



Report with an Inventory of Existing Mobility and Training Programmes

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Table of Contents

Executive summary	7
1. Introduction	8
2. Geothermal Education Opportunities	9
<i>Croatia:</i>	<i>10</i>
University of Zagreb:	10
<i>France:</i>	<i>10</i>
University of Montpellier 2:	10
University of Orléans:	10
University of Lorraine: Graduate National school of geology – ENSG:	11
University de Savoie:	11
University of Strasbourg - LabEx G-EAU-THERMIE PROFONDE:	11
<i>Germany:</i>	<i>12</i>
RWTH Aachen University:	12
Freie Universität Berlin:	12
University of Applied Science Bochum with international Geothermal Center in Bochum (GZB):	12
Clausthal University of Technology:	12
University of Technology Darmstadt:	13
Friedrich-Alexander University of Erlangen-Nürnberg:	13
Technical University and Mining Academy of Freiberg:	13
Albert-Ludwig University, Freiburg:	13
Georg-August University of Göttingen:	14
Leibniz University of Hannover:	14
Technical University of Hamburg-Harburg (TUHH):	14
Karlsruhe Institute of Technology:	14
Karlshochschule International University:	15
Johannes Gutenberg University Mainz/Bingen am Rhein:	15
Ludwig Maximilians University of Munich/ Technical University of Munich:	15
University of Potsdam:	16
<i>Greece:</i>	<i>16</i>
Aristoteles university of Thessaloniki:	16
<i>Hungary:</i>	<i>16</i>
University of Miskolc:	16
Eötvös Loránd University, Budapest:	17
<i>Iceland:</i>	<i>17</i>
University of Iceland, Reykjavík:	17
United Nations University, Reykjavík:	18
Iceland School of Energy – Reykjavík University, Reykjavík:	18
Reykjavík University:	19
Keilir Atlantic Center of Excellence, Reykjanesbær:	19
GEORG:	19
<i>Italy:</i>	<i>19</i>
University of Bari:	20
University of Camerino:	20
University of Firenze:	20
University of Genova:	20

University of Pisa:	21
University of Roma Tre:	21
University of Torino:	21
CNR Institute of Geosciences and Earth Resources (IGG):	23
<i>Macedonia: St. Ciril and Methodious University, Skopje:</i>	23
International summer school on Direct Application of Geothermal Energy, Skopje:	23
<i>Netherlands:</i>	23
Delft University of Technology:	23
<i>Poland:</i>	24
AGH – University of Science and Technology, Krakow:	24
Wroclaw University of Technology:	24
<i>Portugal</i>	24
Higher Institute of Education and Science, Lisbon:	24
University Nova of Lisbon:	24
University of Aveiro:	24
University of Azores:	25
University of Évora:	25
University of Lisbon:	25
University of Porto:	25
University of Trás-os-Montes e Alto Douro:	25
<i>Romania:</i>	26
University of Oradea:	26
<i>Slovakia:</i>	26
The Technical University of Košice	26
<i>Switzerland: University of Neuchatel:</i>	26
ETH Zurich:	27
<i>Turkey:</i>	27
Middle East Technical University, Ankara:	27
Dokuz Eylul University, Izmir:	27
<i>European wide:</i>	28
European Geothermal Energy Council (EGEC):	28
Geotrained: European wide educational programme	28
GeoElec:	28
EFTA:	28
NORDPLUS:	29
3. Mobility Programmes	30
<i>Erasmus:</i>	30
<i>Erasmus+:</i>	30
<i>Marie Curie Actions - Research Fellowship Programme:</i>	30
<i>COST:</i>	31
4. International Geothermal Education Opportunities	32
<i>The International Geothermal Associations:</i>	32
<i>IRELP:</i>	32

5. North America:	32
<i>Mexico: IIE, Institute of Electrical Investigations, Cuernavaca:</i>	32
<i>United States of America: Geothermal Energy Association:</i>	32
Geothermal Resources Council (U.S.A.)	33
Geothermal Training Institute, Maple Plain:	33
International ground source heat pump association (IGSHPA), Stillwater:	33
Gateway Technical College, Kenosha:	34
6. South America	35
<i>Chile:</i>	35
Technical University Federico Santa María, University of Chile:	35
University of Chile:	35
<i>El Salvador:</i>	35
University of El Salvador:	35
7. Asia and Australia:	35
<i>Australia:</i>	35
University of Adelaide:	35
<i>Japan:</i>	36
Akita University:	36
Kyoto University, Beppu:	36
Kyushu University, Fukuoka:	36
Kumamoto University, Kumamoto:	36
Tohoku University, Sendai:	37
<i>Indonesia:</i>	37
Gadjah Mada University, Yogyakarta:	37
<i>New Zealand:</i>	37
University of Auckland:	37
Institute of Earth Science and Engineering, University of Auckland:	38
<i>Philippines:</i>	38
Bicol University, Legazpi City:	38
Negros Oriental State University:	38

List of Figures

Figure 1 Map of existing mobility and training programmes in Geothermal worldwide	8
Figure 2 Map of existing mobility and training programmes in Geothermal in Europe	9
Figure 3 Nordplus Programme Information on support by countries	29

Abstract

This WP addresses trans-national researchers' mobility and a common approach in training of research talents as adequate human resources and capacity have to be in place to achieve targets in geothermal research. A coordinated approach to research has to be supplemented by idea exchange and the development of a trans-national approach to research training.

Executive summary

The objective of Work Package 6 is to increase opportunities for transnational collaboration in research training and mobility in geothermal sector by sharing of best practices, gap analysis and increased programme collaboration. In line with work package 6 the objective of task 6.1 of the Geothermal ERA-NET is to identify and map existing mobility and training programmes at national and European level. The task addresses trans-national researchers' mobility and a common approach in training of research talents, as adequate human resources and capacity have to be in place to achieve targets in geothermal research.

This report is the result of work package 6.1. Special attention is given to the trans-national aspects of the programmes, such as if they are open to researchers of all nationalities and the language they are taught in. The main results of the mapping exercise are presented in this report with a comprehensive list of the educational programs with their characteristics and their brief status. Having brought all this together, the following types of programs have been investigated; geothermal education opportunities, education programs at Pan-European level, Mobility programs, and international geothermal education programs.

Opportunities for undergraduate students in the field of geothermal energy studies are available in most universities in Europe. However, these are not specifically in geothermal studies but rather in associated fields and studies that form a good basis for further studies in the geothermal section. Due to the more specialised nature of graduate studies, many more educational programs in geothermal-related education exist at the graduate level than at the undergraduate level. Quite a few institutions offer master's degrees, and some offer doctorate degrees as well, in geothermal based fields. Institutions offering programmes, at all levels, specific or related to geothermal studies have been listed in the report in alphabetical order of countries. The list is not exhaustive but is intended to be of guidance to what programmes are offered by European institutions as well as opportunities around the world, which are listed by continents in the back of the report.

There are also International Geothermal Education opportunities offered through international organizations although most seem to be focused on short courses and events. There are however no specific mobility programmes aimed at geothermal researchers and students to be found. Nevertheless researchers and students can make use of general mobility programmes such as Erasmus+ and Marie Curie Actions.

A great majority of the opportunities for geothermal related studies are found in the Northern hemisphere, Europe and North America, although some can be found in South America, Asia and Australia. The knowledge of all of these actions has relevance for the systematic knowledge on training programs and promotion of the application of geothermal energy.

The findings of the report have also been made available through interactive geographical mapping of opportunities of geothermal training throughout the world which can be accessed by following this link:

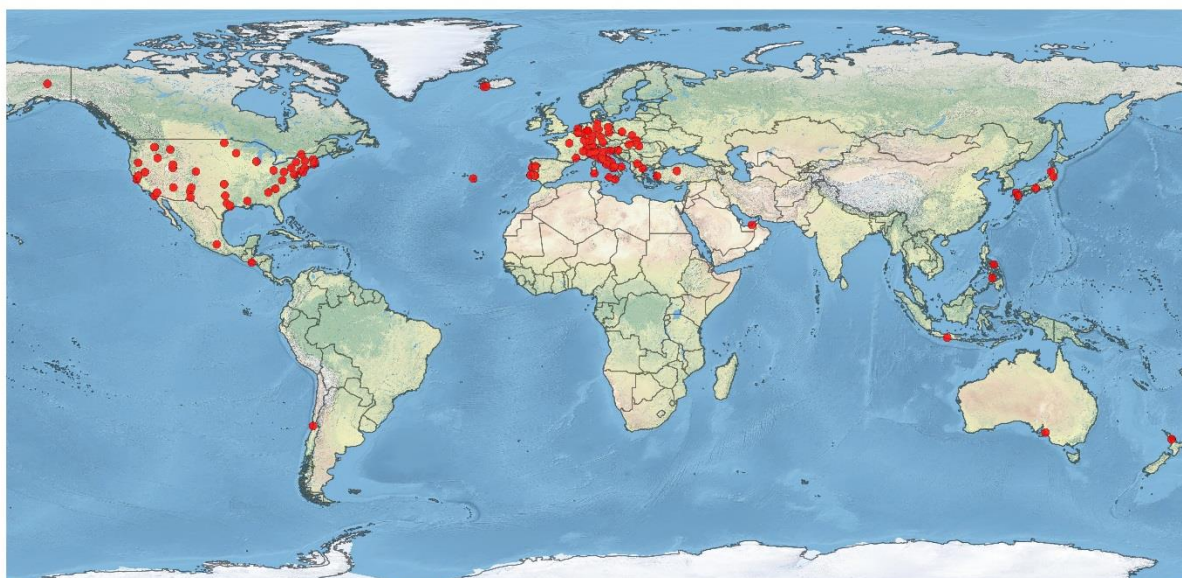
https://mapsengine.google.com/map/edit?mid=zNS2gGS2ksy0.keqp4Fd_o7YA

1. Introduction

This WP addresses trans-national researchers' mobility and a common approach in training of research talents as adequate human resources and capacity have to be in place to achieve targets in geothermal research. A coordinated approach to research has to be supplemented by idea exchange and the development of a trans-national approach to research training.

