

## Capacity building in geothermal: Update and summary of UNU-GTP's recent activities with emphasis on Europe

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### ABSTRACT

The United Nations University Geothermal Training Programme (UNU-GTP) in Iceland specializes in capacity building for geothermal exploration and development. Emphasis is on developing, but the programme is open for European professionals, if external financial support is available. The programme has a long standing history and celebrated its 40th anniversary in 2018.

The operations of UNU-GTP can be classified into four different categories: a) Hands-on training in Iceland for professionals; b) Post-graduate academic studies in Iceland; c) UN SDG Short Course Series given in E-Africa and Latin America; and d) Short courses, workshops and training based on special financial mechanisms and given in the relevant countries. In the 2000s, Africa with its high geothermal potential in E-Africa has had a priority within our system. Here, the UN Sustainable Development Goals (SDGs) also set norms that need to be adhered to.

From its start in 1979, the annual 6-month training in Iceland has been the core of UNU-GTP's operations. During 1979-2018, 694 UNU Fellows completed the 6-month training. Of these 75, or 11% have come from Europe. In addition, 62 Fellows have graduated with an MSc degree with 15 currently pursuing their studies, while two have graduated with a PhD degree and 4 are enrolled for PhD studies in Iceland, on UNU-GTP Fellowships. The annual UN Millennium Short Course series, in 2016 redeveloped as the UN SDG Short Course series, given in Kenya for E-Africa since 2005 and in El Salvador for Latin-America since 2006, have also been very important in UNU-GTP's activities. Approximately 1300 participants have benefitted from these. Furthermore, UNU-GTP has also been able to offer customer-designed training and courses extending from 2 days up to 6 months, in all including more than 40 events since 2010.

Most of the UNU Fellowships for training or studies in Iceland have been financed by the Icelandic Government. This was also the case for European UNU Fellows, which mainly came from E-Europe before the turn of the century. With most of these countries joining the European Union in 2004-2007, this conventional way of entrance was not open anymore due to the

previously mentioned emphasis on developing nations. However, more recently new possibilities have opened through the EEA-funds, which are a special contribution from the EFTA countries (Norway, Iceland, Lichtenstein) to the lesser developed parts of the EU, to get access to the EU markets through the European Economic Area (EEA) with projects supporting renewable energy development. In recent years, this has given professionals from Portugal, Hungary and Romania access to UNU-GTP, both through the 6-month training and series of short courses on geothermal exploration and development given in the respective countries, with considerable benefits. We look forward to see a continuation of this in the coming years. The paper summarizes the operations of UNU-GTP in recent years with special emphasis on Europe.

### 1. INTRODUCTION

The United Nations University (UNU) dates back to 1973, when its charter was adopted by the UN General Assembly, and Tokyo was selected as the site for its operations, which started in September 1975. From the start, Iceland supported the idea of establishing UNU and even considered it a good venue, where Iceland could come in with support to developing nations. The Geothermal Training Programme was established by UNU and the Government of Iceland in December 1978 (Fridleifsson 1998).

The first two UNU Fellows, who came from the Philippines, arrived in Iceland in May 1979 (Fridleifsson, 2008). During 1979-2018, 694 UNU Fellows from 61 countries completed the 6-month training (Fig. 1). Of these 75, or 11% have come from Europe.

### 2. INSTITUTIONAL BACKGROUND AND ORGANIZATION

UNU-GTP has from the start of its activities been operated at Orkustofnun (The National Energy Authority of Iceland). Orkustofnun is an advisory agent to the Government of Iceland on energy related topics. Most of the UNU-GTP's hired lectures and supervisors come from ISOR (Iceland GeoSurvey) which are located in the same building as OS and UNU-GTP. The UNU Fellows have full access to the research facilities and a multidisciplinary research environment of ISOR



