TAKING AFRICAN GEOTHERMAL KNOWLEDGE TO A HIGHER LEVEL – TRAINING ACTIVITIES OF UNU-GTP FOR AFRICA

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ABSTRACT

United Nations University Geothermal Training Programme (UNU-GTP) in Iceland specializes in capacity building for geothermal exploration and development for professionals from developing countries. This is achieved through training and post-graduate academic studies in Iceland and, more recently, also through short courses, workshops and hands-on training in the developing countries themselves. As Africa is a priority area within the UN system and with the increasing geothermal development in E-Africa, UNU-GTP is putting more emphasis than ever before on capacity building and geothermal research aimed at furthering geothermal development in the region.

From its start, the annual 6-month training in Iceland has been at the core of UNU-GTP operations. In recent years, academic studies at MSc and PhD level, and short courses and training on-site in the developing countries have gained importance. Of the 647 UNU Fellows, who have completed the 6-month training between 1979 and 2016, 244, or 38%, have come from 17 African countries. In addition, 30 of 51 UNU-GTP MSc-graduates to date (late 2016) are from 7 African countries, and the first four PhD-Fellowships have gone to Kenyans. Most UNU Fellowships have been financed by the Icelandic Government, while some have been sponsored through local institutions or companies.

The UN Millennium Short Course Series for E-Africa, which started in Kenya in 2005 with the week-long "Workshop for Decision Makers on Geothermal Projects and their Management", has since 2006 continued through annual Short Courses, first aimed only at surface exploration, but gradually extended to about 3½ week events that cover most aspects of surface geothermal exploration, drilling and an introduction to development. In this, UNU-GTP has worked closely with Kenya, through KenGen and GDC. Now more than 550 Africans from 22 countries have benefitted from these training efforts. With the new UN Sustainable Development Goals (SDGs), these series will be reviewed in line with the new SDGs. From 2010, UNU-GTP has also been able to offer customer-designed training and courses in line with the needs of clients from developing countries which have been supported by local or external financial mechanisms. This has become an increasing part of the operations, and several countries of Africa have benefitted from this. An important part has been the "Geothermal Exploration Project in E-Africa", aimed at 13 countries and mainly financed through ICEIDA of Iceland and the Nordic Development Fund (NDF). In it, UNU-GTP has had the task of geothermal capacity building and strengthening of institutional build-up with regards to geothermal expertise. Examples of activities include Workshops for Decision-Makers for various countries of E-Africa and a Workshop for Geothermal Development Donors held in Iceland. Furthermore, new course material has been developed, such as in project management, and for preparations of bankable documents for geothermal projects. This has been specially aimed at strengthening the management side of geothermal development, with the courses having been carried out in Ethiopia, Djibouti and partly in Kenya. In the long-term, this should also strengthen sound policy-making in the region.

The need for geothermal capacity building in Africa is higher than ever. A natural development to meet this need is the establishment of the Geothermal Center of Excellence in Kenya where UNU-GTP is in a supporting role. With it, local training should be able to reach a new level. Here, we hope to see a breakthrough in 2016-2017.

1. INTRODUCTION

The United Nations University Geothermal Training Programme (UNU-GTP) was established in Iceland in late 1978. The task of UNU-GTP is to help developing countries with significant geothermal potential to establish groups of specialists in geothermal exploration and development. Since 1979, annual 6-month courses have been held with 8-9 different lines of geothermal science and engineering for professionals from developing countries. The hallmark of UNU-GTP is to give university graduates, engaged in geothermal work, intensive on-the-job training in their chosen fields of specialization. The programme is hosted at Orkustofnun – The National Energy Authority of Iceland. During 1979-2016, 647 scientists and engineers from 60 countries have completed the 6-month course (Figure 1). In 2016, 34 UNU Fellows were enrolled for the training.

