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From Training to Impact: Beneath the Surface of the UNU/GRÓ Geothermal Training Programme

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ABSTRACT

The Geothermal Training Programme (GTP) in Iceland has over 45 years of experience in training people around the world, indicating that its training is both highly valued and in continuous demand. Its success and impact have been confirmed by several external evaluations and in some cases, life changing effects. The evaluations pointed out that continued support and adaptation to changing circumstances is crucial for maintaining and enhancing the impact. The Programme is funded through the official development cooperation of the Icelandic Government creating a multi-dimensional knowledge sharing venue, enabling fellows to not only learn from mentors, but vice versa, and from each other. Stepping out of the comfort zone and knowledge sharing often lead to innovation and solutions to longstanding problems. As a geothermal leader, Iceland provides a chance to experience firsthand what geothermal can do and how it matters. In times of conflict, it has rarely been more important to build bridges between countries and focus on cooperation in energy security as well as endorse tolerance. Examples show that the fellows expand their network, acquire leadership capabilities, and by sharing their time and space working towards a common goal, they generally create an understanding of each other across religion, culture, and race, leading to less prejudiced individuals and then advocate for more tolerance in their own country upon their return. This paper presents an opportunity to look beneath the surface of the training success and provide a valuable insight into what it takes to train experts in geothermal development.

1 INTRODUCTION

As the longest running geothermal training in the world, the Geothermal Training Programme (GTP) in Iceland has accumulated decades of experience in sharing the knowledge and expertise gained within the Icelandic geothermal sector. Established in 1978, and as of 2025, 839 geothermal experts from 68 countries have graduated from the Six-Month Training. The main goal of the Programme is to provide technical advancement in geothermal exploration and development through lectures, hands-on training, and research but experience has shown that the effects of participating in the training often reach far beyond only that. This paper aims to provide an exclusive behind-the-scenes insight into the Programme's success, which usually is only perceived by staff and other affiliates. The success is of course based on many factors, and it is often difficult to pinpoint exact reasons in terms of cause and effects, as humans are inherently complicated beings with a lot of influencing aspects occurring through time. However, with over 45 years of operation and almost a thousand graduates, the correlation between the training and the influence on the success of its graduates becomes increasingly more evident. Of course, the long running record in itself is a testimony to the training's successful impact, but standard evaluation methods are available to measure these. Several extensive evaluations have confirmed the Programme's successful impact, strong relevance and effectiveness, while also stressing that continued support and adaptation are essential to sustain these results (Ljungman et al., 2017; Gollifer et al., 2023; Webb et al., 2024).

1.1 Why Iceland?

One of the factors in the success of GTP is the location of its operation. The long experience and knowledge gained in Iceland from developing its geothermal resources makes it the ideal place to experience and witness firsthand the impact geothermal development can have on societies, culture, and standard of living. The history of Iceland as a remote island in the North Atlantic demonstrates well how much impact geothermal development has had on its country's development. Up until the 1970s, Iceland was a developing country. For centuries it was one of Europe's poorest countries, dependent on imported coal and fossil fuels for its energy and house heating needs. As a country close to the Arctic Circle, house heating was a major economical concern, as well as an important factor for the wellbeing of the people. As the name suggest, Iceland is a cold country, and the smog created through the burning of coals and oil to heat up the houses had detrimental effects

both in terms of CO2 emissions as well as on people's health. As the world's fossil fuel prices rose in the early 1970s, the Government of Iceland made the decision to switch from imported fossil fuels to geothermal resources to reduce heating and energy costs. This decision was a game changer in the economic and social development of the country and in catalyzing it into the modern nation it is today. It resulted in massive savings to the national economy and increased wellbeing of its citizens due to i.a., lower heating bills and cleaner air (Orkustofnun, 2006; Haraldsson et al., 2010; Ouko and Omarsdottir, 2015).

Presently, the country has one of the highest energy use per capita in the world and the proportion provided by renewable energy sources exceeds most other nations. In fact, hardly anywhere else does geothermal energy play a larger role in providing a nation's energy supply, with ~90% of domestic heating and ~30% of the electricity production (NEA and MIC, 2006; Orkustofnun, 2022). For Iceland, geothermal changed everything. From house heating, greenhouse horticulture, fish farming, and balneology to national football team success through year-round access to heated football fields, geothermal energy is more important for the energy economy of Iceland than anything else (Georgsson et al., 2021; Orkustofnun, 2025). Due to these significant transition efforts, a large group of geothermal experts exist in the country, with extensive hands-on experience of the challenges, failures, and breakthroughs of developing this often complex but valuable resource. And it is exactly because of this experience, that the United Nations University considered Iceland to be the ideal place to establish a geothermal training programme (Georgsson, 2018).

