40th Anniversary

Forty Years of Geothermal Training in Iceland – History, Status and Future Direction –

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Director
UNU-GTP

UNITED NATIONS UNIVERSITY
UNU-GTP
Geothermal Training Programme

UNU-GTP

Our Purpose Is …

… to assist developing nations with significant geothermal potential to build up geothermal expertise to be able to develop these important renewable energy resources for the benefit of its people

… to provide university graduates engaged in geothermal work with intensive on-the-job training in their chosen field of specialization

… to enhance the skills of UNU Fellows by working side by side with geothermal professionals in Iceland

… to tailor-make the training for the individual and the needs of his institution and country

The First Steps

- UNU established in Tokyo 1975
- A platform where Iceland wants to make an impact – either in geothermal or fisheries
- Geothermal chosen and Governmental support confirmed in April 1978
- Organization discussed and decided at the Laugarvatn Workshop in July 1978 – with 8 different lines of study
- December 27, 1978, UNU signs a cooperation contract with Orkustofnun on establishment of UNU Geothermal Training Programme
- **Dr. Ingvar Birgir Fridleifsson** hired as Director
- First two UNU Fellows arrive in spring of 1979


UNU Headquarters in Tokyo


Laugarvatn Workshop 1978

Basic Setup at the Start


First UNU Fellows, staff and visitors

Six-month training of professionals offered in eight different lines of study – the ninth line added in 1997

Geological Exploration
Borehole Geology
Geophysical Exploration
Borehole Geophysics
Reservoir Engineering
Chemistry of Thermal Fluids
Environmental Science ('97)
Geothermal Utilization
Drilling Technology

Gradual growth of the programme during the first 20 years:

2 UNU Fellows in 1979 ***11 UNU Fellows in 1985*** ***18 UNU Fellows in 1996***

Some Milestones in the 2000s

2000: Agreement signed with University of Iceland on cooperation in MSc studies.
6-month training valid as 30 ECTs units - first UNU-GTP MSc Fellowships awarded

2005-6: The first *UN Millennium Series* events, in Kenya 2005 – *Workshop for Decision Makers on Geothermal Projects and their Management,* and El Salvador in 2006 with *Workshop for Decision Makers on Geothermal Projects*

2008: First UNU-GTP PhD Fellowships awarded

2010: First Customer Designed Short Courses held in Indonesia

2013: First UNU Fellow and African to defend her PhD thesis at UI
Cooperation Agreement signed with Reykjavik University
Biggest group of 6-month fellows 34 in Iceland plus the 5 trained in Kenya

2015: The 6-month training reorganized and a new line added in *Project Management*

2016: Cooperation with LaGeo & UES on Diploma Course in Spanish for Latin America:

2018: 40 years anniversary of UNU-GTP

Our Organization Today

- Operated at **Orkustofnun** – the National Energy Authority of Iceland (OS) on a special contract between United Nations University (UNU), Government of Iceland (GoI) and Orkustofnun (OS)
- Five full time staff members
- General activities governed by a Board – meets about 2 times/year
- Academic activities governed by a Studies Board – meets 3-4 times/year
- Annually, 80-120 lecturers and support staff are hired from Iceland‘s leading geothermal institutes, universities, engineering companies or energy companies in line with the needs of the programme and its trainees at each given time

