



**UNITED NATIONS  
UNIVERSITY**

**UNU-GTP**

Geothermal Training Programme

Orkustofnun, Grensasvegur 9,  
IS-108 Reykjavik, Iceland

# **UNU GEOTHERMAL TRAINING PROGRAMME**

## **STRATEGIC PLAN FOR 2016-2019**

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**TABLE OF ACRONYMS**

CNE	National Energy Council, El Salvador
DAC	Development Assistance Committee of OECD
GDC	Geothermal Development Company, Ltd., Kenya
IDB	Inter-American Development Bank
IGA	International Geothermal Association
MDGs	UN Millennium Development Goals
MFAI	Ministry for Foreign Affairs in Iceland
NDF	Nordic Development Fund
ODA	Official Development Aid
OS	Orkustofnun – National Energy Authority of Iceland
PAUWES	Pan African University – Institute of Water and Energy
RU	Reykjavík University
SDGs	UN Sustainable Development Goals
SE4A	Sustainable Energy for All
SIDS	Small Island Development States
UI	University of Iceland
UNFCCC	United Nations Framework Convention on Climate Change
UNU	United Nations University
UNU-EHS	UNU Institute for Environment and Humans Security
UNU-FLORES	UNU Institute for Integrated Management of Material Fluxes and of Resources
UNU-FTP	UNU Fisheries Training Programme
UNU-GEST	UNU Gender Equality Studies and Training Programme
UNU-GTP	UNU Geothermal Training Programme
UNU-LRT	UNU Land Restoration Training Programme
WGC	World Geothermal Congress - held once every 5 years

## SUMMARY OF STRATEGIC OBJECTIVES

The *United Nations University Geothermal Training Programme (UNU-GTP)* straddles the objectives and policies of the *United Nations University (UNU)* as its mother institution and the *Ministry for Foreign Affairs in Iceland (MFAI)*, which provides the primary funding for UNU-GTP from its development cooperation budget. Within this twin framework UNU-GTP is expected to work through a *results based management framework* to produce specific outputs in geothermal training and capacity building as contribution toward sector outcomes and impact.

At the highest level of objectives (**impact**), UNU-GTP seeks to contribute to the UN Sustainable Development Goals through facilitating increased access to geothermal energy and thus support economic growth through clean energy use, poverty reduction, and the fight against climate change. This UNU-GTP does by providing knowledge transfer and capacity strengthening for selected low- and middle-income countries, which is expected to lead to increased provision of low-carbon energy and the associated increased energy access.

UNU-GTP has identified specific **outcomes** which it will aim for as its contribution to the objectives as stated above, as follows:

- Increased installed geothermal electrical generation capacity (MW) in selected low- and middle-income countries – with emphasis over time on low-income countries;
- Increased direct use of geothermal energy for heating, bathing and other direct uses;
- Increased institutional capacity in selected low- and middle-income countries to set geothermal sector policies and operational guidelines, to prepare and implement geothermal projects and to operate geothermal facilities;
- Increased theoretical knowledge of geothermal resources in relevant countries and regions.

To obtain the outcomes above, the following **outputs** will be the main direct contribution of UNU-GTP:

- Fellows of the 6-month training programme in Iceland;
- Graduates from MSc and PhD programmes in cooperation with University of Iceland and Reykjavik University;
- Participants from short courses, primarily held in developing countries;
- Reports and other results from advisory services provided upon request;
- Academic papers published by GTP staff and its alumni.

The **inputs** necessary to produce the outputs above will come from a combination of budgetary allocations from MFAI, as the primary source of funding, direct payments for training at the 6-month programme and short courses from paying clients, and from specific assignments UNU-GTP may undertake for paying clients.

Gender policy and environment, notably climate change, are key issues in the development cooperation strategy of the Icelandic government. UNU-GTP's activities are directly related to addressing climate change issues. UNU-GTP intends to strengthen its gender focus by continuing to improve the gender ratios among UNU Fellows and course participants, to the degree the still limited number of female graduates in fields related to geothermal disciplines in developing countries allow. To provide nominating countries with incentives, UNU-GTP will e.g. emphasize that if two fellows are invited from a country at least one should be a woman. UNU-GTP will also opportunistically seek to support capacity building for projects on direct use of geothermal resources which may directly benefit women in relevant developing countries.

## 1. INTRODUCTION

Development of reliable indigenous renewable energy sources, such as geothermal energy, is an important factor in achieving a brighter future for many developing countries. For many of them traditional biomass represents the largest category of energy used, with expensive fossil fuels often complimenting it as the primary energy source for electrical production, with an associated environmental degradation. Utilization of available geothermal resources can help to reverse this.

The United Nations Sustainable Development Goals (SDGs) highlight the contribution which geothermal energy can make, with Goals 7 and 13 stating<sup>1</sup>:

**Goal 7:** *Ensure access to affordable, reliable, sustainable and modern energy for all.*

**Goal 13:** *Take urgent action to combat climate change and its impacts.*

Developing sustainable geothermal resources is a multi-disciplinary task for scientists and engineers of various specialties. It has been the mission of United Nations University Geothermal Training Programme (UNU-GTP) to assist developing countries with access to geothermal resources in enhancing their institutional and individual capacity in exploring and developing these resources in a sustainable way<sup>2</sup>. During the last several years, special emphasis has been placed on East Africa, with Latin America also given due focus. Geothermal energy has the possibility to make a real impact in these regions with high potential for electricity production, not forgetting co-benefits such as heating, drying and bathing. In other regions the main emphasis is placed on direct use, as witnessed by cooperation with countries like China, Mongolia and others.