In order to identify areas of collaboration this Task 6.1 will map existing mobility and training programmes at national and European level. Special attention will be given to the trans-national aspects of the programmes, i.e. if they are open to researchers of all nationalities. The main results of the mapping exercise will be presented in a report with an inventory of existing programmes.

Geothermal Education Opportunities



• Location of Schools with Geothermal Programmes

Orkustofnun og Rannís
23.02.2015

Figure 1 Map of existing mobility and training programmes in Geothermal worldwide

Most of the information in this report can also be accessed in an interactive map by following this link:

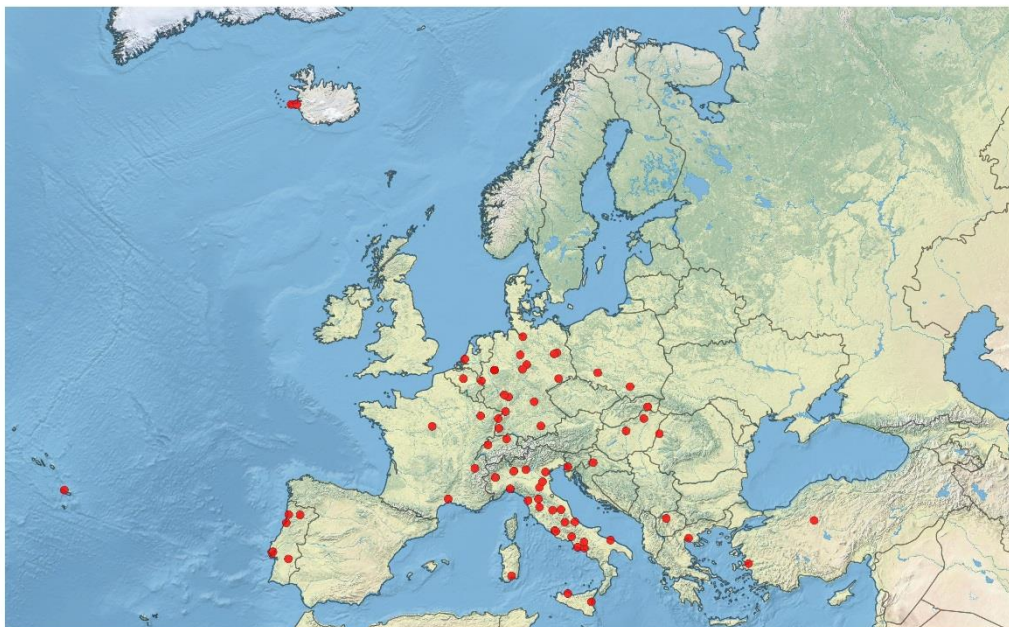
https://mapsengine.google.com/map/edit?mid=zNS2gGS2ksy0.keqp4Fd_o7YA

2. Geothermal Education Opportunities

Undergraduate studies: Opportunities for undergraduate students in the field of geothermal studies are available in most universities in Europe. These include geology, geophysics and hydrology, as well as multiple types of engineering including; civil- , environmental- , chemical- , geological- , mechanical- , and petroleum- engineering. A degree in any of these is a good basis for further studies in the geothermal section.

Graduate Studies: Due to the more specialised nature of graduate studies, many more opportunities in geothermal-specific education exist at the graduate level than at the undergraduate level. Quite a few institutions offer master's degrees and some offer doctorate degrees as well. Institutions carrying programmes, of all levels, specific to geothermal studies have been listed below in order by countries. The list is not exhaustive but is intended to be of guidance to what programmes are offered by European institutions.

Geothermal Education Opportunities



• Location of Schools with Geothermal Programmes

Orkustofnun og Rannís
23.02.2015

Figure 2 Map of existing mobility and training programmes in Geothermal in Europe

Most of the information in this report can also be accessed in an interactive map by following this link:

https://mapsengine.google.com/map/edit?mid=zNS2gGS2ksy0.keqp4Fd_o7YA

Croatia:

University of Zagreb:

<http://www.grad.unizg.hr/en>

University of Zagreb offers a programme in Geotechnical Engineering within the Faculty of Civil Engineering, both undergraduate and master's. University of Zagreb offers courses in Geotechnical Engineering, Hydrogeology and Engineering Geology, Underground Constructions, Site Investigations and Rock Mechanics.

France:

In France, Schools of Science and Engineering Institutes in the field of Earth Sciences, Energy, and Renewables increasingly offer training in geothermal science, in addition to other modules from earth science, economy, energy systems etc. Geothermal modules are offered at both graduate and undergraduate level, as well as within other university courses (IUT). In addition, training is available for engineering contractors and project management consultants. The specialisation in a specific domain of geothermal energy also takes place through internships in specialised enterprises (6 months or more). The following inventory outlines programmes which explicitly provide training on geothermal energy in their graduate and master's degree in Geosciences.

University of Montpellier 2:

The University of Montpellier 2 offer a Master's degree in Energy and geology, with a specific course on the field of geothermal energy.

- **Master 2 Energy**

<http://www.master-energie.univ-montp2.fr/>

Direct uses, deep water reservoir. Electricity production, vapour reservoir

- **Master 2 Geology**

<http://www.gm.univ-montp2.fr/spip.php?article441>

Applied Master in Geology with a focus on Reservoirs Geology – GR2M. Direct uses, deep water reservoir. Electricity production, vapour reservoir.

Language: French.

University of Orléans:

IUT Génie Thermique et Energétique (DUT GTE): <http://www.univ-orleans.fr/iut-orleans/gte/>

Second-year university level, training for senior technicians in thermal transfers.

Geothermal energy course focusing on geothermal heat pumps systems and ground heat exchangers. **Language: French.**

Observatory of sciences of the Universe in Région Centre-OSUC:

<http://www.univ-orleans.fr/osuc/observatoire-des-sciences-de-lunivers-en-region-centre>

The OSUC is an internal school of the University of Orléans. It has the mission to dispense multidisciplinary teaching (Bachelor, Master, Doctorate), in initial and continuous training, in the domain of Earth sciences. Geothermal energy is presented in the Master 2 “3F”(Fluids, Fractures, Faults), with a focus on Geothermal energy in sedimentary basin and EGS. **Language: French.**

The Polytech Orléans engineering faculty:

<http://www.univ-orleans.fr/polytech/mastere-specialise-capteurs-et-geosciences>

Master in Sensors and geosciences, including geothermal energy ground heat exchangers. **Language: French.**

University of Lorraine: Graduate National school of geology – ENSG:

<http://www.ensg.univ-lorraine.fr/>

Training for Engineers on naturalistic observation and control of the physics as well as the chemistry of the Earth and Water. Geotechnics, Mineral and Energetic Raw material, Water, Environment. **Language: French.**

University de Savoie:

Master Pro GAIA: <http://www.cism.univ-savoie.fr/index.php/fr/formations?id=41>

<http://www.cism.univ-savoie.fr/images/GAIA/GAIA%20module%20forages%20et%20diagraphies.pdf>

Geosciences Applied to the Engineering of Territory Planning. Optional Module on Drilling and Loggings (see latter link). **Language: French.**

In preparation:

University of Strasbourg - LabEx G-EAU-THERMIE PROFONDE:

<http://eost.unistra.fr/recherche/g-eau-thermieprofonde/>

Will be dedicated to the knowledge of deep geothermal reservoirs and to the development of new technologies for their exploitation.

Language: French.