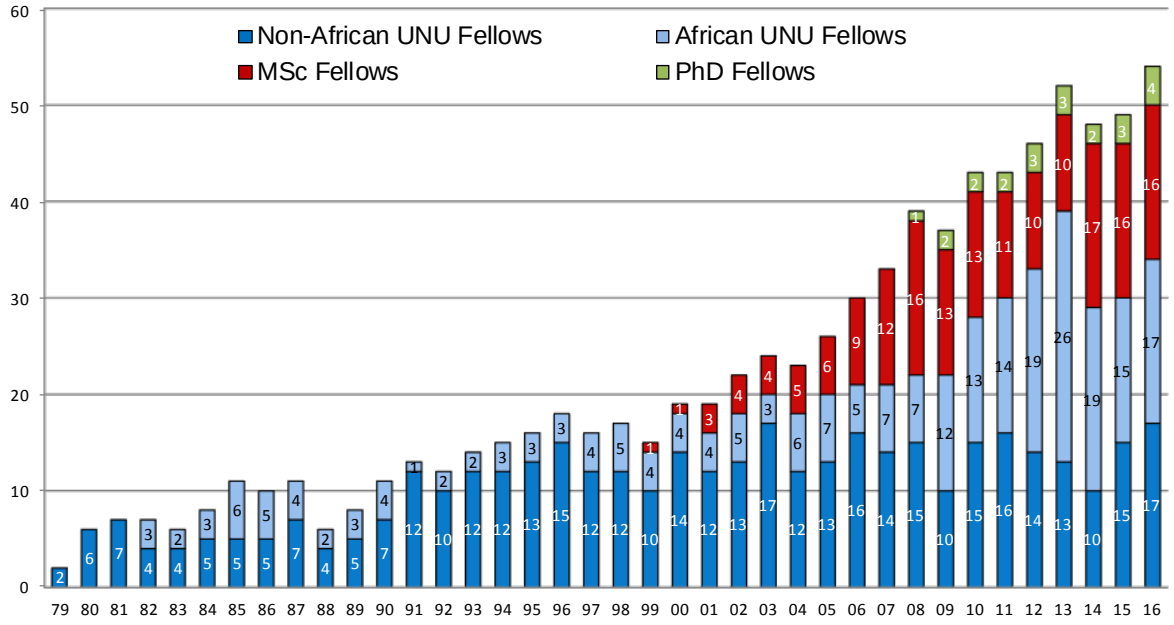

Figure 1: UNU Fellows completing the 6-month training and studying for MSc and PhD in Iceland between 1979 and 2015

The MSc programme, in geothermal science and engineering, was started in 2000 in cooperation with University of Iceland, and a PhD programme in late 2008. Now, in late 2016, 51 MSc Fellows have completed their degree, with 11 currently pursuing their studies. Thirty of these 51 MSc Fellows have come from Africa, or 59%. Similarly, the first PhD Fellow defended her thesis in 2013, and the next one is due to defend her thesis in early September 2016, with three more pursuing their studies. Four of these are from Kenya, while one is from Asia.

From 2005, funding has also been secured for additional training efforts, taking the training to the partner countries. This was Iceland's official contribution to the UN Millennium Development Goals, and has been implemented through regular workshops/short courses hosted in selected countries on different continents, in cooperation with local energy institutions/companies (Fridleifsson, 2004; Georgsson et al., 2015a; 2015b). The first phase was a week-long workshop during which decision makers in energy and environmental matters in the target region meet with leading local geothermal experts and specially invited international experts. The purpose is to educate the participants about the possibilities of geothermal energy, and increase the awareness for further geothermal education and cooperation between specialists in the different countries of the region. This is then followed by specialized Short Courses for earth scientists and engineers on surface exploration, deep exploration, production exploration, drilling, resource assessment, utilization, operation and management, production monitoring, environmental issues, planning and financial aspects etc., in line with the needs of the respective region. These series are referred to as the "UN Millennium Short Course

Series". Regular series with annual Short Courses have been held for East Africa (in Kenya from 2005) and for Central America – later extended to Latin America and the Caribbean Islands (in El Salvador from 2006) (Georgsson et al., 2015b). Material presented and written for the events is published on CDs and is available on the website of UNU-GTP (*www.unugtp.is*).

The UN Millennium Development Goals have now run their course and have been replaced by the UN Sustainable Development Goals (SDGs) adopted during the Paris Convention in late 2015. In line with the new goals set forward by UN through the SDGs, new series of Short Courses will be introduced in late 2016 - replacing the old ones – taking its inspiration from the SDGs.

The need for geothermal training has now grown far beyond what UNU-GTP is able to fulfil and service through its regular financing from the official development assistance (ODA) of the Government of Iceland. This has led to requests for additional services, backed up by local or international financial sponsorship. It should also be added that a lot of teaching material has been prepared through the UN Millennium Short Course Series. Together, these factors played a major role in the decision of UNU-GTP taking its training activities one step further and offer courses or training fulfilling special needs of a paying customer. This has become an increasing part of the operations, and several countries of Africa have benefitted from this.