Furthermore, the *2015-2019 Strategic Plan of United Nations University* (UNU) places increased emphasis on UNU's involvement in policy-relevant research and advice for the UN system – acting as a think-tank<sup>3</sup>. This calls for greater efforts to ensure visibility in publishing, and active participation in policy-making in partner countries and in the UN system. In UNU's strategic plan, three thematic clusters are emphasized:

- Peace and governance;
- Global development and inclusion; and
- Environment, climate and energy.

The mission of UNU-GTP, as the only UNU energy programme, fits squarely within the last one and indirectly with the first two.

This document presents the strategic direction of UNU-GTP over the four-year period 2016-2019, taking note of the global needs for affordable, reliable and sustainable energy for all, UNU's emphasis on policy-relevant research and think-tank related involvement in environmental and energy politics, and Iceland's commitments in this regard. A short review of the establishment, stakeholders, and operations of UNU-GTP in Section 2 is followed by a review of the status of and possibilities for geothermal development in the developing countries in Section 3. Section 4 presents the strategic goals of UNU-GTP for 2016-2019, while the pathways to realizing those goals are covered in Section 5. Finally, Section 6 presents the approach for managing for defined development results, through monitoring and periodic assessment of the programme in line with criteria of the Ministry for Foreign Affairs of Iceland (MFAI) and UNU. A simplified logical framework is presented for a concise overview of objectives at different levels.

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<sup>1</sup> UN Sustainable Development Goals: <https://sustainabledevelopment.un.org/topics>

<sup>2</sup> Georgsson et al., 2015: *UNU Geothermal Training Programme in Iceland: Capacity Building for Geothermal Energy Development for 36 years*. Web: <http://www.geothermal-energy.org/pdf/IGAsstandard/WGC/2015/09010.pdf>

<sup>3</sup> United Nations University Strategic Plan 2015-2019. Web: [http://i.unu.edu/media/unu.edu/attachment/48794/unu\\_strategic\\_plan\\_2015-2019\\_en.pdf](http://i.unu.edu/media/unu.edu/attachment/48794/unu_strategic_plan_2015-2019_en.pdf)

## **2. UNITED NATIONS UNIVERSITY GEOTHERMAL TRAINING PROGRAMME (UNU-GTP)**

United Nations University (UNU) was established in 1975 with the aim to create an “international community of scholars engaged in research, postgraduate training and dissemination of knowledge” in line with the Charter of the UN. A cooperation contract was signed by UNU and Orkustofnun (OS), the National Energy Authority of Iceland, at the end of 1978 for the establishment of a postgraduate training programme (UNU-GTP) in Iceland with emphasis on capacity building in geothermal sciences and engineering. It is now the oldest continuously run programme within UNU. This contract has been renewed regularly, gradually modified through time. The current 5-year contract was signed in late 2014, and was a 3-sided contract between UNU, MFAI and OS. With this contract, a Board for UNU-GTP was introduced for the first time, consisting of three representatives, one from the UNU, one from OS, and one expert nominated by the Ministry for Foreign Affairs with the representative of OS serving as the Chairman of the Board. The Director of the Programme serves as an ex officio member of the Board.

UNU is identified by the MFAI as a key implementing agency in its development cooperation agenda. In its recent strategy (2013-2016), the MFAI outlines several areas on which to focus Iceland’s development cooperation; specifically, these include topics that can draw on Icelandic experience and expertise. Highlighted are issues regarding natural resource management, including energy (geothermal) and fisheries, and cross-cutting themes of gender equality, as well as pressing environmental issues like land degradation. This is clearly emphasized by the operations of the four UNU programmes in Iceland, which address these topics.

The primary source of funding for the programmes has been from the budget of the Icelandic Government through the MFAI and has been classified as Official Development Assistance (ODA). However, in recent years, increased emphasis on developing geothermal resources has seen demand for geothermal training and education grow far beyond what UNU-GTP can fulfil through its basic budget from the MFAI. To meet this need, UNU-GTP has been contracted to give short courses, workshops and training on-site, intended for specific nations, funded by international, multilateral or national financing mechanisms. In addition, this has also financed a number of UNU Fellowships for training in Iceland. In 2015, these sponsored activities created extra funding which amounted to more than 40% of the total budget of UNU-GTP.

The current operations of UNU-GTP can be classified into five basic categories:

- a) The 6-month postgraduate training in Iceland, now in eight different study lines, which has been run on an annual basis since the establishment of UNU-GTP, with UNU Fellowships given to promising geothermal geoscientists and engineers. During the 37 years of UNU-GTP’s operation, 613 UNU Fellows from 59 countries have now (2015) completed the 6-month programme in Iceland with around 30 UNU Fellows graduating annually in recent years.
- b) An academic postgraduate scholarship programme run in cooperation with the University of Iceland (UI) since 2000 and Reykjavík University (RU) since 2014, with scholarships awarded to applying former UNU Fellows who excelled during the 6-month training and want to take their education to a higher level. Emphasis has been on MSc studies but a few scholarships for PhD studies have also been awarded. In late 2015, 45 former UNU Fellows had completed MSc studies at the UI under this programme, with 12 additional ones being currently enrolled in UI and RU. The first UNU Fellow completed her PhD degree in 2013, with three more pursuing their PhD studies at UI at present.
- c) The annual “UN Millennium Development Goals Short Courses” given in key geothermal regions<sup>4</sup>. Here the emphasis has been on East Africa with annual Short Course series given since 2005 in Kenya, and Latin America and the Caribbean with another annual series given since 2006

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<sup>4</sup> Georgsson et al., 2015: *The UNU Geothermal Training Programme: Training Activities Offered On-Site in Developing Countries*. Web: <http://www.geothermal-energy.org/pdf/IGAstandard/WGC/2015/09014.pdf>

in El Salvador, adding a single workshop in China in 2008. A total of more than 1000 people have benefitted from these series since 2005.

