothermal development in Suswa is on-going by GDC themselves as well as private players[8], and it is assumed that permits and funding for exploratory drilling are in place.

4) In **Tanzania**, the GEP carried out surface exploration work in Kiejo-Mbaka and Luhoi. Three drilling targets were identified in Kiejo-Mbaka but none in Luhoi due to lower temperatures. A funding application for drilling in Kiejo-Mbaka was accepted by the GRMF in October 2018. Against this background, it is assumed that corresponding drilling permits have also been obtained.

   TA was also provided for the geothermal field in Ngozi consisting in review and quality assurance of surface exploration works (in order to confirm drilling targets). In addition, there was assistance to finalise the ESIA report for exploratory drilling. Subsequently, it appears that a drilling permit has been obtained by TGDC.

   The GEP also provided support to a GRMF application for test drilling in Ngozi, which was approved; the AUC stated that this was the best application to the GRMF received to date (out of a total 64 applications received in the five application rounds so far).

Apart from the four countries mentioned above, reconnaissance and/or surface exploratory work (sometimes also just reviewing work already done by others) was also carried out in Burundi, Malawi, Rwanda, and Zambia, however leading to no further action. Surface exploration in Eritrea (under the Donor Agreement with UN Environment) was temporarily put on hold but is due to resume in 2019 and could still add to positive results under the indicators mentioned above.

4.2 Capacity Building and Technical Assistance

Under the original concept described in the overall Project Document, it is possible that the surface exploratory work of the GEP could have resulted in more than four countries obtaining drilling permits and submitting funding applications at studied sites. However, it turned out that the demand-led approach resulted in partner countries requiring more emphasis on capacity building than initially expected. This led to the project's activities and expenditures being adapted in line with the demand-led identification approach.

It therefore seems adequate to assess the level of achievement of the GEP's Outcome not only in terms of the quantitative indicators above, but also in a more qualitative manner, in order to attempt an assessment of whether geothermal knowledge and capacity have been enhanced in such a way so as to enable further actions on geothermal utilization in EARS countries.

To this end, it is important to focus on the project's various training and capacity building measures which largely consisted of the following:

[8] http://www.thinkgeoenergy.com/u-s-developer-preparing-330-mw-geothermal-development-at-suswa-kenya/

- 14 short courses with a duration between two and 12 days which were coordinated by UNU-GTP. These courses were delivered between 2013 and 2017 primarily in Africa (only one, aimed at donors, was carried out in Iceland) covering the following topics:
  - Geothermal Development for Decision Makers
  - Geothermal Project Management
  - Preparation of Bankable Documents
  - Deep Geothermal Exploration
  - Well Design and Geothermal Drilling Technology
  - Borehole Geophysics

  Four of the short courses targeted multiple EARS countries; the remaining 10 focused on individual countries:
  - three courses for Djibouti,
  - four courses for Ethiopia,
  - two courses for Kenya, and
  - one course for Rwanda.

  A total of 320 persons (primarily from the project's Partner Institutions in the project countries) participated in the short courses with a theoretical total of 2,385 person-training-days having been provided. In most courses, some participants were not present for the full duration; it is estimated that the average attendance rate lies at about 90%. This still leaves around 2,150 person-training-days having been delivered through the short courses.
- Six-Month Training Programme at UNU-GTP in Iceland in which a total of five employees of the project's Partner Institutions (one from Djibouti and Rwanda, and three from Ethiopia) participated in between 2014 and 2016.

  The training programme addressed a broad range of topics across the entire value chain of geothermal development and utilisation. In total, 600 person-training-days were delivered through the Six-Month Programme.
- One-month training attachments with geothermal companies and institutions in Iceland. These training attachments were organized by ISOR for 19 staff members of Kenya's GDC. In addition to the nine Technicians (who composed the largest single group), GDC participants were four Engineers, two Geochemists, two Geophysicists, one Environmental Scientist, and one Meteorologist. A total of 380 person-training-days was delivered.
- On-The-Job Training was provided extensively along the surface exploratory work carried out by consultancy firms such as ELC Electroconsult (Italy) and EFLA Consulting Engineers (Iceland). For example, in 2015 ELC provided micro-seismic equipment in Ethiopia, which for a one year period was used to carry out surface explorations at Aluto Langano. During this time, and along the actual surface exploratory work, ELC mentored EEP and GSE in installation and use of the equipment, as well as interpretation of the data. It is not possible to quantify the number of recipients of on-the-job trainings carried out throughout the GEP, let alone the total number of person-training-days delivered by these means. However, it appears possible that on-the-job training may in fact have been the largest single, and longest lasting, training component of the entire project.

Nearly all the evaluation's interlocutors emphasised that their knowledge and understanding of the respective topics had increased and can to a large degree be put to practical use in their work.

Whilst the short courses, one-month training attachments and on-the-job training were generally seen as providing very specific and focussed training, the six-month training programme in Iceland was perceived rather as covering a broad range of topics without going deep into any specializations. For example, Mr. Habtamu Gerenew of EEP (Site Manager for Aluto Langano) stated that the training program gave him

insights into all aspects of geothermal utilization (both for power generation and direct use) and that it gave him a very broad overview including also a lot of practical components (e.g. through site visits). However, for more advanced and specialized expertise (which, in his view, now is highly necessary in EEP), intensive on-the-job training is seen as the most suitable instrument. Overall, from the feedback received from training participants, on-the-job training was seen as being the most practical and useful for everyday work.

There were also a few critical voices like for instance from a staff member of GDC's Geothermal Resource Management Department who participated in the training attachments in Iceland. He pointed out that GDC does not have four of the seven well logging tools that were trained to use, so this knowledge cannot directly be applied and is likely to get lost. Another staff member from the same department expressed that two important areas were not trained but would have been needed (medium voltage steam gathering and Programmable Logic Controllers). Although there was an initial establishment of knowledge gaps across different levels and departments of GDC, it was underlined that in the trainings not all of these topics were covered. Therefore, taking the particular example of the training attachments for GDC, effectiveness could have been better if training needs and training contents had been better matched.

Nonetheless, such critical tones were the exception rather than the rule. Furthermore, they do not alter the reality that the training and capacity building provided within the scope of the GEP was broadly well suited to the recipients' demands and seen as highly beneficial by most of them: they reported improved abilities to move forward in geothermal development. This counts particularly for those training measures with a strong focus on practical work, namely the training attachments for GDC in Iceland (which were in fact seen as extremely useful by most participants) as well as the numerous on-the-job trainings provided.

Notwithstanding this, it also became clear during engagement with interlocutors that more training is required in the partner countries in order to embed the transferred knowledge more deeply and to move forward faster and efficiently. Particularly, the following were repeatedly mentioned and would be seen as a contribution to increasing the project's effectiveness:

- Refresher courses as well as further coaching and mentoring in the trained topics in order to ensure that the acquired knowledge is correctly applied and not lost over time,
- Repetition of trainings for additional staff so as to broaden the base of knowledgeable experts within partner institutions (also in the context of training of trainers),
- Transfer of more advanced and more specialized training to deepen the expertise (likely best transmitted through on-the-job training),
- Training and capacity building for the „next steps" (particularly related to exploratory drilling).

4.3 GRMF Applications and Financing

One particular field, where the project's support and accompanying on-the-job training have proven to be very effective, is in the field of preparing applications to the GRMF to obtain funding for exploratory drilling. Here, ICEIDA's contributions have either enabled geothermal players to submit an application in the first place, or it has led to significant improvements in the quality of applications received by the GRMF. In fact, some applications like that for Ngozi in Tanzania, were stated to have been the best so far, demonstrating the added value provided through the GEP in moving forward.

Nonetheless, the GEP's partner institutions frequently expressed that financing drilling remains a major hurdle, since the grant contributions from the GRMF cover only 40% of the drilling cost, making it necessary to cover the remaining portion from government funds or other donors. Against this background, the GEP could surely increase its effectiveness by providing support also to obtaining funding from other sources.

4.4 Withdrawal from Policy and Regulatory Work

The AU stated that a further major obstacle in securing financing for drilling lies in a lack of adequate regulatory framework conditions, particularly in the non-availability of bankable Power Purchase Agreements (PPAs). The example of Ethiopia was given, where 30-40% of the GRMF applications come from, but many are on hold, because the drilling costs are only covered, if a PPA is in place (otherwise the risk would be too high that the drilling does not lead to actual construction of power plants and the money would therefore be wasted). In fact, the AU believes that an insufficient regulatory and institutional framework is „the biggest problem today" for the advancement of geothermal energy in the EARS countries.

Although it is comprehensible that ICEIDA decided not to provide policy advice in the first phase of the GEP (due to other donors' activities in this field, e.g. NZAID, USAID and the World Bank), it is possible that the project may have been more effective had it addressed also these issues (and had it been able to make a significant contribution to improving framework conditions). It is therefore recommended to re-consider providing policy and regulatory support in a potential future second phase of the GEP or to work closer with the other donors in this field in order to create synergies.

4.5 African Centre for Geothermal Excellence

The evaluation team was informed that the African Geothermal Centre of Excellence (AGCE), was both important and critical to geothermal development in the region. In this context, MFA-ICEIDA's contributions have been essential towards supporting this through, inter alia:

- Recruitment of a Project Coordinator,
- Development of a training plan and support to the business plan,
- Preparation and implementation of courses,
- Financing the cost recovery for using the facilities of GDC and KenGen,
- Financing the Technical Advisory Team.

Nonetheless, AGCE progress continues to be limited and delayed. In particular, the Centre is still to acquire legal status with this important step (now) an AU responsibility. The current timeline foresees implementing the final organizational structure of the Centre by 2020, which shall include a Board of Directors with representatives from all 54 AU member states. The evaluation team believes that decision making will be made difficult (if not impossible) due to what is perceived as an over-democratic approach which could rather hamper the Centre's effectiveness in the future.