This paper describes the operations of UNU-GTP, with special reference to on-site capacity building activities in Africa, concluding with some scope being given to possible future development.

2. UN MILLENNIUM SHORT COURSE SERIES

The short courses that have been held in support of the United Nations Millennium Development Goals have been described by Georgsson in past years (Georgsson, 2014 and Georgsson et al., 2015b). The latest event in the series was *Short Course X on Exploration for Geothermal Resources*, held at Lake Bogoria and Lake Naivasha from November 9 to December 1, 2015. It was attended by 62 participants from 18 countries. Table 1 lists the Workshop and Short Courses of the UN Millennium Short Course Series held in East Africa 2005-2015, while Table 2 shows the participation from various countries. Table 3 shows the number of lecturers and supervisors at these events, and Table 4 shows an example of the structure of one of the short courses, i.e., the last one held in November 2015.

Table 1: Workshop and Short Courses of the UN Millennium Short Course Series, held in East Africa 2005-2015.

Event	Main site	Dates	Duration (days)
Workshop for Dec. Makers on Geoth.Proj. & their Manag.	Naivasha	Nov. 14 – 18, 2005	5
Short Course on Surface Explo. for Geothermal Resources	Naivasha	Nov. 13 – 22, 2006	10
Short Course II on Surface Explo. for Geothermal Resou.	Naivasha	Nov. 2 – 17, 2007	16
Short Course III on Explorat. for Geothermal Resources	Naivasha	Oc. 24 – No. 17,2008	25
Short Course on Geoth. Proj. Managem. & Development	Entebbe	Nov. 20 – 22, 2008	3
Short Course IV on Explorat. for Geothermal Resources	Naivasha	Nov. 1 – 22, 2009	22
Short Course V on Exploration for Geothermal Resources	Naivasha	Oct.29 – No. 19,2010	22
Short Course VI on Explorat. for Geothermal Resources	Naivasha	Oct.27 – No.18,2011	23
Short Course VII on Explorat, for Geothermal Resources	Naivasha	Oct. 27 – No.18,2012	23
Short Course VIII on Explorat. for Geothermal Resources	Naivasha	Oct. 31 – No.22,2013	23
Short Course IX on Explorat. for Geothermal Resources	Naivasha	Nov. 2 – 24, 2014	22
Short Course X on Exploration for Geothermal Resources	Naivasha	Nov. 9 – De. 1, 2015	22

Throughout the series of Short Courses, UNU-GTP has cooperated with KenGen on their implementation. After the formation of the Geothermal Development Company (GDC) at the end of 2008, GDC came in as an additional partner in this project. This cooperation has generally meant that

the costs of all invited foreign participants (travel and accommodation) and non-local lecturers salaries, travel and accommodation) are covered by UNU-GTP and the Icelandic Government, while the costs of the local Kenyan participation and some of the local arrangements are mainly taken care of by KenGen, and from 2009 by GDC.

Table 2: Participants in the Workshop and Short Courses in East Africa 2005-2015.

Country	Ke 2005*	Ke 2006	Ke 2007	Ke 2008	Ug 2008	Ke 2009	Ke 2010	Ke 2011	Ke 2012	Ke 2013	Ke 2014	Ke 2015	Total	6 mo. Fe**
Algeria			1					1					**2**	**1**
Burundi				2	1	2	2	1	2	2	1	1	**14**	**1**
Cameroon										1	1	1	**3**	
Comoros			2			2	3	2	1	1	2	1	**14**	**2**
Djibouti		2	1	2	3	2	2	3	2	3	2	3	**25**	**12**
DR Congo				1	1			1	3	3	2	2	**13**	**1**
Egypt			1									1	**2**	**1**
Eritrea	2	3	2	2	1	2		2		2	1	2	**19**	**4**
Ethiopia	5+2	3	1	2	3	3	1	3	3	3	3	3	**35**	**14**
Kenya	6+9	10	13	18		21	31	30	28	32	30	28	**256**	**69**
Malawi							3	3	2	3	1	2	**14**	**3**
Morocco							1						**1**	**1**
Mozambique							1	1	2	1	1	1	**7**	
Niger										1			**1**	
Nigeria									2	2	1	1	**6**	
Rwanda			2	2	1	3	3	4	6	3	2	2	**28**	**11**
Sudan									2	3	2	1	**8**	**1**
Tanzania	2	2	2	2	4	3	3	2	3	2	3	7	**35**	**9**
Uganda	4	3	3	2	5	3	2	2	3	2	3	3	**35**	**10**
Zambia				2	2	2	3	2		3	1	2	**17**	**1**
Zimbabwe											1		**1**	
Yemen			2	2	1	2	1	1	2	2	1	1	**15**	**4**
Others					2					1			**3**	
Total	**30**	**23**	**30**	**37**	**24**	**45**	**56**	**58**	**61**	**70**	**58**	**62**	**554**	**145**