However, apart from the geothermal knowledge and the technological experience gained in the country, there are other, perhaps more culturally related social factors, that also influence the success of the training in Iceland. The standard evaluation methods mentioned above mainly measure professional advancement and boost to the geothermal development of the fellow's home countries, but it is not only possible, and no less valuable, to evaluate the effectiveness of the training by first-hand accounts from the trainees themselves. The most impressive and impactful accounts are perhaps not always obtained through formal interviews or questionnaires, but by open spur-of-the-moment conversations and casual friendly chitchats. Perhaps this is even the most meaningful assessment of the training, i.e. when trainees are off-guard and honestly sharing their experience, feelings, and emotions willingly and without compulsion, with people they know and trust, rather than to complete strangers hired to gain the information and not knowing how or with whom the results will be shared with. This is particularly true in cultures where the lower-ranking staff members are not free to speak their mind out of concerns that their personal opinions might adversely affect their career opportunities. However, experience has shown that in Iceland, when these employees have the chance to step out of their otherwise restrictive environments, they feel more free to express themselves with less fear of their outspokenness having consequences. This factor has been expressed by numerous fellows through the years from different backgrounds. Many say they're fascinated by Iceland's open, safe work culture, where employees at every level can share their opinions freely without concern. That is something that they would like to bring back to their companies, i.e. an open and trusting work culture. In some cases, this has been reported to have been successful to a certain extent, especially in workplaces where a significant share of the staff, and especially bosses, has attended the training in Iceland. The no-class system that exists in Iceland is something that fascinates many of the fellows that take part in the training. The fact that everyone is on a first name basis and don't use titles such as sir, ma'am, or even Dr. or Mr., and people are generally accessible and approachable independent of their status, is a new experience for many of them who are used to a more hierarchical system. Some have expressed that being a part of this culture gave them a stronger sense of self-worth and they adopted a new perspective on the unapproachable boss-type personality culture that they are used to back home.

Furthermore, Icelanders are essentially hardworking people in general, but with a relatively easy-going attitude towards work and life balance. In the last few years, there has been a lot of emphasis on work and life balance in Iceland, and for some of the fellows this has been a new revelation to realize that there is more to life than work. Over almost five decades of training experience at GTP a number of examples can be presented but few selected will be brought forth in this paper. More examples and insight can be found in a previous paper on a similar topic (Ómarsdóttir et al., 2023). One example of such accounts is from a fellow who came from a very restrictive work culture and expressed enthusiastically that after experiencing the work culture in Iceland, discovered that it is possible to have fun during work, and it is not necessary to be strict and serious all the time in order to be professional and good at what you do. They said: "I learned how to live in Iceland".

These kinds of feedback along with more examples presented in this paper demonstrate that it is an important aspect to bring to light that cultural context of a training location is not a 'side note' but it is one of the conditions that lets technical learning translate into confidence, leadership, and innovation. A low-hierarchy social environment encourages critical discussion and free exchange of ideas and that is an ideal setting to create leaders and 'agents of change' in development.

2 FROM TRAINING TO IMPACT

Generally, as people progress in their careers, they can usually identify some factors that influenced them most, both professionally and personally. Over the years, the graduated fellows have expressed gratitude to staff and supervisors, exclaiming how their training at GTP and the experience in Iceland influenced their careers and personal growth. The number of promotions and stories shared by fellows have been instrumental in the assurance that the Programme truly makes a difference, not only for the individuals who participate, but also for their home institutions. It is hard to overlook this impact, from almost five decades of experience.