Germany:

RWTH Aachen University:

<http://www.fgeo.rwth-aachen.de/go/id/cgax>

<http://www.idealeague.org/geophysics/>

http://www.fgeo.rwth-aachen.de/cms/Fachgruppen/Geowissenschaften_und_Geographie/Die_Fachgruppe/Institute_und_Lehrstuehle/Gesamtuebersicht/~chxw/Hydrogeologie_LFH/?lidx=1

The Institute for Applied Geophysics and Geothermal Energy E.ON Energy Research Center in RWTH Aachen University offers a master's degree in Applied Geophysics, in collaboration with Delft University of Technology and ETH Zurich (lectures in English). Different courses are taught in each institution, RWTH Aachen offers courses in Geophysics Special Methods, Geophysical Logging and Log Interpretation, Geothermics, Hydrogeophysics, Data Analysis in Geoscience, Mineral Exploration, Petroleum System Modelling, Engineering Geophysics and hydrogeology. A bachelor and master programme is also available for Georesources Management and Applied Geosciences. **Language: German.**

Freie Universität Berlin:

http://www.fu-berlin.de/en/studium/studienangebot/master/environmental_earth_sciences/index.html

The FUB offers a master's programme for Environmental Earth Sciences including lectures on Hydrogeology, Climate and Ecosystems. **Language: lectures in English.** An integral part of the programme is one semester at the Nanjing University (China).

University of Applied Science Bochum with international Geothermal Center in Bochum (GZB):

<http://www.geothermie-zentrum.de/lehre/masterstudiengang-bochum.html>

The University of Applied Science Bochum with International Geothermal Center in Bochum (GZB) offers a master's programme in Construction Engineering/Geothermal Energy Systems. The University of Applied Science Bochum offers courses in Geothermics and Geohydraulics, Groundwater Hydraulics and Exploration, Heat and Fluid Mechanics, Thermodynamics, Fluid Mechanics, Shallow Drilling Engineering, Deep Drilling Engineering, Geothermal Plant Construction and Heat Mining, Borehole Geophysics, Reservoir Engineering, Hydrochemistry and Geochemistry as well as Rock Mechanics. **Language: German.**

Clausthal University of Technology:

<http://www.geologie.tu-clausthal.de/>

The Clausthal University of Technology offers both undergraduate and master's degree in Geosciences, and courses such as Hydrogeology, Introduction to Geosciences, Structure of

the Crust, Petrology and Geochemistry. *Language: German*. In cooperation with the Energieforschungszentrum Niedersachsen (www.efzn.de).

University of Technology Darmstadt:

<http://www.geo.tu-darmstadt.de/iag/index.de.jsp>

The Institute of Applied Geosciences (IAG) and the Chair of Geothermal Science and Technology in University of Technology Darmstadt offers a master's degree in Applied Geosciences (Geothermal Energy, Hydrogeology, engineering Geology and Environmental Management). The University of Technology Darmstadt offers courses in Shallow systems, Deep systems, Analytical and Numerical simulations in Geothermal Systems, Deep Drilling Technology for Geothermal Systems, Hydraulics and Well Design, Field course, Laboratory Course and Excursions. *Language: partly English, mostly German*.

Friedrich-Alexander University of Erlangen-Nürnberg:

<http://www.gzn.uni-erlangen.de/en/applied-geosciences/>

As part of the Friedrich-Alexander University of Erlangen-Nürnberg the Geozentrum Nordbayern offers degrees in applied geology with a focus on hydrogeology and engineering geology. *Language: German*.

Technical University and Mining Academy of Freiberg:

<http://tu-freiberg.de/studiengang/geoscience/index.html>

The TUBAF offers an International Master's Programme in Geoscience with a special focus on Hydrogeology/Hydrochemistry. *Language: lectures in English*.

Albert-Ludwig University, Freiburg:

Undergraduate Geosciences: <http://portal.uni-freiburg.de/geowissenschaften>

Graduate Renewable Energy Management: <http://www.zee-uni-freiburg.de/index.php?id=26>

The department of Geosciences in the Albert-Ludwig University offers an undergraduate degree in Geosciences, and courses in Processes of the Earth, Geochemics, Structural Geology and Tectonics, Energy Resources and Geothermal Energy, Pressure and Deformation of Rocks, Hydrogeology, Geochemistry of Natural Water and Geochemical Material Cycles. *Language: mostly German*. A master in Geology is also available in *English*.

The Centre for Renewable energy within the department of Geosciences at Albert-Ludwig University offers a master's degree in Renewable Energy Management. The Centre for renewable Energy offers courses such as Introduction to Geothermal energy and its Technologies. *Language: English*.

Georg-August University of Göttingen:

<http://www.uni-goettingen.de/de/abteilungsprofil/8575.html>

The Centre for Geosciences at the University of Göttingen offers a master's degree in applied geosciences with a focus on hydrogeology/hydrochemistry. *Language: English.*

Leibniz University of Hannover:

[http://www.geowissenschaften.uni-hannover.de" target=" blank](http://www.geowissenschaften.uni-hannover.de)

Leibniz University of Hannover offers both undergraduate and master's programme in Geosciences, and courses such as Systems of the Earth, Structural Geology, Geophysics, Geochemistry, Methods of Applied Geophysics, Geochemical analysis, Plate Tectonics and Continental Deformation, Hydrogeology, Geographic Information systems GIS, Project Management, Hydrogeology/Water Economics and Engineering Geology. *Language: German.* In cooperation with the Energieforschungszentrum Niedersachsen (www.efzn.de).

Technical University of Hamburg-Harburg (TUHH):

Undergraduate:

<http://www.tu-harburg.de/alt/tuhh/education/students/examination-regulations/bsc-eut.html>

Hamburg-Harburg University of Technology offers both undergraduate and master's degree in Energy and Environmental Engineering. The University offers courses in Thermodynamics, Basics of Electrical Engineering, Fluid Dynamics, Fundamentals of Reciprocating engines and Turbo-machinery, Gas-Steam Power Plant, Heat and Mass Transfer and Steam Generators on undergraduate level. As well as Fluid dynamics, Apparatus Engineering – Heat Exchange – high Pressure Technique, Fluid Process Engineering, Steam turbines, Thermal Engineering, Combined Heat and Power, Air Conditioning, Electricity Generation from Renewable Sources, Alternative Energy systems, Thermal Waste Treatment and Special Areas in energy and Environmental Engineering for higher education. *Language: German.*

Karlsruhe Institute of Technology:

<http://www.agw.kit.edu/english/263.php>

The International Geothermal Centre at Karlsruhe Institute of Technology offers undergraduate as well as master's degree in Applied Geosciences. Karlsruhe Institute of Technology offers courses in Physics, Dynamics of the Earth, Basics of Geology, Basics of Geophysics, Basics of Geochemistry, Basics of Hydrogeology, Basics of Engineering Geology, Basics of Analysis of Geo Data, Basics of Energy resources and Geothermal Energy. *Language: partly English, partly German.*

Karlsruhochschule International University:

[http://karlsruhochschule.de/en/my-studies/energy-management/#course-overview-2"](http://karlsruhochschule.de/en/my-studies/energy-management/#course-overview-2)
[target="_blank](#)

The Faculty of Business Administration and Management at Karlsruhochschule International University offers an undergraduate programme of International Energy management. The university offers courses such as Introduction to International Energy Systems, Introduction to Management and its Quantitative Methods, Business Environment, Introduction to Scientific Work and Empiric Social Research, Global Natural Resources and Sustainability, Basics of Strategic Management, Energy Industry Management, Energy Efficiency, Introductory company Project, Resources: financial, organisation, International Energy Politics and Social Responsibility, Current Issues of the energy Industry, Regional Studies, Change and Innovation. *Language: English.*

Johannes Gutenberg University Mainz/Bingen am Rhein:

["http://www.igem-energie.de" target="_blank](http://www.igem-energie.de)

Institute for Geosciences in Mainz and University of Applied Sciences in Bingen and Institute for Geothermal Resource Management at Johannes Gutenberg University Mainz offers both undergraduate and master's degree in Geosciences. A course on deep geothermal energy for graduate students is also available. *Language: German.*

Ludwig Maximilians University of Munich/ Technical University of Munich:

Undergraduate:

[http://www.geo.uni-muenchen.de/studium/studiengaenge/bgeow/index.html" target="_blank](http://www.geo.uni-muenchen.de/studium/studiengaenge/bgeow/index.html)

Master's in Geophysics:

<http://www.geophysik.uni-muenchen.de/teaching/degreeProgrammes/masterstudiengang-geophysics>

Master's in Engineering Geology and Hydrogeology:

http://portal.mytum.de/studium/studiengaenge/ingenieur_und_hydrogeologie_master/index_html?

Ludwig Maximilians University of Munich and Technical University of Munich offer an undergraduate degree in Geosciences and master's degree in Geophysics (**taught in German**). Offering courses in Applied Geophysics, Thermodynamics, Tectonics, Introduction to Engineering Geology, Introduction to Hydrogeology, Methods of Engineering Geology, Environmental Geochemistry, Geochemistry, Global Geophysics at undergraduate level. And Basic Geophysics, Tools, Advanced Geophysics, Independent Scientific Research, Advanced Geodynamics, Advanced Seismology, Advanced Paleo- and Geomagnetism, Geochemistry and Geomaterials, Applied and Industrial Geophysics and ESPACE (Earth Oriented Space Science) at master's level.