* The second number shows African lecturers, who participated fully in the Workshop;
** UNU Fellows in Iceland for 6-month training during the same period (2005-2015).

Table 3: Lecturers and supervisors in the Workshop and Short Courses in East Africa 2005-2015.

Short Course / Workshop	Home country	Neighbour. countries	Internat.	Iceland	Total	Former UNU-Fellows
Kenya 2005	9	2	1	4	**16**	8
Kenya 2006	11	5	0	4	**20**	15
Kenya 2007	16	4	0	5	**25**	18
Kenya 2008	19	5	0	4	**28**	23
Kenya 2009	27	4	0	4	**35**	26
Kenya 2010	27	3	0	4	**34**	23
Kenya 2011	27	5	0	4	**36**	27
Kenya 2012	40	4	0	4	**48**	29
Kenya 2013	40	6	0	4	**50**	32
Kenya 2014	46	6	0	4	**56**	31
Kenya 2015	54	6	0	4	**64**	38
Uganda 2008	1	7	2	5	**15**	8

Table 4: The structure of "Short Course X on Exploration for Geothermal Resources", held at Lake Bogoria and Lake Naivasha, Kenya, in November 2015.

Dates	Programme	No. lectures	Prac-ticals	Lecturer/Supervisor		
				Local	Neighb.	Iceland
Nov. 9	Arrival at Lake Bogoria Hotel					
Nov. 10	Introductory lectures	8		8		
Nov. 11-14	Site visits to geothermal areas and geothermal field work		X	16		
Nov. 15	Site visit Menengai, drive to Naivasha		X	3		
Nov. 16	Geothermal energy, systems, assessment and mapping – Lecturers	8		5		3
Nov. 17	Geology and logging – Lectures and practicals	6	X	6		1
Nov. 18 - 19	Geophysical exploration – Lectures and practicals on interpretation. Exam 1.	14	X	4		2
Nov. 20	Chemistry of thermal fluids – Lectures and interpretation	7	X	3		1
Nov. 21	Environmental, societal and regulatory issues – Lectures and practicals, including laboratory	6	X	7		2
Nov. 22	Geothermal drilling and utilization – Lectures. Exam 2.	9		9		
Nov. 23	Excursion – Olkaria geothermal field, power plants and drilling rigs		X	3		1
Nov. 24 - 25	Status of geothermal in E-Africa – Lectures and practicals	21	X	2	6 (+12)*	
Nov. 26	Planning and costing, case examples	8	X	4		2
Nov. 27 - 29	Project work in groups		X	15		
Nov. 30	Project presentations, course review, closing	(7)		15		1
Dec. 1	Departure participants – Instructors assessment meeting					

* Trainees gave lectures on geothermal development in their countries, shown in parentheses.

The series has evolved and improved over the last decade since the first course was offered. The short courses were initially based on lectures only, but practical components and field work were soon incorporated. With the adoption of the Sustainable Development Goals (SDGs), which were unanimously accepted by the 193 United Nations member states in September 2015 in Paris, the UNU-GTP, as an established programme within the United Nations University, is taking a critical look at these short courses in order to identify opportunities for further improvement. These improvements are expected to enhance the quality of the course and aid in fulfilling the SDGs – in particular to assist in ensuring access to affordable, reliable, sustainable and modern energy for all, as stated in Goal 7. This work has been taking place in cooperation with the Kenyan partners, KenGen and GDC, in the months leading up to the next short course, scheduled for November 2016. The name of the short course series will change in order to better reflect the relations to the SDGs.

