



GEORG

GEOthermal Research Group

Annual Report

RAN090326-1303

Centres of Excellence and Research Clusters
Strategic Research Programme

Year 4, 2012-2013

May 16th 2013



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SUMMARY

GEORG has now been operating for four successful years. During this time the cooperation has matured and developed further towards the ideology of cluster cooperation. Today, GEORG stands on four main pillars: 1) Support for Geothermal Research Projects; 2) Service to Cluster Participants; 3) Grant Application Support for Participants; and 4) Promotion and Dissemination of geothermal energy and technologies. Following is a list of activities that took place during the operational year April 1st, 2012 till March 31, 2013:

- **Mid Term Evaluation.** As a part of the grant agreement GEORG did undergo mid-term evaluation by an independent external panel in the year. The panel reviewed GEORG based on an evaluation report, submitted by the management team of GEORG in July and the presentations and discussion at a review-meeting in November. GEORG got a very favorable results and valuable recommendations on future development. The panel ***recommended that the funding from Rannís be continued.***
- **GEORG formally established as an association.** GEORG applied for a business ID number in late March 2012. The application was granted on the 3rd of April 2012 and the ID number is 430312-0350.
- The **Fourth General Assembly (GA)** was held on May 29th, 2012.
- **Twenty two** R&D projects are supported by GEORG of operation. The projects have been running smoothly with minor delays in few cases.
- The **DRG project** was defined with the support of GEORG, HS Orka, Orkuveita Reykjavíkur, Landsvirkjun, Orkustofnun and the IDDP project. The DRG project is a collaborative project on the Deep Roots of Geothermal systems. The key supporters, named above, will contribute over 90MISK directly to the project.
- **Project sharing website.** GEORG and Iceland Geothermal have signed a cooperation agreement with the Icelandic Ocean cluster regarding the operation of the project sharing website: www.verkefnamidlun.is. This agreement ensures an access for the geothermal sector to the website as well as input on future development of the site.
- GEORG continued to **support students** during the year. Two students were granted a travel grant to participate in the 4th EGPD and GEORG supported BEST Reykjavík, as they held a spring course on geothermal in Iceland in March.
- GEORG organized an **Open House, November 22nd 2012**, where eight projects that are supported by GEORG were introduced. The venue was the conference room of the National Museum of Iceland.
- GEORG organized a seminar series of five seminars under the headline: ***“From Waste to Value, Treatment and utilization of discharge from Geothermal Power Plant. How can GEORG help?”*** The objective of the seminar series was to discuss the status of treatment and utilization of discharge from geothermal Power Plants and explore possible opportunities of cooperation on research projects within GEORG with the aim to reducing environmental impact and convert waste to value. This development is ongoing.
- The **cluster cooperation** between GEORG and Iceland Geothermal has continued to grow during the year. The cooperation is focused on three main topics: 1) Innovation efforts, 2) Recruitment and 3) Data collection

More detailed information on several of the above items can be found at the GEORG website, www.georg.hi.is

GENERAL ORGANIZATION

The GEORG cluster has four main pillars of operations, as illustrated in Figure 1, which all are present in the current operation of GEORG:

- 1. Support for Geothermal Research Projects.** *GEORG assigns most of its budget to the funding of research projects related to geothermal energy. Through this activity the knowledge base for geothermal utilization and application is strengthened, and the funding works as lubrication to on-going activities of cluster participants and stimulates further cooperation.*
- 2. Service to Cluster Participants.** *The service includes match-making, contact sharing, knowledge sharing among partners, training organization, seminar and workshop preparation and other matters that the participants deem important.*
- 3. Grant Application Support for Participants.** *The goal is to build expertise in applying for grants at the European and International level. This has the potential to significantly improve the success rate for research grant application and therefore leveraging the muscle of the cluster for the benefits of the participants.*
- 4. Promotion and Dissemination.** *GEORG endeavours to form a platform to promote knowledge on the geothermal energy resource, its utilization potential, sustainability and environmental issues. This is accomplished through training and information sharing through courses, workshops, seminars and conferences. Increased knowledge on this topic in the general public should improve the quality of the coverage of this topic in media and society in general. This should also facilitate high quality policy making by government and public administration. Promotion of the geothermal energy resource at the European and International level increases the awareness of the opportunities this renewable energy source offers, making international funding more accessible.*

As the current funding base is from the Centres of Excellence and Research Clusters, the main part of the budget is allocated to the first post. The other three posts however remain an integral part of the cluster operations, in particular there has been considerable activity related to dissemination and network building as well as grant support. This has without doubt benefited the Icelandic geothermal community.



Figure 1: Illustration of the four main pillars of GEORG operations.

MANAGEMENT OF GEORG PROJECT AND GEORG ASSOCIATION

General Assembly (GA) was held at Reykjavik Energy headquarters May 29th, 2012. The minutes from the meeting are annexed in Annex I.

The following **Board of Directors (BoD)** was elected at the GA:

- | | | |
|-------------------------------|-----------------------|----------|
| • Sigurður Magnús Garðarsson | University of Iceland | Chairman |
| • Magnús Tumi Guðmundsson | University of Iceland | |
| • Auður Andrésdóttir | Mannvit | |
| • Guðmundur Ómar Friðleifsson | HS Orka | |
| • Ernst Huenges | GFZ, Potsdam, Germany | |
| • Guðrún Sævarsdóttir | Reykjavík University | |
| • Rúnar Unnþórsson | University of Iceland | |
| • Ólafur G Flóvenz | ISOR | |

The BoD of GEORG has met 70 times, in total since 2009, and minutes of those meetings are available.

Science Academy (SA) is responsible for setting the scientific direction, and proposing the funding procedures to be employed by the BoD on annual basis. The individuals appointed on the Science Academy are selected by voting by the GA. The SA is led by Sveinbjörn Björnsson and the members for the third operational year are:

- | | |
|-------------------------------|--------------------------------|
| • Árný Erla Sveinbjörnsdóttir | University of Iceland |
| • Brynhildur Davíðsdóttir | University of Iceland |
| • David Brunh | GFZ |
| • David Mainprice | Geosciences Montpellier (CNRS) |
| • Einar Gunnlaugsson | Reykjavik Energy |
| • Guðni Axelsson | Iceland GeoSurvey |
| • Guðni A Jóhannesson | National Energy Authority |
| • Halldór Pálsson | University of Iceland |
| • Hrefna Kristmannsdóttir | Independent expert |
| • Ingólfur Örn Þorbjörnsson | Innovation Centre Iceland |
| • Kristinn Ingason | Mannvit |
| • María S Guðjónsdóttir | Reykjavik University |
| • Sæunn Halldórsdóttir | ISOR |

Work Package leaders (WPL) are responsible for coordinating all activities within a given work package, and ensure proper interactions via the sub-activity groupings and the integrating WPs with the other work packages. The WPL are responsible for ensuring that the deliverables from their work packages are completed according to the global GEORG project work plan and achieve the necessary levels of quality. The WPL are:

- | | | |
|-------|----------------------------|-----------------------|
| • WP1 | Sigurður Magnús Garðarsson | University of Iceland |
| • WP2 | Guðrún Sævarsdóttir | Reykjavik University |
| • WP3 | Rúnar Unnþórsson | University of Iceland |

- | | | |
|-------|--------------------|-----------------------|
| • WP4 | Ólafur G Flóvenz | ISOR |
| • WP5 | Halldór Pálsson | University of Iceland |
| • WP6 | Guðni Axelsson | ISOR |
| • WP7 | Sveinn Agnarsson | University of Iceland |
| • WP8 | Sigurður G Bogason | MarkMar |

Rúnar Unnpórsson replaced Ágúst Valfells as WP 3 leader in January 2013.

NEW MEMBER

One new member applied for participating in GEORG on the fourth year of operation and the BoD will recommend its inauguration at the 2013 GA. This is the Uppsala University in Sweden. The following argument was given for the participation:

"The geophysics section at the dept. of Earth Sciences, Uppsala University (UU), has been involved in many projects on Iceland in the last 20 years. The projects have ranged from structural studies based on local seismicity, seismicity studies, earthquake induced stress fields, reflection seismics to electromagnetic studies. Some of these have been of direct relevance for geothermal research, though some have had other objectives. Recently, UU has been (and still is) involved in several projects of direct relevance for geothermal research in cooperation with other research institutes on Iceland and the US."