The Technical University Munich also offers a master's degree in Engineering Geology and Hydrology, with courses such as Geoscientific Introduction to Applied Geology, Rock Mechanics and Rock Engineering, Soil Mechanics and Introduction to Engineering, Flow and Transport, Rock Mechanical Laboratory (Practice) and Hydrogeological Fluid Laboratory, Regional Geology, Slope Movement, Hydrogeological Methods, Soil Mechanics Laboratory training and Hydrochemical Laboratory training, Landslide mapping, Technical Petrology, Applied Quaternary Sciences, Hydrogeological Case Studies, Statistic and Geostatistics, Cross-disciplinary Qualifications, Geological Engineering Project Work, Geothermal, Mineral Resources, Numerical Methods, Hydrochemistry, Technical Hydrogeology and Advanced Groundwater Modelling. *Language: German.*

University of Potsdam:

<http://www.geo.uni-potsdam.de/950.html> target=" blank

University of Potsdam offers both undergraduate and master's degree in Geosciences - with Geothermal as part of the studies. University of Potsdam offers courses in Geosciences, Experimental physics, Materials of the Earth, Basics of Structural Geology, Numerical Methods, Advanced Petrology and Geochemistry, Hydrogeology. A degree in geocology is also available, international courses are available in *English*.

Greece:

Aristoteles university of Thessaloniki:

<http://www.auth.gr/>

Aristoteles University of Thessaloniki offers master's degree in Applied and Environmental Geology as well as in Geoinformatics and various other fields related to geothermal exploration.

Hungary:

University of Miskolc:

http://www.kfgi.uni-miskolc.hu/index_en.html

Post graduate Diploma in Geothermal Energy Technology:

http://www.kfgi.uni-miskolc.hu/index_en.html

University of Miskolc offers undergraduate, master's and PhD degrees related to Geothermal studies, such as MSc in Petroleum and Natural Gas Institute, MSc Hydrogeological Engineering and BSc in Earth Science and Engineering. Courses that are related to geothermal energy are such as Geothermal Energy Production and Utilisation, Heat Transfer at Geothermal Wells, Renewable Energy, Flow dynamics, Risk and Safety in Pipe-line Systems and Pipe-line risk Analysis.

The University of Miskolc also offers a four semester post graduate courses with twenty courses ending with a diploma on geothermal engineering. The courses available are for example Renewable energy, Advanced Geology, Advanced Geophysics, Fluid Dynamics, Hydrogeology, Drilling Well Design, Geothermal Reservoir, Geothermal Water Production, Geoinformatics, Geothermal Chemistry, Geothermal Heat-Transfer systems, Geothermal Power Production, Geothermal Direct Uses, Geothermal Heat Pump and Geothermal Environmental Impacts.

In 2012 the university won an EU competition to continue the development of postgraduate courses in Geothermal Engineering in the form of E-learning courses. University of Miskolc's cooperative partners in this endeavour are the University of Colorado and Colorado School of mines, and the project is being executed by INNOCENTER Ltd. Within this framework international educators and geothermal experts are working together to develop a state-of-the-art curriculum.

The Hungarian Engineering Chamber together with the University of Miskolc also organised several geothermal short courses about shallow and deep geothermal direct uses, as well.

Eötvös Loránd University, Budapest:

http://geosci.elte.hu/en_index.htm

Eötvös Loránd University offers geothermal related BSc degrees in Geosciences and Environmental Science, MSc degrees in Geology and Geophysics. Geothermal PhD courses are also available at the Institute of Geography and Earth Sciences, in the Center of Earth Sciences.

Undergraduate, graduate and PhD courses include Hydrogeology, Groundwater Flow in Sedimentary Basins, Thermal Waters and Geothermal Energy, Geophysics, Geothermics and Radiometric Dating, Geodynamics, Global Geodynamics and Geothermics, Geochemistry, Resource Management and Waste Management, Sustainable Energy Management, Field Course. During education main focus is put on regional, basin scale fluid and heat flow processes.

Iceland:

University of Iceland, Reykjavík:

<https://ugla.hi.is/kennsluskra/index.php?tab=skoli&chapter=content&id=25958&kennsluar=2012>

The Mechanical Engineering and Computer Science department of the Faculty of Industry Engineering at the School of Engineering and Natural Sciences at the University of Iceland offer undergraduate, masters and PhD in Mechanical Engineering and Renewable Energy

Engineering. Offering courses such as Reservoir Engineering, Geothermal Power Plants, Geothermal Drilling and Direct Geothermal Utilisation. The University of Iceland's Faculty of Earth Science also offers undergraduate, masters and PhD in Geology and Geophysics. *Language: partly Icelandic, partly English.*

United Nations University, Reykjavík:

<http://www.unugtp.is/>

The Geothermal Training Programme of the United Nations University offers a UNU postgraduate certificate diploma of 6 months Geothermal Training Programme (April-October), divided into three phases: 1) introductory lectures, 2) specialised training, 3) research project. The programme can be extended to MSc and PhD in cooperation between UNU-GTP and the University of Iceland. The programme is aiming at assisting developing countries in capacity building within geothermal exploration and development. The programme involves six months of training for practicing geothermal professionals and draws fellows from developing and transitional countries with significant geothermal potential.

Iceland School of Energy – Reykjavík University, Reykjavík:

<http://en.ru.is/ise/>

Iceland School of Energy is part of Reykjavik University and is run in close collaboration with the Icelandic energy industry. The School offers two master's programmes, a PhD programme, professional development courses, as well as a summer school, all on sustainable energy. The programmes are designed to produce experts in sustainable energy from the fields of engineering, earth sciences, and business. The 18-month master's programmes are international in nature and primarily cover geothermal energy, though other sustainable energy systems are included. Courses offered include Well Logging and Geothermal and Groundwater Reservoir Management, Energy Carriers and Energy Storage, Measurements and Systems Analysis in Geothermal Power Plants, Seminar in Aqueous Geochemistry, Groundwater Hydrology, Dynamics of the Earth's Crust, Geophysical Inversion Measurements and Models in Geodynamics, Seismology, Geothermal Resources, Aquatic Geochemistry, Space and District Heating, Geothermal Power Development, Advanced Fluid Mechanics, Advanced Heat Transfer, Numerical Solutions in Fluid Mechanics and Heat Transfer.

Reykjavík University:

[http://en.ru.is/sse/" target=" blank](http://en.ru.is/sse/)

School of Science and Engineering at Reykjavík University offers an undergraduate degree in Mechanical and Energy Engineering. The programme offers courses such as Thermodynamics, Fluid Mechanics and Heat Transfer, Overview of Sustainable Energy Systems, Heating, Ventilation and Air Conditioning as well as Thermo and Hydraulics Lab.

Keilir Atlantic Center of Excellence, Reykjanesbær:

<http://www.keilir.net/technology/technology/education/green-energy-technology>

Keilir Atlantic Center of Excellence offers an undergraduate programme in Energy and Environmental Engineering Technology in collaboration with the University of Iceland. The programme offers courses such as Reservoirs and Utilisation of Geothermal Energy, Sustainable Energy Systems, Thermodynamics and Heat Transfer, Energy and the Environment, and Energy Systems of Civil Structures. In preparation is a Geothermal Power Plant Technician programme, in association with University of Iceland, Reykjavík Energy and HS-Orka.

GEORG:

<http://www.georg.hi.is/efni/georg>

GEORG is an international Geothermal Cluster Cooperation creating a platform for universities, scientific institutions, geothermal power companies and engineering consultancies to join forces with the aim to strengthen research and development of innovations in the field of geothermal energy.

Italy:

Many Universities in Italy dedicate parts of their courses to geothermal energy. Most of them are related to Earth Sciences disciplines, offering courses on geology, hydrogeology, geophysics, geochemistry, earth resources and rock mechanics where geothermal applications are explicitly referred in the programmes of the courses. Also Engineering Departments provide education with reference to power production, H&C plant design and renewable energy technologies. Economics Departments offer courses that are mainly focused on social and economic aspects related to energy, in particular to renewables. Most of these Universities actively participate to geothermal research activities, both national and international, and provide BSc's, MSc's and PhD's theses and training. Some Universities give the possibility to activate courses on geothermal resources upon request.

The universities listed below offer courses/laboratory that are entirely dedicated to geothermal energy:

University of Bari:

<http://www.uniba.it>

The University of Bari offers a master's degree in Geology with courses covering basic principles of geophysical exploration related to geothermal resources. It is also available a laboratory fully dedicated to geothermal measurements. *Language: Italian.*

University of Camerino:

http://www.unicam.it/geologia/teaching/allegati/guide_LM74_2013-14.pdf

University of Camerino offers a master's degree in Geoenvironmental Resources and Risks, with a course on Energy Resources and Risk. The key topics of the course are exploration, exploitation and sustainable use of georesources, including those related to energy. Studies of geological hazards in the various phases, from monitoring and evaluation, to the mitigation management are deepened aspects. The course is designed to create a geoscientist with a strong geological background and multidisciplinary expertise (chemical, physical and environmental), useful to address the environmental issues and with attention to the implications regarding society. *Language: English.*

As a novelty in Italy for the courses in the Earth Sciences, the University of Camerino has signed an international agreement with the Ludwig Maximilians University (LMU) - München (Germany), which offers the students the possibility of obtaining the double Italian and German University degree, with a period of study in the partner University. The Double Degree programme with LMU-München University (Germany) is an opportunity which aims to increase the level of internationalisation of the Italian Earth Sciences degrees at the Master level.

