

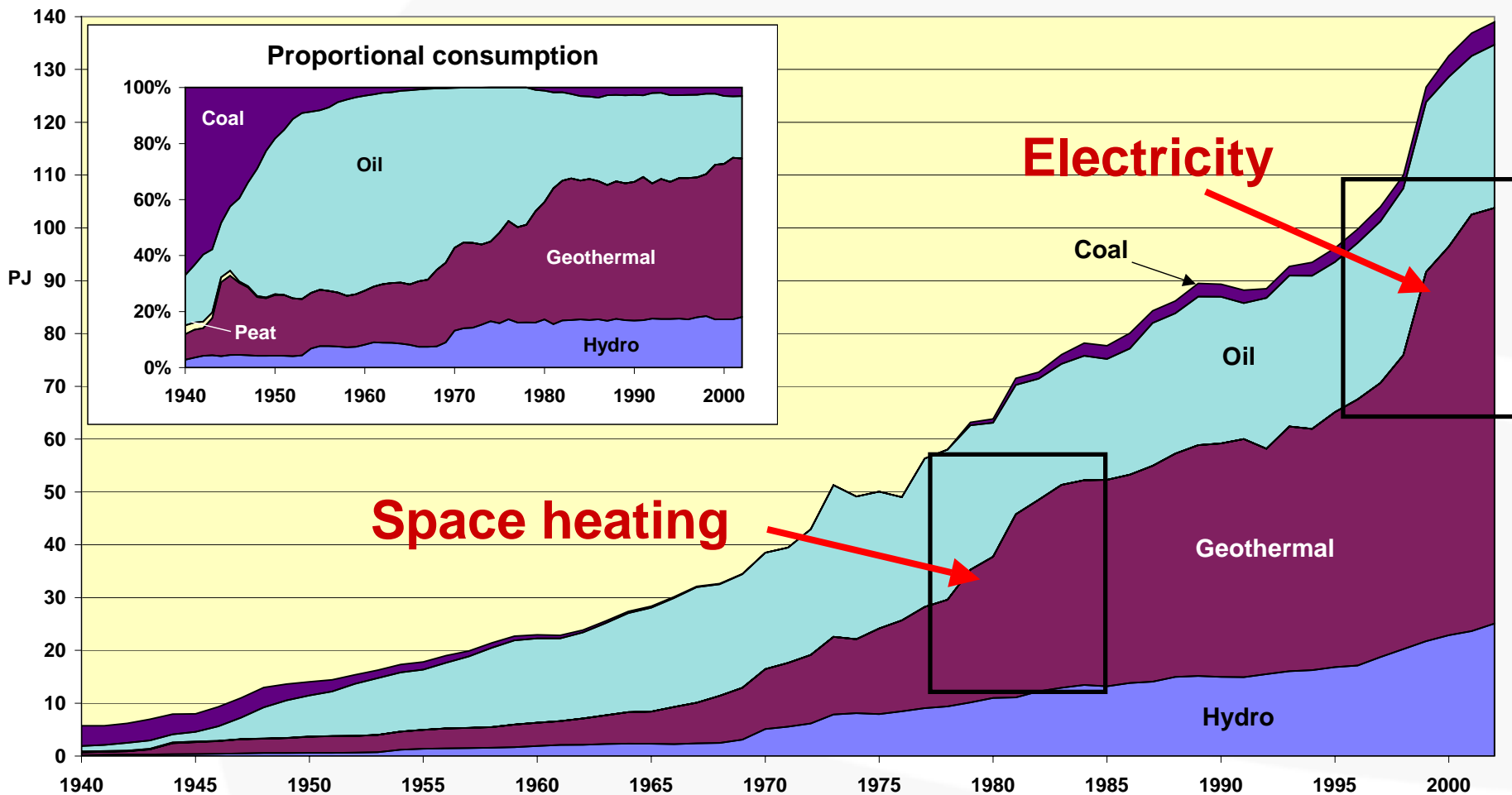


# Dissemination of Geothermal Knowledge at ÍSOR

Ólafur G. Flóvenz  
Brynja Jónsdóttir



# Primary energy consumption in Iceland 1940-2002



# Steps in the geothermal evolution in Iceland:



- 1930-1970: The learning phase. Solving technical problems and gain public acceptance for space heating by geothermal energy
- 1970-1980: Fossil fuel replaced by geothermal in the space heating sector – a major step forward
- 1980-1995: The space heating sector saturated –slow increase in geothermal for electricity and industrial use. General low confidence in geothermal for electricity. Learning period and promotion activity
- 1996-2006. Big steps forward in electricity production from geothermal. Two new power plants, 90 MW and 100MW on-line in 2006. Rapid progress