Having said this, under its Interim Project Coordination Unit (IPCU), the Centre has already delivered training in a number of Rift Valley countries specific to their identified individual needs. Further such training is planned for the immediate future (e.g. a training module prepared with help of ICEIDA to prepare Eritrea for surface exploration works, which are scheduled to resume in 2019). Having noted this, however, the evaluation is of the view that the Centre's contribution so far to enhancing geothermal knowledge and capacity, and therefore its effectiveness, has only been limited.

4.6 Cross-Cutting Issues

Environment

As noted above, environmental concerns were a central part of the identification of potential drilling sites. Once a potential site was identified, it was standard practice to initiate an ESIA. In many instances, TA support to review the consultant's report was provided through the GEP.

Gender

At the outset, it is important to note that there is a particular challenge confronting equal gender representation in projects involving the hard sciences. According to the UNESCO Science Report (2015), women accounted for 53% of the world's bachelor's and master's graduates and 43% of PhDs but just 28% of researchers. Whereas women have achieved parity in life sciences in many countries, they still trail men in engineering and computer sciences. In Kenya, women are grossly underrepresented in science, technology and engineering where UNESCO estimates women's representation in engineering at 11% (The Nation, 11 February 2019). In the light of this, aspirations for equal participation of women in the project's training and capacity building measures seems difficult to achieve, if not unrealistic.

Nonetheless, the evaluation analysed the number of women who participated in some of the different capacity building measures carried in the course of the GEP. In doing so, we attempted to put these into relation to the percentage of female employees in the respective companies (or their relevant departments), in order to assess if women were fairly represented:

Short Courses

In the course of the 14 short courses carried out by UNU-GTP there were 49 female participants out of a total number of 320, which corresponds to 15%. Although it is clear that the workforce for geothermal energy in East Africa is predominantly male, the average share of female employees across the institutions that participated in the short courses, is not known. In absence of a corresponding percentage, it is difficult to put this overall figure into context. However, from the information obtained during the evaluation mission to East Africa, it is possible to assess the representation of women at least for a sample of Implementing Agencies in the project's partner countries:

For instance, of the 80-90 employees working for ODDEG in **Djibouti**, roughly 20% are women. However, out of 57 people who participated in the three short courses for ODDEG (Preparation of Bankable Documents, Geothermal Project Management, and Well Design and Geothermal Drilling Technology) only 6 were women, which corresponds to roughly 11%. This number varied only insignificantly across the different topics of the short courses and was therefore apparently not related to the degree of technical training content. It can be concluded that women were clearly underrepresented in the short courses for ODDEG.

In GDC of **Kenya**, the percentage of female employees varies largely depending on the respective department (from only 5% in the Geothermal Resource Management Department to 30-35% in the Geothermal Resource Assessment Department). However, on average the share of women at GDC is roughly 25%. A similar share (26%) participated in the two short courses on Geothermal Project Management which were provided to GDC which means that women were fairly represented in comparison to the amount of female employees in the company.

As stated by UNU-GTP and confirmed by several implementing agencies in the partner countries, the participants for the country-specific short courses are selected by the respective countries' institutions themselves, without a meaningful possibility for UNU-GTP to influence the selection process. According to UNU-GTP, they did however explicitly suggest female participation to the partner institutions for the two short courses on „Geothermal Development for Decision Makers" which were held in Kenya in 2013 for participants from multiple countries. Interestingly, in these two courses only 8% of the participants (3 out

of 36) were women, which is only half of the average share of women across all 14 short courses held by UNU-GTP.

6-month Training Program in Iceland

The situation is different when looking at the 6-month training program implemented in Iceland for UNU-GTP. Although at five participants, the total number of persons who benefited from this program under the GEP is small, it does stand out that two of them (40%) were women. These were the participants from Rwanda and Djibouti respectively, whilst the three participants from Ethiopia were all male. According to UNU-GTP, they do attempt to influence the selection of participants in the 6-month training program more strongly than that in the short courses, and at least so far this is reflected in the share of women.

Training Attachments for GDC in Iceland

A further important training measure was the training attachments in Iceland in which 19 employees of Kenya's GDC participated in. These consisted in visits to Icelandic geothermal companies and institutions for practical and hands on training in relation to specific assignments. This was rounded off by visits to a geothermal power plant as well as a direct use application (the Blue Lagoon geothermal pool). The training attachments were carried out for a duration of 4 weeks in October 2017.

Out of the 19 participants from GDC, six were women, which corresponds to a share of roughly one third. This is even slightly higher than the overall share of women at GDC which (as mentioned above) is roughly 25%. Therefore, like in the short courses for GDC, women were also fairly represented (in fact, even slightly overrepresented) in the training attachments in comparison to the amount of female employees in the company.

Summary and recommendations

The evaluation team believes that the GEP is hardly in a position to influence the general share of women working in geothermal exploration and development in EARS countries, where women (like in other technical and engineering careers) are clearly underrepresented.

However, we do believe that the Project can take influence on a fair representation of women in training and capacity building measures (in comparison to their percentage in the participating companies' or relevant departments' workforce). Whilst women were fairly, or even over-represented in the trainings in Iceland, this was not always the case for the short courses in the partner countries.

Therefore, the evaluation team recommends that for any potential future short courses, MFA-ICEIDA (either directly or through UNU-GTP) should more pro-actively encourage the participation of women and form part of the selection process in order to guarantee a fair representation of women. For instance, this could be done through defining a minimum percentage of female participants and communicating this in corresponding invitation letters to the partner institutions.

4.7 Conclusion

In summary, the GEP's activities have clearly lead to an advancement in the partner countries' stage of geothermal development and their capabilities to take further action. The project's effectiveness has therefore been satisfactory. However, although surface exploration will continue to be an important field of work (even in very advanced countries like Kenya), many of them have now shifted the focus of their efforts towards exploratory drilling and it became clear during the evaluation that (apart from broadening and deepening the knowledge transferred so far), future support should focus largely on the following links of the geothermal value chain. Future capacity building measures should focus more on practical methods like on-the-job- training and training attachments in geothermal companies and institutions rather than on instruments like short courses.

5 IMPACT

According to the DAC, Impact is

the positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended.

This involves the main impacts and effects resulting from the activity on the local social, economic, environmental and other development indicators. The examination should be concerned with both intended and unintended results and must also include the positive and negative impact of external factors, such as changes in terms of trade and financial conditions.

When evaluating the impact of a programme or a project, it is useful to consider the following questions:

- What has happened as a result of the programme or project?
- What real difference has the activity made to the beneficiaries?
- How many people have been affected?

Impact is understandably limited at this point in time. In the first instance, impact is usually measured ex post. However, there are suggestions of where impact will be achieved.

5.1 PROGRESS TOWARDS GOAL

According to the GEP's framework logframe, the intended Impact of Geothermal Compact was defined as:

Increased access to renewable energy through low emissions geothermal energy development in East African Rift Valley countries.

Achievement of this Overall Objective was to be measured by the indicator:

200 MWs of geothermal energy produced in „EARS" countries as a result of activities under the Geothermal Compact (10-15 years).

Since the Impact and corresponding indicators were defined on the level of Geothermal Compact (to which the GEP is a sub-project), it is evident that the GEP never intended to achieve this Impact independently. Rather, the GEP was designed to contribute to the implementation of geothermal power generating capacity through providing support in the early steps of geothermal development, namely stages 1 and 2 of the following value chain of geothermal development (as presented in the original Project Document):

- Stage 1: Reconnaissance – Gathering of existing data
- Stage 2: Exploration
- Stage 3: Exploratory drilling of 1-3 wells
- Stage 4: Prefeasibility report
- Stage 5: Further drilling of wells – as needed
- Stage 6: Feasibility report
- Stage 7: Concept design and tender documents
- Stage 8: Detailed design and construction
- Stage 9: Testing, training and operations start-up

It is therefore clear that the intended Impact of Geothermal Compact can only be achieved through significant additional activities covering stages 3 to 9, many of which are likely only to be possible with donor support. In fact, a potential second phase of the GEP could move forward into the following stages, particularly stages 3 to 6. It is also clear that there must be a significant delay between the interventions of

the GEP and the eventual (hopeful) achievement of the intended Impact of Geothermal Compact, which is also reflected in the indicator's time-frame of 10-15 years. It is, therefore, currently not possible to assess the final achievement of the intended Impact of Geothermal Compact.

Notwithstanding the foregoing, it is possible to at least make an estimation of the amount of potential geothermal power generating capacity to whose early stages of development the GEP has provided support to date. In line with the Outcomes of the surface exploratory work provided by the GEP (see chapter on Effectiveness) drilling sites have been identified for the following projects (with indications of the estimated power generation capacity which could be installed):

- Djibouti:
  - Lake Assal: 30 MW[9]
  - Lake Abhé: 15 MW[10]
- Ethiopia[11]:
  - Aluto Langano: 70 MW
  - Tendaho Alalobeda: 100 MW
- Kenya:
  - Suswa: 150 MW[12]
- Tanzania:
  - Ngozi: 200 MW[13]
  - Kiejo-Mbaka: currently no capacity estimates available

Furthermore, the GEP will likely still contribute to the identification of drilling sites in Eritrea, where surface exploration was temporarily put on hold, but is scheduled to resume in 2019. Here, the expectations are for at least 70 MW of installed capacity (possibly considerably more) [14].

The total potential power generating capacity which could result at the sites studied within the GEP therefore amounts to more than 600 MW. If circa one third of this potential capacity is eventually implemented, the intended Impact of Geothermal Compact will have been achieved.