MID TERM EVALUATION

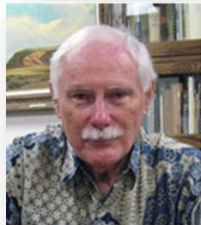
As a part of the grant agreement GEORG was required to undergo mid-term evaluation by an independent external panel after three years of operation, i.e. in 2012. Continued support to the centre as subject to a favourable outcome from the mid-term evaluation. Rannís appointed Jean-Marie Hombert, Director of Research, Institute of Human Sciences, University of Lyon, to chair this evaluation panel for the mid-term evaluation. Dr. Hombert was in charge of appointing additional members in the panel and he chose the following team, see Figure 2.



Dr. Jean-Marie Hombert
Director of Research
University of Lyon



Dr. Gerd Meier zu Köcker
Director
Kompetenznetze Deutschland



Dr. John Lund
Director of the Geo-Heat Center at the
Oregon Institute of Technology (OIT) in
US and former president of the
Geothermal Resources Council and the
International Geothermal Association



Dr. Patrick Browne
Associate Professor
Institute of Earth, Science &
Engineering,
The University of Auckland,

Figure 2 The Mid Term Evaluation team

The fourth year started with preparation for this Mid Term Evaluation and an evaluation report was submitted to Rannís in the first week of July 2012. The evaluation team visited Iceland in week 45 and had a full day review-meeting on the 7th of November with the GEORG team, the agenda for the evaluation day can be found in Annex II. Several members of the cluster participated in the meeting with valuable inputs.

The committee reviewed GEORG based on the evaluation report, the presentations and discussion at the review-meeting and in accordance with the original contract. GEORG got very favourable results and valuable recommendations on future development.

The evaluation outcome was stated as follows:

*„We congratulate the instigators, participants and supporters of GEORG on how much the cluster has achieved in a short time. In our opinion its focus is appropriate and augers well for its future activities and consequently **we recommend that the funding from Rannís be continued.**“*

The reviewers report is in Annex III.

SHORT SUMMARY OF GEORG ACHIEVEMENTS TO DATE AS REPORTED IN THE MID-TERM EVALUATION REPORT

GEORG – GEothermal Research Group – is funded by grant by the Science and Technology Policy Council through Centres of Excellence and Research Clusters program which is administrated by Rannis. GEORG was formerly established April 1st, 2009. The operation of GEORG has been efficient and significant results have already been achieved. The operation of the cluster is based on four pillars: Support for Geothermal Research Projects; Service to Cluster Participants; Grant Application Support for Participants; and Promotion and Dissemination. The 22 members are the main players in the Icelandic geothermal community as well as key international players. About 90 person years have been recorded during the first four years of operation.

In April 2012 GEORG took a significant step towards formalizing the operation by establishing a formal legal association so GEORG can now act as a unity towards other legal entities.

GEORG has supported 22 research projects that respond to the goals set out in the original Description of Work. The results that have been attained so far from the research projects have been extensively published and disseminated in journals, at conferences, at workshops and seminars, and in student theses.

GEORG has put considerable effort into EU activities, including participating actively in the 7th Framework Program Committee for Energy and leading and/or participating in grant applications under the 7th framework, with some notable success regarding an EU – ERA NET. GEORG also puts emphasis on international research cooperation which manifests in the research projects where 10 out of 22 have cross border partner and/or staff exchange.

GEORG has actively supported students by expecting the research projects to include funding for students and supporting students conferences, including annual European Geothermal PhD day.

GEORG has organized several seminar series where subjects regarding the geothermal field have been discussed.

GEORG participates in an industrial driven cluster, the Iceland Geothermal Cluster, which provides intriguing possibilities for the development of GEORG, and the geothermal community in Iceland in general, both short and long term.

GEORG has worked on developing the cluster operation and understanding by participating in the Nordic-German-Polish Cluster Excellence Project on Benchmarking of clusters; by working closely with Gekon, which is specialize in cluster management; and by participating in a cluster application to EU.

The long term vision of GEORG is to be a sustainable cluster with clear value addition for the cluster participants and thereby strengthening the geothermal community for the benefit of the society.

THE FOURTH OPERATIONAL YEAR OF GEORG

The fourth year has mainly been focused on internal work and development of GEORG. The mid-term evaluation took a long time in progress. The evaluation report was submitted in July, following a review meeting in November and a final result in January 2013. GEORG was not able to make any binding commitments until the evaluation result was clear. For this reason the 5th open call, planned for fall 2012, was postponed and efforts put on further development of DRG and other cooperative projects as well as close cooperation with Iceland Geothermal cluster.

DRG PROJECT

Since 2010 GEORG has been supporting activities on the topic of Deep Roots of Geothermal systems, called DRG. Several workshops and seminar have been held and organized with the aim of defining research gaps and opportunities in this field. During this time the project idea has developed and due to high interest and many unanswered questions it was evident that the budget of 30MISK for a comprehensive project would not be enough. The DRG group therefore proposed to seek additional support to the energy companies and Orkustofnun.

The DRG-group suggested a three year project sponsored by GEORG, HS Orka, Orkuveita Reykjavíkur, Landsvirkjun, Orkustofnun and foreign sponsors. The contribution would be as follows: GEORG 30 MISK, each other sponsor at least 15 MISK, total >90 MISK. The project would be governed by a steering committee with representatives from each sponsor. The DRG steering committee members are as follows: Sveinbjörn Björnsson and Hjalti Páll Ingólfsson would represent GEORG, Jónas Ketilsson would represent Orkustofnun, Ásgrímur Guðmundsson would represent Landsvirkjun, Guðmundur Ómar Friðleifsson would represent HS Orka and Einar Gunnlaugsson would represent Orkuveita Reykjavíkur. The project should emphasise research on magmatic intrusions as heat sources of geothermal systems and the mode of superheated or supercritical heat transfer up to the conventional geothermal systems at subcritical temperatures and pressures. This state was given the name of “Suprastate” see Table 1

Table 1: Definition of states in a geothermal system

No	State	Temp. °C	Location	Main heat transfer
1	Cap-rock formation	0 - 220	Surface - 1 km	Conduction/convection
2	Reservoir formation	220 - 370	1 km - 3 km	Free convection
3	Suprastate *	370 - 600	3 km - x km	Forced convection of supercritical and superheated steam
4	Critical/Magma region	600 - 1000	> x km	Intrusion of dykes and conduction **

*Formation occupied by superheated or supercritical steam down into brittle rock. x may vary.

**Forced convection also possible as a result of dyke penetration up through the suprastate layer

Representatives of the DRG group and GEORG met with the representatives of the energy companies and Orkustofnun to discuss this approach on the September 10th 2012.

GEORG, Landsvirkjun, HS-Orka and Orkustofnun gave a “principle YES” on funding the DRG project, given that the budget plan for next year will be approved within their respective company/institution. Orkuveita Reykjavíkur was also positive but asked for some time to discuss this

internally before their final decision on this matter. Later in the process the IDDP project also joined in as key supporter.

Following the meeting in September the actual work on defining a comprehensive DRG - project started for real, with an emphasis on three main categories or groups: 1) ***Targets in the „Suprastate“***, 2) ***Modelling and Stimulation*** and 3) ***Well-drilling and treatment technologies***.

A workshop was held in October 11th, 2012, where the groups were formed and a skeleton of the project description was made (see agenda in Figure 3).

