

# Education and research - Geothermal Institute: current trends and its reality

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# Geothermal Education

Institution	Country	Year Started	Year Stopped	Duration (months)	Funding support
Pisa	Italy	1970	1985	8	United Nations Development Program (UNDP).
		1985	1992	9	UNESCO
Kyushu	Japan	1970	2001	2 – 4	UNDP
		2016	Continuing	6	The government of Japan (JICA)
Auckland	New Zealand	1978	2002	9	UNDP and MFAT Scholarships (varying number over the years)
		2007	Continuing	4	Employer-funded students Self-supported students
Reykjavik	Iceland	1979	Continuing	6	UNDP and the Icelandic geothermal industry (UNU-GDP) Employer-funded students



# Geothermal Earth Science





# Geothermal Engineering

# Other geothermal training programmes



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China, Chile, Croatia, El Salvador, Germany-Netherlands, Hungary, Indonesia, Japan, Kenya, Philippines, Poland, Switzerland, Turkey, Romania, Mexico and USA with full or partial geothermal focus offered at undergraduate and postgraduate level within different education programs (geology, geophysics, environmental science, petroleum engineering and mechanical engineering) .

# Other geothermal training programmes



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- Some of these courses are taught in the local language (not English) which means that they are mainly attended by domestic students.
- Several universities and research institutions offers geothermal energy research (not taught) at Masters (MSc) and PhD levels. However, from our experience, MSc and PhD graduates will not grasp the full picture of geothermal energy resources and technology from carrying focused research only, due to the interdisciplinary nature of this industry.

