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THE UN SUSTAINABLE DEVELOPMENT GOALS SHORT COURSES FOR AFRICA, LATIN AMERICA AND THE CARIBBEAN

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ABSTRACT

The United Nations University Geothermal Training Programme (UNU-GTP) responded to the adoption of the United Nations Sustainable Development Goals (SDGs) by starting new series of Short Courses in El Salvador for Latin America and the Caribbean (LAC region) and in Kenya for African countries, referred to as SDG Short Courses. The new series rest on the solid foundations of the earlier MDG Short Courses, with a refined structure and approach to better meet the objectives of the SDGs, as well as the evolving needs of partner countries. The two series were started off in El Salvador in September 2016 and in Kenya in November the same year, with the second courses held in 2017. The SDG Short Courses are an important component of the multi-faceted operations of UNU-GTP.

1. THE UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS AND GEOTHERMAL TRAINING

The United Nations Sustainable Development Summit 2015 was held during 25-27 September 2015. On the opening day of the summit, the post-2015 Sustainable Development Goals (SDGs) were unanimously adopted as targets to be reached by 2030 (United Nations, 2015a; Figure 1).

In response, the pre-2016 Short Course series for Africa, and Latin America and the Caribbean (LAC region) (Georgsson et al., 2008; Georgsson, 2010a; Georgsson, 2010b; Georgsson, 2012; Georgsson, 2014; Georgsson et al., 2015; Georgsson and Haraldsson, 2016), which had been dedicated to the United Nations Millennium Development Goals, underwent a critical review by UNU-GTP and its cooperating partners in order to identify ways to adjust the training to the evolving needs of the partner countries and better support and meet the Goals and targets of the SDGs (Georgsson and Haraldsson, 2017a and 2017b, Haraldsson, 2018). In particular, the courses were to support Goal 7, which has the overall aim of ensuring access to affordable, reliable, sustainable and modern energy for all, with the following stated targets (United Nations, 2015b):

- By 2030, ensure universal access to affordable, reliable and modern energy services;
- By 2030, increase substantially the share of renewable energy in the global energy mix;
- By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy; and

FIGURE 1: Graphical representation of the UN Sustainable Development Goals (United Nations, 2015c)

- By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, Small Island Developing States (SIDS), and land-locked developing countries, in accordance with their respective programmes of support.

The annual Short Courses in Kenya and El Salvador are well suited to help fulfil the Goal as:

- Geothermal energy prices compare well with other environmentally benign energy sources;
- Medium- to high-enthalpy geothermal resources can be used to provide reliable base load power over long periods of time to large populations;
- While the sustainability of geothermal utilization can be drawn into question, partly on account of the transient nature of the resources themselves when looking at long time spans, the resources can be utilized for extended durations provided that development is approached cautiously and resources managed well;
- Geothermal resources can be utilized to provide heat and electricity in as modern a way as any other energy resources;
- The short courses come about through international cooperation that is meant to facilitate research and transfer knowledge between countries and generations;
- The short courses are directed at the developing countries and Small Island Developing States (e.g. Caribbean Islands and the Comoros).

In addition, special note is taken of Goals 5 and 13:

- *Goal 5: Achieve gender equality and empower all women and girls.*
  This is in line with UNU-GTP's strategic plan. The ratio of women to the overall number of participants in short courses, 6-month studies and advanced academic studies in Iceland has been improving with time and the goal is to improve further on this. However, it must be noted that the pool of candidates is often male dominated, so even if women are given preference over men in the selection process, it is still difficult to reach gender parity. This is counter-acted by informing cooperating entities of the emphasis placed on gender equality and the importance of nominating women.

- *Goal 13: Take urgent action to combat climate change and its impacts*.
  It is well recognized that greenhouse gas emissions from geothermal utilization projects are significantly lower than the emissions associated with projects that make use of fossil energy. The utilization of geothermal resources therefore contributes to the mitigation of climate change when used in place of fossil fuels. Geothermal energy may also be used to help with adaptation where climate change effects are inescapable and negative.

Furthermore, the Short Course series are expected to support other SDGs indirectly:

- *Goal 1: End poverty in all its forms everywhere*.
  It is expected that capacity building aimed at enhancing geothermal development will help to bring energy to more people, which in turn will increase their economic opportunities and reduce poverty. Such opportunities may arise from better and more reliable access to electricity, but also possibilities for direct utilization of geothermal resources in specific areas, such as for drying agricultural products, horticulture, aquaculture, bathing and tourism, and various industrial processes. The development of geothermal resources will lead to direct and derived employment, with positive local economic effects, and some businesses may be established in response to opportunities arising with availability of geothermal energy.