[9] Source: IGA-Presentation "Geothermal Outlook in East Africa"
[10] Source: https://orkustofnun.is/gogn/unu-gtp-40-ann/UNU-GTP-40-B-8-Hamoud-Cheik.pdf
[11] Source for both projects: IGA-Presentation "Geothermal Outlook in East Africa"
[12] Source: http://geothermalresourcescouncil.blogspot.com/2016/08/kenya-gdc-to-start-150-mw-suswa.html
[13] Source: http://www.thinkgeoenergy.com/development-cost-of-821m-estimated-for-200-mw-ngozi-geothermal-project-in-tanzania/
[14] With the changed political situation, the Eritrean Government and the World Bank have entered into negotiations around clearing the country's arrears. It is also worth noting that the EU has earmarked US $ 150 million to support renewables in the country.

5.2 Development of Organisational Capacity

Apart from actual surface exploratory work (and provision of relevant equipment), the GEP's contribution to achieving this lies particularly in contributing to building-up required human and organisational capacities, support in the preparation of GRMF-applications as well as ESIAs for exploratory drilling. Furthermore, and outside of the realm of the overall intended Impact, the GEP has provided support to direct use applications through elaboration of a pre-feasibility study on potential uses and is currently in the process of getting a geothermal grain dryer on the ground in Kenya for demonstration purposes. Although mostly covered in the chapter on Effectiveness, the essential contributions of the GEP are briefly described in the following:

a) Djibouti

   ODDEG reports that there are definite plans to drill in three prospect areas identified through the improved analysis arising from support to interpretation of surface exploration data. The major constraint affecting this is finance as the GRMF support only meets 40% of the cost.

b) Ethiopia

   As a result of the two good conceptual models developed based on the support to the review of the surface exploration data, both being achieved through the project, twenty-six (22 in Aluto Langano, four in Tendaho Alalobeda) spots have been identified for drilling. Project support also resulted in a successful GRMF application realizing $6 million in support. Based on the conceptual models, the government has signed a World Bank loan agreement worth $212 million to support the drilling programme.

c) Kenya

   GDC capacity in the GRA, GRM and direct Use departments has been strengthened through the training placements, the experience of which was very positive. As a result, the departments are able to make better use of the analytical tools that they have and trainees have been introduced to others, which provide more detailed analysis in other areas.

   The equipment provided has seen the reestablishment of the geochemical laboratory (albeit in temporary premises – and some equipment awaits the supplier's arrival before unpacking and installation), which enables the company to provide analytical support to its surface exploration activities (as well as those carried out by KenGen, where its laboratory does not have the requisite equipment). Final accreditation will only be possible once the laboratory is in its permanent premises at the Menangai site; at the same time, the preparatory accreditation process has started.

   The dryer is yet to arrive. The delay arose from the application for tax exemption for its import; when this was refused, the GDC Board agreed to pay the tax and the dryer's shipment was initiated. The foundation on which the dryer will be mounted has been completed and once the dryer arrives and the supplier is on site, it will be installed and training in its use delivered.

   In the interim, GDC has reached agreement with the Agricultural University for its supply of its grain for demonstration trials. There are two harvests/year, so the installation delay is not necessarily problematic. In fact, given the immediate harvest will be during the dry season, meaning existing drying technology is functional, it may be more successful for the demonstration trials to take place following the rainy season harvest. Potential clients have also been identified, including the National Grain Cereals Board, large farmers in the region, and Traders, who buy from small producers.

d) Tanzania

Three sites (Kiejo-Mbaka) have been identified with ISOR support. Lahoi's prospects have not proved positive. Ngozi was successfully advanced as a result of the TA received and is ready for moving down the value chain to drilling test sites.

Technical assistance (Geology, Geochemical, Soil Gas, TEM-MT, Gravity Survey, Conceptual Modelling, Well design and Drilling Programme) has advanced capacity across all the identified areas. Resulting from this, it was decided to focus on Kiejo-Mbaka for exploratory drilling. Feasibility study prepared and there were reports on direct use potential.

Other progress included:

- It was decided that ESIAs only required for identified drilling prospects. Preliminary ESIA was contracted for Kiejo-Mbaka exploration. At present, it awaits finalization (quality assessment and assurance).
- ISOR has provided independent support to the quality monitoring, which has ensured that progress is in line with contracted obligations and in line with identified deliverables.
- ISOR has supported their internal review (mostly remotely) through their inputs, advice and suggestions. This has resulted in better quality reports than TGDC personnel would have been able to secure independently.
- Ngozi's TA support has advanced further along the value chain and test drilling sites have been identified. Kenyan (GDC) expertise has been an important contribution to this.
- Support for Capacity development for Geothermal Management and Planning has focused on needs that reflect where TGDC is currently located in the value chain. Further support in this respect is necessary in respect of drilling, once it commences.

Equipment supply has been based on identification of key gaps in what TGDC had available. In the main, this has mostly been laboratory equipment but it has ensured that they have both been able to use the supplied equipment successfully in the course of their own surface studies but also in the support provided for this purpose to Malawi.

e) African Geothermal Centre of Excellence (AGCE)

Progress in regard to the Centre of Excellence continues to be limited. The Centre is still to acquire legal status; it is not conceived that this will be achieved at continental level, with a Board of Governors comprising AU member states. Having said this, experts attached to the Centre have delivered training in a number of Rift Valley countries, specific to their identified individual needs. Further such training is planned for the immediate future (e.g. Eritrea, once surface exploration restarts). Having noted this, however, the evaluation is of the view that the Centre's impact has been limited at best.

f) AU Commission

MFA-ICEIDA entered into a MOU with the African Union Commission (AUC) in recognition of the AUC's coordination role in respect to geothermal energy development. In terms of the MOU, MFA-ICEIDA collaborates with the Commission to enhance the development of geothermal energy in through

- providing technical expertise
- assistance for geothermal database
- capacity building assistance
- assist with developing a regional training center for geothermal;
- developing policy, regulatory, and institutional framework in the countries covered by the Commission Regional Geothermal Program and the ICEIDA Geothermal Exploration Project. This aspect was subsequently dropped from the GEP, being covered by other donors (NZAID, USAID and the World Bank).

According to AUC interlocutors, the cooperation with MFA-ICEIDA to date has mainly consisted in:

- Support to the GRMF (particularly in helping companies prepare their applications);
- Support to capacity building for the AGCE; and
- Certification of the laboratory.

MFA-ICEIDA support to development of GRMF applications has also led to significant improvement in the quality of applications received.

5.3 CONCLUSIONS

Cleary, the GEP has made relevant contributions both towards individual countries achieving the overall Goal of the Compact and in strengthening their organisational and human resource capacities in order to achieve this progress.

6 SUSTAINABILITY

According to the DAC, sustainability is concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally as well as financially sustainable.

When evaluating the sustainability of a programme or a project, it is useful to consider the following questions:

- To what extent will the benefits of a programme or project continue after donor funding ceased?
- What were the major factors, which influenced the achievement or non-achievement of sustainability of the programme or project?

6.1 TO WHAT EXTENT WILL THE BENEFITS OF A PROGRAMME OR PROJECT CONTINUE AFTER DONOR FUNDING CEASED?

There are a number of reasons to believe that should MFA-ICEIDA support cease, the GEP's identified benefits, in particular the capacity that has been built in the national partner counterparts will be maintained. Most interlocutors expressed confidence that their abilities in implementation and data analysis of surface explorations, while still having gaps, were nonetheless sufficiently enhanced that they would be able to meet future needs. However, some (such as ODDEG in Djibouti) also expressed that continuing support, for instance in shape of on-the-job mentoring to further establish the knowledge firmly within their institutions and to ensure that it is correctly applied and not lost over time. Similarly, most project partners were confident in their ability to utilise the equipment that had been provided efficiently and effectively into the future.

They were equally confident that the TA support provided in areas such as tenders, including specifications development and bid evaluation had resulted in an increase of their independent capacities in this regard, as had been their organisational abilities to evaluate contracted consultants' reporting. However, in some cases (e.g. ODDEG), further training was desired to be enabled to not only review consultant work, but to carry out corresponding studies themselves.

It was commonly stated by the interview partners that the recipients of training and capacity building measures are still within their institutions and the skills and knowledge have therefore not been lost for them. However, GSE of Ethiopia expressed concern that, should better paid opportunities arise, trainees would leave (although at present this is not seen as an immediate problem since the private sector is still too small to impact on recruitment from the public sector).

It was also frequently stated that the knowledge and skills delivered through the GEP were being spread by the recipients to other staff within their institutions. GDC, for instance, is carrying out monthly internal training sessions, so that the people who participated in the training attachments in Iceland can train other employees of GDC. However, it was also expressed by GDC that more "first-hand training" would be desirable to broaden the knowledge within the company, as inevitably some of it gets lost as it gets passed on from the recipients themselves. In a similar notion, training recipients from ODDEG believe that they can pass on their acquired knowledge to other staff, however it was clearly stated that "refresher trainings" would be helpful to avoid knowledge from diluting over time. Also regular "up-skilling" (at least annually) was requested to take account of technological advances and to stay up to date.

Lastly, the support for the establishment of the AGCE is an important contributor to sustainability at a regional level. In a number of instances, the nascent Centre has demonstrated the benefits of inter-regional skills transfers; for example, TGDC reported that the experience gained through working with GDC experts had substantially contributed to increased skill levels and appreciation of geothermal national potential and the challenges to be overcome. Similarly, the nascent Centre's experts engaged the topic of direct use successfully that added knowledge in countries where this was a primary use and where it could

supplement power generation. Nonetheless, in the longer term, the Centre's ability to further strengthen capacities will depend also on how it is institutionalized and managed. Particularly, the intention to establish a Board of Directors with representatives from all 54 AU member states entails the danger that it could eventually represent more of a debating club than an effective training centre.

6.2 WHAT WERE THE MAJOR FACTORS, WHICH INFLUENCED THE ACHIEVEMENT OR NON-ACHIEVEMENT OF SUSTAINABILITY OF THE PROGRAMME OR PROJECT?

A note of caution is appropriate, however. Much of the equipment provided was either significantly under-utilised (e.g. the GDC/AGCE Laboratory) or unused (packed away until needed for the next exploration – as in Ethiopia). While the evaluation notes that this demonstrates resourcefulness and demonstrable conservation, it is also important to note that skills learned can become rusty through lack of regular application.