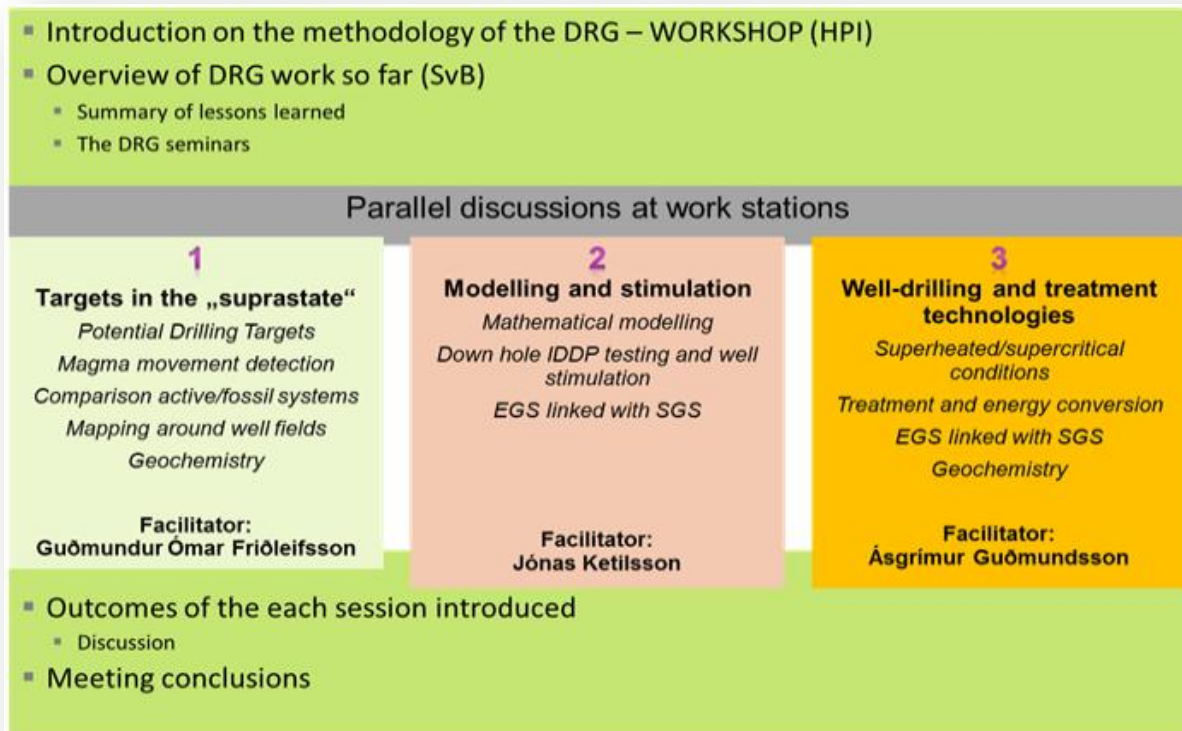


Figure 3: The agenda of the DRG workshop held on October 11 2012.

An extensive work followed on further defining the project and cooperation resulting in a comprehensive project description with very good cooperation angles to different international projects in the same field, like COTHERM, FP7 IMAGE project and other. The project setup is illustrated in Figure 4. The DRG project is divided in six subprojects each with one Principal Investigator (PI). The overall project supervision will be in the hands of the Steering Committee and the funding will be challenged through GEORG, the association. GEORG will sign a support agreement with each of the supporters, declaring the support amount and payment plan. GEORG association will also make a grant agreement with each of the PI's based on an approved project description (see Figure 5).

The project preparation is now in the final stages of negotiation and project work is expected to start in early summer 2013.

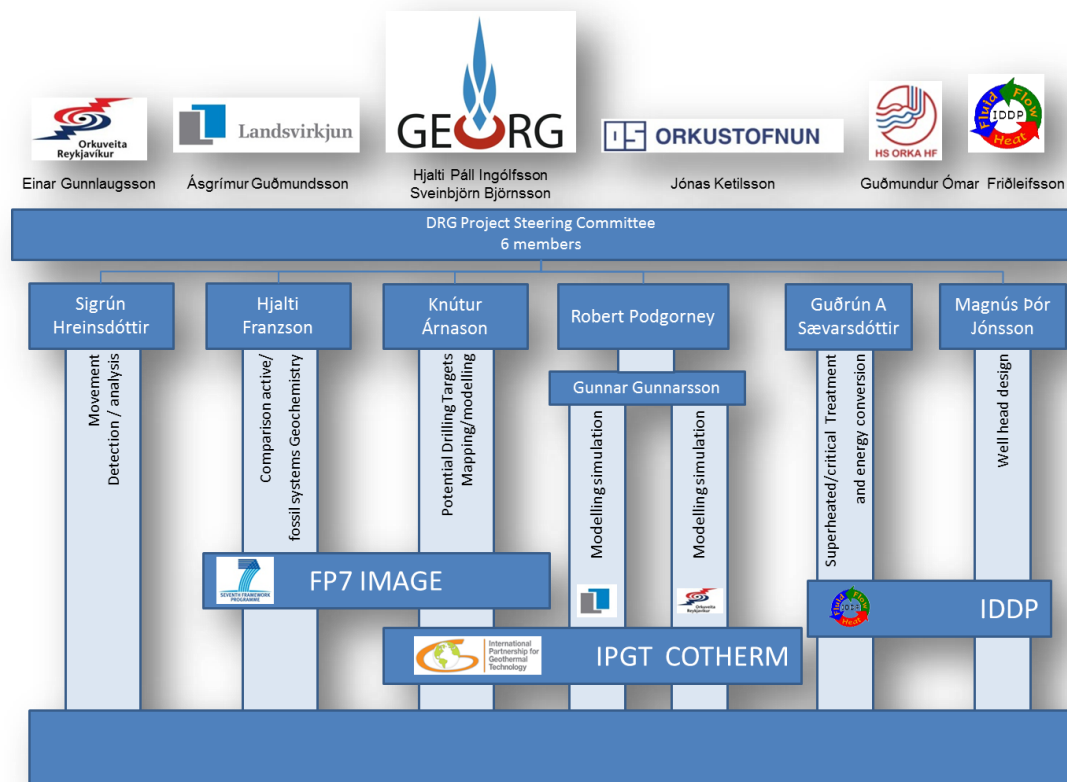


Figure 4: An illustration of the DRG project setup

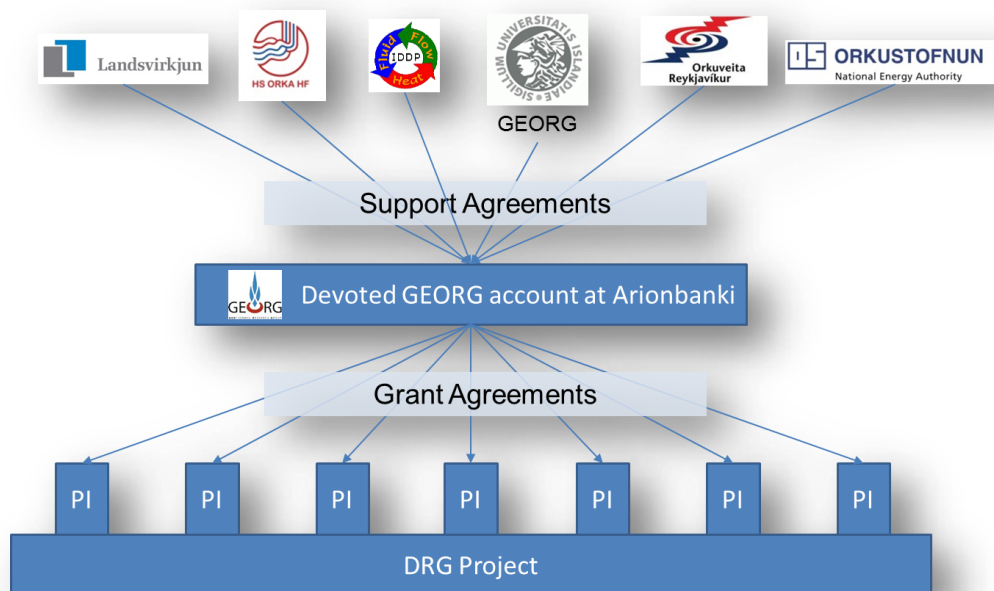
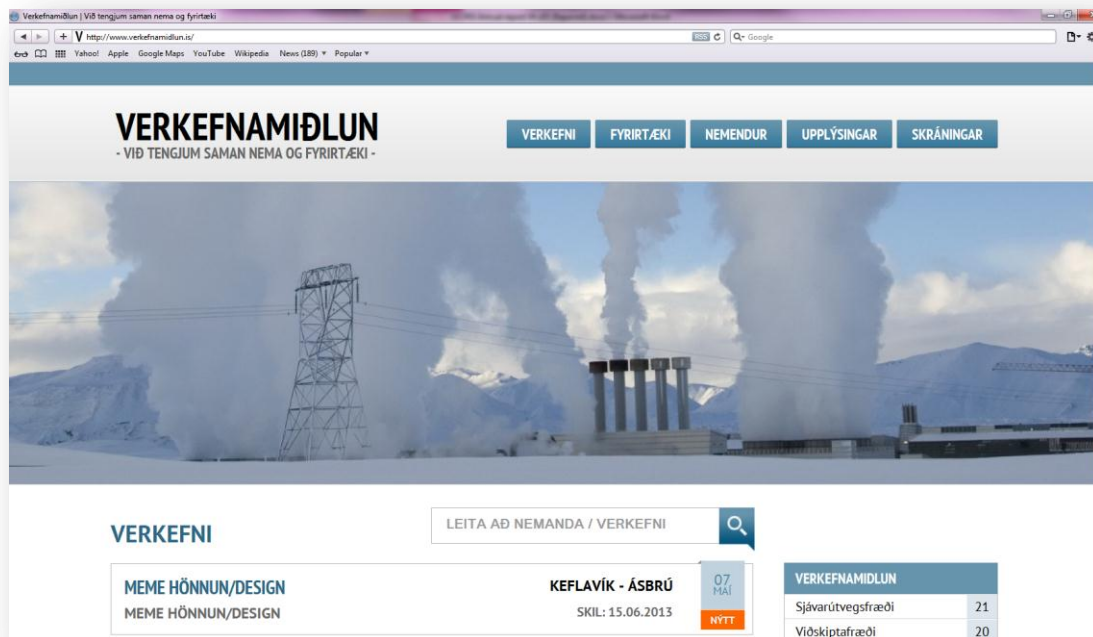