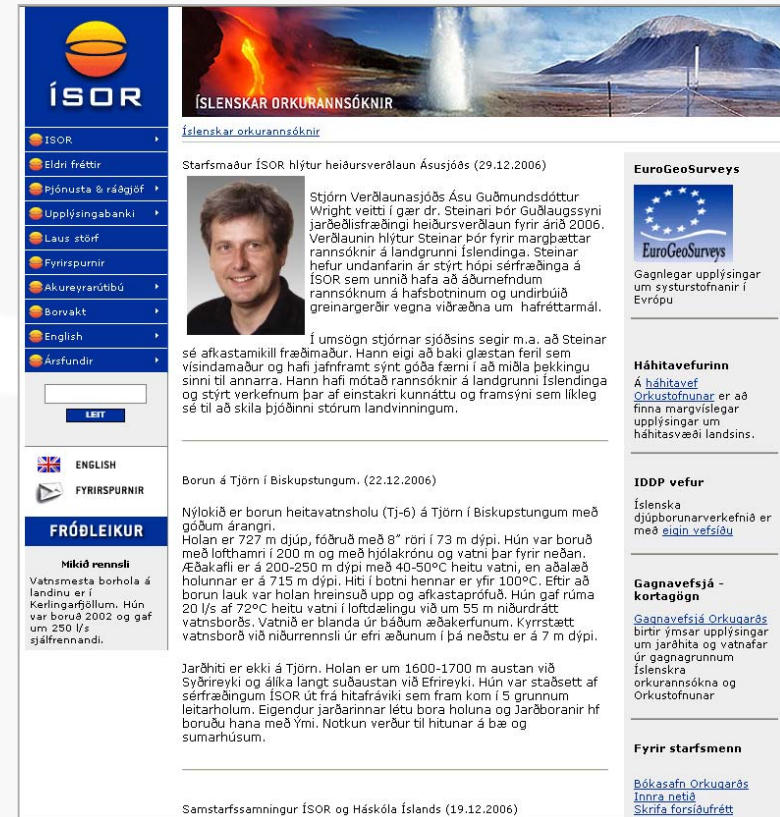
# Dissemination of geothermal knowledge

## Within Iceland

- Web-based activities
  - web-page ÍSOR
  - the geological data viewer named “Gagnavefsja”
- Participation in meetings
- Printed material
- Teaching activities

## Outside Iceland

- UNU Geothermal training programme
- Development aid
- International organisations
- Governmental activities



The screenshot shows the ÍSOR website interface. At the top left is the ÍSOR logo. Below it is a navigation menu with items like 'ÍSOR', 'Eldri fréttir', 'Þjónusta & ráðgjöf', 'Upplýsingabanki', 'Laus stöf', 'Fyrirspurnir', 'Akureyrardíbú', 'Borvakt', 'English', and 'Ársfundir'. A search bar is present below the menu. The main content area features several news items:

- Íslenskar orkurannsóknir**: Starfsmaður ÍSOR hlýtur heiðursverlaun Ásusjóðs (29.12.2006). A photo of Steinar Þór Guðlaugssyni is shown. Text: Stjórn Verðlaunastofnunar Ásu Guðmundsdóttur Wright veitti í gær dr. Steinari Þór Guðlaugssyni jarðeðlisfræðingi heiðursverlaun fyrir árið 2006. Verðlaunin hlýtur Steinar þór fyrir margbættar rannsóknir á landgrunni Íslendinga. Steinar hefur undanfarin ár stýrt hópi sérfræðinga á ÍSOR sem unnið hafa að áðurnefndum rannsóknum á hafsbotninum og undirbúið greinargerðir vegna viðræðna um hafreittarmál.
- Borun á Tjörn í Biskupstungum**: (22.12.2006). Nýjokið er borun heitvatnsholu (Tj-6) á Tjörn í Biskupstungum með göðum árangri. Holan er 727 m djúp, fódruð með 8" röri í 73 m dýpi. Hún var boruð með lofthamri í 200 m og með hjóla krónu og vatni þar fyrir neðan. Æðakafli er á 200-250 m dýpi með 40-50°C heitu vatni, en aðalæð holunnar er á 715 m dýpi. Hiti í botni hennar er yfir 100°C. Eftir að borun lauk var holan hreinsuð upp og afkastaprófuð. Hún gaf rúma 20 l/s af 72°C heitu vatni í loftdælingu við um 55 m niðurdrátt vatnsborðs. Vatnið er blanda úr báðum æðakerfunum. Kyrnstætt vatnsborð við niðurrennsli úr efn æðunum í þá neðstu er á 7 m dýpi.
- Mikið rennsli**: Vatnsmesta borhola á landinu er í Ketlingarfjallum. Hún var boruð 2002 og gaf um 250 l/s sjálfrennsandi.