- d) With the increased need for capacity building in geothermal development, the Millennium Short Course series became a motivator for UNU-GTP to offer services of customer-designed and sponsored courses/training in partner countries. Since 2010, this has become an increasing part of the operations of UNU-GTP, with 26 short courses, workshops and training activities given so far.
- e) Finally, UNU-GTP has supported former UNU Fellows to participate in international geothermal conferences, with emphasis on the quinquennial World Geothermal Congress. At the World Geothermal Congress in Melbourne in April 2015, 184 former UNU Fellows presented 262 papers on geothermal research and development, which represents about 20% of the total number of papers published in the congress proceedings.

### **3. GEOTHERMAL DEVELOPMENT AND ITS IMPACT**

#### **3.1 The geothermal chain**

Geothermal energy is a renewable and clean energy source that can often be economically attractive. It results from heat flow from the interior of the earth towards its surface, which is in essence unaffected by human utilization. Geothermal systems are found where this heat flow is concentrated due to favourable geological conditions in the crust of the earth. The heat is extracted by using water as a heat carrying medium, so either the system has to contain water that is naturally replenished or to have water introduced artificially.

Geothermal exploration, through disciplines of geoscience, has the aim of finding anomalies, where heat flow and hydrogeological conditions allow for sustainable and economic utilization. In order to be truly sustainable, the utilization of a system must be managed properly to avoid overexploitation. The technical solutions employed to transfer the energy from the reservoir to the consumer have to be affordable and ensure that the resource is not abused.

It is a fundamental human need in cold climate to have a warm shelter from the harsh environment. Heating buildings with geothermal energy is clean, and can contribute to reduced emissions of CO<sub>2</sub>, as heating of buildings with the help of fossil fuels is one of the largest sources of greenhouse gases.

Modern society relies on electricity, not only as a power source for industry, but also for domestic consumption and the information infrastructure. It is e.g. the modest dream of many families worldwide to receive electricity to supply power for a television and a satellite receiver, or just the mobile phone.

Geothermal utilization involves a chain from the reservoir to the consumer, and as with all chains, each link is important. All of these diverse links are addressed at UNU-GTP, through transferring existing knowledge to new countries and generations as well as through research that can lead to new applications in the developing countries and the global geothermal community.

#### **3.2 Geothermal resources, their utilization in developing countries and associated needs**

Geothermal resources of varying quality are found in many countries and have been developed to a varying extent for multiple purposes. Here, countries aligned along the *Pacific Rim of Fire* and the *Great East African Rift System* can be emphasized due to the potential of their geothermal resources, especially for electricity production. The importance of low-temperature resources associated with large sedimentary basins or extensive fracture zones like in China and North Africa should not be underestimated. Looking beyond the industrialized part of the world, countries like the Philippines, Indonesia, Mexico, Kenya, the countries along the Central American isthmus, and China have made important progress in developing their geothermal resources. Some of these are currently among the

main drivers of the rapidly increasing development of geothermal energy in the world. In other regions of the world, extensive potential geothermal resources are waiting to be developed, such as in the countries along the Andes mountain chain in South America, in Papua New Guinea, Ethiopia and Djibouti, naming just a few.

UNU-GTP is proud to have been a prime player in the capacity building effort making this development possible, and in fuelling the momentum that is currently being witnessed in geothermal development, especially in East Africa. The needs in geothermal capacity building for the developing countries are only foreseen to increase in the coming years. The efforts seen these days in Kenya and Indonesia are on a grand scale, exceeding most activities of a similar kind seen anywhere in the past, but other geothermal regions also need to be taken into consideration. UNU-GTP is expected to continue to be a key player in this development.

### **3.3 Environmental, social and economic impacts**

Geothermal energy is considered a low-carbon energy source and therefore directly enables greenhouse gas mitigation if used in place of more carbon intensive energy sources such as fossil fuels. It is also an effective resource to facilitate adaptation to climate impacts, as it can improve local economic development, in addition to the impacts of electrification<sup>5</sup>.

Social impacts vary substantially between countries, but implications for the Millennium Development Goals can be substantive. Countries like Iceland have witnessed substantial positive impact through a century of geothermal development. Space heating at low prices has brought comfort to families, swimming centres have become places of well-being and socialization, geothermally heated greenhouses have brought high quality vegetables to the market, snow-melting on pathways and roads has increased the safety of pedestrians and commuters, geothermal drying of various products has created jobs in remote areas, fairly priced geothermal electricity has lighted up the darkness, and towns have even been established due to the presence of geothermal resources that have been used for one or more of the aforementioned purposes. All of this has increased the quality of life for the general population and created numerous social benefits. The same is shown to be the case for countries around the world.

In many developing countries, utilization of geothermal energy can open up new areas through the construction of new roads. Communities around a new geothermal project can benefit from a better connection to the outside world, which can bring schooling for children and new economic opportunities, but detrimental effects can also materialize through disruption of traditions and an influx of people that compete for resources. Through effective management and consultation with communities inhabiting areas around a new geothermal power project, social benefits can be maximized, while disadvantages are minimized.

The price of electricity generated from geothermal resources varies depending on countries, the quality of the resource, the distance from existing power lines and roads, the experience of those involved, etc., but in most cases, the price is competitive with electricity generated from other sources, particularly from other renewables. Where the geothermal resource is of high quality, as for example in Olkaria in Kenya, the price can be lower than other options. Similarly, in many small island states with limited energy options, geothermal resources may provide the only indigenous economically viable generation resource. Finally, the case of Iceland highlights the enormous value of geothermal district heating to consumers, and savings of great amounts of foreign currency compared to heating by imported fossil fuels like oil.