University of Firenze:

<http://www.smfn.unifi.it/index.php?module=ofform&mode=1&cmd=2&AA=2011&fac=200010&cds=B103&pds=D56®did=2011&lan=0>

The study courses for the master Degree in Earth Science and Technologies of the University of Florence include a course on Geothermal energy. The course covers the basic principles of geothermal systems, the geothermal exploration techniques and the geological aspects related to the use and exploitation of geothermal fluids. *Language: Italian.*

University of Genova:

http://www.sgeo.unige.it/index.php?option=com_courses&id=485&view=courses

University of Genova offers master's degree in Geological Sciences, with a course on Geothermal Physics, related to the physical description of geothermal systems (heat transmission and flow, thermodynamical processes, geophysical exploration methods). *Language: Italian.*

University of Pisa:

<http://www.dst.unipi.it/corso-di-laurea-in-scienze-geologiche.html>

The Department of Geosciences of the University of Pisa offers both undergraduate and master's degree in Geology - with a course on Geothermal Resources. The course gives a general knowledge of the geothermal systems, of the exploration techniques and of the geological aspects related to the use and exploitation of geothermal fluids. **Language: Italian.**

University of Roma Tre:

https://uniroma3.esse3.cineca.it/ProgrammaCorso.do?CDS_ID=198375&AA_OFF_ID=2013&AD_ID=30105054&AA_ORD_ID=2010&PDS_ID=10001&FAT_PART_COD=N0&DOM_PART_COD=N0

University of Roma Tre offers both undergraduate and master's degree in Geology of the Territory and of the Resources Geology, with a course on Geothermal Resources. The course provides fundamentals for the understanding of the characteristics of geothermal systems and the main methods of prospecting in which the professional geologist is essential, classification of geothermal resources, geothermal exploration, regional geothermal and use of geothermal resources. **Language: Italian.**

The universities listed below offer undergraduate, master and PhD courses, laboratory/facilities that are partly dedicated to geothermal energy:

University of Bologna:

<http://www.eng.unibo.it/PortaleEn/Academic+programmes/Teachings/dettaglio.htm?AnnoAccademico=2013&IdComponenteAF=377650&CodDocente=030601&CodMateria=34757>

The Department of Civil, Chemical, Environmental and Materials Engineering of the University of Bologna offers both undergraduate and master's degree in Geoengineering and Natural Resources focusing on Mines and Quarries, Geothermal and Excavations with courses in simulation of hydrocarbon and geothermal reservoirs. **Language: Italian.**

University of Torino:

<http://geologia.campusnet.unito.it/do/corsi.pl/Show?id=52f1;sort=DEFAULT;search=;hits=47>

The Department of Earth Sciences of the University of Turin offers undergraduate's degree in Earth Science, and a course on Volcanology and Introduction to Geothermal Resources. **Language: Italian.**

University of Trieste:

<http://international.units.it/about-university>

<http://www2.units.it/dida/pdf/042000guida.pdf>

The courses offered by the University of Trieste for obtaining the Master's Degree in Civil Engineering include a course on Low Temperature Geothermal Systems, beside many others partly related to geothermal topics (hydrogeology, hydrodynamics, geophysical exploration, economic evaluation of projects, GIS). **Language: Italian.**

All the universities mentioned below offer other courses, laboratory/ facilities and training that partly cover geothermal topics:

Politecnico di Milano: <http://www.polimi.it/en/>

Politecnico di Torino: <http://www.polito.it/index.php?lang=en>

SSSUP (Scuola Superiore Sant'Anna), Pisa: <http://www.sssup.it>

Università degli Studi dell'Aquila: <http://www.univaq.it/>

Università degli Studi di Brescia: <http://www.unibs.it/english-version>

Università degli Studi di Cagliari: <http://www.unica.it/pub/english/>

Università di Cassino e del Lazio Meridionale: <http://www.eng.unicas.it>

Università degli Studi di Catania: <http://www.unict.it/en/>

Università degli Studi di Chieti-Pescara: <http://www.unich.it>

Università degli Studi di Ferrara: <http://www.unife.it>

Università degli Studi di Milano: <http://www.unimi.it>

Università degli Studi di Napoli Federico II: <http://www.unina.it>

Seconda Università degli Studi di Napoli: <http://www.dii.unina2.it/>

Università degli Studi di Padova: <http://www.unipd.it/international-area/>

Università degli Studi di Palermo: <http://portale.unipa.it>

Università degli Studi di Perugia: <http://cclgeol.unipg.it/cclgeol/index.html>

Università degli Studi di Roma La Sapienza: <http://en.uniroma1.it/sapienza>

Università degli Studi di Roma Tor Vergata: <http://web.uniroma2.it/home.php>

Università degli Studi di Salerno: <http://www.unisa.it/english/index>

Università degli Studi del Sannio di Benevento: <http://www.unisannio.it>

Università degli Studi di Siena: <http://en.unisi.it>

Geothermal training is also offered by Research Institutions:

CNR Institute of Geosciences and Earth Resources (IGG):

Long training in collaboration with ICTP and ICS, short training in collaboration with Universities in Italy and abroad, and specific training organised in many developing countries in collaboration with UNESCO and the Italian Ministry of Foreign Affairs

<http://www.igg.cnr.it>

Macedonia:

St. Cyril and Methodius University, Skopje:

<http://www.mf.ukim.edu.mk>

Faculty of Mechanical Engineering at St. Cyril and Methodius University offering undergraduate and master's degree in Energy and Ecology as well as Applied Thermal Engineering, which offer courses on Non-conventional Energy Sources (Solar, Geothermal, Biomass and Wind) and on Renewable Energy Sources.

St. Cyril and Methodius University also offers other master's degrees, such as Thermal Engineering, Power Engineering and Ecology, and Non-conventional Energy Sources. The university offers courses on Non-conventional Thermal Power Plant (Solar, Geothermal and Biomass), Non-conventional energy Sources (Solar, Geothermal and Biomass) and Geothermal Heat Pumps.

International summer school on Direct Application of Geothermal Energy, Skopje:

Contact: Prof. Kiril Popovski (kpopovski@mac.com)

The International summer school on Direct Application of Geothermal Energy organises yearly schools throughout Europe in co-operation with universities and associations targeting various topics.

Netherlands:

Delft University of Technology:

<http://www.idealeague.org/geophysics/>

Faculty of Engineering and Geosciences in Delft university of Technology offers a master's degree in Applied Geophysics, in collaboration with RWTH Aachen University and ETH Zurich. Different courses are taught in each institution, Delft University of Technology offers courses in Introduction to Reflection Seismics, Petroleum Geology, Matlab/Programming, Geologic Interpretation of Seismic Data, Electromagnetic Exploration Methods, Advanced

Reflection Seismology and Seismic Imaging, Sedimentary Systems, Geophysics Special Subjects and Seismic Resolution.

Poland:

AGH – University of Science and Technology, Krakow:

<http://www.wggios.agh.edu.pl/en/education/degprogrammes>

The Department of Energy Resources within Geophysics and Environment Protection in the Faculty of Geology at AGH – University of Science and Technology offers both undergraduate and master's programmes in Environmental Engineering with specialisation in Renewable Energy (including Geothermal Energy). Thus offering both undergraduate and graduate degree in Geothermal Energy.

Wroclaw University of Technology:

<http://www.portal.pwr.wroc.pl/345888,242.dhtml?s=346060>

Faculty of Mechanical and Power Engineering at Wroclaw University of Technology offers a master's degree in Power Engineering – Specialisation in Renewable Sources of Energy. The university offers a course in Geothermal Power Engineering.

Portugal

Universities in Portugal don't offer courses on geothermal energy. All the universities mentioned below offer other courses (like courses on renewable energy, on geology, on environmental engineering and/or on geological engineering) that partly cover geothermal topics.