On the right side, there are links to external resources: EuroGeoSurveys, Háhitavefurinn, IDDP vefur, and Gagnavefsjá - kortagögn.



# Geological data viewer “Gagnavefsja”

- It is operated in close co-operation with the National Energy Authority (NEA).
- It contains an open internet access to large parts of NEA’s and ISOR’s data bases on geology and energy issues in Iceland.



# Geological data viewer “Gagnavefsja”

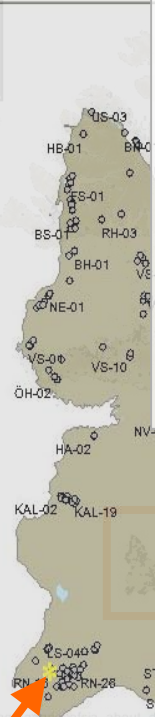
- It serve different user groups
  - External version:
    - The public
    - Power companies and contractors
      - Password protected access to proprietary data and publications
  - Internal version:
    - Scientists at ISOR
      - Overview of available data and access to database, input and output of data and primary processing
  - English version



Titill	Höfundar	OS-Númer	Útgáfudags.	Blaðiður	Skýrsla
Fyrstu niðurstöður varðandi efnasamsetningu jarðhitavökvu úr holu RN-10 á Reykjanesi	Magnús Ólafsson	MÓ-2002/06	02-09-2002	6	
Reykjanes RN-10. Borun 1. og 2. áfangi. Áfangaskýrsla	Guðmundur Ómar Friðleifsson, Benedikt Steingrímsson, Bjarni Richter, Guðlaugur Hermannsson, Hjalti Franzson, Kjartan Birgisson, Sigvaldi Thordarson, Sverrir Þórhalsson, Dagbjartur Sigursteinsson	OS-99003	JAN 1999	32	
Reykjanes. Hóla RN-10. Borun 3. áfangi. Áfangaskýrsla	Hjalti Franzson, Benedikt Steingrímsson, Guðlaugur Hermannsson, Guðmundur Ómar Friðleifsson, Kjartan Birgisson, Sigvaldi Thordarson, Sverrir Þórhalsson, Dagbjartur Sigursteinsson	OS-99015	MAR 1999	21	
Reykjanes. Rannsóknir á vökvabólum í útfellingum í holum RN-9 og RN-10	Hjalti Franzson	OS-2000/021	APR 2000	20	<a href="#">Sækja</a>
Reykjanes - hóla RN-10: borun og rannsóknir. Lokaskýrsla	Hjalti Franzson, Sigvaldi Thordarson, Grímur Björnsson, Steinar Þór Guðlaugsson, Bjarni Richter, Guðmundur Ómar Friðleifsson, Sverrir Þórhalsson	OS-2001/066	NOV 2002	144	<a href="#">Sækja</a>
Háhitakerfið á Reykjanesi : jarðfræði- og jarðhitalkan	Hjalti Franzson	ÍSOR-2004/012	MAY 2004	70 s. : myndir, toflur, linurit	