**Figure 1: Map showing the number of trained Fellows at UNU-GTP in Iceland and their home countries from 1979-2018.**

(and Orkustofnun), which is amongst the leading geothermal energy research institutions in the world. Thus, there is a close cooperation between UNU-GTP and the main geothermal research and advisory entities in the country. The UNU-GTP also has a close cooperation with University of Iceland (UI) and Reykjavik University (RU). Staff members of the geoscientific and engineering departments have been amongst key lecturers and supervisors of UNU Fellows since the establishment of UNU-GTP. Furthermore, a co-operation agreement was signed in 2000 between UNU-GTP and UI on MSc studies in geothermal science and engineering. This is designed for UNU Fellows who have already completed the traditional 6-month courses at the UNU-GTP, which constitute 25% of the MSc programme (30 ECTS units). The agreement was later extended to PhD studies. A similar cooperation agreement was signed with RU in 2013.

UNU-GTP has five permanent staff members (employed by Orkustofnun), but lecturers, supervisors and support staff are hired on short-term contracts from ISOR, UI, RU, and other geothermal and engineering agencies/companies. Every year, about 70-100 staff members of these institutions render services to UNU-GTP. This makes it possible to provide the highly specialized training in the eight lines of specialization offered.

Since 2015, the UNU-GTP is governed by a Board, with the Director General of Orkustofnun as its chairman. Other board members include a representative from the Ministry for Foreign Affairs, the Vice Rector of UNU for Europe, representing UNU, and the Director of UNU-GTP, ex officio. The Board of UNU-GTP meets two times a year.

The UNU-GTP is academically governed by a Studies Board, which is composed of high-level geothermal experts responsible for each of the specialized lines of study which have been on offer in the 6-month training in recent years. The Director of UNU-GTP is the chairman of the Studies Board. Other members are from Iceland’s leading geothermal companies and

universities. The Studies Board meets 3-4 times a year. It sets the academic standards for the training and designs training schedules for the different study lines and each UNU Fellow.

### 3. MAIN OPERATIONS OF UNU-GTP

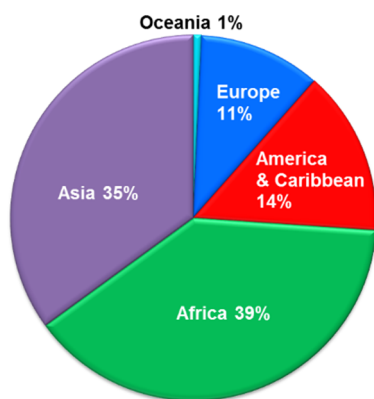
The mandate of the Programme is capacity building in developing countries with the aim of establishing a team of geothermal experts to assist developing countries in developing and utilising their indigenous geothermal resources. This is achieved through four activities described in the following chapters.

#### 3.1 The 6-month training

The core activity of UNU-GTP is the 6-month training in Iceland, which is a post-graduate training programme, funded through Iceland’s official developing assistance.

The hallmark of UNU-GTP is to give university graduates engaged in geothermal work intensive training in their chosen fields of specialization, with the UNU Fellows working under the guidance of geothermal professionals in Iceland. The training is to some extent tailor-made for the individual and the needs of his institution/country. All participants are selected by private interviews. During site visits to the developing countries, UNU-GTP representatives visit geothermal fields, research institutions and energy utilities. Fellows are selected for training in the specialized fields, which are considered most relevant to promote geothermal development in their respective country.

During 1979-2018, 694 scientists and engineers from 61 countries completed the 6-month course. Of these, 39% have come from Africa, 35% from Asia, 14% from Latin America and the Caribbean, 11% from Europe, and 1% from Oceania (Fig. 2). During this period, 158 women have completed the programme, or 23% of the participants. Gender equality is an important part of UNU-GTP strategic policy, and, in recent years, female participation has grown consistently, reaching 38% in 2018.