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<sup>5</sup> Ogola, P.F.A., 2013: *The power to change: Creating lifeline and mitigation-adaptation opportunities through geothermal energy utilisation*. PhD dissertation, University of Iceland / UNU-GTP. Web: [http://skemman.is/en/stream/get/1946/14022/33585/5/Creating\\_lifeline\\_and\\_mitigation-adaptation\\_opportunities\\_through\\_geothermal\\_energy\\_utilisation-Ch.5.pdf](http://skemman.is/en/stream/get/1946/14022/33585/5/Creating_lifeline_and_mitigation-adaptation_opportunities_through_geothermal_energy_utilisation-Ch.5.pdf)

#### 4. THE MISSION OF UNU-GTP

*The mission of United Nations University Geothermal Training Programme is to facilitate access to, and promote utilization and sustainable management of, reliable, economically viable and environmentally sound geothermal energy resources for the improvement of human quality of life in developing countries, through training and research in different aspects of geothermal development and management covering the whole geothermal chain, as well as support in development of appropriate policies on the level of member states and the UN system.*

This aim corresponds closely with several UN initiatives including the UN Sustainable Development Goals (SDGs), the 2014-2024 Decade of Sustainable Energy for All (SE4A), and United Nations Framework Convention on Climate Change (UNFCCC).

UNU-GTP directly addresses the SDG goal 7, and also contributes to SDG goal 13, as already mentioned, as well as their more specific targets.

The SE4A initiative has three interlinked objectives, with UNU-GTP contributing directly to two<sup>6</sup>:

- a) Ensuring universal access to modern energy services, as access to geothermal energy can for example facilitate electrification in rural and underdeveloped areas; and
- b) Doubling the share of renewable energy in the global mix, as geothermal energy is considered renewable.

UNU-GTP contributes to the UNFCCC through its efforts to promote increased use of renewable energy sources and thus aiming at reducing output of greenhouse gases from burning fossil fuels.

The mission of UNU-GTP falls within the overall UNU mission, which is to...

*...contribute, through collaborative research and education, dissemination, and advisory services, to efforts to resolve the pressing global problems of human survival, development and welfare that are the concern of the United Nations, its Peoples and Member States.*

While the emphasis is placed on *education, research and dissemination of knowledge* on a particular subject of relevance that can contribute significantly to solve the problem of insufficient and inequitable access to energy among the Peoples of a particular subset of UN Member States, the UNU-GTP mission will also increasingly be realized through *advisory services* to aspiring geothermal education programmes in the cooperating countries.

Energy and gender issues are an important factor in Iceland's international development cooperation. The mission also supports the development aid goals of the Ministry for Foreign Affairs in Iceland, which places an emphasis on reducing poverty and promoting general welfare on the basis of *equality and sustainable development*. Through the realization of the mission, UNU-GTP promotes *sustainable* use of geothermal resources and thus contributes to more *equitable* access to energy in developing countries with geothermal potential, promotes *gender equality* and empowerment of women through higher education in the geothermal energy sector in those countries. The development of clean high-quality energy sources such as geothermal resources has multiple effects on all levels of society in developing countries. Among which, it replaces or reduces the use of biomass for cooking, thus improving the health of numerous women who tend to be more involved in food preparations at home. Furthermore, the collection of firewood is often in the hands of girls who otherwise might have more time and opportunities to attend school and therefore increase their possibilities for higher learning. Higher education opportunities for women in the energy sector also increase their prospects to

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<sup>6</sup> Sustainable Energy for All, Objectives: <http://www.se4all.org/our-vision/our-objectives/>

participate in energy related issues on all levels such as decision and policy making in environmental, resource and climate matters.

Due note will be given to countries of the East African Rift Valley, in line with MFAI's emphasis on geothermal development of those countries. Furthermore, through its programme and initiatives where cross-national knowledge on geothermal resources and use is brought together, UNU-GTP enhances international cooperation in the field of sustainable energy.

Section 5 details the vision and strategic plan for carrying out the mission of UNU-GTP over the period 2016-2019.

## 5. STRATEGIC PLAN

UNU-GTP realizes its mission through various educational programmes at different levels, as presented in Section 2, i.e. through:

- a) Short courses, workshops and training activities conducted on site in developing countries;
- b) The 6-month training in Iceland; and
- c) Support for studies at the university level leading to advanced degrees.

While dissemination of information to students is important at all levels, the weight of research increases from (a) to (c) and with the duration of a particular programme. In these programmes, research can be founded on two main methodologies of discovering new information or refining existing information to suit the needs of a geothermal project:

- a) Fundamental scientific research on any of the topics addressed by the geothermal chain, through independent observation and/or processing and interpretation of existing rough data;
- b) Synthesis of existing knowledge to develop an approach or solution that is suited for a particular application or problem, as realized through literature review and desktop studies.

Research is needed to obtain new knowledge, and transfer of knowledge from non-geothermal research may not always be an appropriate solution. Yet, utilization systems are based on engineering solutions, which can in many cases be taken from other industries. The approach there is often that of a synthesis, transferring knowledge from many non-geothermal areas and combining them into the required solutions as appropriate. Finally the results and experience of the research have to be shared with the global geothermal community and disseminated into the political and economic arena as appropriate, where it may enlighten and influence discussion on policy issues relevant to geothermal development.

In order to fulfil UNU-GTP's mission, the following strategic plan is put forward for 2016 - 2019:

### 5.1 6-month training programme

The 6-month training programme has been the core activity of UNU-GTP since it was founded in 1978. In 2014, UNU-GTP set into motion a revision of its activities. Four of the nine study lines on offer at that time were combined into two, and a new study line in *Project Management and Finances* was added, with the 6-month training thus reorganized into 8 different lines, run for the first time in the present format in 2015. Furthermore, a group-project assignment was added into the study schedule parallel with lectures, where the Fellows work together as a team with actual data from geothermal systems to train them in the various fields of geothermal science and engineering. What remains is to try to frame the research of the 6-month Fellows, as well as that of the academic postgraduate studies, as possible into defined key geothermal research projects or clusters.