Gagnavefsíja

ABOUT DATA | COMMENTS | HELP



Myndir



Borholumælingar fyrir mælistað

Dagsetning	Texti
31. janúar 2006	Ljósmyndun
30. janúar 2006	Ljósmyndun
4. september 2003	Þrýstingur (Bar-y)
4. september 2003	Þrýstingur (Bar-y)
4. september 2003	Þrýstingur (Bar-y)
4. september 2003	Þrýstingur (Bar-y)
4. september 2003	Hiti (°C)
5. júní 2003	Hiti (°C)
3. febrúar 2003	Hiti (°C)
8. janúar 2003	Hiti (°C)
8. janúar 2003	Hiti (°C)
8. janúar 2003	Hiti (°C)
8. janúar 2003	Hiti (°C)
23. janúar 2002	Þrýstingur (Bar-y)
17. janúar 2002	Löðun
17. janúar 2002	Þrýstingur (Bar-y)
17. janúar 2002	Hiti (°C)
17. janúar 2002	Hiti (°C)
17. janúar 2002	Hiti (°C)
14. janúar 2002	Þrýstingur (Bar-y)
13. mars 2001	Þrýstingur (Bar-y)
13. mars 2001	Hiti (°C)
28. desember 1999	Þrýstingur (Bar-y)
28. desember 1999	Hiti (°C)
18. ágúst 1999	Vatnsborð (m)
12. apríl 1999	Þrýstingur (Bar-y)
12. apríl 1999	Hiti (°C)
15. mars 1999	Þrýstingur (Bar-y)
15. mars 1999	Hiti (°C)

ORKUSTOFNUN  
Rannsóknasvið

Vækkir: 8463095

1600x1200 - 205k

Hjalti Franzson, Sigvaldi Thordarson, Grímur Björnsson, Steinar Þór Guðlaugsson, Bjarni Richter, Guðmundur Ómar Friðleifsson, Sverrir Þórhalsson

Reykjanes - Hóla RN-10 Borun og rannsóknir

Lokaskýrsla

Unnið fyrir Hitaveitu Suðurnesja

OS-2001/066

ISBN 9970-66-128-8

November 2002

ORKUSTOFNUN - RANNSÓKNAEVIÐ

Reykjavík: Grandvegur 5, 108 Rík. - Sími: 563 8000 - Fax: 569 8886  
Árangi: Hlíðvegur 2, Álftveit, Seltúnir & Þorlákshöfn, 520 Rík. - Sími: 493 0559 - Fax: 493 0560  
Netfang: orku@is.oru.is - Vefling: http://www.is.oru.is

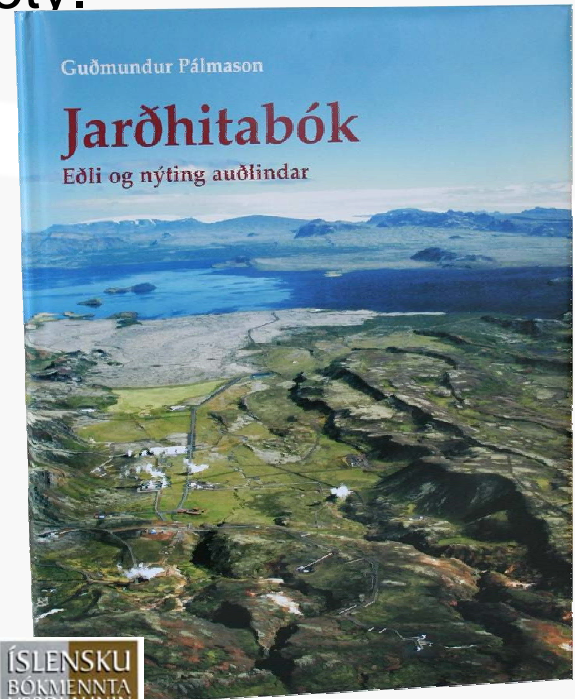


From: Steinunn Hauksdóttir

ICELAND GEOSURVEY

# Printed material

- Publications of printed material, books and newspaper articles and radio & TV interviews are widely used to make the public aware of the possibilities and importance of geothermal in our society.
- ISOR and NEA issued last year a comprehensive book of the geothermal sector in Iceland.
  - history
  - technical aspects
  - development
- This book was last year appointed to the national price for excellent books.





# Teaching activities

- ISOR's staff participates each year in numerous conferences and open meetings in local societies, clubs and organisations.
- ISOR has good relation to universities and high schools where our experts held give lectures, and supervise students in research projects.

The Rector of the University of Iceland and Director of ÍSOR signed a new co-operation contract last year.