From a more general perspective, the *UN Millennium Short Course Series* proved to be an important channel to the more advanced training in Iceland, giving outstanding participants the chance to show their ability and strength, and consequently opening the possibility to be selected for training in Iceland. Thus, the series have to some extent reduced the need for UNU-GTP to make conventional site visits to partner countries. There are now many examples of good participants in the Short Courses being selected for the 6-month training in Iceland. And in some cases, this has led to MSc studies in Iceland. The Short Courses have also become an important element in catalysing increased cooperation between the countries within the region.

Finally, the availability of the papers and presentations prepared for these events, not only on CDs but as open-file material on the internet, has really proven important as can be seen from the high number of downloads of papers published for some of these events which can be counted in hundreds of thousands per year for the most popular ones (Georgsson et al., 2015a).

With the UN Millennium Workshops and Short Courses, UNU-GTP reached a much wider audience than before. More than 550 African scientists and engineers (including Yemen) participated from 2005 to 2015 and close to 60 individuals from the region have lectured in these events. This can be compared with the 145 UNU Fellows from Africa and 4 from Yemen (which has been a regular participant in the Short courses) trained for 6 months in Iceland during the same period. It can be argued that the Short Courses are really creating a critical mass to seriously further geothermal development in the region.

The Short Courses have also opened up new connections. In East Africa, key geothermal scientists are lecturing and supervising a new generation of young and promising scientists. This way the geothermal know-how is being transferred from one generation to the next. Similar to the 6-month training, the Short Courses have also created bonds and friendship between individuals with different backgrounds and across national boundaries, which can only help the development of geothermal in the region. The effect of the Millennium Short Courses is also reaching well beyond East Africa, with new countries being added every year, the most recent additions from Central and West Africa, as Nigeria, Niger and Cameroon are examples of. Even though geothermal energy will hardly be a major player in the energy spectrum for these countries based on the current technology, it can still play an important role in some regions as a good renewable alternative to fossil fuels and biomass.

3. CUSTOMER DESIGNED SHORT COURSES

UNU-GTP has offered customer designed short courses since 2010 (Georgsson et al., 2015b). These activities, including various types of short courses and training, have been increasing with each passing year and are now an integral part of the operations of UNU-GTP. The content of these events has varied significantly, based on the needs of the respective client. It has covered both regular Short Courses and more extensive hands-on training. As of June 2016, 35 events have been held in 5 continents, ranging from 2 day workshops to 6-month in-depth practical training on site. Out of these, 20 have been held in Africa, with over 50% given in Kenya, as shown in Table 5, and one has been held in Iceland for African countries. Many have been held for and financed by the two large geothermal companies in Kenya, KenGen and GDC, while others have been financed by multilateral development donors. Twelve events in Africa have been financed through the *Geothermal Exploration Project in E-Africa*, in cooperation with the Icelandic International Development Agency (ICEIDA), the Icelandic Ministry for Foreign Affairs (IMfA) and/or the Nordic Development Fund (NDF). Within the project, UNU-GTP has been given the task of geothermal capacity building and assisting in strengthening institutional build-up with regards to geothermal expertise. This cooperation is expected to continue into 2017. Table 6 lists some of the more important events in these series.

Table 5: Number of customer designed short courses or training events held in Africa from May 2010 to June 2016

Country	Number of events
Djibouti	3
Ethiopia	4
Kenya	11
Rwanda	2

Table 6: Examples of customer-designed Workshops, Short Courses and Training given by UNU-GTP for different customers in 2010-2015.