Figure 5: GEORG association is the centre point for the DRG project. The supporter's transfer their donation to GEORG based on a support agreement and GEORG allocate the funds to the different PI's based on a grant agreement.

PROJECT SHARING WEBSITE

GEORG and Iceland Geothermal have signed a cooperation agreement with the Icelandic Ocean cluster regarding the operation of the project sharing website: www.verkefnamidlun.is owned and operated by the Ocean Cluster. This agreement ensures an access for the geothermal sector to the website as well as ensuring the influence of the sector on future development of the website and its service. The website has been active since the last fall and with the aim of strengthening the connections between students and businesses and encouraging their cooperation.



STUDENT SUPPORT

THE FOURTH EUROPEAN GEOTHERMAL PHD DAY - EGPD 2013

The GEORG BoD decided to support up to 8 students to participate in the 4th European Geothermal PhD day, held in Hungary in early May. 3 students were offered support of which one decided not to accept the grant as it did not fit its schedule.

OTHER TRAVEL SUPPORT

In addition to the EGPD travel support, the GEORG BoD decided to allocate additional funds to general travel support for students. The amount allocate would sum up to 2MISK per year, including the support for EGPD. Two deadlines are foreseen per year and up to 10 students supported each time.

BEST

GEORG also supported the BEST Reykjavík, as they did hold a spring course on geothermal in Iceland in March. The event was called “let’s heat it up”. The group got a support of 250.000 ISK.

BEST, Board of European Students of Technology is a non-profit and non-political organisation, consisting of 95 Local BEST Groups (LBGs) in 33 countries of which BEST Reykjavik is one of them.

BEST strives to help European students of technology to become more internationally minded, by reaching a better understanding of European cultures and developing capacities to work on an international basis. BEST creates opportunities for the students to meet and learn from one another through our academic and non-academic events and educational symposia.

EVENTS / CONFERENCES

GEORG DAY



GEORG organized an Open House, November 22nd 2012, where 8 projects, that have been supported by GEORG and tackles the objectives of the research cluster cooperation, were introduced. The venue was the conference room of the National Museum of Iceland.

In addition GEORG organized a poster session where team members could promote their projects as well as introducing new ideas and seek potential partnerships and/or introduce students to interesting research projects.

Up to fifty people attended the event and the projects were promoted are shown in Table 2.

Table 2: Project promoted at GEORG Open House, Nov. 22nd 2012.

Project presented ID number	Name	Coordinator Name	Promotion	
			Presentation	Poster
09-01-003	Development of coupled reactive fluid flow models	Hannes Jónsson	X	
09-01-011	Properties of two phase flow of water and steam in geothermal reservoirs	Guðrún Sævarsdóttir	X	
09-01-012	RENEWABILITY OF GEOTHERMAL RESOURCES	Guðni Axelsson		X
09-01-028	Evaluation and Improvements of Geothermal Models using Inverse Analysis	Magnus Þor Jonsson,	X	
09-02-001	CarbFix project	Sigurður R. Gíslason		XX
09-02-005	The Hengill geothermal reservoir. Evaluation of subsurface geological data	Hjalti Franzson		x
09-02-017	Geothermal economic impact data base	Sveinn Agnarsson	X	
10-03-005	GeoChem	Sigurður Brynjólfsson	X	
10-03-012	Sustainability Assessment Protocol for Geothermal Utilization	Brynhildur Davíðsdóttir		x
10-03-013	Mapping interaction between magmatic and hydrothermal system with fluid inclusion analysis	Anette K. Mortensen	X	
11-04-003	H ₂ S sequestration into geothermal systems	Andri Stefánsson		x
11-04-005	Efficient Maintenance Management of Geothermal Power Plants	Rúnar Unnþórsson	X	X

FROM WASTE TO VALUE W2V

GEORG organized a seminar series of five seminars under the headline: ***“From Waste to Value, Treatment and utilization of discharge from Geothermal Power Plant. How can GEORG help?”***

The first seminar was held on Wednesday, April 3rd @ the University of Iceland.



The objective of the seminar was to discuss the status of treatment and utilization of discharge from geothermal Power Plants and explore possible opportunities of cooperation on research projects within GEORG with the aim to reducing environmental impact and convert waste to value.

The idea of this seminar series is to start the communication within the partnership of GEORG to form a research project on this topic, somewhat in the same spirit as the DRG project.

Out of the 22 supported projects of GEORG several of them are linked with environmental impact and therefore there is a good potential increasing the value of the research by combining forces as has been done in the DRG project.

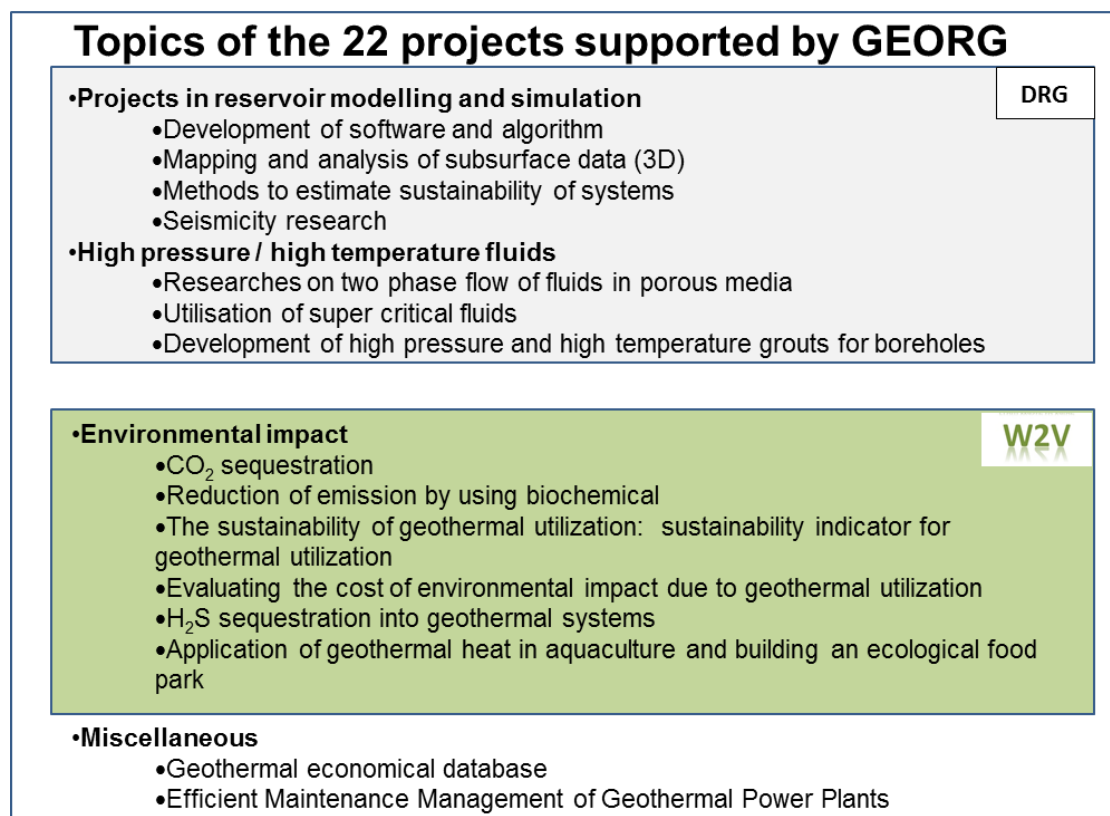


Figure 6 The ideology of W2V is to activate the synergy of the environmental impact project funded by GEORG and eventually define a comprehensive research project on the topic of downstream utilization of Geothermal Power Plants.