# Dissemination of geothermal knowledge

## Outside Iceland

- Education
- Development aid
- Participation in international organizations
- Meetings and conferences and publication of scientific papers on geothermal energy
- Assist our ministries in their dissemination activities abroad
- United Nations University Geothermal Training Programme (UNU-GTP)

# United Nations University Geothermal Training Programme (UNU-GTP)

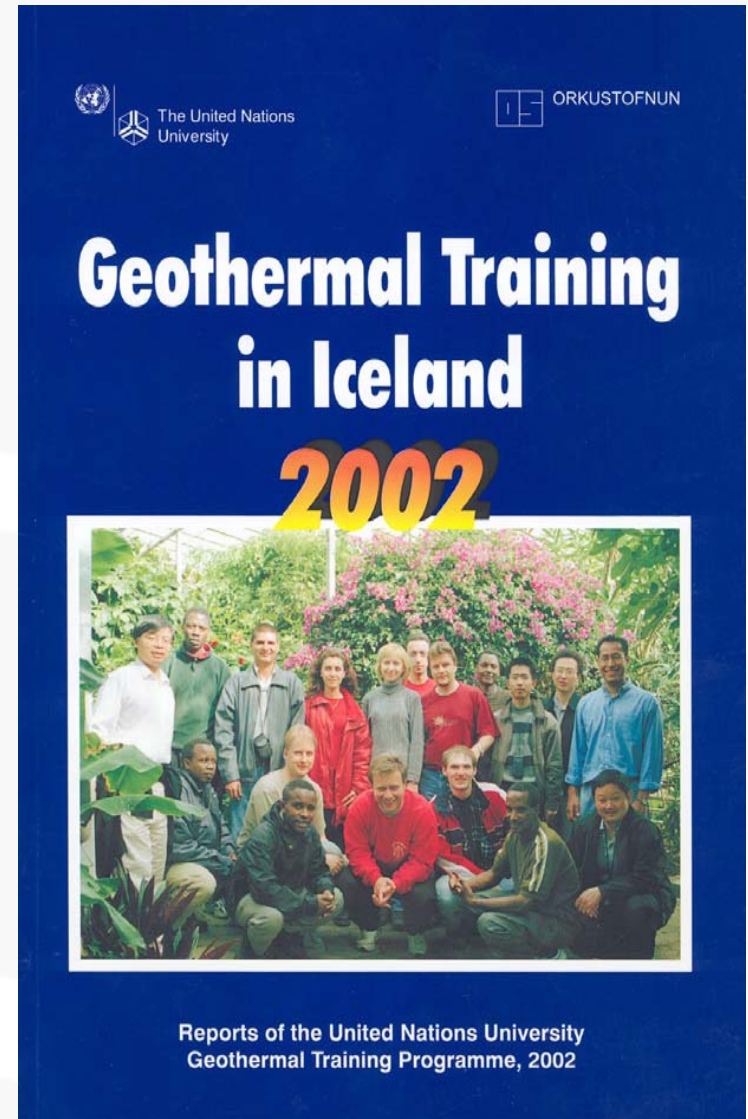


- The UNU-GTP has been run in Iceland since 1979.
- It is financed mainly by the Icelandic ministry of foreign affairs.
- It is run by NEA but 60-70% of the training is provided by ISOR.
- Yearly over 20 geothermal fellows from the developing countries participate in a 6 month intensive geothermal course in Iceland.
- 3 month courses and 3 months of research projects
- 6-9 fellows complete a 2 year MSc studies in geothermal sciences.