Board and Studies Board

Board of UNU-GTP 2018

Dr. Gudni Jóhannesson, Dir. Gen. OS
Chairman

Dr. Jakob Rhyner, Vice Rector UNU

Amb. María Erla Marelsdóttir, MFA

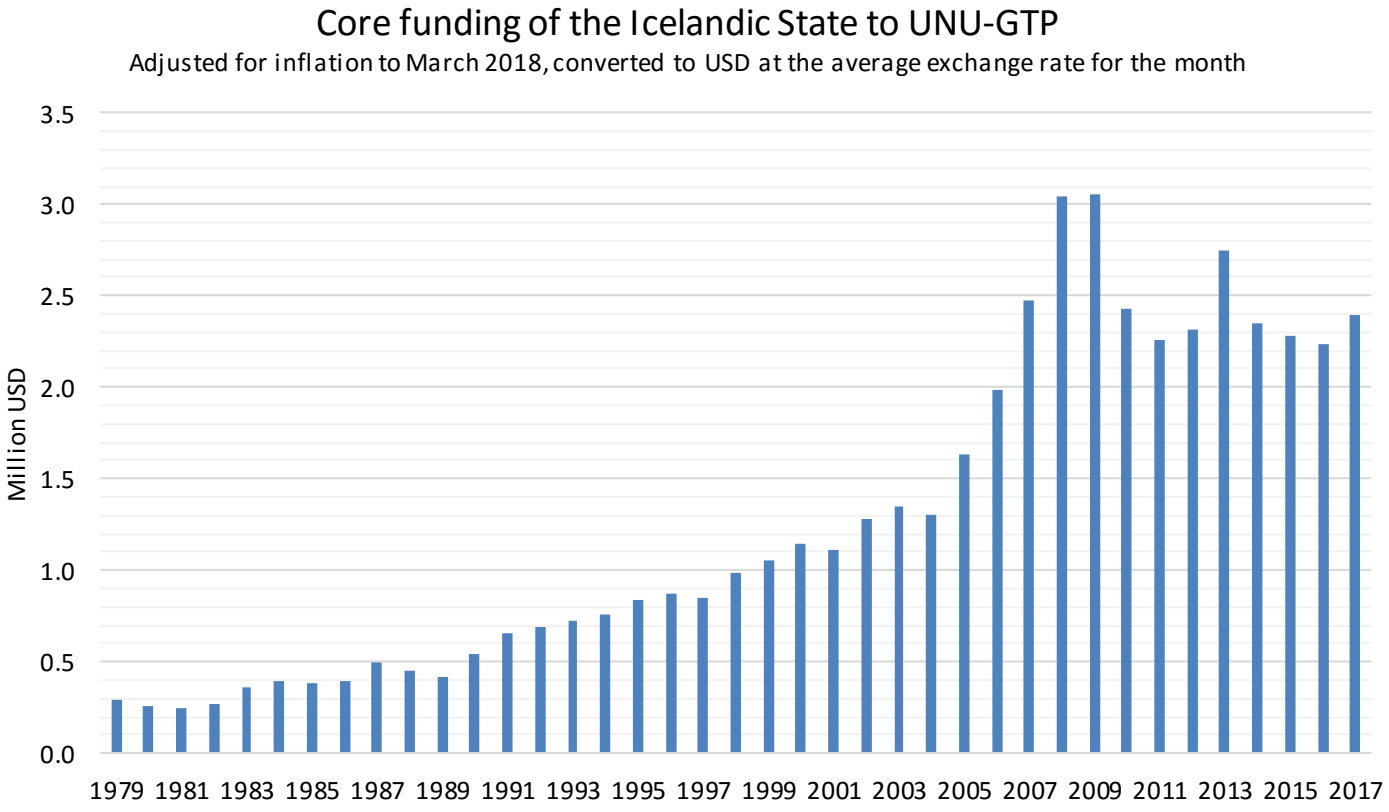
Eng. Lúdvík S. Georgsson, Director

Studies Board in 2018

Chairman	*Lúdvík S. Georgsson, Dir.*
Geothermal Geology	*Anette K. Mortensen LV*
Borehole Geology	*Dr. Hjalti Franzson ÍSOR*
Geophysical Exploration	*Gylfi Páll Hersir ÍSOR*
Borehole Geophysics	*Benedikt Steingríms. ÍSOR*
Reservoir Engineering	*Saeunn Halldórsd. ÍSOR*
Chemistry Thermal Fluids	*Finnbogi Óskarsson ÍSOR*
Environmental Sciences	*Dr. Brynhildur Davídsd. UI*
Geothermal Utilization	*Dr. Páll Valdimarsson pvald*
Drilling Technology	*Kristinn Ingason Mannvit*
Project Managem. & Financ.	*Dr. Helgi Thór Ingason RU*

Financial Support from the Government

- Base operations financed by Government of Iceland
  - In recent years amounted to **215-220 M ISK**
  - An increase in 2018 to **249 M ISK**
- Sponsored activities created **35-40%** extra income in 2012-2016 and more importantly extra job opportunities for Icelandic geothermal industry
- Current strong ISK is **difficult**



Selection

Candidates for 6-month training are selected **by personal interviews** usually during site visits to the respective country or at short courses

Candidates

.. must have **a permanent position** at a governmental energy company, research institution or university, and be nominated for this training by their institution

.. should have at least **one year's practical experience** in geothermal work

.. need to be fluent in **English**

.. must have **a university degree in science, engineering** (or economics)