**Figure 2: Participation share of the continents in the 6-month training at UNU-GTP.**

### 3.1.2 European participation

Despite UNU-GTP focusing mainly on developing countries, there are cases when countries have sent candidates for training through their own funding, or through an external funding mechanism, or special agreements. One such example is the funding of training of European participants through the EEA Grants. As can be seen from Fig. 1, European countries account for 11% of the participation in the Programme. However, most of the European participants attended the training in the first two decades of the Programme when they still had the status of being developing countries. After reaching the development status, they were no longer applicable for the training under the conventional funding through the Iceland's Official Development Assistance. The EEA Grants provided a new platform for European participants to attend the 6-month training in Iceland. The Grants are funded by Iceland, Liechtenstein and Norway with the aim to reduce social and economic disparities within the European Economic Area (EEA) and to strengthen bilateral relations between donor and beneficiary countries. With the support of Orkustofnun, as a donor programme partner in renewable energy programmes in Hungary, Portugal and Romania, UNU-GTP entered into agreements on training activities with several project promoters in these countries (Haraldsson, 2018). In 2014 and 2015, a total of four participants from Portugal (Azores Islands) attended the 6-month training in Iceland and in 2016, six Hungarian and four Romanian attended on behalf of their countries.

### 3.2 MSc and PhD Fellowships

UNU-GTP offers UNU Fellows the possibility of extending their studies to pursue MSc or PhD degrees in geothermal sciences or engineering in cooperation at University of Iceland or Reykjavik University. The MSc programme was started in 1999 in cooperation with University of Iceland, and the PhD programme in late 2008. The aim of establishing an MSc and PhD programme in cooperation with UI and RU was to go further in assisting the UNU-GTP partner countries to strengthen their specialist groups and increase their geothermal research capacity. The 6-month training at

UNU-GTP fulfils 25% of the MSc programme credit requirements (30 of 120 ECTS units) at UI and RU.

In 2018, 62 MSc Fellows have completed their degree, with 10 currently pursuing their studies. The first PhD Fellows defended their theses in 2013 and 2016 at UI, both women from Kenya dealing with environmental and social effects of geothermal development (Fig. 3).



**Figure 3: The first two PhD Fellows at UNU-GTP who also were the first two Africans to defend a PhD from the University of Iceland.**

Presently, four are pursuing their PhD studies at UI. All of the MSc and PhD Fellows have received UNU-GTP Fellowships funded by the Government of Iceland, but three MSc Fellowships have been co-sponsored by the home-country. All MSc theses have been published in the UNU-GTP publication series, and can be obtained from the UNU-GTP website ([www.unugtp.is](http://www.unugtp.is)).

### 3.3 SDG Short Course series

With the adoption of the UN Millennium Development Goals, the UN member states committed to reach the targets set at the Millennium Summit in 2000 (UN, 2000). One of Iceland's contribution towards these targets was the establishment of a series of Short Courses aimed at accelerating the development of geothermal resources in developing countries. The MDG Short Course Series in 2005-2015, succeeded in 2016 by the UN SDGs Short Course Series, were a very important addition to the activities of UNU-GTP, allowing it to bring considerable part of the training to UNU-GTP's important partner regions in East Africa and Latin America, in cooperation with local energy institutions/companies (Fridleifsson, 2004; Georgsson et al., 2015a and 2015b). The Short Courses have been held annually in Kenya since 2005 for African countries (main emphasis on East Africa), and in El Salvador for Central America since 2006, and later including South America and the Caribbean Islands. A lot of material presented and papers written for these events were published on CDs and is also available on the website of UNU-GTP ([www.unugtp.is](http://www.unugtp.is)).

In Africa, 684 participants have had the opportunity to attend events of these two series since their start in 2005, and in Latin America the number is now 662 participants. These numbers show that with the Short Courses UNU-GTP has been able to reach a far larger number of geoscientists and engineers in developing countries than through the conventional training in

Iceland, and, thus, it has been possible to spread geothermal knowledge to a wider region and audience, and contribute to potential geothermal development in new countries. The Short Courses have also been an important element in catalyzing increased cooperation between the participating countries.