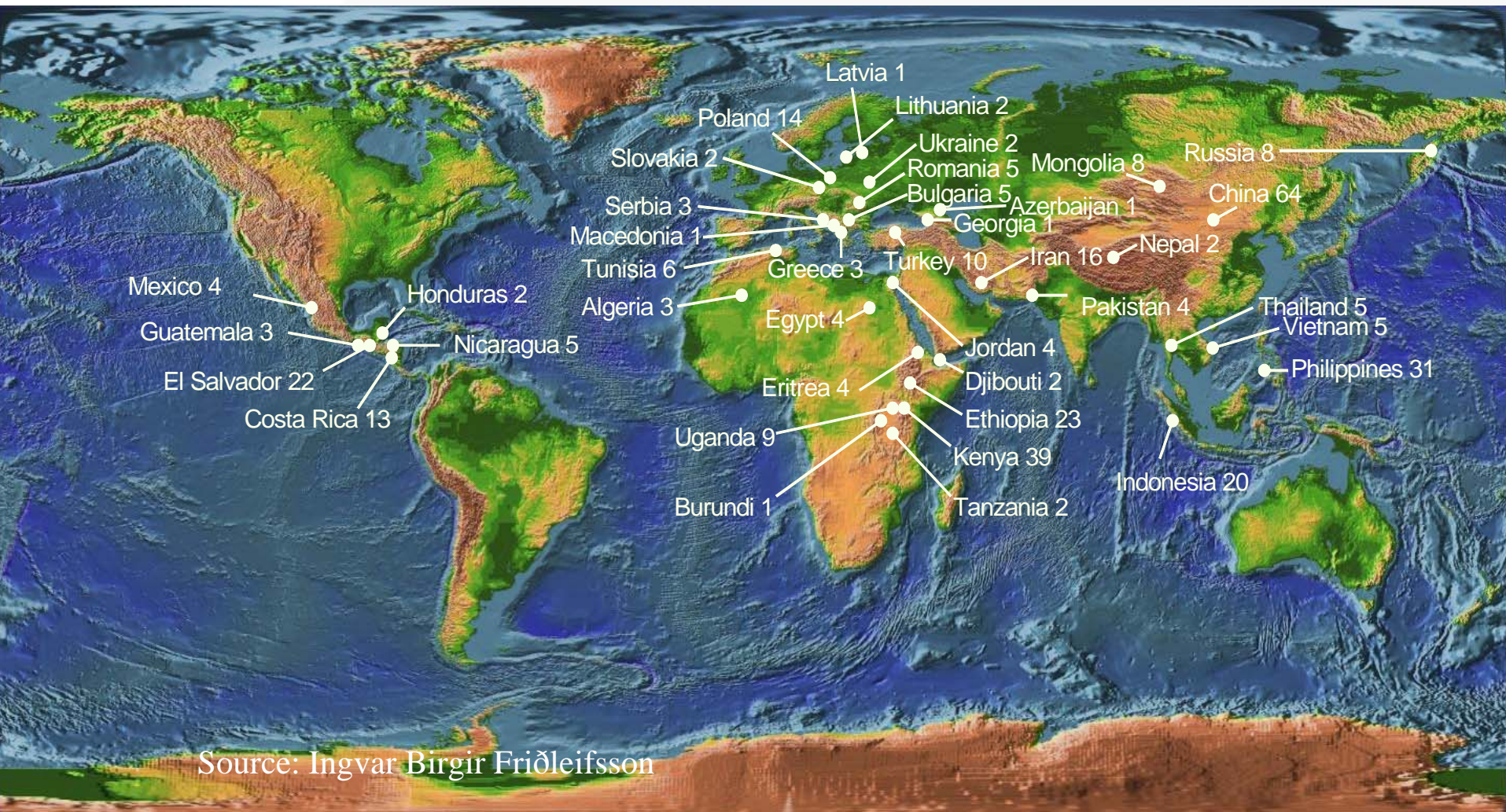


# Research projects

- Are selected from home country if possible and data is available
- Otherwise, data is provided from Icelandic geothermal fields of similar characteristics
- Are published in UNU-GTP yearbook “Geothermal Training in Iceland”



# Fellows of the UNU Geothermal Training Programme in Iceland 1979-2006



Source: Ingvar Birgir Friðleifsson



## Top thirteen countries with highest % share of geothermal in national electricity production

Country	GWh/a	% electricity	UNU Fellows
El Salvador	967	22	22
Kenya	1,088	19	39
Philippines	9,253	19	31
Iceland	1,483	17	
Costa Rica	1,145	15	13
Nicaragua	271	10	5
Guadeloupe	102	9	
New Zealand	2,774	7	
Indonesia	6,085	7	20
Mexico	6,282	3	4
Guatemala	212	3	3
Italy	5,340	2	
USA	17,917	0.5	



# UNU-GTP graduates

- .. are among the leading specialists in geothermal research and development in many countries in Africa, Asia, Central America and Eastern Europe
- .. have been very successful, and have contributed significantly to renewable energy development in their parts of the world
- .. are very active in the international geothermal community
- .. were authors or co-authors of 85 technical papers at the World Geothermal Congress in