- *Goal 3: Ensure healthy lives and promote well-being for all at all ages*.
  It is expected that access to geothermal energy will increase opportunities for leading healthier lives. One example is the possibility of changing from biomass cook-stoves to electrical cook-stoves, with improved and more reliable access to electricity, which has the potential of improving indoor air quality.

- *Goal 8: Promote inclusive and sustainable economic growth, employment and decent work for all*.
  Economic growth is strongly linked to energy utilization: In order for an economy to grow, access to energy is of major importance. This in turn is linked to Goal 1. It is expected that capacity building aimed at enhancing geothermal development will help realize this goal.

- *Goal 9: Build resilient infrastructure, promote sustainable industrialization and foster innovation*.
  Geothermal development brings with it construction of energy utilization systems, such as power plants, and calls for a power grid to carry the electricity to consumers. The availability of energy also promotes industrialization, whether it be through utilization of electricity or heat. Geothermal power plants often bring with them new roads that are utilized by the wider population and sometimes open access to regions that were inaccessible before. There are also examples of locals benefitting from water supply systems that have been constructed for the primary purpose of supplying water for geothermal drilling and power plant operations.

- *Goal 15: Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss*.
  The utilization of geothermal energy can in some cases help reduce reliance on wood for cooking, which can decrease pressure on forests.

- *Goal 16: Revitalize the global partnership for sustainable development*.
  One of the aims of the short courses is to strengthen relationships between stakeholders in geothermal development within and between countries, for the benefit of geothermal development on national, regional and global scales. In particular, the short courses are a realization of the following target: Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including North-South, South-South and triangular cooperation.

2. SDG SHORT COURSES FOR LATIN AMERICA AND THE CARIBBEAN

The first short course associated with the SDGs was *SDG Short Course I on Sustainability and Environmental Management of Geothermal Resource Utilization, and the Role of Geothermal in Combatting Climate Change*, held in cooperation with LaGeo S.A. de C.V. in El Salvador during 4-10 September 2016 (Table 1; Figure 2). As the title implies, the emphasis was on sustainable management and utilization of geothermal resources, and the contribution that geothermal development can make towards climate change mitigation. The second course of the series was *SDG Short Course II on Feasibility Studies for Geothermal Projects* (Table 1; Figure 3). The launching of the Salvadoran SDG series coincided with the Short Course being incorporated as an internal component of the *Geothermal Diploma Course for Latin America* (Georgsson and Haraldsson, 2017a; Section 5).

TABLE 1: SDG Short Courses for Latin America and the Caribbean (LAC region)

Name	Dates	No. countries	No. participants
SDG Short Course I on Sustainability and Environmental Management of Geothermal Resource Utilization, and the Role of Geothermal in Combatting Climate Change	4-10 Sept, 2016	14[1]	68
SDG Short Course II on Feasibility Studies for Geothermal Projects	17-23 Sept, 2017	14[2]	66
	Total:	**16[3]**	**134**

1: As well as representatives from the World Bank; 2: As well as a representative from the Organization of Eastern Caribbean States; 3: Argentina, Bolivia, Chile, Colombia, Costa Rica, Dominica, Ecuador, El Salvador, Guatemala, Mexico, Montserrat, Nicaragua, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines.

FIGURE 2: SDG Short Course I in El Salvador. Clockwise from top left: Group photo, lecture, project work, field trip to Berlin geothermal power plant.

FIGURE 3: SDG Short Course II in El Salvador. Group photo (left) and group work (right).

3. SDG SHORT COURSES FOR AFRICA

The first Short Course dedicated to the SDGs in Africa was *SDG Short Course I on Exploration and Development of Geothermal Resources*, held in cooperation with KenGen and GDC at Lake Bogoria and Lake Naivasha in Kenya during 10-30 November 2016 (Table 2; Figures 4 and 5). The second course in the series was *SDG Short Course II on Exploration and Development of Geothermal Resources* (Table 2; Figure 6). As implied by the titles, the subject coverage is similar from year to year. The course structure, as run in 2016 and 2017 is shown in Table 3.