A list of presenters in the seminar series can be found in Annex IV

DISSEMINATION

GEORG maintains an overview of all dissemination and publication outputs as a part of the objectives managed under WP8 Dissemination and outreach. The objectives are the following:

- To make available to a wider audience information about the work and the outcome of the GEORG project with the aim of enhancing the uptake of its results.
- To strengthen the networking relationships between R&D Centres, Energy Authorities, Energy Companies, Geothermal Industry SMEs, NGOs and other stakeholders in the sustainable geothermal resources utilisation.
- To promote and encourage the uptake and use of the results by policy makers, energy and environmental managers in Europe, and prepare the basis for maximum impacts of the results.

A list of publications from the projects as reported by the project coordinators in June 2012 can be found in Annex V.

In addition GEORG members have also disseminated results in seminars organized by the cluster. The seminars include:

- Open Conferences at GEORG General Assemblies 2009 and 2010
- Support for PhD students to present results at European PhD days 2010 (Germany), 2011 (Iceland), 2012 (Italy) and 2013 (Hungary)
- Roots of Geothermal Systems: 6 seminars in Year 3
- Series of five seminars under the headline: "From Waste to Value, Treatment
- Deep Root seminar at Hotel Hengill, August 27th, 2011
- GEORG Open House, Oct. 20th, 2011 and Nov. 22nd, 2012.
- Four seminars on the four main Icelandic geothermal areas: Hengill, Krýsuvík, Krafla, and Reykjanes
- From Steam to Currency: Six seminars from February to May 2011, on the theme of generating value from the geothermal resource, other than for district heating and electrical power generation.

GEORG web address is www.georg.hi.is. All relevant information on the cluster is gathered at this website as well as all application documents and evaluation guidelines for the call of GEORG. The website is maintained and updated by the Operational Manager.

GEORG is also active on Facebook. The site can be found at <http://www.facebook.com/pages/GEORG-GEOthermal-Research-Group/203518776344624> or simply by looking up GEORG – GEOthermal Research Group.

CLUSTERS COOPERATION

GEORG AND THE ICELANDIC GEOTHERMAL CLUSTER

The cooperation between GEORG and Iceland Geothermal is continually growing. GEORG participated in the “expert panel” from the beginning. When Iceland Geothermal was established as an association Sigurður Magnús Garðarsson and Hjalti Páll Ingólfsson got an observer seat BoD meeting of Iceland Geothermal. Iceland Geothermal also has an observer seat at the GEORG BoD meetings.

The cooperation is focused on three main topics:

1. Innovation efforts

Innovation is a key aspect for the two cooperation platforms to work on. The last few months the clusters have been developing an instrument to accelerate product development in geothermal technologies. The instrument is based on the ideology of innovation accelerators but with certain improvements to fit the specific needs of the geothermal sector. The development is on-going and the first steps are expected to materialize in coming months.

2. Project sharing website

The clusters jointly signed a cooperation agreement with the Ocean Cluster regarding accessibility of the geothermal industry to the project sharing website www.verkefnamidlun.is. The three clusters management teams will cooperate on further developing the website and its service.

3. Data collection

The cluster management teams are seeking ways to start a cooperation project on data gathering and analysis for the geothermal sector. This could also include cooperation with Orkustofnun and the Geothermal ERA NET to streamline data collection and avoiding duplicating efforts in data collection and analysis.

ANNUAL ACCOUNTS

In April 2012 the association of GEORG was established and this is the first year of its operation. On the bases of a service agreement between UNI, on behalf of the GEORG Project, and GEORG the new association handled all the operational cost of the GEORG office except for the cost of staff (a copy of the service agreement is annexed in Annex VI). Therefore there are two accounts presented in the annual report, the accounts of the GEORG Project and accounts for the GEORG Association. In both cases the operating year is April 1st, 2012 –March 31th, 2013. All amounts are in thousand ISK. The accounts were audited and approved by Sveinbjörn Sveinbjörnsson at Íslenskir Endurskoðendur slf.

ANNUAL ACCOUNTS-GEORG PROJECT

GEORG Project- Cost and financing account

Cost	Note	Year 4		
		GEORG	Partners	Total
Grants	1	34.520	70.099	104.619
Contracted services.....	2	292		292
Conferences, dissem. & outreach.....	3	105	3.600	3.705
Overhead total.....	4	10.405	5.276	15.681
Total operation cost		45.322	78.975	124.298
Financing				
Partner Co-financing.....		0	78.975	78.975
Funding from Rannis.....	5	14.000		14.000
Total financing		14.000	78.975	92.975
Results of operational activities		-31.322	0	-31.322
Transferred between years				
Unpaid funding from Rannís.....		70.000		
Acquired funding from last year.....		-14.000		
Other receivables.....		-2.400		
Allocated but unpaid grants to R&D projects.....		-89.185		
Allocated grants to R&D projects last year.....		71.950		
Other short term liabilities from last year.....		73		
Final results of the year		5.115	0	5.115

GEORG Project - Balance sheet

		Year 4
Assets	Note	31. March 2013
Cash and cash equivalents.....	6	39.944
Unpaid funding from Rannís.....	5	70.000
Other receivables.....	7	32
Total assets		109.977
Debts and liabilities		
Unpaid grants for projects.....	8	89.185
Other short term liabilities.....	1	0
Total debts and liabilities		89.185
Balance at beginning of period.....		15.644
Final results of the year.....		5.115
Total assets		20.792

ANNUAL ACCOUNTS GEORG PROJECT- NOTES

1. Grants

GEORG has supported 22 projects as well as supporting student activity. The partners co-financing is estimated according to the projects status.

Grants	Year 3 April 2011- April 2012			Year 4 April 2012- April 2013		
	GEORG	Partners	Total	GEORG	Partners	Total
<i>RTD Projects first call</i>						
09-01-003.....	0	0	0	0	0	0
09-01-005.....	1.350	4.705	6.055	0	0	0
09-01-007.....	0	0	0	0	0	0
09-01-011.....	250	1.724	1.974	0	0	0
09-01-012.....	5.500	7.513	13.013	4.000	9.425	13.425
09-01-013.....	0	0	0	0	0	0
09-01-016.....	0	0	0	0	0	0
09-01-017.....	0	0	0	0	0	0
09-01-028.....	4.070	8.681	12.751	5.420	11.561	16.981
09-01-029.....	0	0	0	0	0	0
<i>RTD Projects second call</i>						
09-02-001.....	2.000	5.445	7.445	8.000	21.780	29.780
09-02-003.....	0	0	0	0	0	0
09-01-005.....	0	0	0	1.125	8.338	9.463
09-02-010.....	1.500	5.681	7.181	0	0	0
09-02-017.....	1.630	2.334	3.964	1.000	1.432	2.432
09-02-017.....	1.630	2.334	3.964	1.000	0	1.000
<i>RTD Projects third call</i>						
10-03-004.....	4.000	6.330	10.330	3.000	4.748	7.748
10-03-005.....	3.100	13.292	16.392	0	0	0
10-03-012.....	5.800	3.534	9.334	3.000	3.118	6.118
10-03-013.....	3.209	3.214	6.423	2.500	2.504	5.004
<i>RTD Projects fourth call</i>						
11-04-002.....	0	0	0	1.500	1.826	3.326
11-04-003.....	0	0	0	2.000	2.330	4.330
11-04-005.....	0	0	0	2.725	3.038	5.763
PhD day travel grants.....	480	0	480	0	0	0
BEST Reykjavik.....				250		
Grants Total	34.519	64.787	99.306	35.520	70.099	105.369

The cash flow is somewhat slower than planned because of unexpected postponement of project start-ups. GEORG is however liable to pay the planned amount, given that the projects deliver according to the grant agreements. The project partners are also liable to provide the planned co-financing accordingly.