In this context, the, at best, partial utilisation of the Laboratory and its links to the AGCE is most challenging in terms of overall sustainability: the Centre proposes that GDC costs should be reimbursable, which, at first sight, appears entirely reasonable. However, at least two different interlocutors, expressed reservations in this connection, principally arising from expectations that their respective national authorities would be resistant to transferring resources to another national entity. This, which is mirrored in other regional (e.g. SADC, EAC) and continental (AU and its predecessor, the OAU) bodies (none, for example, are fully funded through member states and remain dependent on external donor funding[15]) raises serious concerns concerning the Centre's medium-term sustainability.

Furthermore, it is evident that donor support in the region is likely to continue for the foreseeable future: the adoption of the SDGs and rising concerns over climate change and the need to address this in a climate that permits economic growth both point to continued donor commitment to supporting the switch to geothermal as a reliable contributor to an environmentally sustainable regional energy portfolio. This continued donor interest, however, is unlikely to wean, at least some of the national entities, off dependence of external public sector funding and encourage them to move towards a more sustainable mix of public and private sector providers[16]. Furthermore, despite substantial donor support[17], few regional partner countries have the necessary enabling policy and regulatory environment in place that is required for substantial private sector investment to advance development significantly beyond proof of concept.

A final challenge to sustainability is the partner organisations' expansion plans. Clearly the AGCE is an attempt to address this but the reality is that, as GDC explicitly acknowledged in connection with the learning gained during the placements in Iceland, the technology gap between post-industrial countries and those in the region is significant. In other words, the best the AGCE can hope to achieve is the recycling of existing knowledge; new knowledge and techniques will have to continue to be gained from international sources.

Regional governments have demonstrated willingness to support UNU-GTP candidates, as well as candidates for advanced (Masters and PhDs). However, the reality is that resources for these areas will always be constrained; as such, donor support for necessary technology and skills transfer will continue to be in demand for the foreseeable future[18].

[15] The West African regional association, ECOWAS, may be a more positive example.

[16] Even in Kenya, the most advanced in terms of geothermal and environmentally-neutral energy production for development, KenGen is a state-owned enterprise (SOE) with minimal private sector participation. As of December 2016, The National Treasury, which holds the Government ownership in KenGen, converted a Sh20.2 billion debt into equity, which had the effect of pushing up its shareholding. Treasury now owns 4.62 billion shares (74%) out of the total 6.24 billion shares.

[17] The reason MFA-ICEIDA withdrew from engagement in the policy and regulatory aspects to the initially conceived project concept and included in the MOU with the AUC. Key players in this regard include NZAID, USAID and the World Bank.

[18] In this connection, it is important to note that as Rift Valley countries continue to develop their geothermal energy industry, there will be increased opportunities for mutually advantageous learning and experiential exchanges both within the region and, at

6.3 CONCLUSIONS

There are both positives and challenges surrounding sustainability. On the one hand, the considerable skills transfers that have taken place have increased organisational capacity in partner countries to a considerable degree. All interlocutors indicated that their organisations were now better placed to advance the national development of geothermal as an energy source and to share their learning with others in the region.

On the other, there are unquestioned risks linked to the achievement of medium-term sustainability. These include the region's propensity to donor-dependence in the area, the absence of a stable policy and regulatory environment and the ongoing needs for technology and skills transfers to respond to ongoing institutional and organisational development needs.

In conclusion, the evaluation finds that there is potential for sustainability in the long-term but short- and medium-term considerations are capable of undermining these.

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least as importantly, internationally. In other words, with development, sustainability becomes less dependent on external experiential knowledge.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

As the foregoing review has shown, the evaluation is of the opinion that the GEP is both on track to make an important contribution to achieving progress towards a reduction of the share of non-renewable energy in African Rift Valley partner countries. Furthermore, the role of geothermal energy as a base-load supplier makes the project and its partnership with other donor and partner country actors an important and valuable contributor to addressing climate change and increasing partner countries resilience in the face of this growing challenge. Clearly, further support in this regard is desirable.

The project's design is demonstrably relevant to the needs of the geothermal sub-sector across the region. It supports the emphasis on the development of renewable energy development as espoused on behalf of its member states by the AU Commission. Furthermore, it supports the achievement of African Rift Valley (ARV) countries national policies in this respect, many of which have had such policies in place for a lengthy period. The project has reinvigorated geothermal development in a variety of countries, including Ethiopia, and promoted it in others, e.g. Malawi.

The project is also in line with Iceland's Development Act, building on sharing the country's expertise in the area. Furthermore, it is fully in line with the Development Cooperation strategy, 2013-16 and reflects MFA-ICEIDA's commitment to addressing climate change and promoting resilience in partner countries. Equally, the project matches the NDF's priorities, adding a further aspect to the Fund's loan portfolio and deepening its ability to respond to climate change, which successfully contributes to the portfolio of development partners. As such, the design is relevant to the identified needs.

The logframe is beset by weaknesses that emerged from the need to implement a framework project through demand-led national projects. This also undermined the initially identified Outputs and the indicators across all levels of the logframe. Having noted this, the national projects clearly seek to contribute to the common Overall Objective (Goal) and Outcome and reporting has demonstrated contributions to the achievement of Outcome and Goal. As such, the individual country projects promote the achievement of overall project's Outcome and Goal, despite the inevitable reality that the country-level logframe indicators bear no relation to those in the overall project logframe.

The divergence between the overall logframe and the individual country ones could have been addressed had the overall logframe been regarded as a living document and amended in the light of experience. This would have addressed the shortcomings that developed over time, which undermined any efficacy in the overall documents role as a project management tool. Having noted this, it is important to emphasise that the evaluation does not believe that his has negatively impacted on progress towards Outcome and Goal. As such, the critique is valuable in underlining the logframe's project management function but, despite the shortcomings in this respect, there appears evidence of progress towards Outcome and Goal.

The identification of individual national projects resulted in a necessary focus shift away from the initial emphasis on actual surface exploration towards a demand-led emphasis on capacity building (training and technical assistance) and organisational development that would deliver better surface exploration results. It is important to emphasise that it was inevitable that such an adjustment of focus would likely result from the identification of the individual country projects and that the overall goal and outcome remained the same.

Classically, resource utilisation over a project cycle is ideally in the form of a bell curve; it reflects a slow start, followed by a rapid rise and, as the project approaches completion, a graduated fall. In broad terms, this is in line with the actual experience of the MFA-ICEIDA Geothermal Programme as a whole. Expenditure in the first two years was flat (although significant); this was followed by a sharp rise and then an equally steep fall off in 2017. Resource management, centrally, therefore has been efficient.

The, generally successful, purpose of International Competitive Bidding (ICB) is to ensure that value for money is achieved and that the tender process is transparent and open to competition. Because of the

transparent and competitive nature of the bidding process, the evaluation is satisfied that the utilisation of resources represented value for money and was within reasonable bounds. Because of the transparent and competitive nature of the bidding process, the evaluation is satisfied that the utilisation of resources represented value for money and was within reasonable bounds.

If there are any questions to be raised in this connection it is in respect of the supplier relationship with ISOR and the UNU-GTP. However, in the evaluation's opinion, the unquestioned advantage both demonstrate in terms of the level of technical expertise arising out of Iceland's extensive experience in geothermal power (both generation and direct use) suggests that in both instances a 'natural monopoly' is present. In this situation a 'framework agreement' with ISOR and meeting UNU-GTP fees appears a value for money response.

The GEP's activities have clearly lead to an advancement in the partner countries' stage of geothermal development and their capabilities to take further action. However, although surface exploration will continue to be an important field of work (even in very advanced countries like Kenya), many of them have now shifted the focus of their efforts towards exploratory drilling. It became clear during the evaluation that (apart from broadening and deepening the knowledge transferred so far), future support should focus largely on the following links of the geothermal value chain.

There are both positives and challenges surrounding sustainability. On the one hand, the considerable skills transfers that have taken place have increased organisational capacity in partner countries to a considerable degree. On the other, there are unquestioned risks linked to the achievement of medium-term sustainability. On balance, the evaluation finds that there is potential for sustainability in the long-term but short- and medium-term considerations are capable of undermining these.

7.2 RECOMMENDATIONS

At the outset, the evaluation believes that a second phase of support to geothermal development in the ARV countries is desirable. Should this recommendation be accepted, it is desirable that the following should be pursued:

Overall

- Further support for geothermal development in the region is desirable.

Design

- Any future programme should pursue actively the standard MFA-ICEIDA stakeholder approach in order to ensure achieving widespread ownership of the demand-driven project design.
- Adjust the overall project logframe to reflect realities that emerge through experience in order to maintain and enhance its relevance.
- While there is a need for further surface exploration (and corresponding training), future TA and capacity building should focus more on the next steps, i.e. along the geothermal value chain.

Surface Exploration

- Provide further guidance and mentoring to countries who are still not capable of doing things fully on their own for further surface explorations.
- "More of the same" is still needed, even in advanced countries like Ethiopia and Kenya! Particularly, there is a need to strengthen knowledge for interpretation, processing and management of data from surface studies (including also more sophisticated software solutions than Excel).

Technical Assistance and Equipment

- TA for (pre-) feasibility studies and ESIA for drilling as well as in defining specifications for drilling rigs and drilling work.
- Additional equipment is needed together with training in proper use (for instance, GDC requested new technology tools for well logging and reservoir operations).