Higher Institute of Education and Science, Lisbon:

<http://www.isec.universitas.pt/index.php/pt/>

The Higher Institute of Education and Science offers a degree in renewable energy and environment. **Language: Portuguese.**

University Nova of Lisbon:

<http://www.fct.unl.pt/en/curricular-profile>

The University Nova of Lisbon offers a degree in geological engineering. It also offers a degree with an integrated master in Environmental Engineering. **Language: Portuguese.**

University of Aveiro:

<http://www.ua.pt/>

The University of Aveiro offers a degree with an integrated master in Environmental Engineering. **Language: Portuguese.**

University of Azores:

<http://www.uac.pt/>

The University of Azores, offers in Ponta Delgada, São Miguel Island and Azores, a master in Environment of Geology. **Language: Portuguese.**

University of Évora:

<http://www.uevora.pt/>

The University of Évora, in Évora, offers a degree in geology. Language: Portuguese. It also offers a master in geological engineering. **Language: Portuguese or English**

University of Lisbon:

School of Sciences: <http://www.fc.ul.pt/>

The University of Lisbon - School of Sciences offers a degree in geology. **Language: Portuguese.**

Higher Technical Institute: <http://tecnico.ulisboa.pt/>

The University of Lisbon - Higher Technical Institute, in Lisbon, offers a degree with an integrated master in Environmental Engineering. It also offers a degree in geological and mining engineering. **Language: Portuguese.**

Higher Institute of Agronomy: <http://www.isa.ulisboa.pt/>

The University of Lisbon - Higher Institute of Agronomy, in Lisbon, offers a degree in Environmental Engineering. **Language: Portuguese.**

University of Porto:

http://sigarra.up.pt/feup/pt/web_page.inicial

The University of Porto, in Oporto, offers a degree in geology and a degree in mining engineering and geoenvironment. It also offers a degree with an integrated master in Environmental Engineering. **Language: Portuguese.**

University of Trás-os-Montes e Alto Douro:

<http://www.utad.pt/vPT/Paginas/HomepageUtad.aspx>

The University of Trás-os-Montes e Alto Douro, in Vila Real, offers a degree in Environmental Engineering. **Language: Portuguese.**

Romania:

University of Oradea:

<http://www.energetica-oradea.ro/oferta-educationala.html>

Department of Energy Engineering of the Faculty of Energy Engineering and Industrial Management at the University of Oradea offers an undergraduate degree in Engineering of Renewable Energy Systems and Thermal Energy Engineering, as well as a master's degree in Renewable Energy and Utilisation of Geothermal and Solar Energy, and PhD including geothermal energy utilisation. The University of Oradea offers Specialisation and lectures about Geothermal Energy in the courses. The University of Oradea also offers summer courses.

Slovakia:

The Technical University of Košice

<http://www.fberg.tuke.sk/bergweb/index.php?IdLang=1&Selection=1.1>

Faculty of Mining, Ecology, Process Control and Geotechnologies at the Technical University of Košice, is located in the city with the most significant geothermal potential in Slovakia. Institute of Geo-sciences offers the possibility of studying at the fields related to geothermal energy. The faculty is leading or participating in projects focused on wider geothermal energy utilisation in Slovakia such as “Technology research for finding exploitable geothermal resources in Slovakia” funded from Structural funds of EU. The faculty cooperates with more than 30 foreign partners, either universities or research institutes. The faculty actively cooperated in the realisation of the study programme of the international educational project EGEC.

Switzerland:

University of Neuchatel:

http://www2.unine.ch/files/content/sites/sciences/files/brochures/MSc_hydro_geo_ENG.pdf

Training Course in Deep Geothermal System: <http://www2.unine.ch/foco/CAS-DEEGEOSYS>

Center for Hydrogeology and Geothermics (CHYN) at the University of Neuchatel offers master's and PhD degrees in Hydrogeology and Geothermics in Cooperation with the Swiss Federal Institute of Technology and the University of Lausanne. The University of Neuchatel

offer courses in General Hydrogeology, Flow and Transport Processes, Hydrochemistry and Microbiology, Introduction to Geothermics, Statistical analysis and Modelling, Numerical simulations, Applied Geology, Operational Hydrogeology, Integrated Management of Water Resources, Contaminant Hydrogeology, Reservoir Modelling, Geothermal Exploration and Engineering, and Hydrogeochemistry.

The Center for Hydrogeology and Geothermics also offers a Certificate of Advanced Studies in a programme called Training course in Deep Geothermal System: CAS DEEGOSYS. The programme includes four one-week long modules separated by two-month breaks, aimed to train specialists. Each module covers a specific topic: Geothermics and Geophysics, Geochemistry and Hydrogeochemistry, Drilling and Logging, Reservoir evaluation and Production.

ETH Zurich:

<http://www.idealeague.org/geophysics/>

Institute of Geophysics in ETH Zurich offers a master's degree in Applied Geophysics, in collaboration with RWTH Aachen University and Delft University of Technology. Different courses are taught in each institution, ETH Zurich offers courses in Reflection Seismology Processing, Groundwater, Modelling for Applied Geophysics, Inverse Theory for Applied Geophysics, Geophysical Field Work & Processing: Methods, Geophysical Field Work & Processing: Preparation, Geophysical Field Work & Processing: Fieldwork, Soil Mechanics for Geophysics, Case Studies in Engineering and Environmental Geophysics.

Turkey:

Middle East Technical University, Ankara:

<http://www.metu.edu.tr/>

The Middle East Technical University in Ankara offers both Mechanical Engineering and Petroleum and Natural Gas Engineering which deal with exploitation, production and transportation of petroleum, natural gas and geothermal energy. The institution offers courses such as Utilisation of Geothermal engineering, Thermodynamics, Reservoir rock and Fluid properties, Drilling Engineering, Well Logging, Drilling fluid Engineering, Well Stimulation, Transport Phenomena in Geosystems, Thermal Recovery methods and Fluid Mechanics.

Dokuz Eylul University, Izmir:

<http://www.deu.edu.tr/ders-katalog/eng/eng-c1.html>

The Dokuz Eylul University offers a range of programmes related to geothermal studies, such as undergraduate and master's programmes in Geophysical Engineering as well as Geological Engineering, master's programmes in Geothermal Energy, Economic Geology and Applied Geology. Of these the master's programme in Geothermal Energy offers the biggest range in geothermal related courses, such as Thermal water and geothermal energy, Geophysical

applications in Geothermal sites, Geothermal fluid and environment, Drilling Geothermal Wells, Geothermal Energy Technology, Geothermal Well Logs, Material Selection for Geothermal Applications, Geothermal Resources and utilisation, Reservoir Engineering, Geothermal Hydrogeochemistry, Geothermal Hydrogeology, Reservoir monitoring and well tests, Urban design in Geothermal Fields, Paleogeothermal Systems, Well Logging of Geothermal Systems, Investigation of Marine Geothermal Areas, Spa Treatment and the role of Balneotherapy in health tourism to mention some.

European wide:

European Geothermal Energy Council (EGEC):

<http://egec.info/>

The European Geothermal Energy Council has more than 129 members from 28 European countries: private companies, national associations, consultants, research centers, geological surveys and other public authorities. It is a member of EREC, the European Renewable Energy Council, which groups together all of the main European renewable energy industry and research associations. It is also a member of the International Geothermal association (IGA). Its aim is to promote the use of geothermal energy. It holds various ongoing projects at a given time such as Geotrained and GeoElec as well as a number of others.

Geotrained: European wide educational programme

<http://www.geotrained.eu/moodle/mod/resource/view.php?id=133>

Geotrained, Geo-education for a sustainable geothermal heating and cooling market has held various courses in the past such as training for trainers, drillers and designers. Another programme is also in preparation.

GeoElec:

<http://www.geoelec.eu/events/>

A central objective of the GeoElec project is to bring together experts in the geothermal sector in Europe, to access the existing resources and therefore potential for producing geothermal power. Its final course was held in Pisa, in October 2013. The courses aimed to provide a geothermal background to those working in public authorities and the financial sector, and a specialisation for geothermal professionals and employees of the oil/gas/mining sectors.

EFTA:

<http://eeagrants.org/>

The EEA Grants and Norway Grants represent the contribution of Iceland, Liechtenstein and Norway to reducing economic and social disparities and to strengthening bilateral relations with 15 EU countries in Central and Southern Europe.

NORDPLUS:

<http://www.nordplusonline.org/>

The Nordplus Programme is aimed at institutions and organisations in the participating countries that focus mainly on education and lifelong learning. Individuals may not apply for grants directly from Nordplus, but they may take part in activities organised by an organisation or institution.



Figure 3 Nordplus Programme | Information on support by countries

Only participants from the participating countries (Denmark - including Greenland and Faeroe Islands-, Estonia, Finland - including Åland -, Iceland, Latvia, Lithuania, Norway and Sweden) are eligible for financial support from Nordplus. Participants from other countries may take part in programme activities, but are not eligible for financial support from the programme.

The Nordplus Programme also offers a student exchange, which is the Nordic parallel to the Erasmus programme. The programme aims for the Nordic and Baltic countries to be one educational market. This means that students from any of the participating countries can pursue part of their studies, one or two semesters, at another university within the participating countries and get credit for those studies at home.

3. Mobility Programmes

Erasmus:

<http://www.esn.org/content/erasmus-programme>

http://ec.europa.eu/education/lifelong-learning-programme/erasmus_en.htm

The Erasmus Programme is a Student Exchange programme to pursue a part of ones studies, or internship, in a different country within Europe, from 3 – 12 months. It is offered for university students to pursue studies at another university within the programme from one semester to a full year, or for internships. In countries that speak other languages than English, German, French or Spanish there are normally offered language courses before the studies begin.