2. Contracted services

Contracted services	Year 3 April 2011- April 2012			Year 4 April 2012- April 2013		
	GEORG	Partners	Total	GEORG	Partners	Total
<i>Printing & publishing etc.</i>						
Advertisements	128		128	0		0
Website	0		0	80		80
<i>Legal & audits</i>	0					0
Account audit	0			212		212
<i>Subcontracted other</i>	0					
MarkMar-consult.	150	150	300	0		0
Contracted services Total	278	150	428	292	0	292

3. Other costs

As before the largest part of conference and dissemination costs is covered by the partners themselves and involves cost of setting up and hosting the seminar series and meetings on Roots of Geothermal systems and others.

Conferences, dissem. & outreach	Year 3 April 2011- April 2012			Year 4 April 2012- April 2013		
	GEORG	Partners	Total	GEORG	Partners	Total
<i>GEORG - Open Conferences</i>	120		120	0		0
<i>Conference participation</i>				105		
<i>Workshops</i>		2.000	2.000	0	2.000	2.105
<i>DRG</i>	315	4.020	4.335	0	4.020	4.020
Dissimination Total	435	6.020	6.455	105	6.020	6.125

4. Overhead

The largest part of GEORG overhead goes into operating the office and paying the salaries of the Operational Manager. A large part is also involved in the participation of partners in committees as BoD, SA and other. The cost of these participations is paid by the partners themselves and is accounted as partner co-financing.

Overhead for GEORG	Year 3 April 2011- April 2012			Year 4 April 2012- April 2013		
	GEORG	Partners	Total	GEORG	Partners	Total
<i>Operational Manager & secretariat</i>	8.044		8.044	7.987		7.987
<i>Office operation</i>	938		938	2.418		2.418
<i>Other general operational costs</i>	0	3.900	3.900	0	3.900	3.900
	8.982	3.900	12.882	10.405	3.900	14.305

5. Funding from Rannís

Rannís paid the final payment (14MISK) for the third year at the delivery and acceptance of the 3rd year annual report

However due to how long it took to finalize the mid term evaluation GEORG had no contract with Rannís for larger part of this operating year and due to some other delays the Rannís has still not paid out the grants for Y4. The grant for the fourth year is divided in two payments, one by signing of the contract (56MISK) and the other (14MISK) at the delivery and acceptance of this annual report, see table below.

<i>Payments upon:</i>	<i>Date</i>	<i>Amounts in ISK thousand</i>
Signature of the contract		56.000
An Annual report	June 2013	14.000
Total amount for the 4 th year		70.000

6. Cash and cash equivalents

On the 31st of March 2013 the status of GEORG accounts was **39.944 thousand ISK**.

7. Other receivables

GEORG Project has an outstanding claim on GEORG Association for cost related to the formal establishment of GEORG Association.

8. Unpaid grants to R&D projects

ID #	Allocated grants 31.3.2013	Committed grants 31.3.2013	Unpaid grants 31.3.2013
09-01-003	2.580	6.660	4.080
09-01-005	5.400	13.400	8.000
09-01-007	4.500	11.400	6.900
09-01-011	1.000	4.600	3.600
09-01-012	16.000	21.800	5.800
09-01-013	7.452	7.452	0
09-01-016	7.425	7.425	0
09-01-017	1.250	2.500	1.250
09-01-028	15.410	16.910	1.500
09-01-029	1.000	1.350	350
	62.017	93.497	31.480

ID #	Allocated grants 31.3.2013	Committed grants 31.3.2013	Unpaid grants 31.3.2013
09-02-001	16.000	16.000	0
09-02-003	7.500	10.000	2.500
09-02-005	4.500	4.500	0
09-02-010	2.500	3.020	520
09-02-017	4.530	5.535	1.005
	35.030	39.055	4.025

ID #	Allocated grants 31.3.2013	Committed grants 31.3.2013	Unpaid grants 31.3.2013
10-03-004	9.000	9.000	0
10-03-005	3.100	7.600	4.500
10-03-012	8.800	11.200	2.400
10-03-013	5.709	10.534	4.825
	26.609	38.334	11.725

ID #	Allocated grants 31.3.2013	Committed grants 31.3.2013	Unpaid grants 31.3.2013
11-04-002	1.500	2.000	500
11-04-003	2.000	2.500	500
11-04-005	2.725	2.725	0
	6.225	7.225	1.000
	129.881	178.111	48.230

ANNUAL ACCOUNTS-GEORG ASSOCIATION

Total Revenues for the year 2012 amounted to ISK 1.981.443 and deferred revenues amounted to ISK 1.538.967. Total revenues over expenditures for the financial year were none. Assets total were ISK 1.886.417 at financial year end.

The complete financial statements for GEORG Association can be found in Annex VII

SUMMARY

A summary is provided at page 5.

ANNEX I-VII

ANNEX I



GEORG - GEOthermal Research Group

General Assembly 2012

Tuesday, May 29th, 2012, 10:00-12:00

REYKJAVÍK ENERGY HEADQUARTERS, BÆJARHÁLS 1, REYKJAVÍK



Agenda

10:00-10:05

WELCOME NOTE BY THE CHAIRMAN OF THE BOARD

10:05-10:30

ANNUAL REPORT PRESENTED

10:30-10:45

ANNUAL ACCOUNTS PRESENTED

10:45-11:00

DECISION ON MEMBERSHIP FEES

11:00-11:15

ELECTIONS

11:15-11:30

OTHER MATTERS

11:30-12:00

LUNCH

Aðalfundur, "General Assembly"

er æðsta stjórnvald GEORG og er haldinn einu sinni á ári.

Aðalfundur er eingöngu ætlaður meðlimum klasans og eru þátttakendur beðnir um að skrá sig með því að senda tölvupóst á: georg@orkugardur.is

eða með því að samþykkja fundarboð sem á þá er sent



GENERAL ASSEMBLY. #4.

Meeting Minutes

Date: 2012-05-29, 10:00-12:00

Present: See Appendix 1; Registration sheet

The meeting was attended by 7 of 22 partners of GEORG. The meeting was therefore *postponed for 30 min as described in the consortium agreement, article 6.3.3.*

„If less than 50% are present or represented, the quorum can be reached in pointing out in the convocation that a second General Assembly will be started 30 minutes after the intended start of the first one, and that this second GA has the quorum independently from the presence of the members.“

The second meeting started at 10:30

1. Welcome note by the Chairman of the Board.

The Chairman of the board (Sigurður Magnús Garðarsson) welcomes the participants and goes introduces the agenda. He proposes Guðrún Sævarsdóttir as chair of the meeting and Hjalti Páll Ingólfsson to take the minutes. Approved by the meeting.

2. Annual Report Presentation

Report of the Board

Sigurður Magnús Garðarsson presented the annual report and explained the progress of the third year.

Annual Accounts

Hjalti Páll Ingólfsson presented the annual accounts for the first year, account period 1. April 2011 - 31. March 2012. He presented also the budget plan for 2021-2013.

Discussion

No comments were made to the annual report and accounts and it was approved by the meeting.

3. Decision on membership fees

The BoD proposes to continue operating without membership fees, which was approved by the meeting.

4. Elections

Board of Directors (BoD)

The board members are elected for two years and the following seats were open for election this year:

Open seats

Representing

Sigrún Hreinsdóttir	<i>Icelandic Universities, research institutions and governmental agencies</i>
Rúnar Unnþórsson	
Einar Gunnlaugsson	<i>Energy companies</i>
Auður Andrésdóttir	<i>Private companies</i>

The outgoing Board of Directors proposed the following changes in the Board of Directors for this election.

- Guðmundur Ómar Friðleifsson (HS Orka) to replace Einar Gunnlaugsson (OR)
- Magnús Tumi Guðmundsson to replace Sigrún Hreinsdóttir
- Auður Andrésdóttir and Rúnar Unnþórsson continue in the BoD

This proposal was approved using e-mail voting.

After the election the BoD consist of the following individuals. The numbers in the brackets indicate the number of years left.