Event	Location	Dates	Customer	Duration
Course on Geothermal Drilling	Indonesia	Jan. 25 – Feb. 19, 2010	SenterNovem, Bappenas, & PT. Pertamina G.E	4 weeks
Training Course on Exploration for Geothermal Resources	Silali, Kenya	May 17 – Jun. 12, 2010	GDC, Kenya	4 weeks
Course on Geothermal Exploration and Development	El Salvador	Nov. 7 – 12, 2011	Organization of American States - OAS	1 week
Course on Geothermal Technology	Naivasha, Kenya	Apr. 16 – Jul. 14, 2012	KenGen, Kenya	13 weeks
Advanced Training in Borehole Geology	Naivasha, Kenya	Jul. 16 – Dec.16 2012, Jan. 7 – Feb. 2, 2013	KenGen, Kenya	6 months
Training in Drilling Supervision	Karisimbi & Kigali	Jul. 1, 2013 – Feb. 8, 2014	ICEIDA & EWSA, Rwanda	10 weeks
Short Course for Decision Makers on Geothermal Development	Naivasha, Kenya	Sept. 24 – 28, 2013	ICEIDA	5 days
Training in TFT-Measurements of Two-Phase Flow	Naivasha, Kenya	Mar. 31 – Apr. 12, 2014	KenGen, Kenya	2 weeks
Workshop for Geothermal Development Donors	Iceland	May 27 – 28, 2014	ICEIDA, African Union	2 days
Short Course on Well Design and Geothermal Drilling Technology	Addis Ababa and Lake Ziway, Ethiopia	Jan. 12 – 24, 2015	ICEIDA, NDF, GSE, EEP	2 weeks
Short Course on Geothermal Project Management	Nakuru, Kenya	May 18 – 28, 2015	ICEIDA, NDF, GDC	10 days
Short Course on Preparation of Bankable Documents for Geothermal Projects	Djibouti, Republic of Djibouti	Sep. 5 – 10, 2015	ICEIDA, ODDEG, CERD, MERN	6 days
Short Course on Borehole Geophysics for Geothermal Development	Addis Ababa and Aluto Langano, Ethiopia	June 6 – 18, 2015	ICEIDA, NDF, GSE, EEP	2 weeks

4. SUPPORT TO GEOTHERMAL TRAINING CENTRES IN THE DEVELOPING COUNTRIES

4.1 The Geothermal Diploma Course in El Salvador for the Latin American region

There is a substantial demand for geothermal training in the world and the capacity building activities of UNU-GTP can only meet so much of it. UNU-GTP has therefore opened up possibilities for supporting newly established geothermal training centres in the developing countries. The cooperation with LaGeo, the University of El Salvador and the National Energy Council of El Salvador in the past few years is a good example of this. UNU-GTP was approached by the Nordic Development Fund (NDF) and the Inter-American Development Bank (IDB) in 2012, with the request to evaluate a geothermal diploma course that had been run at the University of El Salvador in 2010 and 2012 with Italian support (Caprai et al., 2012). After the mission, in which a thorough review was undertaken, UNU-GTP produced a report with recommendations for improvements and a

possible future direction of the program (Haraldsson et al., 2013). These recommendations were largely taken into account and implemented during the annual offerings of the diploma course in 2013-2015, which were financed by NDF and IDB (de Velis, 2014). During this time, UNU-GTP took part in the Academic Committee of the programme and produced annual evaluations and recommendations for improvement. In 2016, UNU-GTP assumed a direct role in the management of the program, which became funded solely by NDF, and implementing partners' contributions.

The geothermal diploma courses in El Salvador have offered new possibilities for aspiring geothermal experts in Latin America, as the program is conducted in Spanish and in a cultural environment that is in many respects similar to that in the participants' home countries. Fellowships, covering all basic costs, have been awarded to participants from the whole Latin American Region, which means that close to half of the 25-30 participants are foreigners and the rest Salvadorians. These courses, which have lasted 4-5 months, have, though, been general in scope and have not offered specializations in a particular geothermal discipline or extensive individual project work. Some outstanding students who have completed the program have therefore later been admitted to the 6-month training programme in Iceland where they have had opportunities to specialize in their chosen field of study and work on individual projects in close cooperation with Icelandic experts, using data from home. The completion of the diploma course in El Salvador has in some cases allowed the Fellows to skip the introductory lecture courses at the UNU-GTP, while others have been enrolled from the start to sharpen their English skills. The success of the diploma course program through the years has rested on the expertise found within LaGeo, the state owned geothermal exploration and electricity generation company in El Salvador. UNU-GTP's ties with LaGeo and its predecessors go back to the start of the 6-month training in Iceland and, since 1980, 38 Salvadorans have completed the 6-month training and 5 have completed an MSc degree. The strong ties between the two entities have further served to increase the quality and success of the program.

4.2 African Centre of Excellence for Geothermal capacity building

The increased emphasis on development of geothermal resources, currently experienced in East Africa, and especially in Kenya in association with the goals set forward in Vision Kenya 2030 (e.g., Simiyu, 2010; Ngugi, 2012), has created an overwhelming demand for the current capacity building activities on offer by various training institutions, such as UNU-GTP in Iceland, Auckland University in New Zealand, and local universities, leading to challenges in meeting these needs. To keep the momentum of development going and meet this demand, it is therefore extremely urgent to take the local training to a new level. For some time, it has been discussed that the next step should be the establishment of a Regional Geothermal Training Centre for East Africa, located in Kenya, which UNU-GTP has voiced its support for.