Training and Capacity Building

- "Refresher courses" as well as further coaching and mentoring in the trained topics in order to ensure that the acquired knowledge is correctly applied and not lost over time, and to broaden the knowledge base within partner institutions.
- Intensify train-the-trainer approaches, so that knowledge and capacities acquired through the GEP can be more effectively spread within the partner institutions.
- Focus on the „next steps", such as supervision and management of exploratory drilling (so that partners "are not just observers", as was formulated by ISOR, but understand what is happening and are able to monitor and supervise).
- Future training should also look already at power plant operation to avoid cases like Langano which is out of operation for several years now and to ensure sustainable operation (steam field management and power plant operation, maintenance, etc.).
- Transfer of more advanced and more specialized training to deepen the expertise (likely best transmitted through on-the-job training and mentoring). In this context, it is worth also pursuing the possibility of placements with geothermal institutions in other African countries, like GDC in Kenya.
- Consider supporting mentorships intended to promote skills transfers within and between the national partner organisations, such as GDC.
- Send more people to Iceland for the six-month training program with UNU-GTP. KenGen sees mid-level professionals as the perfect target group since a certain level of knowledge is considered important to get the greatest benefit out of the program.
- There is a need for further short courses (particularly on project management, where often a lack of skills is still observed) which could be implemented through the AGCE.
- Improve matching of training needs and contents, in capacity building measures such as the training attachments for GDC in Iceland.

AGCE

- Continue support the AGCE, for instance in the following:
  - Curriculum verification,
  - Competence testing of teachers and filling of their knowledge gaps (in order to ensure high quality),
  - Bring in direct use expertise,
  - Bringing in the Icelandic expertise from institutions like ISOR, Verkis, etc., through corresponding linkages and partnerships

Direct Use

- Despite support to a geothermal grain dryer for demonstration purposes in Kenya, a cost-benefit study to enable decision making and possibly pave the way for a direct use pilot project in Rwanda remains a recommendation for the future. Also, other countries require support in identifying direct use applications and in developing small demonstration projects.
- Also, other countries require support in identifying direct use applications and in developing small demonstration projects
- GDC has requested funding and expertise for a feasibility study for a business park where geothermal energy is to be supplied to industries who are ready to settle there. Interest of industry is already there, but a study needs to be made.

Policy Support

- Re-consider providing policy and regulatory support (particularly to the development of feed-in tariffs and bankable PPA's, but also for issues such as drilling regulation) since this is seen by the AU Commission as "the biggest problem today" for the advancement of geothermal energy in the EARS countries. Such support could be directed particularly at countries such as Ethiopia and Djibouti, which could serve as model "lighthouses" for other countries.
- In the context of regulatory and policy support, fostering private sector participation is seen as critical as it will multiply potential sources of geothermal investment funding.

Support to Financing

- In case the GRMF continues into further rounds, support in writing funding applications will still be needed.
- However, support should be provided to obtaining funding also from other sources, such as World Bank and Agence Francaise du Dévelopement (problem is that GRMF covers only 40% of drilling costs).
- More pro-actively push Partner Countries to apply for drill funding from the GRMF (or other grant sources), since the initiative is not always taken by the countries themselves.

Other Recommendations

- Continue cooperation with UN-Environment and AU Commission (the latter also in order to continue providing support for donor coordination).
- Further support, as necessary, to Malawi which has potential for around 10 MW of electricity through binary plants and also direct uses!
- In Kenya, include KenGen as a recipient of support, which was explicitly requested for:
  - Capacity building on some specific logging operations (e.g. cement bond log; televiewers)
  - Support in the elaboration of (pre-)feasibility studies e.g for the use of total flow turbines or direct use applications
  - Capacity building for effective field management and monitoring (e.g. for Olkaria)

    - Capacity Building for surface exploration is still needed, particularly for modelling, data processing and analysing for geophysical and geochemical methods.
    - Support in plant management and production management (carrying out required field tests and provision of the necessary tools, for instance for geochemical treatment of reinjected water).
- For any potential future short courses, more pro-actively encourage the participation of women and form part of the selection process in order to guarantee a fair representation of women.
- Explore the introduction of compensation of greenhouse gas emissions caused by airplane travel carried out within the project.

8 APPENDICES

8.1 ANNEX 1 - TERMS OF REFERENCE

Annex 1_ToR_GEP_final and annex.pdf

8.2 ANNEX 2 - DOCUMENTS CONSULTED

General Documents:

- Act on Development Cooperation (21/2008)
- Evaluation Policy For Iceland's International Development Cooperation (MFA-ICEIDA)
- Strategy for Iceland's Development Cooperation 2013-2016 (MFA), adopted in 2013

Project Documents:

- Cumulative Annual Report, 2013 – 17
- UNEP Donor Agreement, including Annexes A, Concept Note for ARGeo, Phase 2, and B, Concept Note for Cooperation
- Geothermal Exploration Project Document
- Country Project Documents (and updates) of Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Tanzania
- MTR, Geothermal Exploration Project, August 2016
- MOU, African Union
- Report on Geothermal Training Attachments for GDC by Daði Þorbjörnsson (ISOR)
- Technical Review Memorandums prepared by ISOR for work done in Ethiopia, Kenya, Malawi, Tanzania
- "UNU Geothermal Training Programme in Africa: Short Courses held in support of the UN Sustainable Development Goals and the ICEIDA/NDF
- Geothermal Exploration Project", by Ingimar G. Haraldsson and Lúdvík S. Georgsson, from the Proceedings of the 7th African Rift Geothermal Conference
- Summary Reports on the 14 Short Courses implemented by UNU-GTP
- Workshop Report from the Second Africa Geothermal Center of Excellence Stakeholders Workshop

Presentations:

- "The Geothermal Exploration Project" – Presentation by MFA-ICEIDA
- "Geothermal Outlook in East Africa (Perspectives for Geothermal Development)" - Presentation by Dr. Peter Omenda
- "Kenya's Geothermal Journey" – Presentation by Daniel Saitet (KenGen)
- "ODDEG-ICEIDA Partnership Since 2016" – Presentation by ODDEG
- "Geothermal direct use, with a focus on agriculture and agro-industry sectors" – Presentation by Margeir Gissurarson and Sigurjón Arason (matís)
- "UNEP-ARGeo" – Presentation by Meseret Teklemariam (UN Environment) at the Tenth ARGeo Steering Committee Meeting
- "UNU-GTP Short Courses in Africa" – Presentation by Ingimar G. Haraldsson (UNU-GTP)

8.3 ANNEX 3 - PERSONS MET

- Hannes Hauksson, Counsellor, Head, Monitoring and Evaluation Unit, Ministry of Foreign Affairs
- Engilbert Gudmundsson, Special Advisor, Ministry of Foreign Affairs
- David Bjarnason, Project Manager, Ministry of Foreign Affairs
- John Lagat, Regional Manager, North Rift, Geothermal Development Company
- Rashid Ali Abdallah, Head, Energy Division, Department of Infrastructure and Energy, African Union Commission
- Meseret Zemedkun UN Environment (UNEP)
- Dadi Thorbjornsson, Iceland GeoSurvey
- Gylfi Pall Hersir, Iceland GeoSurvey
- Thrainn Fridriksson, World Bank
- Bjarni Richter, Director, Geothermal Energy, Iceland GeoSurvey
- Olafur G Flovenz, Director, Iceland GeoSurvey
- Ingimar Haraldsson, United National University Geothermal Training Project
- Erik Holmquist, (former) Project Officer, Nordic Development Fund

ODDEG

- Hassan Mohamed Magareh, Chief, Geosciences Department
- Rokiya Houssain, Geochemist
- Ayan Ahmed, Geologist/Project Manager
- Omar Abdillelin (omar.abdillelin.assoweh@gmail.com, Planning Service
- Abdek Mahamoud Abdi, Environmental Scientist, Planning and Geothermal Development Department
- Kayad Moussa Ahmed, Director General

GSE/EEP

- Solomon Kebede, DG Geological Survey of Ethiopia (GSE)
- Fikru Woldemariam, Project Manager (Aluto & Alalobeda), Ethiopian Electric Power (EEP)
- Sahele Tamiru Febede, Ministry of Water, Irrigation and Energy
- Mr. Neway Abera (Technical Manager)
- Mr. Habtamu Gerenew (Aluto Site Manager)
- Mr. Leul Asgawosen (Civil Engineer)

GDC/KenGen

- Anthona Wamalwa (Deputy Manager GRA)
- Sylvia Joan Malino (Chief Geochemist GRA)
- Hilary Mwawasi (Engineer Geothermal Resource Management), GRM
- Patrick Wandot (Technician Resource Management), GRM
- James Akali (Technician Steam Field and Power Plant Operations), GRM
- Jack Kiruja, Direct Use

- Japhet Towett, Direct Use
- Esther Nyambura, Direct Use

KenGen

- Edwin Watula, Geochemist
- Philip Omollo, Geophusicist
- Samuel Haganga, Drilling Engineer
- David Wanjohi, Geologist
- Urbanis Mbithi, Reservoir Engineer
- Daniel Saitet, Reservoir Scientist
- Johannes Ochome, Electrical and Electronics Engineer

TGDC

- Kato Kabaka, General Manager
- Taramaeli Mnjokava, Project Manager

8.4 ANNEX 4 - FINANCIAL TABLES

Table 8-1: Overall Funding envelope, upper limit

Stage	Activity	US$
1	Reconnaissance	1 000 000.00
2	Explorations	9 000 000.00
3	Technical Assistance Response	2 000 000.00
	Management, Administration, etc.	1 000 000.00
Total		13 000 000.00