The 6-month training programme will continue to play an important role at UNU-GTP. The UNU Fellows participate in lectures and excursions through the first half of the programme and work on

individual projects and research in their chosen field of expertise for the second half of the programme as shown in the following table:

	W E E K	Geothermal Geology	Geophysical Exploration	Reservoir Eng. & Borehole Geoph.	Chemistry of Thermal Fluids	Environmental Science	Geothermal Utilization	Drilling Technology	Project Managm. and Finances
Group Project Work	1	Introductory Lecture Course and Group Project Work							
	2								
	3								
	4								
	5								
	6								
	7	Specialized Training: Lectures, Practicals, Visits and Excursions							
	8								
	9								
	10	Main Excursion							
	11								
	12	Specialized Training cont.							
	13								
	14	Individual Project and Report Writing							
	15								
	16								
	17								
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28									

By offering the different study lines, UNU-GTP has been able to create a sound basis for geothermal capacity knowledge in its partner countries. The programme itself, as well as its close connection to research fields of geothermal energy, will continue to be an essential contribution to geothermal research worldwide.

### 5.2 Post-graduate studies at University of Iceland and Reykjavík University

UNU-GTP aims to continue its cooperation with the University of Iceland and Reykjavík University regarding post-graduate studies, as this has been successful during the last several years. The goal is to accept a minimum of five new MSc-students and one new PhD-student each year, with the candidates selected from the former UNU Fellows of the 6-month training. The application and selection process needs to be streamlined to ensure that the best former Fellows apply. Yet, the selection process must also take into account the distribution between countries and regions, distribution between subjects and gender equality. The process of allocating supervisors should also be improved to maintain the highest possible standard and an even work-load on the limited number of advisors available. The same applies to the selection of research subjects for the MSc- and PhD-students; these should be coordinated and approved by the Studies Board of UNU-GTP, and with regards to the PhD-students this needs to be a part of the selection procedure of the PhD-student. Cooperation with the two universities should be strengthened, with the aim to e.g. improve the diversity and quality of the courses. Cooperation with international universities, on both the educational or research aspects of the post-graduate studies, should also be considered, either through the connections of the two universities or directly through UNU-GTP.

### 5.3 Short courses and training activities abroad

Courses that have been financed by the core funding of UNU-GTP from the MFAI, in support of the UN Millennium Development Goals (MDGs) have been held annually in Kenya for the Africa region since 2005, and almost annually in El Salvador for the Latin America and Caribbean region since 2006. As the SDGs succeed the MDGs, the emphasis will be shifted more towards sustainability and the opportunity will be used to re-evaluate the structure of both course series in order to ascertain that they keep up with the times and answer the needs of the target regions in the best possible way, within budget constraints. UNU-GTP will also keep open the possibility of opening up a third short course series for Asia, provided that funding becomes available.

Since 2010, UNU-GTP has furthermore run 26 short courses and training programmes in five continents that are funded by outside entities, ranging from two-day workshops for decision makers, to in-depth six-month training for practising experts on site. This has proven a good opportunity for some countries/institutions in need of rapid capacity building, beyond what UNU-GTP can service under its conventional operations, and which have themselves the strength or the support of external sources (e.g. multilateral or bilateral aid agencies) to finance such events. The paying customer defines the outline of the short course or training activity, while UNU-GTP is responsible for the quality of the contents. UNU-

GTP will continue to offer such customer designed short courses in line with the needs in the partner countries. Currently, UNU-GTP has a capacity of running 5-10 such events per year.

#### **5.4 Selection of countries and Fellows**

When considering the eligibility of countries to participate in activities funded by UNU-GTP, the Human Development Index will be used as guide, but the status and importance of geothermal development for the country is also of relevance. The selection of a country starts with an assessment of the potential role that geothermal energy can play within its energy plans. If positive, this is followed up with a site visit, by a representative of UNU-GTP, where an evaluation is made of institutional capacities in geothermal research and development. The training needs are assessed and recipient institutions selected. Directors of selected institutions are invited to nominate candidates, which are interviewed during the site visit. The site visits aim to tailor the training and associated research to the needs of the country and relevant institutions. In recent years, the Millennium Short Course Series have also served as venues for selection of candidates for the more advanced programmes in Iceland. The courses enable the participants to prove their ability which consequently may lead to an opportunity to be interviewed, and selection for training in Iceland. In a few cases, computer telephone interviews may also be used.

The interviews have proven valuable for the quality of the candidates selected for training in Iceland. This is well demonstrated by the success rate of the 6-month programme. During the first 37 years of the 6-month programme in Iceland, only eight invited UNU Fellows have not been able to complete the 6-month training, and in majority of cases due to medical or family reasons. This can be compared to the 613 individuals who have completed successfully. The site visits have, without doubt, contributed very significantly to the successful sharing and transfer of specialized geothermal knowledge from Iceland to these countries.

Candidates for participation in the Short Courses and the 6-month programme in Iceland must generally have a university degree in science, engineering or other disciplines that provide a useful basis for the studies and associated research, and speak English well. Experience in geothermal is beneficial, and a permanent position dealing with energy research is required, preferably in geothermal. Selection based on these principles has been successful, and these principles will continue to be adhered to in future.