# The Challenge

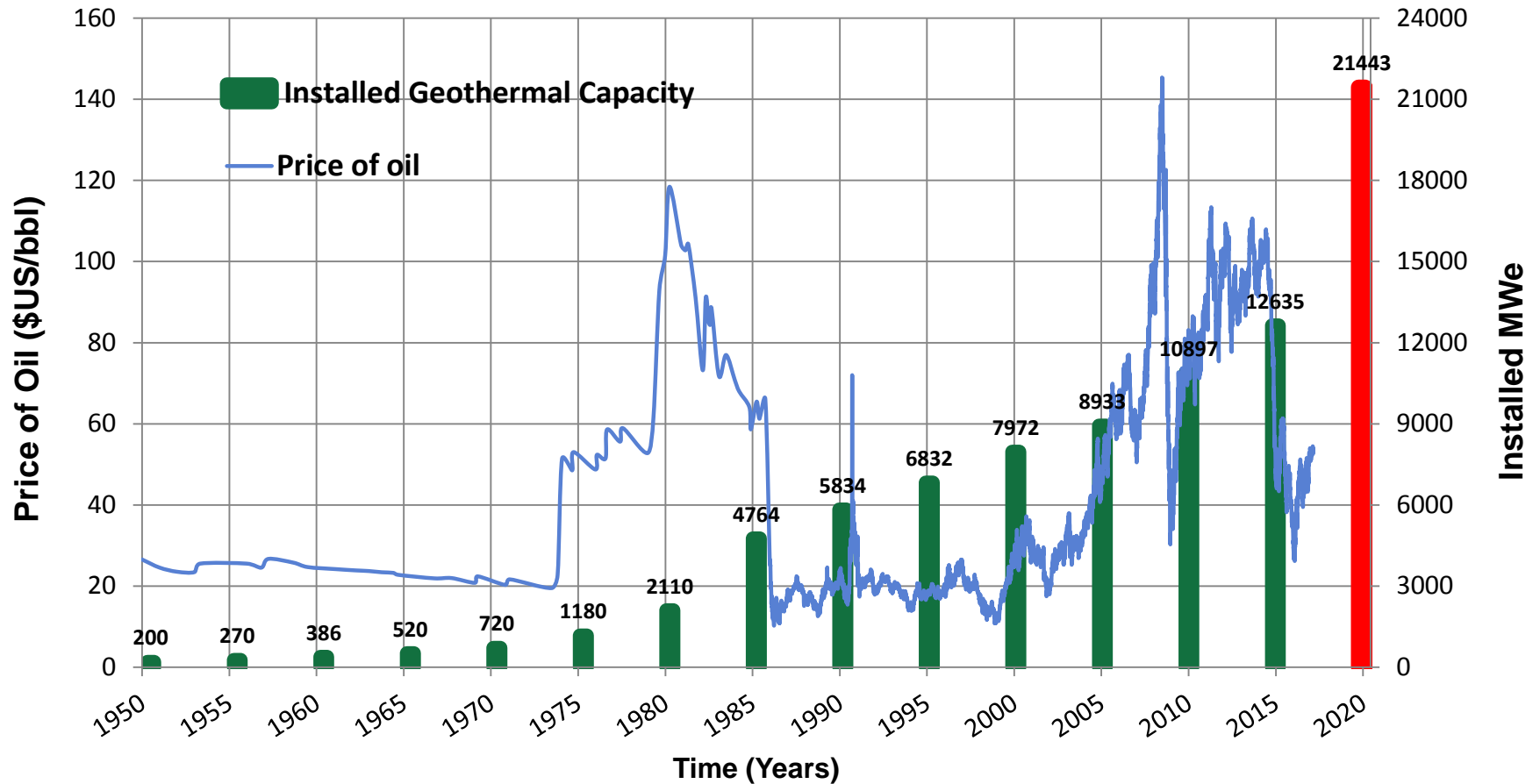


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Experience has shown that it is difficult to sustainably run geothermal energy education programmes as a stand-alone and self-supporting program without external funding. This due to:

- High overhead and running costs,
- Changing demand for graduates,
- Limited employment opportunities,
- Limited number of interested students as well as the fact that most interested students come from developing countries where they do not have access to funding.

# Geothermal Energy and the price of Oil



Zarrouk (2017)



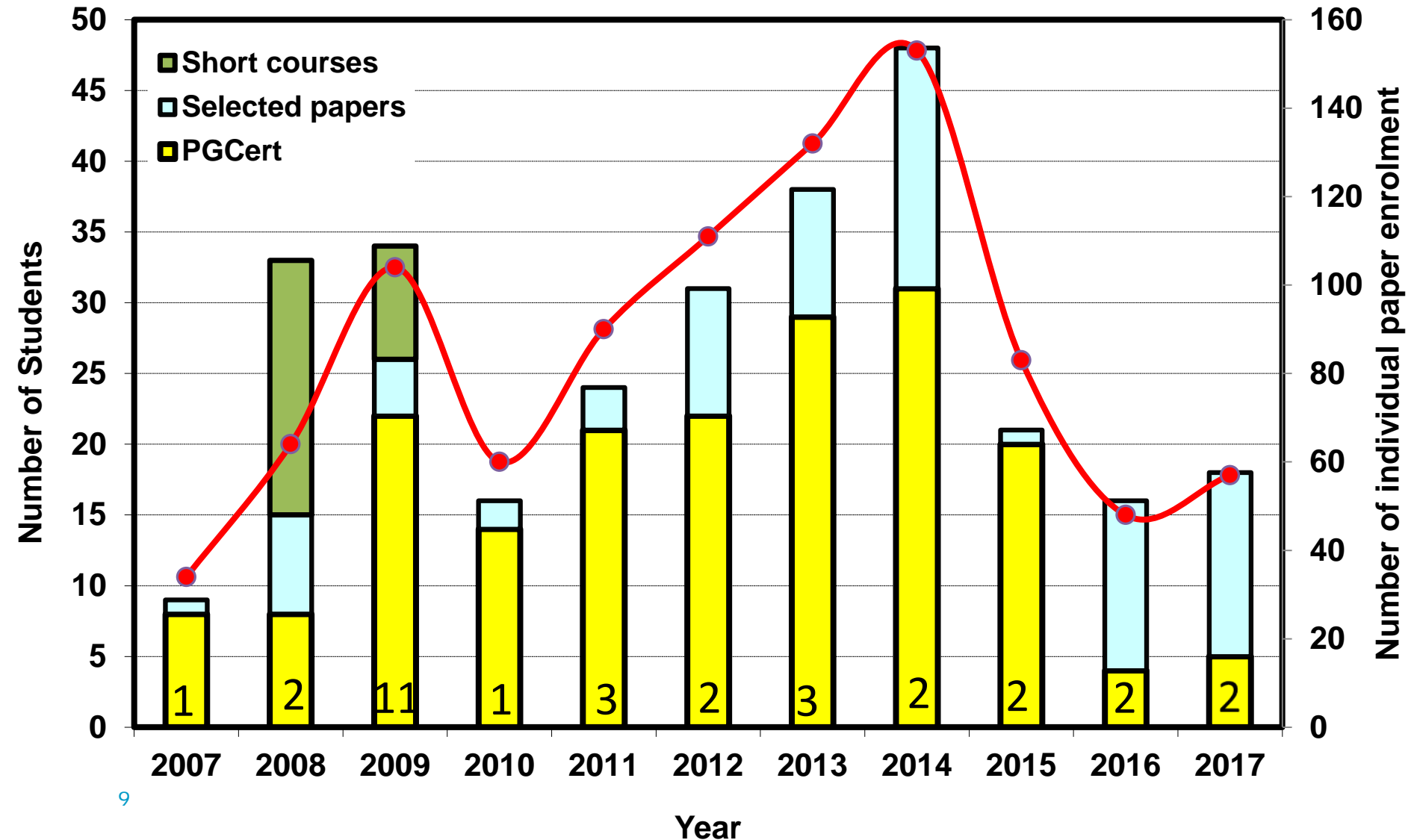


GEOTHERMAL  
INSTITUTE

# Enrolment in the PGCert course



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# Education facts and trends



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- Post Graduate Diplomas are no longer of interest to students and are being phased out from many universities.
- Post Graduate Certificate courses are short in duration allowing students to go back to employment in ~4 months, but they are not a Masters degrees.
- It is the era of the (12-18 months) taught Masters.