Source: Project Document, ICE23066-1301

Table 8-2: Djibouti Budget, 2014 – 2016

Capacity Building sub-Sector	Output	2014 (US$ - '000s)	2015 (US$ - '000s)	2016 (US$ - '000s)	Total (US$ - '000s)
Training	1. Improved project management and planning capacity for geothermal projects 1.1 Short course on geothermal project management implemented in Djibouti 1.2 Follow up on project management training and IPMA accreditation 1.3 Short course on Preparation of bankable geothermal documents implemented in Djibouti		60 55	30	60 30 55
Sub-total					145
	2. Increased capacity for geothermal drilling established at ODDEG 2.1 Short course on geothermal well design and drilling technology implemented in Djibouti 2.2 Hands on drill training for up to 8 experts conducted in Kenya in cooperation with GDC (4-8 weeks)			60 65	60 65
Sub-total					125
Organisational Capacitation	3. Improved knowledge of geothermal surface exploration methods and conceptual model for Lake Abhe revised 3.1 Training programme for ODDEG in surface exploration methods and modelling to review conceptual model and identify drilling targets for Lake Abhe. 3.1.1 One month training of 2 ODDEG geophysicists and 1 geologist in Iceland for analyzing geophysical data and modelling for Lake Abhe. 3.2 UNU-GTP one candidate for geothermal exploration in relation to studies at Lake Abhe 3.3 Training in reservoir engineering model (Tough) for Lake Assal (1 expert)		100	75 35 40 12.5	175 35 40 12.5
Sub-total					250

Capacity Building sub-Sector	Output	2014 (US$ - '000s)	2015 (US$ - '000s)	2016 (US$ - '000s)	Total (US$ - '000s)
Technical Assistance	4. Technical assistance (finalization of GRFM applications and other matters as might be applicable)	25	25	25	75
Sub-total					75
Other	Miscellaneous (consultants input for preparations of ToR, implementation advice, travel and meetings)	5	15	10	30
Sub-total					30
TOTAL		30	267.5	352.5	650

Source: Project Document, Djibouti

Table 8-3: Proposed Djibouti Budgetary Revisions

Capacity Building sub-Sector	Output	US$ ('000s)
Training	Technical assistance GRMF application	30.5
	Training in project management and bankable documents	98.8
Organisational Capacitation	UNU-GTP one candidate	41.4
	Drill training course	58.3
Total End 2016		443.9
	Estimated 2017	
	Technical assistance Assal review	50
	Technical assistance for drill manufacture supervision	115
Total Estimated 2017		165
Total (Actual and Estimated)		608.9

Source: MFA-ICEIDA Project Manager, 18 August 2017

Table 8-4: UNEP Financial Support (ARGeo)

Purpose	Tranches – US$ (and dates payable)	Total – US$
ARGeo, Phase 2	500 000.00 (25 May 2017) 535 000.00 (I January 2018)	1 035 000.00

Source: Donor Agreement, 25 May 2017

Table 8-5: Eritrea Proposed Budget by Partner

	Output	MoEM (US$ - 000s)	ARGeo (US$ - 000s)	MFA-ICEIDA (US$ - 000s)
Surface Exploration	1. Survey Costs 2. Other Contract Costs 3. Field work Costs	 72.8	10 20 	540 13.5
Sub-total		72.8	30	553.5
Organisational Capacitation	Laboratory Equipment & Services Field Scientific Equipment Field Geophysical and Technical Equipment • MT • TEM • Gravity • Micro seismic • Radon counter	2.5 1.5	 180 100 70 45 30	
Sub-total		4	425	0
Project Administration and Overheads	Office Running Costs	17.75		
Sub-total		17.75	0	0
TOTAL		94.55	455	553.5

Source: Project Document, May 2014

Table 8-6: Ethiopia Support to Geothermal Exploration

Description	Outputs	2013 (US$ - '000s)	2014 (US$ - '000s)	2015 (US$ - '000s)	Total (US$ - '000s)
Surface Exploration	1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langano. 1.1 Geothermal surface exploration conducted in Aluto Langano. 1.2 Review of exploration report by external reviewers		296 7.4		296 7.4
	2. Four exploration wells sited and designed in Tendaho Alalobeda. 2.1 Geothermal surface exploration conducted. 2.2 Supervision/monitoring of the exploration 2.3 Review of exploration report by external reviewers. 2.4 Environmental and social impact assessment	494 20	494 20 7.4 102		988 40 7.4 102
Sub-total: Surface Exploration		514	927	0	1 441
Capacity Building	3. Exploration wells sited and designed in Gedemsa through training activities where GSE scientists will enhance their capacity. 3.1 Training course for surface exploration carried out by the UNU-GTP for exploration in the Gedemsa area. 3.2 Review of exploration report by external reviewers. 3.3 Environmental and social impact assessment		410	7.4 102	410 7.4 102
	4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modelling. 4.1 Needs assessment for equipment conducted 4.2 Procurement, tender and purchase of equipment	631			631
	5. Drill rig specifications defined and training strategy developed for geothermal drilling 5.1 Drill rig specifications and required technical input for bid documents. 5.2 Assessment of training needs for Geothermal drilling in general, including drilling engineers, drillers and borehole geologists.	50 11			50 11

Description	Outputs	2013 (US$ - '000s)	2014 (US$ - '000s)	2015 (US$ - '000s)	Total (US$ - '000s)
	6. Enhanced capacity for implementing agencies to monitor and administer relevant scientific and practical aspects of geothermal drilling 6.1 On-site training in geothermal drilling in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia 6.2 Staff of implementing agencies attends relevant courses for drill training, in accordance with drill training needs assessment.		100 60	100 60	200 120
	7. List of consumables and estimated cost for about 20 wells in Aluto Langano established 7.1 Preparation/review of a list of consumables for next drilling phase (20 wells)		26		26
	8. Enhanced capacity in power plant operation, maintaining geothermal power plants and reservoir monitoring. 8.1 Two-week training course carried out following a needs assessment. 8.2 staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise.				
	9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders). 9.1 A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts.	70			70
Sub-total: Capacity Building		762	596	269	1 627
Evaluation	Evaluation of capacity building and final project evaluation	10	20	30	60
TOTAL[19]		1 286	1 653	379	3 318

Source: Project Document, Ethiopia - Iceland Cooperation in Geothermal Development Initiated under the Iceland - World Bank Compact on Geothermal Energy

[19] Totals are rounded.

Table 8-7: Ethiopia - Budgetary Changes as a Result of ISOR Recommendations

Description	Outputs	Original (US$ - '000s)	Revised (US$ - '000s)
Surface Exploration	1. Up to 10-12 new wells sited and designed for additional energy production of 35MW in Aluto Langano. 1.1 Geothermal surface exploration conducted in Aluto Langano. 1.2 Review of exploration report by external reviewers *1.3 Supervision and monitoring of surface exploration*	 296 7.4 0	 *523* 7.4 *40*
	2. Four exploration wells sited and designed in Tendaho Alalobeda. 2.1 Geothermal surface exploration conducted. 2.2 Supervision/monitoring of the exploration 2.3 Review of exploration report by external reviewers. 2.4 Environmental and social impact assessment	 988 40 7.4 102	 *740* 40 7.4 102
Sub-total: Surface Exploration			1 367.8
Capacity Building	3. Exploration wells sited and designed in Gedemsa through training activities where GSE scientists will enhance their capacity. 3.1 Training course for surface exploration carried out by the UNU-GTP for exploration in the Gedemsa area. 3.2 Review of exploration report by external reviewers. 3.3 Environmental and social impact assessment *3.4 Preparation and supervision on/monitoring of surface exploration in Gedemsa*	 410 7.4 102 *0*	 410 7.4 102 *30*
	4. Implementing agencies in Ethiopia have the required equipment to conduct field surveys and geothermal modelling. 4.1 Needs assessment for equipment conducted *4.2 Procurement, tender and purchase of equipment*	 0 *631*	 0 *700*
	5. Drill rig specifications defined and training strategy developed for geothermal drilling *5.1 Drill rig specifications and required technical input for bid documents.* 5.2 Assessment of training needs for Geothermal drilling in general, including drilling engineers, drillers and borehole geologists.	 *50* 11	 *130* 11
	6. Enhanced capacity for implementing agencies to monitor and administer relevant scientific and practical aspects of geothermal drilling*: combined with the same total estimated* 6.1 On-site training in geothermal drilling in accordance with needs assessment carried out in conjunction with on-going drilling in Ethiopia 6.2 Staff of implementing agencies attends relevant courses for drill training, in accordance with drill training needs assessment.	*320*	*320*

Description	Outputs	Original (US$ - '000s)	Revised (US$ - '000s)
	7. List of consumables and estimated cost for about 20 wells in Aluto Langano established 7.1 Preparation/review of a list of consumables for next drilling phase (20 wells)	26	26
	8. Enhanced capacity in power plant operation, maintaining geothermal power plants and reservoir monitoring. 8.1 Two-week training course carried out following a needs assessment. 8.2 staff members from implementing agencies attend the 6 months UNU-GTP with a focus on the relevant areas of expertise.	70 120	70 120
	9. Enhanced local capacity in preparation of bankable geothermal project documents for external finance institutions (donors and lenders). *9.1 A two weeks training program to be designed at UNU-GTP in Iceland, with input from leading experts.*	*70*	*63*
Additional TA support	*Other project costs: consultancy, technical assistance, preparation of tenders, tender evaluations, etc.*	*0*	*100*
Sub-total: Capacity Building			2 089.4
Evaluation	Evaluation of capacity building and final project evaluation		
TOTAL[20]		3 318	3 610

Source: Memo, Revision of PD and Budget, Ethiopia, 17 September 2015. (Revisions in italics)

[20] All table totals are rounded.