#### **5.5 Gender equality**

Energy related research and development is generally quite male dominated, not least in the developing part of the world. On the other hand, gender equality and gender issues are a key element in Icelandic foreign policy and also for UN, aiming at full gender equality. Through the 37 years of 6-month training at UNU-GTP in Iceland, only about 20% of the UNU Fellows have been women. With considerable emphasis on improving this balance, the ratio has now grown to 30-35% in recent annual groups of UNU Fellows.

To promote gender equality awareness, the UNU Fellows attend lectures on energy politics and gender equality given by UNU-GEST, covering the social and right-based approaches to gender equality and energy. The presentation also focusses on gendered impact of energy access and the political economy of energy sector dynamics. Furthermore, the Fellows attend a workshop on group dynamics where gender related issues and cultural differences are discussed and problem solving is approached with a neutral perspective, free from gender or cultural bias. This gives the Fellows a new perspective and enables them to tackle such issues with an open mind and respect for individual abilities, free from prejudice.

Having female experts as supervisors and teachers is for some of the Fellows a relatively new experience. Seeing women in positions of leadership and power can encourage them to both seek further opportunities for themselves and adopt and accept the idea of women being in leadership roles in their

home countries. Working and living in an environment, where gender equality is important, encourages the Fellows to incorporate gender mainstreaming into their own career environment in the future, which is especially important for Fellows who rise to managerial positions.

The UNU-GTP will continue to seek opportunities to reach full gender equality in its operations, both in terms of selection of Fellows, and in recruiting lecturers and supervisors. Selection of UNU Fellows and candidates for scholarships and activities funded from the UNU-GTP core budget, such as Fellowships for studies leading to advanced university degrees and participation in the annual short course series, will take note of this. In the case of customer-designed short courses and sponsored training UNU-GTP will promote female participation, but here the paying customer generally has a final say in selecting the participants.

### **5.6 Continued alumni support**

Many UNU Fellows come from countries with a weak institutional set-up and limited resources for continued professional development in geothermal. UNU-GTP has therefore always put emphasis on continued support to former UNU Fellows. UNU-GTP has thus strived to create a supporting and encouraging environment for former Fellows so they can feel that they belong to a larger community and may as a result be even more confident in their endeavours knowing that they have a strong hinterland in their geothermal family. Annual newsletters are now sent out at the end of the year to all former UNU Fellows with an active e-mail account, compiling all main activities of the year. This way they are able to keep up with the current activities and operations of UNU-GTP, as well as being aware of any changes that may occur, giving them a feeling of 'belonging to a group' and that they are still remembered.

Social media networks like Facebook are a useful tool in keeping in contact with the Fellows and perhaps more importantly enabling former Fellows to keep in touch with each other and establishing new relations within the international geothermal community. A closed Facebook group has been operated since 2011 by a former Fellow, which has now over 200 members, all of whom are former UNU Fellows, attendees of one of the two Millennium Short Course Series or UNU-GTP staff members and teachers. This group enables the Fellows to share ideas or any news about themselves or their interests. This way they can also find out about the UNU-GTP geothermal team and make their own connections. Further social media tools such as LinkedIn and a specific UNU-GTP Facebook page would enable further contact possibilities with and between the Fellows but the focus must be kept on the purpose and usefulness of the media so the contact points are not spread too widely.

In the past UNU-GTP has supported a large number of former Fellows to present their research through attending the World Geothermal Congress (WGC), held by the International Geothermal Association (IGA) every five years (see Section 2). The aim is to continue this on a comparable scale, and thus make the research conducted under UNU-GTP more visible, in accordance with the strategic goals of UNU. Expanding this to include other relevant conferences or workshops should be considered, especially for Fellows who have conducted some of the more outstanding research, such as MSc- and PhD-students.

### **5.7 Research**

High quality research has always been the focus of UNU-GTP, in agreement with the emphasis of the UNU Strategic Plan. The aim of UNU-GTP is to maintain this standard, but also to make all research linked with the programme, directly or indirectly, more visible. By making the associated research more visible, its impact can be increased. The research activities linked with UNU-GTP include:

- Fellow-projects completed during the 6-month training at UNU-GTP, MSc- and PhD-projects supported by UNU-GTP;
- Papers written by former UNU Fellows and presented at geothermal congresses under Fellowships from UNU-GTP;

- Research conducted by Studies Board members as well as by lecturers and supervisors with strong links to UNU-GTP;
- Papers based on lecture material presented at short courses organized by UNU-GTP, as well as those presented by Visiting Lecturers of UNU-GTP, also constitute important material, often research related.

The material referred to here will be made accessible through the web-page of UNU-GTP as well as searchable through a search-engine linked with the page. In addition, the key researchers affiliated with UNU-GTP could be introduced under the web-page. In order to make UNU-GTP related research more visible it is also envisaged that when former UNU Fellows present results of their research, either from the 6-month training or MSc- and PhD-projects, in journals or conference-proceedings, that they do so under a double affiliation where one of them is the address of UNU-GTP.

Annually, one guest lecturer with an international reputation has been invited to Iceland as the UNU Visiting Lecturer to give a series of lectures on their research and involvement in geothermal development, and to lead discussions with the UNU Fellows. The UNU Visiting Lecturers have usually stayed 1-2 weeks in Reykjavík, and their lectures have been published by UNU-GTP both in a printed format and open-file at the UNU-GTP website. This is foreseen to continue.

The aim of UNU-GTP is also to provide a yearly research grant for a renowned geothermal expert, linked with UNU-GTP, aimed at a research-topic of significance for developing countries with geothermal potential and the geothermal industry in general. The grant, which is new in the operations of UNU-GTP, would involve a 3 month “sabbatical” stay in Iceland, during the period of the six-month training, with interaction with UNU Fellows, MSc- and PhD-students and affiliated researchers. The awarding of the grant would be supervised by the Studies Board of UNU-GTP and would either be linked with specialists highly recommended by the Board or specific applications. The Studies Board needs to define a framework encompassing research subjects and geographical areas, by which applications will be assessed.