# Conclusions



- The current worldwide slowdown in the geothermal industry is reflected in the declining number of students in the past two years. It will likely to last until ?
- Measures are in place to run one of the elective courses every other year to reduce overhead if the demand continues to fluctuate in the future.
- As long as most of the teaching is carried out by the course's academic staff, it will remain sustainable and viable to run despite the ever evolving energy market.

# Support from the New Zealand Geothermal Industry



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**JACOBS**



Andy Bloomer



# Geothermal Research



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- Geothermal research requires: funding, access to field data and laboratories.
- Traditionally the research work done in the Geothermal Institute is through collaboration with the Industry through students projects (mainly Diploma and PGCert Projects), also Masters and PhD work. These are mainly done through in-kind support, covering costs and expenses (no money exchange hands) bases.



# Geothermal Research

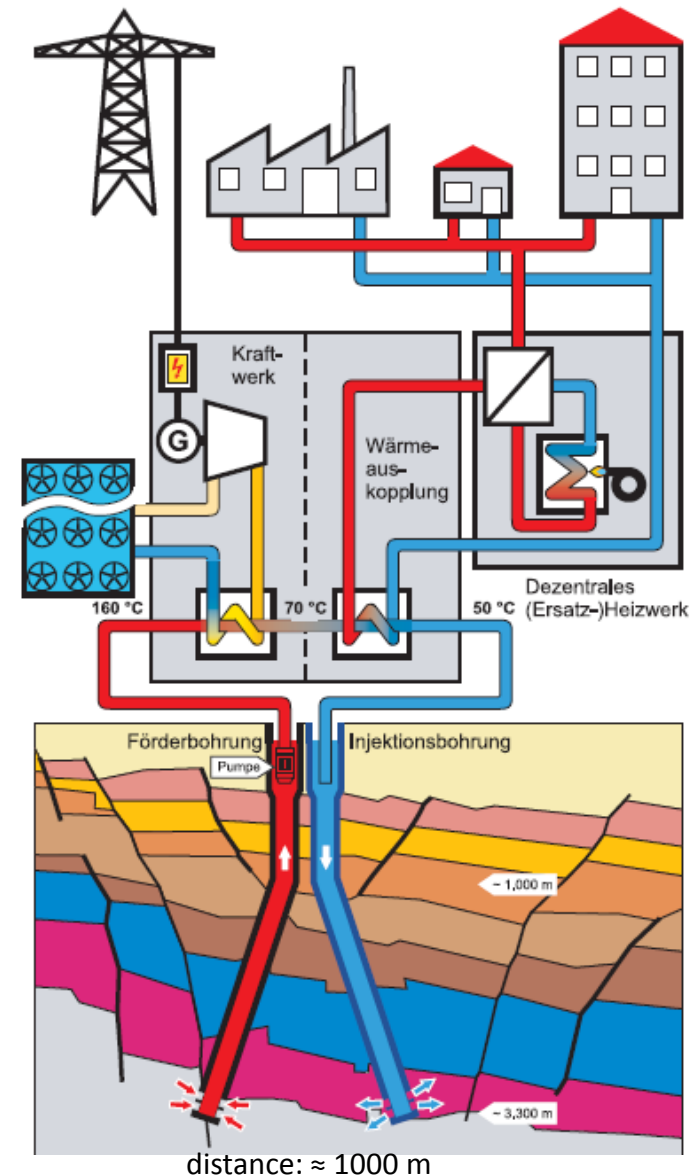


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- The focus has always been on conventional high temperature geothermal systems and the associated technology.
- The NZ Geothermal Research Setting is interesting.
- Currently we are more and more under pressure to bring research funding, paid consultancy work and apply for research grants.

# Current trends in Research in Europe

Low temperature  
Advective, Sedimentary  
basins, EGS and **SEGS**  
systems for both Direct  
use and Binary plants.



# Permeability Enhancement

Permeability Enhancement of tight EGS rock using water jet, laser and plasma technology.



# Direct use

- Ground source Heat Pump
- Down hole heat Exchangers



# Drilling Technology



Non-metallic coil  
tubing drilling





# Drilling Technology for Deep Hard Rock



# Challenge



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- Difficult to break into the European Geothermal research market, but possible.
- This can be done through offering short courses and consultancy services mainly in Reservoir Engineering (Well testing, completion and Stimulation).

# Recommendation Go Europe



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