Table 8-8: Capacity Building Support to GDC, Kenya

Capacity Building – sub-sector	Outputs	2014 (US$ - '000s)	2015 (US$ - '000s)	2016 (US$ - '000s)	Total (US$ - '000s)
Training	Capacity Building for GDC staff 1.1 15 GDC staff1 go through 1-3 months attachments with Icelandic geothermal companies and institutions, organized and administered by the UNU-GTP. 1.2 20 GDC staff attend two-week training course on Geothermal Project Management, carried out by the UNU- GTP in Kenya. 1.3 IPMA project management D accreditation carried out.		200 60 20	200	400 60 20
Resource Utilisation	2. Direct Use Pre-Feasibility study carried out, with reference to geothermal drying in Kenya		200		200
	Revised conceptual model for Suswa 3.1 Exploration data and interpretation reviewed and conceptual model and drilling targets revised or confirmed by external experts in collaboration with GDC staff. 3.2 Revised model presented in technical review meeting (in collaboration with ARGeo and high level panel of experts)	50	250 50		300 50
Facility Capacity Enhanced	4. GDC chemical laboratory fully accredited 4.1 Quality Manual for laboratory management and data management structures, procedures for chemical analysis and sample collection prepared. 4.2 Future laboratory facilities designed in compliance with the ISO-17025 standard 4.3 Up to 10 GDC geochemists and laboratory staff undergoes method specific training and method validation including documentation 4.4 Required equipment for laboratory needed for accreditation procured.	25	100 50 75 100	25 100	125 50 100 1200

Capacity Building – sub-sector	Outputs	2014 (US$ - '000s)	2015 (US$ - '000s)	2016 (US$ - '000s)	Total (US$ - '000s)
Management and Administration	Other 5.1 External final programme evaluation 5.2 Miscellaneous (consultants input for preparations of ToR, procurement costs, implementation advice, travel and meetings)	15	15	30 15	30 45
TOTAL		90	1 120	370	1 580

Source: Project Document: Capacity Building GDC –ICEIDA/NDF Cooperation

Table 8-9: Approved Budget, Rwanda

Capacity Building sub-sector	Activity	Total (US$ - 000s)
Training	Capacity Building for Geothermal Drilling in Rwanda 1.1 One week short course on geothermal drilling for EWSA staff	30
Technical Assistance	2. Technical assistance for drilling supervision 2.1 Consultation fees and travel for drilling supervisor for a total of (9 weeks) 2.2 On-site capacity building program for geothermal drilling (for a period of 6 months, with a total of 12 1⁄2 working months as input). 2.2.i Flights 2.2.ii Accommodation	 100 463 40 12
Formal Training	3. UNU-GPT 6 months course for one (1) EWSA geothermal expert (Funded by ICEIDA)	40
Institutional Capacitation	4.1 Equipment for geothermal analysis and monitoring according to needs assessment (estimated) 4.2 Chemical sampling and analysis (Estimated)	150 15
TOTAL		850

Source: Capacity Building and Technical Assistance for Geothermal Drilling in Rwanda, Project Document

Table 8-10: Proposed Budget, 2015 – 2017

Sector and sub-Sector	Outputs	2015 (US$ - '000s)	2016 (US$ - '000s)	2017 (US$ - '000s)	Total (US$ - '000s)
Surface Exploration	1. Up to 3 drill targets identified in the Luhoi geothermal prospect 1.1 Geothermal surface exploration conducted in Luhoi, including preliminary ESIA for drilling targets if applicable		750		750
Sub-total					750
Capacity Development					
Organisational Capacity	2. Training in surface exploration conducted in Kiejo-Mbaka area and preliminary conceptual model developed 2.1 Consultancy for training and interpretations for the Kiejo-Mbaka area		100	100	200
	3. Supervision/monitoring of the surface exploration and technical assistance for follow up if applicable 3.1 Support for quality monitoring and supervision under output 1 and 2. 3.2 Review of final exploration report and conceptual models by external reviewers		35 20	15	50 20
	4. Technical Assistance for advancing the development of the Ngozi geothermal prospect		100	50	150
	5. Equipment to conduct field surveys provided along with relevant training for operations and maintenance (coordinated with other donor funding) 5.1 Procurement, tender and purchase of equipment	200	50		250
Sub-total					670
Staff Capacity Enhancement	6. Improved capacity of TGDC staff 6.1 TGDC experts attend regional training courses. The assumption is that 10-15 TGDC experts would attend an average of 2 training courses each.		60	20	80
Sub-total					80
Other	7. Consultants input for preparations of ToR, procurement costs, implementation advice, travel and meetings	30	25	10	65
Sub-total					65
TOTAL		230	1 140	191	1 565

Source: Tanzania Project Document

8.5 ANNEX 5 - MTR RECOMMENDATIONS AND POST-MTR DELIVERY

MTR Recommendations	Final Evaluation Findings
Continue emphasis on capacity building through short courses.	Since the MTR dated August 2016, only two more short courses (both on Geothermal Project Management) were carried out, the last one in May 2017. Nonetheless, including all forms of capacity building (and considering also on-the-job training), it is quite clear that the focus of the GEP has been shifted more towards capacity building thereby responding to the needs of the partner countries.
Set up an appraisal committee to evaluate reconnaissance and surface exploration reports and especially the siting of exploration wells.	TA support has been provided for • Revaluation of surface data; and • Preparation of Conceptual models where this has been requested.
Organize training "on the job" by 1) getting overseas experts to the countries for 6-12 months and work in close cooperation with local experts in certain field like geology, reservoir engineering etc. (Rwanda, Ethiopia), 2) organizing training in other countries where African experts can work for 6-12 months in firms and/or organizations in geothermal countries.	'On the job training' has been provided by TA in response to specific requests in a variety of fields, including • Drilling and use of equipment • Software application • Training placements preceded by on-site support Training has been provided through the nascent 'Centre of Excellence' to professionals from numerous African countries The suggestion for 6-12 months training through placements in firms and/or organizations in other countries is difficult to implement due to work requirements in home countries. However, shorter trainings of this kind are possible and have proven very helpful. For instance, in August 2017 of GDC's staff went to one-month training attachments in geothermal firms and institutions in Iceland which was generally very well received. Furthermore, in 2017, GDC hosted 4 engineers from TGDC for 3 months for onsite drill related training and experience in Kenya.
Conduct refresher courses in various topics concerning exploration and utilization of geothermal energy. These courses could be given in cooperation with the African Geothermal Centre of Excellence.	Training support has been provided in line with the demand-led nature of the project. No refresher courses were identified by the evaluation
Repeat the successful short courses in Project Management, Bankable Documents and others in other EARS countries.	As stated above: following the MTR, only two more short courses (on Project Management) were carried out (one in Ethiopia for participants from 11 African countries, and one in Kenya aimed exclusively at Kenyan participants). Hence, only the first of those two short courses was aimed at other EARS countries. Project management training beneficiaries have emphasised the value-added they obtained through this, but there is a need for further short courses (also in other topics). In the future, these could be implemented through the AGCE.

MTR Recommendations	Final Evaluation Findings
In Rwanda it is recommended to continue studying drying of agricultural products with a study on cost benefits and other direct uses. This would also benefit other countries with low enthalpy fluids.	This recommendation is likely an outcome of the pre-feasibility study on geothermal drying of agricultural commodities in East Africa which was carried out by the GEP in 2014 and which included Rwanda as a case study. In the scope of this study, some potential direct use applications were identified for Rwanda but could not be concretized since the geothermal potential in Rwanda was not sufficiently known. Since then, no deeper analysis of costs and benefits of geothermal drying in Rwanda has been undertaken under the GEP. However, a geothermal drying demonstration project is being set up in Kenya with support from the GEP, the findings of which are likely to be used for decision making also in other countries, such as Rwanda. Nonetheless, at the ARGeo 7 conference in Kigali, representatives from Rwanda expressed the wish for support in setting up their own geothermal drying pilot project to prove viability under the specific geothermal conditions found in Rwanda. Therefore, a cost-benefit study to enable decision making and possibly pave the way for such a pilot project remains a recommendation for a potential future phase of the GEP.
Give both financial and practical (experts for training) assistance to the Geothermal Centre of Excellence in Kenya.	Under a Donor Agreement signed with UN Environment in May 2017, the project has supported the extended establishment and accreditation phase of the Centre of Excellence. This has included also the preparation and implementation of first courses carried out under the Interim Project Coordination Unit. At the time of the evaluation, this was still ongoing.
Put more funding into Tanzania, Eritrea and Djibouti during the latter half of the Project.	At the time of the evaluation, all funds had been disbursed. Both Djibouti and Tanzanian support had been completed and Eritrea remained completion although the government had indicated a request to finalise the work, which was suspended in 2015.
Sort out jointly with NDF the financial situation due to the limited funds left for new projects in the remaining Project period. Possibly, reallocation of unspent funding to the most promising countries could be considered, as well as additional funding by NDF/MFA. The legality/feasibility of such changes needs to be established.	According to the NDF, relations with ICEIDA as a partner had been extremely positive, which was a strong point of their experience. Interaction with ICEIDA was positive and frequently achieved through telephone conversations and verified by email confirmation. There has been no issue raised by NDF with respect to funding questions.
Facilitate that the relatively small investments done by the Project are leveraged by sufficient funding for the remaining stages. In this respect it could be considered that the Project gets more involved in the preparation of project proposals for further funding of subsequent stages. This could possibly be based on the structure taught in the courses on “Bankable Documents”. Continued close cooperation with the World Bank and other financiers would be required in this respect.	A number of partner countries (e.g. Djibouti, Ethiopia, Tanzania) had submitted successful applications to the GRMF and, in Ethiopia, the World Bank agreed a $212 loan for drilling in Aluto(22 of 26 identified drill sites) following the TA to assist in the review of surface exploration data and the development of two conceptual models. However, securing the WB funds in Ethiopia was not supported by the GEP. Generally, in terms of securing funding for the following stages (particularly drilling), the GEP has focused mainly on the GRMF. Therefore, the recommendation remains to extend this support also to other funding sources, such as the World Bank,

MTR Recommendations	Final Evaluation Findings
Training in Ethiopia is still required and even more important in Tanzania, Eritrea and Djibouti.	This recommendation was implemented. Some examples: • On-the-job training continued particularly in Ethiopia, Djibouti and Tanzania. • Participants from these three countries also participated in a further regional short course on Project Management. • GDC hosted 4 engineers from TGDC for 3 months for onsite drill related training and experience in Kenya. • Under the AGCE and with support from the GEP, training is under preparation on surface exploration for 25 Eritrean participants in order to prepare Eritrea's surface exploration works, which will resume in 2019. Nonetheless, it became clear during the evaluation that all countries require further training (both refresher trainings as well as new topics moving forward)
The split between training in Iceland and local training should be evaluated with respect to cost and benefits for students.	Such an analysis under the GEP is not known to the evaluation team. However, in the course of the final evaluation itself, an assessment has been carried out indicating that short courses in the countries and the six-month training program in Iceland have similar costs per training day per person (around 350 USD). Due to the duration and intense nature of the six-month program, this surely has a larger overall benefit, but of course also much higher overall costs. However, participants stated that the 6-month program rather gave a good, broad overview, but not too much in-depth and specialized knowledge. Due to the very practical approach, the one-month training attachments for GDC in Iceland seem to stand out in terms of their usefulness for the participants. Their cost per training day per person is about double that of the short courses and six-month training programmes. However, given the largely positive feedback, these costs seem justified. An assessment of the cost/benefit ratio of on-the-job training in the countries could not be carried out due to a lack of corresponding numbers.
It is recommended that social and environmental impact issues related to the nomads are further considered and that ESIA to be started well before exploration wells are drilled.	Some ESIAs have been completed. Others await award of drilling licenses and availability of funding.