<i>Icelandic Universities, research institutions and governmental agencies – 5 BoD seats</i>	<i>Energy companies – 1 BoD seat</i>	<i>Private companies– 1 BoD seat</i>	<i>Other EEA based participating collaborators and Associate members – 1 BoD seat</i>
Sigurður Magnús Garðarsson (1) kt: 030567-4479			
Magnús Tumi Guðmundsson (2) kt: 080561-5639			
Guðrún Sævarsdóttir (1) kt: 030871-3919	Guðmundur Ómar Friðleifsson (2) kt: 120650-7699	Auður Andrésdóttir (2) kt: 130555-4899	Ernst Huenges (1)
Rúnar Unnþórsson (2) kt: 081071-3499			
Ólafur G Flóvenz (1) kt: 220551-4079			

Science Academy

The outgoing BoD proposed the following individuals for the Science Academy. .

<i>Name</i>	<i>Position</i>	<i>Name</i>	<i>Position</i>
Sveinbjörn Björnsson	Chair	Ingólfur Örn Þorbjörnsson	Innovation Center Iceland
Brynhildur Davíðsdóttir	University of Iceland	María S Guðjónsdóttir	Reykjavik University
Árný Erla Sveinbjörnsdóttir	University of Iceland	Guðni A Jóhannesson	OS
Guðni Axelsson	Iceland GeoSurvey	Einar Gunnlaugsson	OR
Halldór Pálsson	University of Iceland	Kristinn Ingason	Mannvit

David Mainprice
Hrefna Kristmannsdóttir

CNRS

David Bruhn
Sæunn Halldórsdóttir

GFZ
ISOR

The new SA members were elected with all votes in favour, through e-mail voting.

5. *Other matters*

Sigurður Magnús Garðarsson introduces the operational plan for the fourth year

- Mid-term evaluation (three year evaluation)
 - Report due July 1st 2012
 - Evaluation meeting by external review committee in the fall
- GEORG – Iceland Geothermal cooperation
 - The first 18month operation of Iceland Geothermal expires Dec 31. 2012
 - GEORG participates in a working group during the summer and fall to form further cluster activities
 - The further development of GEORG as a cluster will be influenced by the outcome
- Call 5 will be published in the fall
- GEORG day 2012
- Further external grant seeking
 - Possible renewing of the CHORUS participation (FP7)
 - Deep Root participation in FP7 call this fall
 - DRG funding and cooperation development

No other conclusions made and meeting adjourned

Appendix 1; Registration sheet

4th GENERAL ASSEMBLY 2012
REGISTRATION SHEET[illegible]

ANNEX II**Mid-term Evaluation Agenda****Wednesday November 7th 09:00 - 17:30, Visit to GEORG****9h-9h30: Meeting with Head of Centre of Excellence**

Sigurður Magnús Garðarsson	Chairman of the Board	University of Iceland
Hjalti Páll Ingolfsson	Operational Manager	GEORG

9h30-10h: Meeting with delegation of Board of Directors

Sigurður Magnús Garðarsson	Chairman of the Board	University of Iceland
Ólafur Flóvenz	Board member	ISOR
Guðrún Sævarsdóttir	Board member	Reykjavik University
Magnús Tumi Guðmundsson	Board member	University of Iceland
Auður Andrésdóttir	Board member	Mannvit
Hjalti Páll Ingolfsson	Operational Manager	GEORG

10h-11h30: Meeting with directors of Work packages (or Research projects)

Sigurður Magnús Garðarsson	WP1 leader/Chairman of the board	University of Iceland
Guðrún Sævarsdóttir	WP2 leader	Reykjavik University
Guðrún Sævarsdóttir	WP3 leader substitute	Reykjavik University
Ólafur Flóvenz	WP4 leader	ISOR
Halldór Pálsson	WP5 leader	University of Iceland
Guðni Axelsson	WP6 leader	ISOR
Sveinn Agnarsson	WP7 leader	University of Iceland
Sigurður Bogason	WP8 leader	MarkMar
Hjalti Páll Ingolfsson	Operational Manager	GEORG

11h30-12h: Presentation of a SWOT analysis of the Center

Sigurður Magnús Garðarsson	Chairman of the Board	University of Iceland
Hjalti Páll Ingolfsson	Operational Manager	GEORG

12h- 12h30: Internal evaluation team meeting**12h30-13h30: Lunch****13h30-14h30 Project presentations**

Ólafur G. Flóvenz	Selected geothermal resource projects
Halldór Pálsson	Evaluation and Improvements of Geothermal Models using Inverse Analysis
Hannes Jónsson	Efficient Maintenance Management of Geothermal Power Plants
	Development of coupled reactive fluid flow models

Sigurður Brynjólfsson	GeoChem	
Sigurður Magnús Garðarsson	Chairman of the Board	University of Iceland
Hjalti Páll Ingolfsson	Operational Manager	GEORG

14h30-15h: Meeting with stakeholders

Guðni A Jóhannesson,	Representing stakeholder	Orkustofnun
Sigurður Arnalds	Representing stakeholder	Mannvit
Bjarni Pálsson	Representing stakeholder	Landsvirkjun
Ingólfur Örn Þorbjörnsson	Representing stakeholder	Iceland Innovation centre

15h-15h30 Project presentations continued....**15h30- 16h: Meeting with Host Institution (University)**

Halldór Jónsson	Representing host institution	University of Iceland
Ólafur Flóvenz	Representing host institution	ISOR
Ari Kristinn Jónsson	Representing host institution	Reykjavik University

16h-16h30: Possibility to talk to evaluation committee in private**16h30-17h: Closing session with Head of Centre**

Sigurður Magnús Garðarsson	Chairman of the Board	University of Iceland
Hjalti Páll Ingolfsson	Operational Manager	GEORG

17h- 17h30: Internal evaluation team meeting

ANNEX III

Centres of Excellence Mid Term Evaluation (November 2012)

-GEORG Centre of Excellence-

Summary of Findings

An impressive number of organisations are members of the GEORG with academic, commercial and governmental participants. This organisation already provides opportunities that would not have been identified without GEORG. It is pleasing to see that there are some well regarded international members of GEORG with complementary or matching interests. The Evaluation Team recognises that the expertise of Icelandic geothermal researchers will contribute to projects in the EU and widen the knowledge base of Icelandic participants, especially about low enthalpy geothermal systems.

There is close communication between the administration, members and researchers. All partners seem to be quite open, as is best. The Board has met an impressive number of times on a regular basis and its decisions are evident to the geothermal community of Iceland.

The process to evaluate applications for funding seems thorough and timely.

According to the partners' feedback the operation of GEORG is functioning well. GEORG benefits from the open access to technical data, including drilling and reservoir data, as well as the good will of participating organisations.

The original GEORG objectives have been met, implemented according to plan and has been done well under the difficult economic conditions in Iceland since 2008.

Collaborative Impact

As mentioned in the mid-term report, the partners of GEORG have collaborated not only within the funded research projects but also outside the core research projects. Additional

support measures have been set up with the partners that have resulted in innovative working groups, for example, the Deep Roots of Geothermal System (DRG).

The readiness of the partners to give GEORG a certain legal entity expresses its confidence that the GEORG approach is both beneficial and of long term.

GEORG is a good entry point for those with interests in geothermal in Iceland and has made early progress in establishing a Knowledge Hub. There are close interactions between science and industry. This has also contributed to better cooperation within industries and within the academic sector. Good progress has also been made in furthering interdisciplinary collaborations (for example, with partners from socio-economic disciplines). On the international level, many well regarded foreign partners have been involved in projects funded by GEORG, which has also assisted closer collaborations between them.

Close cooperation has been sought with the Icelandic Geothermal Cluster which is appreciated by the Evaluation Team. We judge that this is the right way to deal with the challenge of having two geothermal clusters in Iceland.

Scientific Impact

GEORG has become an excellent forum to stimulate R&D in the geothermal sector. It has brought together key researchers from academia and members of industry. A large number of graduate students have been supported. The number of publications at this stage is acceptable, taking into account that many projects have just been finished or are still in progress and that it takes time to get results published. Based upon papers presented by students and co-authors at national and international conferences we judge that there is considerable material that deserves to be published in international journals.

The R&D outcomes presented were impressive and several are state-of-the art. Indeed some have already yielded publications of international significance, for example, those of DRG, Hydrorift and GeoChem. Thus, some of the research done within GEORG has already had a major impact, particularly on the geosciences community.