# World Geothermal Congress 2005

- Amongst 705 refereed papers accepted by WGC 2005 for presentation (oral and poster), 141 papers were authored or co-authored by 104 former UNU Fellows from 26 countries
- The papers were divided between 23 of the 24 technical sessions of the congress
- Seventy seven former UNU Fellows attended the congress out of 318 graduates of the UNU-GTP or 24%





# World Geothermal Congress 2005

77 UNU Fellows from 25 countries presented papers



# Short courses as Contribution to UN Millennium Development Goals



Government of Iceland has secured core funding for the UNU-GTP to expand its capacity building activities by annual workshops/short courses in geothermal development in selected countries in Africa (started in 2005), Central America (started in 2006), and later in Asia (probably starting in 2007).

Announcement made at International Conference for Renewable Energies held in Bonn (Germany) June 2004. This is a contribution of the Government of Iceland towards the Millennium Development Goals of the UN

# United Nations University Geothermal Training Programme (UNU-GTP)



- The UNU-GTP has been extremely successful in world-wide capacity building in the field geothermal.
- The UNU-GTP has started geothermal short courses for decision makers in developing countries with geothermal potential.



# Governmental promotion of geothermal energy



The government of Iceland as well as the president of Iceland are highly supportive in dissemination of geothermal energy

- The president of Iceland did visit ISOR few months ago and shows strong interest in our activity

# Governmental promotion of geothermal energy with assistance from ISOR:



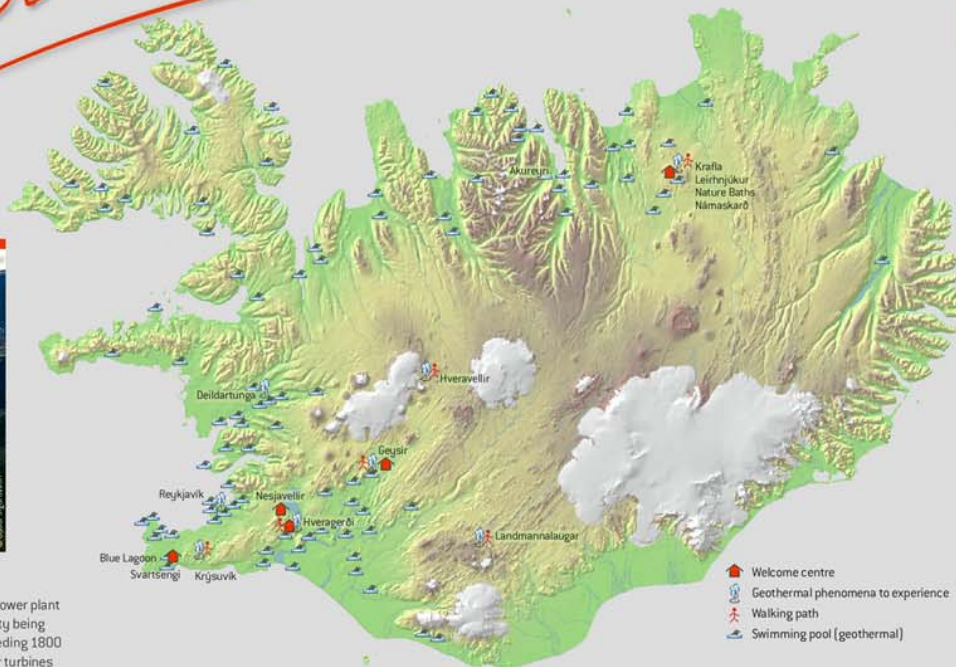
- During official visits to Iceland the government uses every opportunity to introduce to world's leaders the possibilities of geothermal energy.
- The president of Iceland is actively participating in the campaign against global warming. He is now organizing a renewable energy meeting in Djibouti together with the president of Djibouti where presidents or prime ministers from several African geothermal countries together with major investors will participate.
- The ministry of foreign affairs in Iceland actively uses their channels for promoting geothermal energy, especially in developing countries and international organisations.