Erasmus+:

http://ec.europa.eu/programmes/erasmus-plus/index_en.htm

Erasmus+ is a new programme starting in 2014 combining existing EU programmes for education, youth and sports into a comprehensive plan. It provides opportunities for cooperation in education and training abroad, development of education and innovation in practice. The Erasmus+ programme brings together European and national priorities in education and training programmes that it supports. Erasmus+ provides grants in three categories; learning mobility of individuals– travel and subsidence grants, cooperation for innovation and the exchange of good practices – between institutions in two/three countries, and support for policy reform - policy making in education and cooperation with countries outside Europe. Only organisations can apply for grants, not individuals. The exchange grants are meant for students in vocational and higher education for training in the workplace, as well as staff education to learning, training and teaching jobs.

Marie Curie Actions - Research Fellowship Programme:

<http://ec.europa.eu/research/mariecurieactions/>

Marie Curie Fellowships are European research grants available to researchers regardless of their nationality or field of research. In addition to generous research funding scientists have the possibility to gain experience abroad and in the private sector, and to complete their training with competences or disciplines useful for their careers.

There are two categories of researchers:

Early Stage Researcher: Less than 4 years of research experience, and without a doctoral degree

Experienced Researcher: In possession of a doctoral degree or at least 4 years of research experience

Marie Curie Actions in FP7 are:

- **Initial Training Networks (ITN)** - an action providing training opportunities for Early Stage Researchers usually provided by a network of universities, businesses and research institutes;
- **Intra-European Fellowships for Career Development (IEF)** – an individual grant allowing an Experienced Researcher to move within Europe to pursue his/her research project;
- **Career Integration Grants (CIG)** – a lump sum to encourage Experienced Researchers to settle/return in Europe;
- **Co-funding of Regional, National, and International Programmes (COFUND)** – a co-funding mechanism providing an-extra financial support to national, regional research mobility programmes;
- **Industry Academia Partnerships and Pathways (IAPP)** – an action promoting partnership and collaboration between business and academia. Early Stage Researchers, Experienced Researchers, or technical research staff can participate;
- **International Outgoing Fellowships (IOF)** – an individual grant for Experienced Researchers willing to receive a research training in a host institution in a third country (outside Europe);
- **International Incoming Fellowships (IIF)** - an individual grant for Experienced Researchers based in third countries (non-Europeans) willing to receive a research training in a host institution based in Europe;
- **International Research Staff Exchange Scheme (IRSES)** – a staff exchange scheme fostering collaboration between research institutions based in Europe and in Third countries.

COST:

<http://www.cost.eu/>

COST (European Cooperation in Science and Technology) is one of the longest-running European frameworks supporting cooperation among scientists and researchers across Europe.

As a precursor of advanced multidisciplinary research, COST plays a very important role in building a European Research Area (ERA). It anticipates and complements the activities of the EU Framework Programmes, constituting a “bridge” towards the scientific communities of emerging countries. It also increases the mobility of researchers across Europe and fosters the establishment of scientific excellence in nine key domains.

Scientists and researchers in COST Member Countries can participate in COST-funded science and technology networks - known as COST Actions - in two ways. Submitting a proposals for a new COST Action or Joining an existing COST Action of their interest.

COST Actions are innovative and often interdisciplinary scientific networks. COST does not fund the research in itself. COST Actions contribute to the scientific, economic, cultural or societal development of Europe, by supporting networking activities such as meetings, conferences, short term scientific exchanges and outreach activities.

4. International Geothermal Education Opportunities

The International Geothermal Associations:

Global Geothermal Courses:

http://www.geothermal-energy.org/publications_and_services/global_geothermal_courses.html

Geothermal conferences & Events:

http://www.geothermal-energy.org/publications_and_services/global_geothermal_courses.html

The International Geothermal Association holds conferences and has a detailed list of Geothermal activities going on in the world.

IRELP:

<http://www.irelp.org/>

IRENA Renewable Energy Learning Partnership (IRELP) website has a list of geothermal courses.

5. North America:

Mexico:

IIE, Institute of Electrical Investigations, Cuernavaca:

<http://vmw11.iie.org.mx/sitioIIE/sitio/indice.php>

The Institute of Electrical Investigations offers a Diploma in Chemical and Isotopic Geochemistry and Geothermal Reservoir Engineering.

United States of America:

Geothermal Energy Association:

For training and educational opportunities in the United States of America see the website of the Geothermal energy association, here:

<http://geo-energy.org/reports/2011GEAGeothermalEducationandTrainingGuide.pdf>

Geothermal Resources Council (U.S.A.)

Workshops: <http://www.geothermal.org/workshops.html>

The GRC develops and convenes special meetings, workshops, conferences, courses, and symposia on a full range of subjects pertaining to geothermal exploration, development, and utilisation. Specific topics have included: Drilling, Economics, Environmental Aspects, Financing, Geochemistry, Geology, Geophysics, Heat Pumps, Legal Aspects, Management, Non-Electric Uses and Reservoir Engineering. The GRC also periodically schedules a basic Introductory Course on Geothermal Energy.

Geothermal Training Institute, Maple Plain:

Certified GeoExchange Designer:

http://www.geotrainers.com/15E-Course-Certified_GeoExchange_Designer_Classroom.htm

Thermal Conductivity Testing Boot Camp:

http://www.geotrainers.com/5-Course-Thermal_Conductivity.htm

Accredited Installer/Driller Course:

http://www.geotrainers.com/4-Course-IGSHPA_Installer.htm

Software Training for Loopfields and Piping Design:

http://www.geotrainers.com/12-Course-Software-GLD_Loopfields_Piping_Design_Online.htm

The Geothermal Training Institute offers a certificate as a GeoExchange Designer – IGSPHA CGD Plus which offers courses with topics such as Introduction to Commercial Geothermal System Design, Feasibility of Geothermal System (Energy Modelling, Mechanical System, Site Geology, Preliminary Ground Heat Exchanger Model, Economics), Confirmation of Feasibility, System Design, Ground Heat Exchanger Design, Mechanical System Design, Specifications and documentation, Design Implementation (Construction, Quality Assurance/Quality Control, Commissioning/Owner Training).

The Geothermal Training Institute also offers Thermal Conductivity Testing Boot Camp with Conductivity Test and Equipment Overview, Review of Pre-test Checklists, Test Setup, Testing Procedure, Test Takedown, Data Analysis and Report Generation. The Institute offers both Accredited Installer Course and Accredited Driller Course as well, and courses include GeoExchange Introduction & Overview, Economics, Marketing & Demand Reduction, Soil and Rock Identification; Thermal Conductivity, Selecting, Sizing and Designing the Heat Pump System, Designing the Ground Heat Exchanger, Grouting Procedures for Vertical Ground Heat Exchangers, Installing the Ground Heat Exchanger, Pipe Joining; fusion, Flushing, Purging and Flow Testing the Heat Pump System, Heat Pump System Start-up and checkout, Project Costing and bidding for GeoExchange Drilling.

The Geothermal Training Institute also offers Software Training for Loopfields and Piping Design (Online Course) which includes courses of Loopfield system, Piping Configuration and Exercise Lab w/ Student Data and Examples.

International ground source heat pump association (IGSHPA), Stillwater:

NATE Certified, Accredited installer Workshop:

<http://www.igshpa.okstate.edu/training/accredited.htm>

Accredited drillers Training: <http://www.igshpa.okstate.edu/training/drillers.htm>

Certified GeoExchange Designer course: <http://www.igshpa.okstate.edu/training/cgd.htm>

The International Ground Source Heat Pump Association offer a NATE certified Accredited Installer Workshop with courses such as Design and Material Options, System Layout, Pipe Joining Techniques, Trenching/Drilling Processes, Air and Debris Purging, Pressure Drop Calculations, Pump and Fluid Selection and Thermal Conductivity. It also offers a certificate in Accredited Drillers Training – applications of Production Drilling and Borehole Construction for GeoExchange. With courses such as GSHP System Design and Layout Basics, System Materials, Pressure Drop Calculations, Thermal Conductivity, Drilling Pressure, Containment Procedures, Grouting Concepts, Air and Debris Purging, Pipe Joining Techniques, Project Bidding and Partnerships. The Association also offers a AEE Certified GeoExchange Designer Course which offers for example courses on Well Design, Construction and Geology, Geothermal Plants, turbines and Generators, Fluids, Piping, Valves and Pumps, Environmental Regulations for Geothermal Plant Operators and Fundamentals of Process Controls.