.. should normally be **under 40 years** of age

All candidates adhere to these criteria including those privately sponsored

6-Month Training
Reviewed Time Schedule from 2015

- Some reorganization of study lines and a new line introduced: **Project Management and Finances**
- **Group work introduced** into the introductory lecture course

WEEK	Geothermal Geology	Geophysical Exploration	Reservoir Eng. & Borehole Geoph.	Chemistry of Thermal Fluids	Environmental Science	Geothermal Utilization	Drilling Technology	Project Managm. and Finances
1								
2								
3	Introductory Lecture Course and Group Project Work							
4								
5								
6								
7	Specialized Training: Lectures, Visits and Excursions							
8								
9								
10								
11	Main Excursion							
12								
13	Specialized Training cont.							
14								
15	Individual Project and Report Writing							
...								
26								

Group Project Work

Yearbook

Research projects of 6-month UNU fellows are published in the yearbook:

Geothermal Training in Iceland

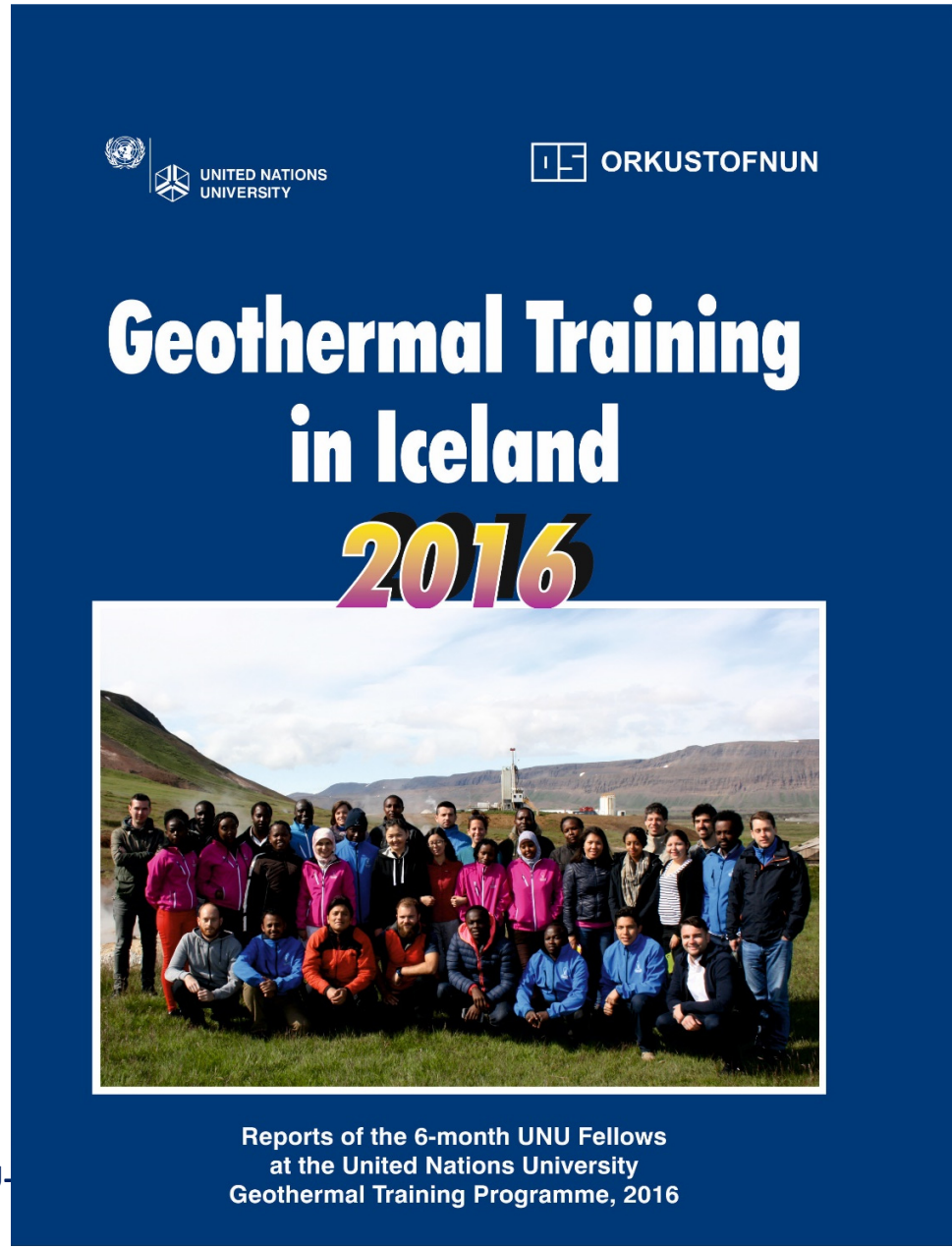
with the publication code:

ISBN 978-9979-68

Is sent to libraries of most active geothermal institutions in world

All reports are also available on our website and the UNU online library in an open distribution:

www.unugtp.is



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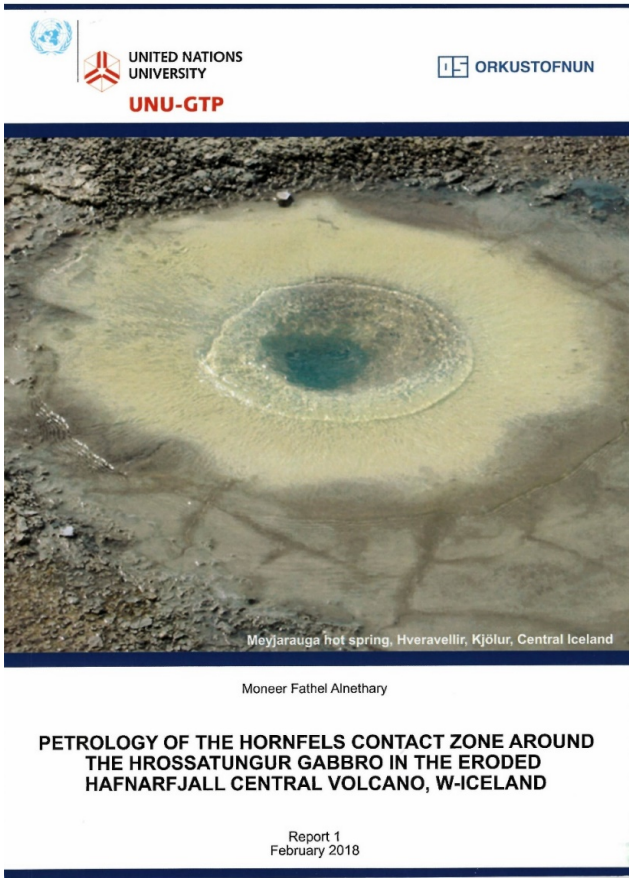
40th Anniversary of UNU-

MSc and PhD studies

- Carried out at the University of Iceland (UI) or Reykjavik University (RU)
- The 6-month training can fulfil 25% of the requirements (30 out of 120 ECTS units) for an MSc degree
- UNU-GTP Fellowships cover costs associated with living and studying in Iceland – 5 fellowships awarded per year
- Research projects are published by UNU-GTP
- PhD studies at the University of Iceland (to date)
- Dr Pacifica Ogola from Kenya was the first UNU Fellow to defend a PhD thesis in Iceland in 2013 – Dr Thecla Mutia from Kenya joined her in 2016 – one new PhD fellowship awarded per year