In early 2014, GDC received the support of the Kenyan Government for establishing a centre of excellence in geothermal capacity building. ICEIDA and the Nordic Development Fund (NDF) declared that it would be ready to step in to secure the financial background for the centre. The African Union also emphasized its support for such a centre in collaboration with regional and international stakeholders. UNU-GTP has also been expected to be a part of this project, and it would also be important to have the cooperation of a Kenyan University to strengthen its academic background. The *Center of Excellence* was expected to offer various types of short courses up to 3 months in length, thus creating something complimentary to the training on offer in Iceland.

For various reasons, the *Center of Excellence* has though taken longer to materialize than expected. Hopefully, the coming year will see it formally opened.

5. THE WAY FORWARD

5.1 Summarizing

With the Millennium Workshops and Short Courses, UNU-GTP has reached a much wider audience than before. More than 550 African scientists and engineers (including Yemen) have participated from 2005 to 2015 and more than 60 individuals from the region have lectured in these events. This can be compared with the 141 UNU Fellows from Africa and 4 from Yemen (Table 2) trained for 6 months in Iceland during the same period. It can be argued that the Short Courses are really creating a critical mass to seriously further geothermal development in the region. Similar things can be said about Central America.

The Short Courses have also opened up new connections. In East Africa, key geothermal scientists are lecturing and supervising a new generation of young and promising scientists. In this way the geothermal know-how is being transferred from one generation to the next.

The customer-designed short courses, which UNU-GTP started offering in 2010, have also proven to be a good opportunity for countries that are fast-tracking geothermal development, and have themselves the financial capacity or the support of external mechanisms to finance it. The first such courses held in 2010 for four different customers, have since increased in number and become an integral part of UNU-GTP's operations. Close to 500 individuals have benefitted from these activities during this period (Mid 2016). This is foreseen to continue in the near future, as need demands.

5.2 Looking to the future

The 6-month training in Iceland has been the cornerstone of the UNU-GTP operations and its importance will remain high in the foreseeable future. Similarly, the academic studies in Iceland for an MSc or a PhD degree in Iceland will also be given due importance. However, expansion in these conventional operations is expected to be slow, except through external financing as has been seen in the last few years, which has contributed to the rise in the annual number of 6-month UNU Fellows in Iceland, rise from 20-22 in 2004-2009 to 34 in 2016. However, this has meant that UNU-GTP is currently close to the practical capacity limit that the 6-month training in Iceland can be expected to reach, at least through the current institutional set-up.

The two Series of the *UN Millennium Short Courses* have developed into a new pillar in the operations of UNU-GTP. These series will now be reviewed in line with the new UN Sustainable Development Goals. This is expected to enhance the quality of the courses and aid in reaching the SDGs – in particular to assist in ensuring access to affordable, reliable, sustainable and modern energy for all, as stated in Goal 7. This work is already on-going and the first Short Course of the new series in Latin America will take place in El Salvador in September 2016, called: *Short Course I on Sustainability and Environmental Management of Geothermal Resource Utilization and the Role of Geothermal in Combating Climate Change.* In E-Africa the first short course of the new series will take place in November 2016, in cooperation with KenGen and GDC, as before.

Further growth of the geothermal training in Africa should be through a sustainable regional geothermal centre, and the new Short Course series can become an integral part of that, as the case is in Latin America. For the next 2 years NDF is providing additional financial support for the running of the almost annual Diploma Course at the University of El Salvador, with UNU-GTP and LaGeo of El Salvador as implementing partners. It is the first time UNU-GTP is a direct implementing authority in such a regional centre, being before in an advisory role. The short course on sustainability is an integral part of the diploma course.

UNU-GTP foresees a similar development in East Africa. It is more urgent than ever to get the regional geothermal centre established, so capacity building in the region can keep up with the

ambitious plans for geothermal development. GDC has the support of the Kenyan Government for establishing a centre of excellence in geothermal capacity building, with KenGen also in an active supporting role. The African Union has emphasized its support for such a centre in collaboration with regional and international stakeholders. With NDF and MfA/ICEIDA ready to step in with GDC in securing the financial background and UNU-GTP ready to assist in developing the curricula for the planned courses, there is no need to delay its development. Hopefully we will see it go ahead in 2016-2017.

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