### 3.4 Sponsored customer-designed short courses and training activities

With the ever increasing need to react to the impending threat of climate change more countries are looking towards renewable energy to fulfil their development goals. This is particularly important in developing countries where the development growth is the fastest. To meet this increased demand UNU-GTP opened up the possibility for customer-designed short courses and training in 2010. This service was triggered by the urgent need for training in countries planning fast-tracking of geothermal development. This has proven a good opportunity for some countries/institutions in need of a rapid capacity building process, which have themselves the strength or the support of external sources to finance such events. The paying customer defines the outline of the Short Course, while UNU-GTP is responsible for the quality of the contents.

In 2010-2018, 43 different events have been given for various customers, with 23 of these held in Africa and 15 in Europe (three in Iceland). Twelve of those have been held in cooperation with entities within the European Economic Area funded by EEA Grants. From 2014 to 2016, seven events were held in the Azores Islands with a total of 102 participants, and from 2016-2017, four events were held in Romania with a total of 106 participants. One was held in Iceland in 2016 for 11 Hungarian geoscientists. All in all, 219 participants attended the workshops and short courses funded through EEA Grants and a total of 1,343 participant days accrued through the EEA Grant events (Haraldsson, 2018). In addition to that, UNU-GTP held a short course "OSCE Field Study on Geothermal Energy to Iceland" for specialists in Renewable Energy from countries in SE-Europe which was funded by the Ministry for Foreign Affairs (ICEIDA).

### 4. IMPACT OF THE UNU GEOTHERMAL TRAINING PROGRAMME

Capacity building and transfer of technology along with increased emphasis on policy making are key issues in the sustainable development of geothermal resources. The impact of UNU-GTP training in capacity building can be clearly seen in its cooperation countries, especially Kenya for example, where most of the UNU Fellows have come from. At present, 129 Kenyans have completed the 6-month training at UNU-GTP. Kenya has accelerated their development of geothermal resources immensely over the last years, and due to the increased need for trained staff, they have funded their staff by their own means to meet that requirement. According to Kenya's Vision 2030, geothermal energy is expected provide 5000 MWe of electricity on-line in 2030. Already, 690 MWe are already on-line and

further geothermal power plants are scheduled in 2019 and onwards (Omenda and Mangi, 2016). It is also very likely that Kenya will surpass Iceland in terms of MW very soon. In recent years the focus of UNU-GTP has been on Africa, the continent in most need of increased energy. Most of the countries in Sub-Saharan Africa acutely need to develop their indigenous energy sources and replace expensive fossil fuel with green energy. Here, the geothermal resources of the East African Rift System (EARS) are very important and Kenya is leading the way.

In Asia, China has traditionally been UNU-GTP's most important partner country. It used to be the country with most UNU Fellows until Kenya passed it in 2013. In 2018, 89 Chinese UNU Fellows had been trained at UNU-GTP, many of whom are among China's leading experts in exploration and development of its geothermal resources. It is difficult to classify China as a developing country today, but due to its strong commitment and future plans for major geothermal development UNU-GTP wants to keep good connections with China and support it along the way.

In Latin America El Salvador has sent 41 UNU candidates for training and has been a key partner of UNU-GTP in recent years through many activities, while Costa Rica (18) and Nicaragua (13) should also be named. In all three countries geothermal plays a significant role in the local electricity production.

### 5. CONCLUSIONS

Through its four main activities, UNU-GTP contributes significantly towards energy development in the development countries as well as to reaching the global targets of the UN Sustainable Development Goals. I.e. in particular Goal nr 7: *Affordable and Clean Energy*, nr 13: *Climate Action*, and through the gender balanced Fellows and lecturer selection, Goal nr 5: *Gender Equality*. UNU Geothermal Training Programme expects to continue focusing on a geothermal future and to successfully support geothermal development in the world through its operations and activities.

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