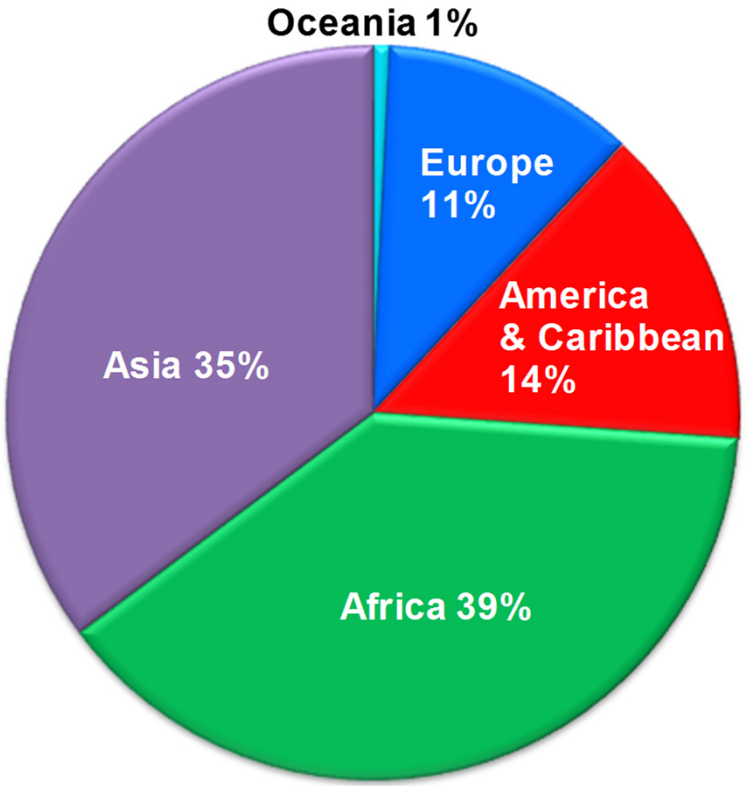


UNU Visiting Lecturers

- Annually a distinguished foreign geothermal expert is invited give lectures on their speciality for the UNU Fellows and discuss and interact with them
- The lectures are also open for the Icelandic geothermal community.
- UNU Visiting Lecturers in the 2000s are:

2000	**Trevor Hunt** (New Zealand)	2010	**Roland N. Horne** (USA)
2001	**Hilel Legman** (Israel)	2011	**Ernst Huenges** (Germany)
2002	**Karsten Pruess** (USA)	2012	**Cornel Ofwona** (Kenya)*
2003	**Beata Kepinska** (Poland)*	2013	**Kevin Brown** (New Zealand)
2004	**Peter Seibt** (Germany)	2014	**Malcolm Grant** (New Zealand)
2005	**Martin Mwangi** (Kenya)*	2015	**Meseret Teklemariam** (Ethiopia)*
2006	**Hagen Hole** (New Zealand)	2016	**James Koenig** (USA)
2007	**José Antionio Rodriguez** (El Salvad.)	2017	**Juliet Newson** (New Zealand)
2008	**Wang Kun** (China)*		
2009	**Wilfred Elders** (USA)		* former UNU Fellow