8.6 ANNEX 6 - SPECIFIC MFA-ICEIDA REQUESTS AND LOCATION OF EVALUATION FINDINGS

Specific Requests	Location in Evaluation Findings
Hannes would like to understand why bankable documents produced by ICEIDA have not led to projects. Engilbert believes this has much to do with the GRMF being too complicated (application procedure) and covering only 40% of the funding needs ... "GRMF needs to be redesigned.". Many countries have approached GRMF with support from ICEIDA, but have had difficulties obtaining the remaining 60% from their governments (with the exception of Tanzania, whose application has been described as the best received to date). Therefore things have come to a halt. Funding from the WB and AFD can be provided to cover the full drilling cost, but this is only accessible if these donors have a corresponding country programme. Also, having AUC as the host of the GRMF is peculiar, because AUC is a political entity, not an implementer.	Discussed under both Efficiency and Effectiveness
Is drilling financially viable if it aims only at identifying low-temperature resources? Has such a project applied to the GRMF? In other words: can direct use justify expensive drilling (even if the drilling is less expensive than for power generation projects)?	Discussed under Effectiveness
How can the feasibility of direct use in lower temperature areas be assessed? What is needed to define a pilot project for food drying or similar? (Questions from GEP presentation at ARGeo7 in Rwanda)	Discussed under Effectiveness and Impact and addressed under Recommendations
How can geothermal projects work with the communities around the sites (how can they profit either through electricity or direct use)?	Engaged under Effectiveness
How can the private sector be better integrated into geothermal development?	Discussed under Effectiveness and Sustainability
David wants us to analyse the question further if ICEIDA should do more of the same (surface exploration) … at least on a mentoring level. Or can such mentoring be provided for instance by GDC without the need of further support from ICEIDA? → In Iceland Seamus already provided a partial answer: regional expertise should be used where possible (more value for your dollar), but some expertise will probably still have to be brought in externally. ICEIDA should respond flexibly.	Addressed under Effectiveness, Sustainability and Recommendations
In Nakuru we should check on the accreditation of the laboratory and speak with the people in charge to understand the challenges there (it took much longer than we hoped) and how things are going now.	Discussed under Effectiveness and Impact
David wants us to "spot check" how people are using the equipment in the field (are they confident and comfortable using it?).	Discussed under Effectiveness and through Ethiopia field visit
We should include feedback from participants in short courses and training attachments in Iceland.	See Effectiveness discussion
The support to the preparation of a geothermal exploration project in the Bugurama/Ruzizi region in Burundi/Rwanda/DRC unfortunately did not lead anywhere. "In Burundi and DRC we worked with the wrong people who had no clue!" How can the commitment of countries like Burundi/DRC be increased?	There is no specific consideration of this – however, it is evident from the political-economy circumstances in both countries that political 'buy-in' is very negatively affected by the prevailing circumstances.
How were the efforts of similar donor programmes coordinated (e.g. BGR and ARGeo had a similar concept and approach to the GEP)?	See discussion of Effectiveness and Impact (in particular Ethiopia, Kenya, Tanzania)

8.7 ANNEX 7 - EVALUATION QUESTIONS / EVALUATION MATRIX (INCEPTION REPORT)

	EQs	Source (Based on the TOR)
Relevance	Does the project follow regional strategy? Is it in line with individual countries' national policy? Is the project in line with MFA-ICEIDA's policy? Does the project contribute to relevant SDGs? Is the logframe constructed in accordance with the achievement of the expected goals and outcomes	Published ECA energy approach National policies and statements MFA-ICEIDA strategy statements SGGs logframe
Efficiency	Were the resources appropriate and adequate to the project's goals and outcomes? Were alternate utilisation of resources more appropriate? Were the resources distributed and disbursed in response to identified needs? Was the management of resources handled efficiently?	Project reports Stakeholder interviews
Effectiveness	To what extent were the envisaged results achieved? Do the envisaged results contribute to planned outcomes? What, if any, gaps are there between the planned results and the expected outcomes? Has the built capacity and expertise been successfully applied? Are partner countries more confident of their understanding of their geothermal resource base?	Project reports Stakeholder interviews Field visits
Impact	How has the project contributed to the resource mix in the partner countries? To what extent has this contributed to the diversification potential of their energy sources? Did the project contribute in the medium- to long-term to the SDG and climate change agenda?	Project reports Stakeholder interviews Field visits
Sustainability	Are the gains achieved sustainable? Has the increased capacity developed through project activities been retained within national public and private sector organisations and at regional level? Are partner countries more able to assess their resource base as a result of the project?	Project reports Stakeholder interviews Field visits
Gender	To what extent, did the project contribute to increased engagement by women and female scientists, in particular? Does the project contribute, overall, to women's empowerment and more egalitarian gender relationships in the region?	Project reports Stakeholder interviews Field visits
Environment	How has the project contributed to the resource mix in the partner countries? To what extent has this contributed to the diversification potential of their energy sources? Did the project contribute in the medium- to long-term to the SDG and climate change agenda?	Project reports Stakeholder interviews Field visits

8.8 ANNEX 8 - INCEPTION MISSION AGENDA

Outline Schedule and Agenda: Inception Mission, Reykjavik, 3 – 4 December 2018

Opening Kick-off Meeting, 3 December 2018

07.30: Team Interviews

09.30: Introductions

09.35: MFA – ICEIDA: Presentation of Priorities for Evaluation

10.30: Break – Tea/Coffee

11.00: Team interviews

12.00: Team: Questions for clarification

13.00: Lunch

14.00: Team engagement around Inception Report

Wrap-up Meeting, 4 December 2018

10.00: Team Interviews

14.00: MFA – ICEIDA: Team proposal – way ahead: Summation of interviews and proposed approach; draft IR submission schedule and outline field work.

15.30: Tea/Coffee and Conclusion:

Date & Time	Location	Interlocutor
3 December, 07.30	ÍSOR's offices: Orkugardur, Grensásvegur 9, Reykjavik	Gylfi Pall Hersir
3 December, 09.30	MFA	Hannes, David, Engilbert, MFA-ICEIDA
3 December, 11.00	MFA	Thrainn Fridriksson, World Bank
4 December, 10.00	UNU-GTP, Orkugardur, Grensásvegur 9, Reykjavik	Ingmar Haraldsson, UNU GTP
4 December, 14.00	MFA	Hannes, David, Engilbert, MFA-ICEIDA

8.9 ANNEX 9 - FIELD WORK PLANNING

Location	Date	Contact	Email	Sent	Response
Djibouti	04/02	Kayad Moussa	kayadmoussa@gmail.com	9 Dec	09.00, Office Djiboutien de Développement de l'Energie Géothermique (ODDEG) Sis PK20, Rue d'Arta BP: 2025, Djibouti Tél: 00253-27500077
Ethiopia: Addis AUC Aluta	 06/02 06/02 05/02	 Solomon Kebede Fikru Woldermain Neway Abera Rashid Abdallah Atef Marzouk Stef Ngaryo Solomon Kebede Fikru Woldermain Neway Abera	 solo450354@yahoo.com wmariamfikr@gmail.com aberaneway@yahoo.com Abdallahr@africa-union.org MarzoukA@africa-union.org solo450354@yahoo.com wmariamfikr@gmail.com aberaneway@yahoo.com	9 Dec	 Solomon: 5 February World Bank HQ, Bole Road (+251911935028) Will collect 07.30 from Trinity Hotel 14 Feb, 15.00: Skype conference Sylvain plus Atef Mazououk
Kenya: Nakuru Naivasha Nairobi	 07/02 08/02 11/02	 John Lagat Peketsa Mangi Meseret Zemdekun Crispin Loupe (Ministry of Energy)	 jlagat@gdc.co.ke pmangi@kengen.co.ke meseret.zemedkun@un.org cloupe@gmail.com	9 Dec	 07 Feb, 09.00, GDC Office, Polo Centre 2nd Floor. KenGen confirmed, 8 Feb am. We are located 21 kms from Naivasha town, at the Geothermal Plaza, along the Moi South Lake Road. Tel: +254705116096 Confirmed, UNEP HQ, 11 Feb, time to be advised
Tanzania: Dar-es-Salaam	 13/02	 Kato Kabaka Taramaeli Mnjokava	 Kato.Kabaka@tanesco.co.tz taramaeli.mnjokava@tanesco.co.tz	9 Dec	13 Feb, 10.00 am Ursino Estate Mwai Kibaki Road, House number 25, Plot number 13 P.O. Box 14801 Dar es Salaam, Tanzania

8.10 ANNEX 10 – FINAL PRESENTATION IN REYKJAVIK ON 1 APRIL 2019

GEP Final Evaluation_presentation_20190401.pdf