### **5.8 Policy support and cooperation with other UNU institutions and UN entities**

When appropriate, UNU-GTP will put emphasis on cooperation with other UNU and UN entities, through participation in projects, congresses and activities which have a common denominator and goals, fitting with the mission of UNU-GTP and the strategic goals of UNU. Here emphasis can be expected to be on research and policy-making in matters related to sustainable use of renewable energy sources, and actions aimed at combatting climate change and its impacts. Examples of UNU cooperation are seen in the PAUWES project implemented by UNU-EHS in Bonn in 2015, where lectures on geothermal energy are given by UNU-GTP, and collaboration with UNU-FLORES in Dresden on multi-media learning package on geothermal water resources.

### **5.9 UNU-GTP website**

The purpose of the UNU-GTP website (*www.unugtp.is*) is to introduce the operations and main activities of UNU-GTP. The user should be able to find there the most relevant up-to-date information about the programme clearly and quickly. UNU-GTP aims at improving its website, making it more interactive, i.e. more up-to-date on what is happening at UNU-GTP in general, but, as importantly, an improved searchable pathway to research carried out and papers written at UNU-GTP, by the UNU Fellows, staff, study board members and key lecturers and supervisors. This will include an effective search engine to make it as user friendly as possible.

### **5.10 Advisory services**

Among other important activities foreseen is the establishment of formal regional geothermal training centres, either under the umbrella of UNU-GTP or based on the advice of the programme. UNU-GTP is

already cooperating with the Inter-American Development Bank (IDB), the Nordic Development Fund (NDF) and the National Energy Council (CNE) of El Salvador in developing and monitoring a regional geothermal diploma course given annually at the University of El Salvador, San Salvador for students from Latin America.

A similar programme intended for East Africa is now also in the starting phase in Kenya with the establishment of Africa Geothermal Center of Excellence in Kenya, under the auspices of the Geothermal Development Company (GDC) of Kenya and with the support of the Government of Kenya and African Union, with ICEIDA and NDF among the driving forces. Here, UNU-GTP is expected to be represented on the organizing committee.

UNU-GTP will be open to further advisory services of this nature.

### 5.11 Funding growth

As described in Section 2, the primary source of funding for UNU-GTP has been from the budget of MFAI, classified as ODA. In recent years the need for additional training has created a market for sponsored training and short courses, which in 2015 amounts to more than 40% of the UNU-GTP budget. UNU is identified by the MFAI as a key implementing agency in its development cooperation agenda. With the Government of Iceland planning to increase its contribution to development aid from 0.21% in 2015 to 0.30% in 2019, the budget contribution to the UNU programmes in Iceland is expected to increase in the medium term. However, a similar trend is also foreseen in sponsored events and projects funded through other financing mechanisms. Therefore, UNU-GTP foresees that in the near future, about 50% of its funding may come from other sources.

## 6. FOCUSING ON RESULTS: PLANS, MONITORING AND EVALUATION

As stated in the latest *Cooperation agreement between UNU, MFAI and OS*, UNU-GTP is expected to adhere to a results-based management approach, in line with those of the UN system and the Government of Iceland. To facilitate UNU-GTP's focus on results, the operational activities described in Section 5, are here organized in accordance with a logical framework approach, with a flow from contributions to impact and outcomes to direct outputs and inputs which can be attributed to UNU-GTP. A simplified logical framework matrix is presented at the end of this section.

The *mission statement* of UNU-GTP provides the expected impact and outcomes of the programme's work. At **impact** level, UNU-GTP seeks to contribute to the UN Sustainable Development Goals, notably Goals 7 and 13. The hoped for impact is for poverty reduction through economic growth and reduction of harmful emissions through transition to cleaner energy sources in particular geothermal energy. UNU-GTP recognizes that at this level its contribution may be small, but still useful.

At the **outcome** level UNU-GTP will contribute, in selected countries, to increased electrical generation capacity from geothermal energy, to increased direct use of geothermal resources for heating and processing of commodities, to increased institutional capacity for policy making, project planning and implementation and operations of geothermal facilities and to increased theoretical and practical knowledge and understanding of geothermal resources. It should be noted, however, that geothermal development is a very time consuming and risk filled activity. A long time can, therefore, pass between the production of outputs and the achievement of outcomes. At times this can even stretch into decades.

The **outputs** by which UNU-GTP seeks to contribute toward outcomes, and which can be directly attributed to its work, are primarily fellows/graduates from 6-month training, MSc and PhD programmes and short courses given in developing countries. Academic papers published by staff and former UNU fellows, with support from UNU-GTP, and reports and other results from advisory assignments are also part of the outputs of UNU-GTP. The **inputs** needed to produce these outputs consist of funding from

the Government of Iceland (MFAI) and from sponsoring governments, organizations and companies, and other income which UNU-GTP may be able to access, translated mainly into staff time for the transfer of geothermal knowledge which is at the heart of UNU-GTP's work.

In addition to regular monitoring of progress on outputs and outcomes, provisions will be made for periodic external assessment of the programme's success. Iceland is a member of the Development Assistance Committee (DAC) of OECD countries, which is a forum to discuss issues surrounding aid, development and poverty reduction in developing countries. According to DAC guidelines, an evaluation is an assessment, as systematic and objective as possible, of an on-going or completed project, programme or policy, its design, implementation and results<sup>7</sup>. Such periodic evaluation will:

- Allow the incorporation of lessons-learned into the management decision making process;
- Establish a basis for re-alignment of the programme to strategic goals, should it veer off course;
- Provide a basis for accountability.