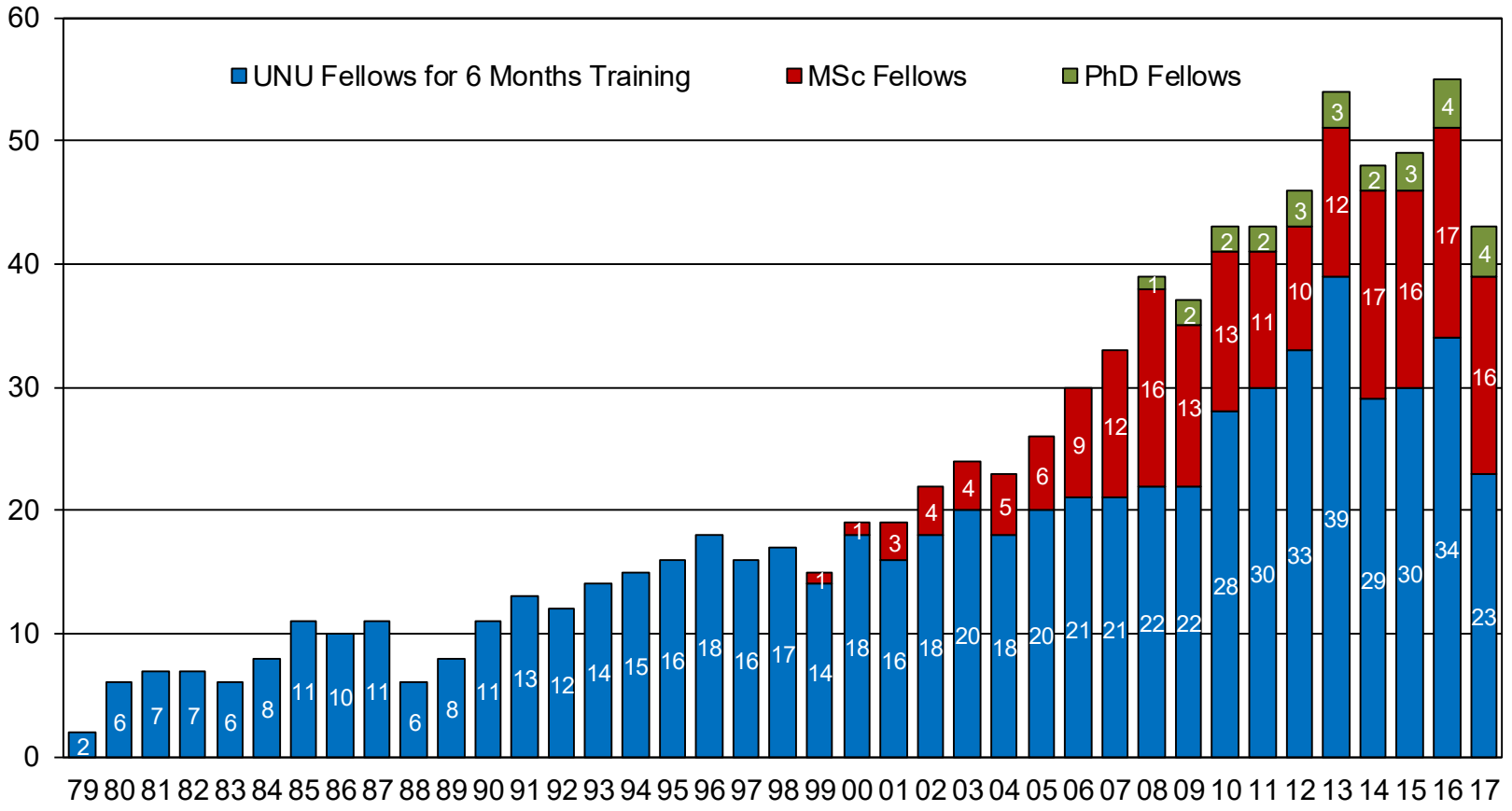
Participation in UNU-GTP in Iceland



1979 – 2017

- 670 scientists and engineers from 60 countries have completed the 6-month specialized course – now given in 8 different lines of study – 24 enrolled in 2018
- Thereof 149 are women (22%) – in 2010s female participation has been 31%
- MSc programme with University of Iceland since 2000, and Reykjavik University since 2013: 57 graduates – 10 presently enrolled
- PhD programme with UI from 2008 – first two defended PhD thesis in 2013 and 2016 – currently four are pursuing their studies
- Support to former UNU Fellows to attend WGC and UNU anniversaries, and other conferences

Number of UNU Fellows in Iceland 1979-2017



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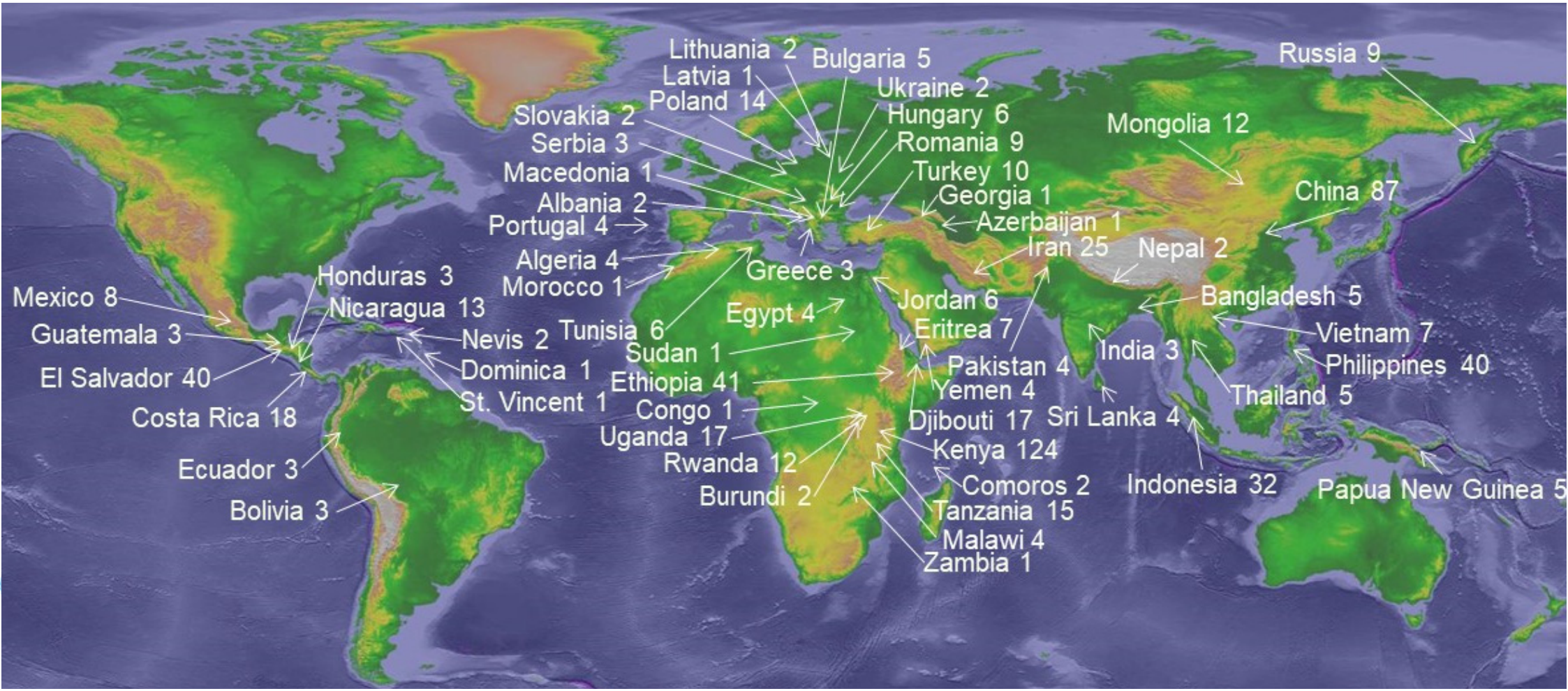
Home Countries of UNU Fellows 1979-2017