Of course, it is recommended to regularly conduct external evaluations of educational training programs as they are very valuable and provide an important complement to the first-hand accounts of the trainees and staff. However, it is important to remember that even though the statistics look impressive, behind every number there is a person, with their own dreams and ambitions (Fig 1). In the case of GTP, the most direct and compelling evidence of the Programme's value comes from the fellows themselves. Therefore, this paper aims to give an insight beneath the surface and behind the numbers and MWs, offering a closer view of the journey from training to impact at GTP. The focus is on the trainees themselves and their own feedback from the training experience through the years, collected through firsthand accounts, personal experiences, and internal unofficial feedback surveys from the Programme's quality assurance system, as well as official results of the standard external evaluations by Nirás, University of Iceland, and GOPA (Ljungman et al., 2017; Gollifer et al., 2023; Webb et al., 2024).

Certainly, everyone can agree that education and increased knowledge is beneficial and promotes development of humanity on many levels. On an individual level, education promotes critical thinking, boosts creativity and innovation, and strengthens character, and self-confidence. On an institutional level, an educated and well-trained workforce is better equipped to deal with challenges efficiently, provide effective solutions and thereby enabling the institute/company to face less economic stress in times of adversity. On a national level, education can serve as a driving force behind a resilient and successful society (Groota and van den Brink, 2007; Kam and Palmer, 2008; Edelmann and Vaisey, 2023). Nelson Mandela even stated that "education is the most powerful weapon which you can use to change the world". There is no doubt that education and knowledge are powerful tools for advancing humanity and societies and they are key components in dealing with the global challenges the world is facing today. The Geothermal Training Programme (GTP) was established in Iceland in 1978 for that exact purpose i.e. to support the development of a renewable and sustainable energy source through education and training, while contributing to the societal development of its partner counties through development cooperation. Energy is the driving force of development, and it is an essential component in the UN Sustainable Development Goals (SDGs), with SDG 7 focusing on access to clean, affordable energy for all. Geothermal energy has been influential in many countries where its development has been successful (World Bank, 2022).



Figure 1. The fellows, and especially the women who come to the GTP training, often have dreams and ambitions that they feel can finally come true with the opportunity of gaining higher education and experience in Iceland.

2.1 The GTP Fellows

The first fellows attended the Geothermal Training Programme in 1979. They were only two and both came from the Philippines. Since then, 839 fellows from 68 countries have graduated from the Programme as of 2025. The Programme offers 8 lines of specializations, covering the full range of expertise needed for geothermal exploration and development (Richter et al., 2026).

But who are the people who travel to Iceland to take part in the Programme and become GTP fellows? What do they expect to gain from the training, and what expectations do they have of Iceland itself? How is their experience in reality? And more importantly what happens to these fellows who come to this cold island in the north for six months, after they return back home? How does the training affect their careers, their personal lives, and their wider outlook on life and the world? Does spending half a year with complete strangers from all around the world with different background, different religion, different ethnicity, different race, different culture, affect them in anyway? And if so, how? These are some of the questions addressed in this paper.

The main aim of the training is to equip fellows with the skills to develop geothermal resources for electricity generation and direct use, as well as the full range of cascading applications. Yet the experience often goes far beyond technical learning. The fellows spend half a year out of their home countries, leaving their families and friends behind, stepping out of their comfort zones, and notably many of whom are traveling internationally for the first time in their lives, some are even stepping into an airplane for the first time, so the mere travel to the training destination is an event in itself. Upon arrival, they don't only meet different people from all around the world whom they might never otherwise encounter, but they have to learn, work, and live alongside them for half a year. In this environment, strangers become colleagues, colleagues become flat mates, and during field trips, roommates. With time they become friends, and in many cases lifelong friends. In this sense, GTP is in itself a sort of an international melting pot where people have the opportunity to engage with one another both professionally and personally while sharing daily life. Spending six months in such close proximity, sharing office space, living space, kitchens, sad moments, happy moments, and everyday routines, creates an opportunity to really get to know someone as a person. Fellows gain insight into one another's lives, perspectives, and worldviews, along with tangible cultural exchanges such as food, traditions, clothing, and customs etc. Of course, all is dependent on people's personalities, as some are open and some reserved, but it is hard to spend six months together without forming deeper and faster connections than is typical among ordinary colleagues. A lot can happen in six months. During this time fellows have lost family members, become parents for the first, second, or third time etc., gotten divorced, lost custody battles, basically gone through all the things that can happen in life as of course life doesn't stop for training. During such times, it is important to have supportive people around, and away from family and friends, the fellows often take their place and either console or rejoice together depending on the occasion.