TABLE 2: SDG short courses for Africa

Name	Dates	No. countries	No. participants
SDG Short Course I on Exploration and Development of Geothermal Resources	10-30 Nov, 2016	16	61
SDG Short Course I on Exploration and Development of Geothermal Resources	9-29 Nov, 2017	17	63
	Total:	**19**[1]	**124**

1: Cameroon, Comoros, Djibouti, Democratic Republic of the Congo (DRC), Egypt, Eritrea, Ethiopia, Kenya, Madagascar, Malawi, Morocco, Mozambique, Nigeria, Rwanda, Sudan, Tanzania, Uganda, Yemen, and Zambia.

FIGURE 4: Group photo from SDG Short Course I in Kenya

FIGURE 5: SDG Short Course I in Kenya. Clockwise from top left: Field work by Lake Bogoria, lecture discussion, project work, instruction at the Oserian flower farm.

As in El Salvador, the African SDG Short Courses rest on the solid foundations of the earlier MDG Short Course series, although some changes in approach and content were introduced to better reflect the SDGs and the evolving needs of African countries. Some of these are as follows:

- Greater emphasis on the concept of sustainability and actions to combat climate change.
- While the emphasis on surface exploration is still strong in the SDG series as it was in the MDG series, the coverage of topics has been expanded to include most aspects of geothermal development.
- While the focus of the project work of the earlier series has first and foremost been on high-temperature geothermal resources, attention is also directed towards low- to medium-temperature resources in the SDG series. This is due to the growing realization over the years that the nature of geothermal resources in the Western Branch of the East African Rift System (EARS) is different from that of the Eastern Branch. This was crystallized in the *Technical Workshop on the Geologic Development and Geophysics of the Western Branch of the Greater East African Rift System*, held during 9-11 March 2016 in Rwanda under the auspices of the African Rift Geothermal Development Facility (ARGeo) of the United Nations Environment Programme (UNEP) (Omenda et al., 2016).

The courses are attended by participants from geothermal institutions and companies in African countries with possibilities for geothermal utilization (e.g. geological surveys, electricity generation companies, regulatory bodies and ministries).

FIGURE 6: SDG Short Course II in Kenya. Clockwise from top left: Lecture on the chemistry of geothermal fluids, lecture on geothermal utilization in Kenya, discussion on the geothermal resources of Sudan, visit to the geothermally heated Oserian flower farm.

TABLE 3: Structure of SDG Short Courses for Africa (continued on next page)

Day	Activities	Location
1	Opening	Lake Bogoria
2	Overview lectures on geothermal field exploration.	Lake Bogoria
3-6	Field work under the guidance of GDC and KenGen.	Lake Bogoria and surroundings
7	Transport to Lake Naivasha, with exploration of the Menengai caldera and tour of the Menengai geothermal field along the way. Visit to GDC facilities.	Transit
8-12	Lectures on geology, geophysics, geochemistry, drilling and more. Field mapping of geological structures in the Olkaria geothermal field. Visit to KenGen laboratories. Assessment test 1.	Lake Naivasha, Olkaria geothermal field
13-16	Project work. Processing of data from high- and low-temperature geothermal fields. Analysis of results. Conceptual models and siting of wells. Presentations.	Lake Naivasha
16-17	Seminar. Reports from guest lecturers and participants on geothermal resources and status of geothermal development in their home countries. Discussion.	Lake Naivasha
18	Reservoir engineering, environmental-, social- and regulatory issues, utilization.	Lake Naivasha

TABLE 3 cont'd: Structure of SDG Short Courses for Africa

Day	Activities	Location
19	Field trip to utilization sites in the Olkaria geothermal field.	Olkaria geoth.field
20-21	Utilization, project management, financial models and financing. Assessment test 2. Closing.	Lake Naivasha

4. SDG SHORT COURSES AS A PATH TOWARDS 6-MONTH TRAINING IN ICELAND

Since the introduction of the MDG Short Course series in the mid 2000's, the Short Courses have proven important venues for assessing and interviewing candidates for the 6-month training in Iceland. The courses are attended by participants from UNU-GTP partner countries in Africa and the LAC region who have been nominated by their companies / institutions. As most of these entities are eligible for, and interested in, sending staff for further training in Iceland, the selection of participants for the Short Courses is a first screening of potential candidates for the 6-month training. Two examinations are administered during the Short Courses in Kenya (Table 3; Figure 7), and interested participants are interviewed for the 6-month studies in both Kenya (Figure 7) and El Salvador. These, as well as direct exposure by UNU-GTP staff and lecturers to the participants during the courses provides important input for the final selection of 6-month Fellows and consequent invitations for studies.