It is suggested that an evaluation be carried out every 5 years by 1-2 external professionals. The evaluation results will guide the board and the staff of UNU-GTP in further operations of the programme. Such evaluations will use the planned outcomes and outputs as a key indicator of intent to be assessed, leading to assessments of relevance, effectiveness, efficiency and sustainability. The evaluation will use a combination of quantitative and qualitative techniques.

As with all evaluations, the quality of the outcome will rely on the expertise of the evaluators, their proficiency in collecting information and their capacity for drawing sound conclusions from the information obtained. The matrix on next page summarizes the suggested approach:

In addition, the collection of the following qualitative information may also be important:

- Interviews;
- Questionnaires passed to:
  - Participants of training activities abroad;
  - Six-month Fellows;
  - MSc and PhD Fellows;
  - Former Fellows (e.g. asking for impact of the programme on their careers);
  - Lecturers and supervisors;
  - Cooperating entities through their directors.

## 7. FINAL REMARKS

With a possible upcoming reorganization of and stronger coordination between UNU-GTP with its Icelandic partner programmes: UNU-FTP, UNU-LRT and UNU-GEST, this Strategic Plan will be updated as appropriate.

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<sup>7</sup> OECD / DAC, 1991: Principles for Evaluation of Development Assistance. Web: <http://www.oecd.org/dac/evaluation/50584880.pdf>

Logical framework	Indicators	Verification
<p><b>1. Impact</b></p> <ul style="list-style-type: none"> <li>• Contribution to UN Sustainable Development Goals 7 and 13 of increased access to energy and less carbon emissions.</li> </ul>	<p>Increased geothermal energy access and use in selected countries by 2020 / 2025 (2015 baseline), incl. Kenya, Ethiopia, Tanzania, Djibouti, El Salvador, Nicaragua, China, Indonesia, Iran and a few others.</p> <p>Avoided CO<sub>2</sub> emissions.</p>	<p>Official statistics</p>
<p><b>2. Outcomes</b></p> <ul style="list-style-type: none"> <li>• Increased installed geothermal capacity in selected countries, with 2015 as a baseline.</li> <li>• Increased direct use of geothermal energy for heating or processing in low and middle income countries.</li> <li>• Increased institutional capacity for policy, projects and geothermal operations – with notable participation by UNU-GTP alumni.</li> <li>• Increased theoretical knowledge of geothermal resources – with important input from UNU-GTP alumni, staff and teachers.</li> </ul>	<p>Installed MW of geothermal electricity in each of Kenya, Ethiopia, Djibouti, Tanzania, El Salvador, Nicaragua and Indonesia – as selected representatives.</p> <p>Projects or operations in place in Kenya, Tunis, China, Mongolia, Rwanda, etc.</p> <p>Number of approved projects and concessions. Significant share of UNU alumni in leading sector positions</p> <p>Reports from surveys and explorations covering an increasing number of important fields. No. of surveys with UNU alumni and staff participation. Significant share of papers at WGC 2020 by former UNU fellows and staff</p>	<p>Official statistics Academic papers</p> <p>Official statistics Geothermal data Academic papers</p> <p>Official statistics Geoth. databases Surveys Academic papers</p> <p>Geoth. databases Survey reports Academic papers UNU-GTP surveys</p>
<p><b>3. Outputs</b></p> <ul style="list-style-type: none"> <li>• Trainees from 6-month programme</li> <li>• Graduates from MSc and PhD programmes</li> <li>• Participants in short courses, mainly in developing countries</li> <li>• Reports and results from advisory services</li> <li>• Academic papers published with UNU-GTP support</li> </ul>	<p>Number of former UNU Fellows Number of graduates</p> <p>Number of participants</p> <p>Reports</p> <p>Number and share of papers at key conferences</p>	<p>Information from UNU-GTP</p> <p>Do.</p> <p>Do.</p> <p>Do.</p>
<p><b>4. Inputs</b></p> <ul style="list-style-type: none"> <li>• Financial and manpower budget from <i>MFAI</i></li> <li>• Other financial and manpower</li> </ul>	<p>UNU-GTP budget</p> <p>Same</p>	

## CONTRIBUTORS

The UNU-GTP Strategic Plan 2016-2019 was composed by a committee formed specifically for the purpose. The committee members are (in alphabetical order):

- a) *Brynhildur Davídsdóttir*, PhD Ecological Economics, professor at University of Iceland, Director of graduate studies at the School of Engineering and Natural Sciences. Member of the UNU-GTP Studies Board since 2014.
- b) *Gudni Axelsson*, PhD Geophysics, Director of geothermal training at ÍSOR – Iceland GeoSurvey and adjunct professor in the School of Engineering and Natural Sciences at the University of Iceland. Gudni served as member of the UNU-GTP Studies Board from 1999 to 2013.
- c) *Ingimar G. Haraldsson*, MSc Civil / Environmental Engineering, Dep. Director of UNU-GTP.
- d) *Lúdvík S. Georgsson*, MSc Physical Engineering, Director of UNU-GTP.
- e) *María S. Gudjónsdóttir*, PhD Mechanical Engineering, assistant professor at Reykjavík University. Former UNU-GTP staff member.
- f) *Páll Valdimarsson*, PhD Mechanical Engineering, former Professor at University of Iceland, Adjunct Professor at Reykjavík University, expert at PVald ehf. Member of the UNU-GTP Studies Board since 2001.

Material was also contributed by *Málfríður Ómarsdóttir*, MSc Environmental Scientist, and *Thórhildur Ísberg*, M.Soc.Sci, School Manager, who both are UNU-GTP staff members, and finally *Engilbert Gudmundsson*, MSE, former director of ICEIDA.