The fellows who complete the Six-Month Training can apply for a MSc and PhD scholarship through GTP to study at University of Iceland or Reykjavík University where it counts as 25% of a master's degree. In terms of impact, the experience for MSc and PhD fellows is similar to that of six-month trainees and if anything, often even more profound. Spending 2-3 years in a foreign country is undeniably a significant experience for anyone, and for GTP fellows coming from developing countries it can be especially meaningful, sometimes life changing. The opportunity to study abroad is in many cases relatively rare, and to have the chance to study in a developed country far away, is an experience that they value on many levels.

The benefits also reach well beyond the individual. Returning home with an MSc degree or a PhD in geothermal science can be a major asset for their career as well as for their institutions and the geothermal development of their countries. For example, a fellow who received a MSc fellowship at GTP, used the skills he gained in Iceland to reduce the time for procurement calls for his country's first geothermal power plant, significantly cutting both the timeline and costs. Previously, securing bids typically required around three procurement rounds, but with his newly acquired skills, they succeeded on the first call to the amazement of his colleagues and superiors. Subsequently, he spearheaded the first pilot power-plant project in the country. The plant is the highest altitude geothermal plant in the world at ~5,000 meters above sea level, and supplies electricity to small communities of about 2,500 indigenous people across the surrounding area. Previously, these communities only received about four hours of electricity per day from diesel generators (SACYR, 2022). This example clearly shows how the skills acquired in Iceland fast-forwarded the development of the plant. This is particularly important in this region as political changes can happen quickly, and energy policies can change without much warning.

Another MSc fellow returned back to his company, was put in charge of geothermal development of his company as Chief Technical Officer, one position below the CEO. With the experience, he then moved on to become an Energy Specialist and Consultant for the World Bank, utilizing the knowledge and experience gained in Iceland, in geothermal projects across Central America. In this role, he is contributing towards geothermal development in the whole region. This case shows that even training just one fellow, in the right position, can have an impact way beyond just the individual or their institute.

In some cases, one PhD recipient can make all the difference in the geothermal advancement of a country. For instance, in the case of the Democratic Republic of Congo, a university programme in Kinshasa offered a geothermal course but due to regulations in place only people with PhDs were allowed to manage the course. The only available geothermal expert in Congo was a GTP fellow who obtained a MSc scholarship but since he didn't have a PhD, he was not permitted to manage the course and therefore he had to inform a PhD staff member at the university how to manage the course. This fellow later obtained a PhD scholarship and with a PhD, that fellow is able to return to his country and contribute directly to the course as a qualified expert at the university and thus distribute the knowledge to a new generation of geothermal experts in his country.

Another example where a PhD scholarship has made a significant impact is in Kenya. A PhD fellow at one of Kenya's geothermal companies, did her PhD research on the mitigation and adaptation opportunities that exist through geothermal energy utilization. She argued that geothermal energy in Kenya should be treated not only as a climate-mitigation tool to replace fossil fuels but also as a climate-adaptation tool that directly helps vulnerable communities cope with drought and poverty. She used the Baringo lowlands as a case study, a region that is extremely poor, under-electrified, and prone to extensive droughts, yet located among vast geothermal resources. She demonstrated that reliable local geothermal power could transform household energy access, public services, and enterprise development which were the main bottlenecks for reaching the targets of the UN Millennium Development Goals. Her research also pointed out that low-temperature geothermal resources could support drought adaptation through food preservation before or during drought. Initiatives such as greenhouse agriculture, livestock and fisheries, small industries (aloe processing, honey/beeswax, dyeing, tourism services), could provide a lifeline to arid areas which generally are inhabited by vulnerable communities prone to extreme poverty. This gives hope to areas facing similar challenges in East Africa and beyond, to explore similar solutions. An interesting fact in her study was the unexpected infrastructural benefits that followed the development of the Olkaria fields. Prior to the geothermal development, Naivasha and the surrounding area was relatively underdeveloped. However, with the necessary construction of asphalted roads from the capital Nairobi to the geothermal fields, for transporting equipment and drill rigs, as well as increased access to the grid, several locals used the new amenities to build shops and services along the route, utilizing the now easy access on paved roads and increased human traffic and demand for service. This then led to further infrastructure development and as a result, the area snowballed into one of the most prosperous recreational facilities in the country with building of schools, and clinics in an area that was mainly rural farmlands before. Now 5-star hotels line up along the road leading up to the geothermal fields with a year-round influx of tourists. Even the geothermal company KenGen constructed a geothermal lagoon and spa facilities using bring from the power plants, which is immensely popular among visitors and locals alike (an idea from a fellow who based the idea off the Blue Lagoon in Iceland). On a personal note, she also claimed that after her time in Iceland, she gained more confidence to stand up for herself and keep striving onwards when facing adversity. Her study time was challenging on many levels but she claims she is stronger for it. Now she uses her strength to lead the climate negotiations on behalf Kenya at COP (Conference of the Parties) contributing significantly to her country's national communications and negotiations on emission inventories on the international venue. She said that if it was not for the support of GTP and experienced gained in Iceland this would not have been possible for her.