UNU Fellows in Iceland 2016

One of two biggest group in Iceland to date – 34 UNU Fellows (as in 2013) at Theistareykir

Short Courses in Support of the UN Development Goals

- A special contribution of the Government of Iceland
- Series of Annual Short Courses on Geothermal Exploration and Development given in two continents, Africa, and Latin America and the Caribbean (LAC)
- UN Millennium Short Course series given during 2005-2015 – in Africa a total of 12 events with about 550 participants from 22 countries, and 8 events in LAC with 410 participants from 15 countries, adding 1 event in China with 120 participants
- Close cooperation partners in the African series have been the Kenyan geothermal companies **KenGen** (from the start) and **GDC** (from its establishment in 2009), and in the LAC series, the Salvadorian energy company **LaGeo**
- Series relaunched in 2016 in line with the recently agreed upon UN Sustainable Development Goals - SDGs with the same main partners
- To be discussed in detail in the next presentation

Customer Designed Training Activities

- Triggered by the urgent need for training in countries planning fast tracking of geothermal development – with the **first events in 2010**
- Have proven **a good opportunity for some countries / institutions in need of a rapid capacity building process**, beyond what the UNU-GTP can offer under its conventional operations and finances
- Financed by the beneficiary company/institution or by the support of external sources such as bilateral or multilateral aid agencies
- **In 2010-2017, 41 events, short courses or advanced training, have been run on 4 continents – 22 of these in Africa** – extending from 2 days to 6 months

World Geothermal Congress - WGC2015
96 UNU Fellows Attended the Melbourne Congress

More than 260 papers published from about 180 UNU Fellows
WGC2020 in Iceland will hopefully be a great success

The Postgraduate Diploma Course in El Salvador

- In 2010-2015, a postgraduate Diploma Course for **Spanish speaking** geothermal students in the LAC region was given five times at University of El Salvador, supported financially by different partners and with most of teachers coming from LaGeo
- In April 2016, UNU-GTP signed a cooperation agreement with LaGeo in becoming an **active partner in this 5-month Diploma Course**, together with LaGeo (and UES)
- Agreement was also reached with the **Nordic Development Fund (NDF),** with **MFA/ICEIDA** as an intermediary partner, to finance this in 2016 and 2017
- The new **SDG Short Course Series in El Salvador is now an integral part of the Diploma Course,** and a few experts from Iceland come in as guest lecturers
- In 2016 and 2017, **30 Spanish speaking geothermal students attended** the course
- **20 full Fellowships awarded** each year - 10 for participants outside El Salvador
- Agreement prolonged for 2018 – **5 year additional agreement in the pipelines**

The website *www.unugtp.is*

Publishing reports and course material open-file on the web, has made the UNU-GTP website (www.unuugtp.is) one of the largest open databases for geothermal information - record views in 2016 include:

No.	No. views	Title and author	Publ. Year & type / event
1	427,176	Piping design: fundamentals by J.L. Henriquez and L. Aguirre	2011 – ES SCIII
2	275,680	Directional well design … by Farah Omar Farah	2013 – Report 27
3	168,247	Intro. to types and classification of rocks by Geoffrey Mibei	2014 – K SCIX
4	127,189	Environmental impact assessment ... by Dr. Pacifica Ogola	2007 – K SCII
5	139,293	Biodiversity conservation by Dr. Thecla M. Mutia	2009 – K SCIV
6	117,159	Gravity and magnetic methods by José Rivas	2009 – ES SCII