# International co-operation

- Member of EuroGeoSurvey.
- Participates in Global Roundtable on Climatic Change.
- Member of European Geothermal Energy Council.
- Represented in BoD of IGA, International Geothermal Association.
- Represents Iceland for NEA in executing the IEA geothermal implementing agreement.
- Involved in the ARGEO project in E-Africa.
- Represents Iceland in the energy committees under EU's framework programs.
- ISOR is a minor shareholder in the Icelandic company Enex Ltd and assist it a lot with its geothermal promotion activities.

# Geothermal welcome centres



## NESSJAVELLIR WELCOME CENTRE

Nesjavellir is the largest geothermal power plant in Iceland, its present installed capacity being 300 MWt, with water production exceeding 1800 litres/second. As of October 2005 four turbines produce 120 MWe of electricity.

At the Welcome Centre an account is given of energy generation from a high-temperature geothermal system as well as the process utilized by the plant, and of the Reykjavik district heating system.

Opening hours 1. June - 31. August  
Monday to Saturday 9 - 17  
Sunday 13 - 18

Free Admittance

For more Information  
Tel: 480 2408  
[www.or.is](http://www.or.is)



## SVARTSENGI / RIFT WELCOME CENTRE

The Rift (Gjáin) is a dramatic exhibition of geology, geothermal heat, and conservation of energy located in Eldborg, near BLUE LAGOON - Geothermal Spa.

Opening hours 1. June - 31. August  
Open for pre-booked groups.

Cost of Admission  
Adults 500,- ISK  
Senior Citizens and 12 - 16 years 250,- ISK  
Children < 11 years Free

For more Information  
Tel: 420 8806 / 420 8840  
[www.bluelagoon.com](http://www.bluelagoon.com)



## KRAFLA WELCOME CENTRE

At the Krafla Welcome Centre you will find information on geothermal energy and the Krafla Eruptions, including a short, entertaining film on how geothermal steam is used to generate electricity.

Opening hours 1. June - 31. August  
Monday to Friday 12:45 - 15:30  
Saturday to Sunday 13 - 17

Free Admittance

For more Information  
Tel: 515 9000  
[www.lv.is](http://www.lv.is)



## GEYSIR WELCOME CENTRE

Geysir Centre is a museum where modern multimedia shows combined with ample information enlighten visitors about some of Iceland's inexplicable natural phenomena, and allow them to feel some, as is the case with the earthquake simulator.

Opening hours  
May - September 10 - 19

Cost of Admission  
Adults 450,- ISK  
Children 6 - 12 years 200,- ISK  
Children < 6 years Free,  
Student 350,- ISK  
Seniors > 66 years 250,- ISK

For more Information  
Tel: 480 6800  
[www.geysircenter.com](http://www.geysircenter.com)



## HVERAGERÐI WELCOME CENTRE

In Hveragerði a geothermal field located in the town centre is harnessed for district heating. At the tourist information facilities on the eastern margin of the area information is available on the nature of the geothermal field and the relation of geology, tectonics, volcanic activity and microbiology to geothermal activity. Information on boreholes and production is presented too.

Opening hours 1. June - 31. August  
Monday to Thursday 9 - 11 / 17 - 20  
Fridays 9 - 11 / 14 - 16  
Saturday to Sunday 14 - 16

Free Admittance

For more Information  
Tel: 483 4000  
[www.hveragerdi.is](http://www.hveragerdi.is)

The ENGINE project (ENhanced Geothermal Innovative Network for Europe) is a co-ordination action supported by the 6th Research and Development framework of the European Union (<http://engine.brgm.fr>). ISOR (Iceland GeoSurvey) is a governmental institution that provides a wide variety of energy research, exploration and development services on contract in Iceland and abroad ([www.isor.is](http://www.isor.is)). This poster is produced by ISOR as part of the promotion activity of ENGINE for furthering the use of geothermal energy within Europe. The welcome centres are independently operated and have not received support from ENGINE.

A wide-angle photograph of the Reykjanes geothermal field in Iceland. In the foreground, there is a dark, gravelly area with patches of green grass. In the middle ground, a large industrial facility is visible, including a tall black chimney emitting a thick plume of white steam that rises into the sky. Other structures include a red truck, a white tank, and various pipes. The background shows rolling green hills under a blue sky with scattered white clouds.

**Thank you for  
your attention**

**Reykjanes geothermal field, Iceland**