The examples here above clearly demonstrate the influence and importance even one MSc and PhD fellow can have. The importance of offering MSc and PhD scholarships at GTP is clear if we are to fast-track the advancement of geothermal development in the world. Likewise, if we are going to have any chance to reach the targets of the UN Sustainable Development Goals and combat climate change, then the need for action is now. The transition from fossil fuels to renewable energy is one of the most urgent challenges facing the world today.

A more humorous example of fellows' interaction and increased cultural understanding is from a couple of fellows who shared an apartment during the training. One of them was talking online to her family back home whose members had never travelled outside of their country and had relatively traditional cultural views and little experience of the outside world. She was telling them that her new roommate just arrived, her country's religion forbids consumption of pork products. The family members were anxious that this would create a risky environment and advised her to refrain from eating pork products herself in front of her roommate as this might

cause a great offence to the roommate and even put herself at risk. The fellow, having not travelled abroad herself, took the advice with a good conscience and vowed to herself never to buy or eat pork in the house to stay safe. As she hung up the online call, she went out of her room into the kitchen, where her roommate was enjoying a ham sandwich with a big smile on her face. The fellow asked surprisingly if eating pork is allowed in her religion after all. The roommate smiled and answered laughing: "Yes, it is forbidden but not everyone is religious, you know". They both laughed and shared ham sandwiches and stories into the evening which was start of a longstanding friendship across countries and cultures.

In times marked by conflict and growing anxiety about global instability, it has rarely been more important to build bridges between countries and continents and to focus on increased cooperation in energy security as well as endorse tolerance towards the fellow man. Examples from the training in Iceland have shown the fellows who share their time and space working towards a common goal generally create understanding of each other across religion, culture, and race leading to less prejudiced individuals who many then advocate for more tolerance in their own country upon their return.

The examples in this paper suggest that for the full effect and continuous success of the training experience which now comprises almost five decades of successful training, it is imperative that the training takes place in Iceland. This is also supported by the GOPA evaluation (Webb et al., 2024). The location in Iceland matters. It is a living laboratory of geothermal success and a neutral, multicultural setting where fellows step outside their normal professional and cultural context. This combination promotes both technical proficiency and the soft skill leadership, tolerance, and collaboration capacities required for real-world geothermal development. Additionally, the evaluation notes that Iceland has a strong international reputation for geothermal know-how, and that the Icelandic experts are teaching at GTP marks competence and credibility for partners. This reputational "country of origin" effect was described as stronger than branding through an international organization like UNESCO. Also, that the Six-Month Training in Iceland offers breadth of specialization that's hard to replicate elsewhere.

Delivering the training in fellows' home countries would diminish its impact, removing the international interaction and the pioneering experience of moving into a new environment and stepping outside one's comfort zone. Being away from home can also create a sense of freedom for some fellows, especially where cultural or political pressures are strong within their institutes. Studying abroad gives them space to grow, build confidence, and discover their own leadership potential. This is particularly significant for women in developing countries, who often face greater barriers to postgraduate study but with GTP's gender-balanced scholarship selection helps broaden their access to advance their knowledge.

There is no doubt that the GTP training provides the fellows with strong technical geothermal expertise and the main focus is on sharing the geothermal knowledge and skills that have been acquired in the country through the decades. But also, emphasis is put on strengthening their soft skills, i.e., such as communication, diplomacy, character development, tolerance, goal setting, motivation, and professional judgment. Many of these, they also reinforced alongside their stay as a result of living abroad and adapting to a different culture. Soft skills are often underestimated but they are equally as valuable as technical know-how in the professional and academic settings. According to Heckman and Kautz (2012), soft skills predict success in life, and causally produce it, and programs that enhance soft skills play an important role in an effective portfolio of public policies. For an effective and successful development programme, it is just as important to emphasize and focus on soft skills as it is to focus on technical and academic knowledge transfer. According to feedback from the fellows, the location of the training in Iceland is essential to this outcome. Especially with regards to opening their minds to new ways and increasing tolerance as examples in this paper demonstrate.