Gateway Technical College, Kenosha:

<http://www.gtc.edu/air-conditioning-heating-and-refrigeration-technology-geothermal-technician>

The Gateway Technical College offers an AAS (Associate of Applied Science) in Air Conditioning, Heating and Refrigerator Technology – Geothermal Technician. And courses such as GeoExchange Site Safety, Geological Formations for Drillers, Geo site, Rotary: Mud Boring Applications, Rig transport, Set-up, and Safety

6. South America

Chile:

Technical University Federico Santa María, University of Chile:

<http://www.geologia.uchile.cl>

Department of Geology of the Faculty of Physical and Mathematical Sciences at The Andean Geothermal Centre of Excellence (CEGA) at the Technical University Federico Santa María offers both undergraduate and master's in Geology. The course offers topics such as Geodynamic Processes in Subduction Environment, Principles of Geothermal, Geothermal Geochemistry, Energy Geological Processes, Geothermal, Physical Volcanology and Hydrogeology.

University of Chile:

<http://www.cega.ing.uchile.cl>

The Andean Geothermal Centre of Excellence (CEGA) at the University of Chile, Santiago offers undergraduate, masters and PhD on Geothermal, Geology, Geological Engineering and Geophysics. The programme offers courses in Magmatic Systems, Heat-water-rock interaction, Fluids Geochemistry, Reservoir architecture and geofluids dynamics, geophysics, Surficial processes and environmental impact, Structural geology and Tectonics.

El Salvador:

University of El Salvador:

<http://www.geotermia.edu.sv/>

The University of El Salvador in association with the National Energy Board of El Salvador (CNE) offers Geothermal courses for Latin America and the Caribbean as a Geothermal training center. Three level specialisation courses are offered. The Nordic Development fund (NDF) co-financing the establishment of a Regional Geothermal Training Centre in El Salvador together with the InterAmerican Development Bank. The other project partners include the Salvadoran National Energy Council, University of El Salvador and the geothermal power company LaGeo. The United Nations University's Geothermal Training Programme from Iceland has outlined the curriculum and made proposals how to organise the training. As the first training activity, the University of El Salvador will implement a five-month training course in geothermal energy.

7. Asia and Australia:

Australia:

University of Adelaide:

<http://www.adelaide.edu.au/geothermal/>

The University of Adelaide instituted the South Australian Centre for Geothermal Energy Research (SACGER), in mid-2010. It **researches enhanced (engineered) geothermal systems and power**

systems to improve the economic and environmental delivery of geothermal energy. This research offers widespread benefits for industry, the community and the environment. The project is funded through the State Government's Renewable Energy Fund and intends to focus on EGS and geothermal power systems. Research is broadly categorised in terms of geothermal exploration, geothermal reservoir modelling, and geothermal reservoir stimulation. Areas include Geophysical tools, fluid rock interactions, fracture modelling and crustal stress characterisation. The University also offers a number of degree programmes which include instruction on geothermal.

Japan:

Akita University:

<http://www.eng.akita-u.ac.jp/eng/>

Department of Earth Science and Technology at the Graduate School of Engineering and Resource Science at Akita University offers postgraduate programmes in Applied Earth Sciences and Geo-Engineering. The Akita University offers courses such as Geothermal Geology, Petroleum and Geothermal Engineering.

Kyoto University, Beppu:

<http://www.vgs.kyoto-u.ac.jp>

Institute for Geothermal Sciences at the Faculty of Science within the Graduate School of Science at Kyoto University offers a PhD degree in Research Section for Geothermal Fluids, Geothermal Tectonics, Volcanic Structure and Volcano-dynamics.

Kyushu University, Fukuoka:

<http://www.q-eaep.kyushu-u.ac.jp/training/en/>

Department of Earth Resources Engineering of the Graduate School of Engineering at the Kyushu University offers a PhD degree as an International Special Course on Environmental Systems Engineering with topics such as Geothermics, Geothermal Reservoir Engineering, Ground Control Engineering and Geotechnical Hazards.

Kumamoto University, Kumamoto:

Master's:

http://www.gsst.kumamoto-u.ac.jp/en/program/masters_c/masters_c_civil_environmental.html#04

PhD:

http://www.gsst.kumamoto-u.ac.jp/en/program/doctoral_c/doctoral_c_computer_science.html#02

Department of Life and Environmental Sciences of the Graduate School of Science and Technology at Kumamoto University offers a master's degree in Civil and Environmental Engineering with courses on Advanced Geotechnical Engineering and Advanced Geoenvironmental Engineering.

Department of Frontier Technology and Department of Life and Environmental Sciences at the Graduate School of Sciences and Technology at Kumamoto University offers a PhD in Computer Science and Electrical Engineering with courses such as Renewable Energy Engineering, Power Electronics and Theory of Electric Devices.

Tohoku University, Sendai:

<http://www.kankyo.tohoku.ac.jp/en/kyoiku.html>

The Graduate School of Environmental Studies at Tohoku University offers a master's and PhD degree in Geosystem and Energy Sciences. At the master's level the University offers courses in Introduction to Geosystem and Energy Sciences, Surface and Subsurface Measurements for Environmental Science, Environmental Geomechanics, Design of Crustal Complex Fracture Systems, Geothermal Energy Extraction Engineering, Seminar on Geosystem and Energy Sciences, Master Source Seminar on Geosystem and energy Sciences. And at the doctoral level there are courses such as Advanced Environmental Studies on Geothermal Energy, Advanced Surface and Subsurface Measurements for Environmental Science as well as Advanced Seminar on Geosystem and Energy Sciences.

Indonesia:

Gadjah Mada University, Yogyakarta:

Degrees: <http://geologi.ugm.ac.id>

Without degree: <http://www.ft.ugm.ac.id>

Department of Geological Engineering within the Faculty of Engineering at Gadjah Mada University offers undergraduate, master's and PhD degrees in Geological Engineering with major in Energy Resources (special papers and thesis on Geothermal Geosciences) and Mechanical Engineering with major in Energy Conversion (special papers and thesis on Geothermal Technology). It also offers short courses without degree on Geothermal Geosciences and Technology, with such topics as 3-D Modelling Geothermal System, Basic Geothermal Geosciences & Engineering, and Geothermal Reservoir Characterisation.

New Zealand:

University of Auckland:

Postgraduate Diploma in Geothermal Energy Technology:

<http://www.engineering.auckland.ac.nz/en/for/futurepostgraduates/fp-study-options/fp-applying-for-a-postgraduate-certificate/pgcertgeothermtech.html>

Geology

Courses:

<http://www.env.auckland.ac.nz/uoa/home/about/our-postgraduate-courses/pg-geology-courses>

Master's of energy degree:

<http://www.engineering.auckland.ac.nz/uoa/master-of-energy>

Department of Engineering Science of the Faculty of Engineering at the University of Auckland offers Postgraduate Diploma in Geothermal Energy Technology; PGCertGeotherm (Post Certificate in Geothermal Energy), ME (Master of Engineering) and PhD. The Department offers courses in Geothermal Science and Technology, Geothermal Engineering, Geothermal Geoscience and Geothermal Field Studies.

The Faculty of Science of the School of Environment at Auckland University offers undergraduate, master's, Postgraduate Diploma of Science (PGDipsci) and PhD in Geothermal geology and

Geochemistry. The Faculty of Science offers such courses as Geothermal Geology and Geochemistry and Analysis Techniques in Engineering Geology.

The Faculty of Engineering, Science and of Business and Economics jointly offer a master's degree of Energy, this is a professional-level degree that covers aspects of science, engineering and energy economics related to renewable energy including a specialisation in geothermal. Other specialisations include wind energy and petroleum. Courses in this programme are such as Geothermal Resources and their use, Geothermal Energy Technology, Geothermal Exploration and Geothermal Engineering.

Institute of Earth Science and Engineering, University of Auckland:

<http://www.iese.co.nz/>

The IESE of The University of Auckland, New Zealand is a research and development organisation which specialises in geothermal exploration, microseismic monitoring, borehole instrumentation and geothermal short course training. It is also a recognised leader in research on volcanic and seismic geo-hazards and the environment, using their expertise in commercial research projects and consulting for geothermal energy development. The Geothermal Institute offers a Geothermal Reservoir Engineering and Modelling Research Group, GEOFLUIDS Research Group and an Annual meeting; New Zealand Geothermal Workshop, but also Geothermal Qualifications and Short Courses. Each year, the Institute of Earth Science and Engineering (IESE) coordinates short courses on various geothermal topics including: geothermal exploration, reservoir engineering and monitoring, power stations, steam-field layout and design, and environmental aspects. The Geothermal Institute also offers a Postgraduate Certificate of Geothermal Technology, Master of Energy – specialist study of energy, Master of Engineering – topics available in many branches of Geothermal Engineering, Master of Science - an opportunity to undertake advanced study and independent research in an area of interest (applied geology, geophysics) and a PhD with a wide range of topics available in geothermal science technology.

Philippines:

Bicol University, Legazpi City:

<http://www.bicol-u.edu.ph/index.php?option=3&taskid=18&subcat=4>

Bicol University offers an undergraduate Bachelor of Science degree in Geothermal Engineering through the College of Engineering.

Negros Oriental State University:

http://www.norsu.edu.ph/system/cea_geothermal.php

Negros Oriental State University offers an undergraduate degree in Geothermal Engineering through the College of Engineering and Architecture. Sub Chapter 2.1



Geothermal ERA-NET

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