The Short Courses have thus reduced the need for site visits to the developing countries for the sake of interviewing candidates for training in Iceland, and improved the efficiency and quality of the selection process with associated reduction in costs.

Some of the individuals who start their association with UNU-GTP as Short Course participants in Kenya or El Salvador find themselves pursuing an MSc or even a PhD degree in Iceland some years down the road, after having successfully completed the 6-month training.

FIGURE 7: SDG Short Course II in Kenya. Participants undertake two written assessments during the Short Course (left) and those who are eligible and interested are interviewed as candidates for the 6-month training in Iceland (right).

5. SDG SHORT COURSES AS CONTRIBUTIONS TO THE CURRICULUM OF REGIONAL GEOTHERMAL TRAINING CENTRES

5.1 The Geothermal Diploma Course for Latin America

After being in an advisory role in the years 2013-2015, UNU-GTP became a full implementing partner of the *Geothermal Diploma Course for Latin America* in 2016 (Georgsson and Haraldsson; 2017a; Georgsson, 2018; Haraldsson, 2018). At this juncture, it was decided to incorporate the annual Short Course in El Salvador into the curriculum of the Diploma Course (Section 2). *SDG Short Course I on Sustainability and Environmental Management of Geothermal Resource Utilization, and the Role of Geothermal in Combatting Climate Change* was thus an integral part of the Diploma Course, with its students participating in the Short Course in addition to participants who had been specially invited for the Short Course only.

This arrangement, which was implemented again in 2017, has allowed a greater number of participants to benefit from the Short Courses, as attested by the fact that the SDG Short Courses in El Salvador have so far seen a larger number of participants than the previous MDG Short Courses. This has most likely increased the impact of the Short Courses, while also increasing diversity and enhancing the richness of discussion. The Short Courses have also benefitted the Diploma Course programme, which is run in Spanish on a day-to-day basis, by allowing its students to participate in a forum of international character. They get exposed to foreign lecturers who communicate in English, as well as other colleagues from the LAC region. The Short Courses are venues of information exchange where professional and personal connections are forged.

5.2 The African Geothermal Centre of Excellence

After having been discussed for several years the African Geothermal Centre of Excellence (AGCE) is currently in an interim phase supported by the Icelandic Ministry for Foreign Affairs and others. The possibility of running the SDG Short Courses for Africa within the framework of the AGCE has been discussed (Georgsson, 2018), but some work remains before this can be implemented.

6. CONCLUDING REMARKS

The Short Courses held in support of the United Nations Sustainable Development Goals in Kenya for African countries and in El Salvador for Latin American and Caribbean countries are an important dimension of UNU-GTP operations, resting on the solid foundations of the earlier MDG Short Course series. The Short Courses:

- Reach out to larger numbers of people than could possibly participate in long term training in Iceland or elsewhere.
- Provide opportunities for sharing information between different countries and between generations, as well as encouraging discussion among professionals of different backgrounds.
- May be the only viable training opportunity for people with young families (especially women) and/or demanding work commitments that do not allow spending extended periods overseas.
- Introduce new subjects from year to year in El Salvador, thus responding to the varied needs of the countries in the LAC region and consequently building up a large body of lecture material in different topics over the years, which may later be utilized in the 6-month studies, in tailored training or subsequent Short Courses.
- Mostly focus on surface exploration in Kenya, with introduction to other disciplines of geothermal development, and are similar in coverage from year to year as most countries in the region are in the early stages of geothermal development (with the exception of Kenya). The courses evolve to meet slowly changing needs of the partner countries.

- May be only the first leg of a journey of training, education and research for some participants. They are an important venue for screening and interviewing candidates for the 6-month training in Iceland, which can then lead to MSc and/or PhD studies in Iceland.
- Have the potential of becoming important components of regional geothermal training centres. This has already happened in El Salvador, with the SDG Short Courses conducted as an integral component of the Geothermal Diploma Course for Latin America, and discussions having taken place regarding a similar incorporation into the framework of the African Geothermal Centre of Excellence in Kenya.
- Are not only a venue of learning for participants, but also provide opportunities for instructors to learn from participants and expand their horizons, which may be of benefit in future work.

The SDG Short Courses are a small, but important part of the global effort to support and meet the targets of the United Nations Sustainable Development Goals by 2030.

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