2.2 Beneath the Surface of GTP

The people who are invited to the training in Iceland must meet certain criteria and because GTP is funded through Iceland's Official Development Cooperation, the fellows are also required to return to their country to work on geothermal advancement for at least three years after completing the training in Iceland. But is it worth it? Spending six months to three years on a remote island far north with an unpredictable climate and strange landscape. Who are these people who become fellows? Who are the individuals behind the statistics?

Through almost five decades countless stories have taken place at GTP. Close to 1000 people have passed through the Programme but interestingly staff turnover has remained strikingly low. Since its establishment in 1978, only about 12 permanent staff members have worked at GTP for shorter or longer periods at a time. Two of them served over three decades, two for 15 years, and two for over a decade, making the average employment time about 13 years. This probably reflects well the uniqueness of the Programme. The success of the training

and the valuable input the Programme has on the fellows as well as the tangible impact in their home countries provides the staff with ongoing motivation and encouragement to continue the good work. The often strong connection of the fellows to Iceland and the GTP staff and supervisors has been evident from the beginning. The first director, Dr Ingvar Birgir Fridleifsson led the Programme from its establishment in 1978 until his retirement in 2013. The long serving deputy director, Lúdvík S. Georgsson started as a teacher in 1980 and as staff member in 1990, and as director from 2013 until his retirement in end of 2019. The following director, Dr Gudni Axelsson, has been a teacher, supervisor, since 1986 and study board member of GTP for many years and also lead the Programme until his retirement. The current director Bjarni Richter took over in mid-2024, having prior been a longtime specialist at GTP's host institute Iceland GeoSurvey.

There is a lot of value in long serving staff both in terms of experience and in terms of continuous connections to the ever-growing network of fellows around the world. Just as the fellows get to know each other over the time periods of six months to three years, they also get to know the GTP staff and vice versa. Long-lasting comradery has formed between the people involved in the Programme over the years, both staff members and externally hired teachers alike, and as one of the long-term teachers and supervisor said: "In my first visit to China with Ingvar, I saw the former fellows proudly showing him their children, I realized this Programme is something more than a training, It is something truly unique!". The other value of having the long serving staff is the ability to follow the Programme's impact over time. As mentioned earlier, it can be difficult to isolate cause and effect in education and training successes, but in the case of Programmes such as GTP, staff members gain a lot of information both by communicating with graduated fellows, their colleagues, and superiors by online means, sharing information at reunions, and the various geothermal conferences as well as witnessing the effects through time as people pass through the Programme. After graduating from the training many fellows receive promotions soon after returning to their home countries, and a significant share of geothermal leaders in partner countries are former GTP fellows (Georgsson, 2019; Fridleifsson, 2013; Barrios, 2003).

It is always very rewarding to witness when fellows arrive nervous and unsure of themselves and in the course of their training gradually gain the confidence to become leaders with a strong sense of self-worth. This applies especially to the women. In particular, those from countries with low gender-equality indicators and restrictive traditional expectations on their role in society. Numerous examples are when they arrive at the Programme, not speaking up for themselves or challenging ideas, remaining quiet during discussions, but by the time that they leave, they have renewed confidence in their ability to deal with adversity and challenges. A lot of it can be assigned to them having to live independently in a foreign country, relying on themselves for the first time in their lives. For many, that experience is as formative for their personal development as the academic training itself. They've often become more vocal and more assertive in their jobs when they go back and have a better understanding of their own value and worth.