Gender Equality

- **Gender equality and gender issues are a key element in Icelandic foreign policy** and also for UN
- Energy related research and development is **still quite male dominated**, not least in the developing part of the world
- Through the 40 years of 6-month training at UNU-GTP in Iceland, only 22% of the UNU Fellows have been women – the **ratio is improving and has grown to 31% for the 2010s and 37% in the last 3 years**
- In line with its *Strategic Plan for 2016-2019*, **UNU-GTP actively promotes Gender Equality** - by a gender balanced candidate selection, cooperating with UNU-GEST on special gender and energy lectures, as well as increasing the share of women lecturers in its programmes
- UNU-GTP will continue to increase the share of women selected for training and studies, with the ultimate goal **to reach full gender equality in our activities as soon as possible**

Important Cooperation Countries

In recent years our focus has been on **Africa - the continent which needs more energy**:

- Here **Kenya** leads with 690 MWe on-line and **124 UNU Fellows** thereof **79 since 2010** most of whom were sponsored by Kenya, adding also many customer designed events
- **Ethiopia (40), Tanzania (15)** and **Djibouti (17)** should be mentioned

Strong emphasis has also been on **Asia**:

- Here **China (87)** with its commitment to LT geothermal development remains a very important partner – where UNU Fellows have been leading the way
- But also **Philippines (40)** and **Indonesia (32)** and even **Iran (25)** must also be mentioned – here the focus is on HT geothermal development for electrical production

Last but not least **Central America and the Caribbean:**

- Here, **El Salvador (40)** has become a key partner in recent years through many activities
- While **Costa Rica (18)** and **Nicaragua (13)** should also be named

Creating Opportunities

The Icelandic geothermal industry has certainly benefitted from UNU-GTP:

- Jobs created through the teaching and supervision of UNU Fellows
  – this was especially important in aftermath of 2008 – keeping many jobs
- This has also created connections around the world
- Through cooperation projects in many developing countries where former UNU Fellows have been instrumental in wanting continued connection and association with Iceland

Possible Changes on the Horizon

Through its 40 years, the operations of UNU-GTP have developed and matured through our good cooperation with our partners around the world and their needs

In recent years four Icelandic programmes have operated within the UNU system, besides UNU-GTP, the Fisheries Training Progr. (UNU-FTP), the Land Restoration Training Progr. (UNU-LRT), and the Gender and Equality Studies and Training Progr. (UNU-GEST)

Currently, discussions are ongoing regarding the future administrational structure of the programmes

But we hope and expect that the programmes will be able to continue their activities in a similar way in the near future

Impact of UNU-GTP

A key and final question is:

Has the UNU-GTP had a serious impact on geothermal development in the developing part of the world?

My short answer is:

YES

I hope the following presentations will convince all of you of the truth in this

Focussing on a Geothermal Future I

- ✓Our base programme is the 6-month training – 24 participants in 2018
- ✓Increased number of fellowships for MSc studies and PhD studies in Iceland
- ✓The annual Short Course Series in E-Africa and LAC area have been replaced with the SDG Short Course Series with a sharper focus on the new UN SDGs
- ✓The Customer-Designed Short Courses are a significant factor in our operations
- ✓Active participation in the running of the 5-month geothermal Diploma Course at UES has strengthened UNU-GTP's status in the Spanish speaking part of world – a possible future model for the African Geothermal Center of Excellence
- ✓Strengthen our general Policy-Making Role in geothermal, with emphasis on specific regions – calling also for a more research orientated framework

Focussing on a Geothermal Future II

- Utilization of indigenous renewable energy resources as a replacement for fossil fuels is a must in a world where ever increasing emission of greenhouse gasses associated with global warming is one of the greatest threats to mankind
- According to the UN Sustainable Development Goals, we must:
  "*Ensure access to affordable, reliable, sustainable and modern energy for all*"
- Capacity building, transfer of technology and increased emphasis on policy making are key issues in the sustainable development of geothermal resources
- The Geothermal Training Programme expects to continue to successfully support geothermal development in the world through its capacity building activities in the near future


Thanks for the Attention