The same applies for the men. Having to live alone for the first time, taking care of themselves, many having never cooked a meal or done laundry or cleaned before, has given some of them a new appreciation for the housework that, in their cultures, is often expected only of women. Some have proclaimed that after having to do the house chores in Iceland they are more willing to share them at home. Especially after seeing the Icelandic men lead by example, pushing prams, taking an active part in the children's upbringing, and doing household chores as a normal everyday task. A male fellow who was a boss in a big geothermal company in his country, explained to the staff upon his arrival in Iceland that he was not going to participate in household chores around the office, such as collecting cups and putting the dishwasher on, as women were made for this purpose. A female GTP staff member laughed and looked at her hands and said: "Ah that is why we were born with dishwashing brushes instead of fingers". This led to a friendly but to-the-point discussion on gender equality. Through his training time, he gradually developed a more relaxed attitude towards house chores being conventionally "women's responsibility" and he later admitted having started partaking in the housework at his home. This also translated to the workplace where he became known for advocating gender equality on occasion. Small steps can often lead to giant leaps.

Around 75% of the fellows trained in Iceland have been men. This largely reflects the fact that STEM fields have generally been male-dominated especially during the Programme's early decades (Newson and Greene, 2019; Ómarsdóttir et al., 2021). In recent years, however, the sector has changed a lot with more women entering the sector (Fig 1). Gender equality is one of the SDGs and GTP supports gender equality in all its activities. As of 2014, GTP adopted a gender-balanced selection and aims to adhere to gender balance in the teacher selection, where possible. In several partner countries, gender discrimination persists, and opportunities for female experts in the geothermal field are limited and challenging (Ómarsdóttir, et al., 2021). For many women, GTP offers a rare opportunity to progress in a field where training opportunities have traditionally gone to male colleagues. The women who attend the Programme Iceland, generally come from countries with a low gender-

equality index rating. The experience of living in a country where gender equality has had the highest gender equality index rating in the world 16 years in a row and is celebrated, can be deeply motivating, inspiring many to push for change in their own workplaces and communities when they return home.

One example of the effects of living in Iceland during the studies is from a fellow who learned about the women's shelters in Iceland. The shelters provide refuge for women escaping abuse or those with nowhere else to turn. In her own country, abuse and violence against women is common and she had never known such shelters existed. She used the chance during her geothermal studies to visit the shelters and interview the staff members in hopes of gaining information on how to establish such a shelter in her own region. Upon her return she contacted the ministry in the capital and advocated for a women's shelter to be established in her region where female abuse is prevalent. Largely due to her efforts to raise awareness of this issue, the first shelter in her region is planned to be built soon. The next goal is to establish a baby cradle where women can leave newborns anonymously instead of disposing them out in the cold, out of cultural shame. Personally, the experience also brought a powerful realization that domestic abuse is not the norm in other countries, and empowered by that insight, she found the courage to press charges herself for domestic violence, becoming the first woman to do so in her region. This pioneering act paved the way for other women to follow in her tracks.

Another aspect of living and working in Iceland is experiencing a society where LGBTQ rights are widely respected. For many of them this is a new experience and can sometimes be challenging as in some cases their cultural norms are very much against it and sometimes even illegal. Through discussions with the locals and witnessing and participating in the annual Gay Pride Parade some of them start to open their minds toward the acceptance of human diversity. Some have even commented that they advocate this fact to their friends and family back home, extending the impact beyond the fellows themselves. After experiencing the safe environment in Iceland toward LGBTQ rights, compared to their home countries, some said they felt confident and safe enough to say for the first time that they are gay. Even though they did not want to reveal it openly back home, they said it was a liberating experience which will last forever.

For many of the fellows the stay in Iceland was an unforgettable experience which influenced many aspects of their lives and the gratitude they show the people who enabled or joined this experience is often everlasting. For some of course, the stay was difficult and overbearing, making them more appreciative of their homes upon their return. But it is safe to say that for most it was unforgettable.

These are some of the feedback examples the GTP staff has received through the years. It is always very encouraging to hear that training and education has many other unforeseeable agreeable side-effects and as Helen Keller once said "The highest result of education is tolerance".

3 THE RESULTS

The value of GTP's capacity building is evident in the progress of individual fellows, as well as by advances in geothermal development in many supported countries. The performed external evaluations also confirm this (Ljungman et al., 2017; Gollifer et al., 2023; Webb et al., 2024). The overall impact on each fellow and their institutes is difficult to measure with scientific methods, but the long-lasting experience and firsthand account of staff and affiliates should be considered equally valuable when assessing development impact. In support of this claim, a PhD study by Wummel (2024) confirmed this. She conducted interviews, followed the fellows through the training and spent months with them after they returned home. She states that the GTP 'makes' experts, providing them with a more senior status that can even mitigate age and gender discrimination.

Of course, the extraordinary success of the training cannot be attributed solely GRÓ GTP's efforts. Several factors come into play. The enduring goodwill extended toward GTP and its fellows by the Icelandic geothermal institutes, and especially the numerous dedicated experts who support the Programme through lectures, field trip guidance, research supervision, is absolutely invaluable and is the foundation of the training. Equally important, but not often mentioned, is the network and opportunities that GTP creates for Iceland, further establishing geothermal cooperation across national and continental boundaries. In this respect, GTP has been fundamental on many levels in enabling a smooth and trusting cooperation between the home countries of the fellows and leading geothermal companies in Iceland such as Iceland GeoSurvey – ÍSOR, National Power Company – Landsvirkjun, National Energy Authority - Orkustofnun, engineering companies such as COWI, Verkís and Vatnaskil, and many more. The network of fellows together with their teachers and project supervisors in Iceland has proven to be especially valuable in terms of supporting advisory work of Icelandic companies involved in geothermal work abroad, which has of course in turn also supported worldwide development of geothermal. This ranges from small-scale advisory missions of individual Icelandic experts to large-scale geothermal projects involving consortia of Icelandic companies, funded through international financial

mechanisms as well as local sources. Examples of smaller missions include expert missions to several Central American countries, Eastern Europe, SE-Asia, among other. Larger projects include involvement in large-scale energy development projects such as district heating developments in China and electricity generation projects in Kenya. In some instances, this advisory work of Icelandic experts overseas has led to new institutes and even new countries, being invited to send fellows for the Six-Month Training, based on the need identified during the missions. The success of the Geothermal Training Programme was aimed to be, and should continue to be, a collective effort of the Icelandic geothermal sector for the prosperity of global geothermal cooperation.

One of the ways GTP monitors the results of the training is through the publication of the fellows. This gives an insight and overview of how actively fellows remain engaged in the geothermal sector and how they contribute to both academic and practical advances. For example, at several World Geothermal Congresses, fellows have authored around 25% of the conference papers, with about 30% of all GTP fellows contributing as authors. In science and engineering, presenting research at international conferences is essential. It creates and strengthens professional networking opportunities and enables participants to be up to date on the latest research and innovation within the sector. GTP encourages its fellows to publish their research in various journals around the world and aims to fund its alumni to attend and present their work where possible.

4 CONCLUSION

In terms of geothermal training, GTP has the most longstanding experience in the world. One of the keys to its sustained success is that the training takes place in Iceland, where the fellows can experience themselves how impactful geothermal has been in building up the modern and sustainable society it is today. Iceland's journey from the poorest country in Europe to one of the richest, serves as an inspiration for fellows coming from some the poorest countries in the world today. Seeing is believing and believing is the first step to change. The world needs to change. The dependence on fossil fuels needs to transit fast to meet the targets of the SDGs, and the working toward that transition, the faster it can be achieved. Cooperation is central to future energy solutions. International training programmes such as GTP are central to that kind of cooperation and solutions. Training away from your home countries creates an opportunity to expand one's mind beyond cultural and traditional pressures or restrictions, often leading to more open-minded thinking and new perspectives to both work and life. It also creates a powerful platform for international networking and comradery. This is particularly imperative as it has rarely been more important to build bridges between countries and continents and to focus on increased cooperation in energy security as well as indorse tolerance towards the fellow man. Examples from the Programme in Iceland show that the fellows who share their time and space working towards a common goal, often develop deeper understanding across religion, culture, and race, leading to less prejudiced individuals who many then advocate for more tolerance in their own country upon their return. All these are fundamental qualities in capable leaders.

As a UN affiliated graduate, fellows are expected to leave Iceland not only with technical expertise, but with an expanded professional network after having spent half a year making international, intercultural, and interracial friendship bonds. They are also expected to have acquired certain leadership capabilities such as good communication skills, diplomacy, respect for others, and as good leaders, have courage and confidence to speak up and make significant and long-lasting contribution to their home environment. Decades of experience suggest that this is exactly what happens. The clearest evidence is that many fellows have become capable leaders of geothermal development and the countries that have received the largest support have advanced substantially in their geothermal development. With ongoing support, GTP will continue turning training into long-term impact, one fellow, one institution, and one country at a time.

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