Economic and Social Impact

Based on the nature of the research done and taking into account the fact that most of the R&D projects are still ongoing or just finished, little has been reported on the economic and social impacts of GEORG. Many firms involved in R&D projects expect to gain some monetary benefits from them in the future. First indications from the report and information given during the site visit left the Evaluation Team with the impression that there will be significant economic impacts in the near future. This will be true if the recommendations about further exploitation and commercialisation of the project outcomes are implemented.

Evaluation Outcome

We congratulate the instigators, participants and supporters of GEORG on how much the cluster has achieved in a short time. In our opinion its focus is appropriate and augers well for its future activities and consequently **we recommend that the funding from Rannís be continued.**

To enhance the operation and impact of the GEORG approach the Evaluation Team makes the following recommendations.

Recommendations

1. Reinforcing Management and Operations

The Evaluation Team was impressed by the amount and quality of work done by the Operational Manager and the Chairman of the Board of GEORG. However, it was clear to us that the manager needs more support in order to develop fully the potentials of GEORG. The management of “Innovation and Startups” (WP3) is presently insufficient to deliver adequate services to GEORG partners. In order to better fulfil these tasks its capacities for public relations and strategic development need to be increased (perhaps by appointing a strategic development officer).

2. Strengthening the Research Capacity

The Evaluation Team is impressed by the quality of the research produced by a relatively small number of researchers. However, several worthwhile research topics could not be funded or initiated due to a lack of qualified staff. More attention should be given to improve the capacity of full time researchers, such as faculty members, post-doctoral fellows and PhD students. Research profiles describing GEORG's research priorities should be used to recruit academic staff from the universities in order to strengthen cooperation between them and GEORG. Given the high quality of geothermal research done in Iceland it is appropriate for academic partners of GEORG to apply for additional national and international funds for post-doctoral and doctoral fellowships.

3. Enhancing Visibility and Impact

The Evaluation Team acknowledged the initial actions made by GEORG management to increase its national and international visibility in academia and industry.

However, we recommend GEORG's management initiates further actions to enhance its visibility and reputation, including;

- Implementing an exploitation strategy that makes better use of the synergies between different R&D projects and focuses on commercialisation support of prototypes developed within the GEORG projects (e.g. by initiating brochures adapted to business and academic interests).
- Lobbying for the interests of GEORG partners (to the public and policy makers).
- Taking an active role to support partners in commercialising the R&D outcomes of the funded projects.
- Setting up accompanying measures to support international visibility for the GEORG partners (e.g. approaching European Geothermal Energy Council (EGEC), Geothermal Resources Council (GRC) and Geothermal Energy Association (GEA)). We recognise the role of UNU graduates as potential advocates for Iceland's geothermal expertise. These should be made aware of

GEORG's role and activities and the opportunities that may benefit their own countries and projects.

- Initiating information exchange and exploring collaborative opportunities with other Icelandic clusters (e.g. food, tourism, EDDA (esp. on policy and economic issues and deliberative poll) etc.).
- Publishing the ongoing research in top academic journals. We especially encourage publications deriving from the research of masters and doctoral students.
- Open access to data and resources should continue.

4. Review of Implementation Plan

We recommend that the mid term evaluation be used by GEORG management, in close cooperation with the key partners, to review whether the tasks within the work packages still meet the needs of the original project objectives. This could also include appropriate budget shifts between work packages.

5. Improving Project Proposal Processes

Although the present process to evaluate proposals seems to be functioning well and is appropriate, we recommend extending the evaluation by using international reviewers as well. This will ensure higher transparency and acceptance by all GEORG partners. For project proposals which were not funded, we recommend face-to-face meetings with unsuccessful applicants to provide feedback and advice.

6. Sustainability

The Evaluation Team is well aware of the efforts made so far to ensure sustainability of the GEORG approach. One of its main pillars is its ability to tailor services to cluster participants. This is a promising approach towards achieving sustainability (e.g. by attracting additional EU funds or workshops conducted with other clusters).

However, from 2014 close attention should be given to implement more services that add value to the GEORG approach for the partners.

We recommend that the status of GEORG, whether it is a research group, centre of excellence, project or cluster, be clarified and communicated as soon as possible to the partners and the public. We expect that GEORG will become a leading internationally recognised cluster in geothermal technology and sciences.

ANNEX IV**1st Seminar: General Introduction**

3. april, 2013 @ 14.00-16.00 University of Iceland, VR-II, room 157;

Sigurður Magnús Garðarsson

Professor at University of Iceland Chairman of GEORG Board of directors

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Bjarni Már Júlíusson

Project Manager at Reykjavik Energy

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Auður Andrésdóttir

Resource manager, enviroment and safety, Mannvit Engineering

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2nd Seminar: H2S emmission from Geothermal Power Plants

10. april, 2013 @ 14.00-16.00 University of Iceland, VR-II, room 157

Hjalti Sigurjónsson

Project manager at Vatnskil Engineering

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[-download model video-](#)

Snjólaug Ólafsdóttir

PhD student at University of Iceland

[-download pdf-](#)

Ragnhildur Finnbjörnsóttir

PhD student at University of Iceland

[-download pdf-](#)

3rd Seminar: Value creation from chemicals/gases

17. april 2013 @ 14.00-16.00 Reykjavík University, room M208

Maria Hildur Maack

Environmental Manager, Icelandic New Energy

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Guðmundur Gunnarsson

Group leader, Innovation Centre Iceland

[-download pdf-](#)

Ómar Sigurbjörnsson

Head of Research, Corbon Recycling International

[-download pdf-](#)

4th Seminar: Value creation from chemicals/gases

24. april 2013 @ 14.00-16.00 Reykjavík University, room M208

Sveinn Aðalsteinsson,
GeoGreenhouse

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Sigurður Brynjólfsson,
Prófessor við Háskóla Íslands

[-download pdf-](#)

Arnpór Ævarsson,
Prokatín

[-download pdf-](#)

5th Seminar: Disposal and Sequestration

8. may 2013 @ 14.00-16.00 Reykjavík University, room M208

Edda Sif Aradóttir,
Reykjavik Energy

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Gunnar Gunnarsson,
Reykjavik Energy

[-download pdf-](#)

ANNEX V**International Journals**

H. A. Alfredsson, K. G. Mesfin and D. Wolff-Boenisch The syringe bailer: A novel borehole sampling technique for CO₂-rich fluids and tracers during mineral sequestration. In review. Submitted to *Geofluids*, Manuscript ID GFL-2011-026.

Edda S.P. Aradóttir, Eric Sonnenthal, Grímur Björnsson and Hannes Jónsson (2012). Multidimensional reactive transport modeling of CO₂ mineral sequestration in basalts at the Hellisheidi geothermal field, Iceland *Int. J. Greenhouse Gas Control* doi:10.1016/j.ijggc.2012.02.006

Edda S.P. Aradóttir, Eric Sonnenthal and Hannes Jónsson (2012). Development and evaluation of a thermodynamic dataset for phases of interest in CO₂ sequestration in basaltic rocks. *Chem. Geol.* (2012) 304-305, 26-38. DOI: 10.1016/j.chemgeo.2012.01.

Edda S. P. Aradóttir, Hólmfríður Sigurðardóttir, Bergur Sigfússon and Einar Gunnlaugsson (2011). CarbFix – a CCS pilot project imitating and accelerating natural CO₂ sequestration *Greenhouse Gases: Science and Technology* 1, 105-118

Kristján Ágústsson, Ólafur G. Flóvenz, Ásgrímur Guðmundsson and Sigurveig Árnadóttir (2012). Induced seismicity in the Krafla high temperature field. Submitted to *Geothermal Resources Transactions*, 2012. 9 p.

Conference proceedings

Daniel Drader, Halldór Pálsson and Magnús Þór Jónsson, Improved Power Production Efficiency of Hydrothermal Reservoirs Using Downhole Pumps, Thirty-Seventh Workshop on Geothermal Reservoir Engineering Stanford University, Stanford, California, January 30 - February 1, 2012. <http://pangea.stanford.edu/ERE/pdf/IGAstandard/SGW/2012/2012program.html>

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ANNEX VI



Hér með gera Háskóli Íslands, kt. 600169-2039, annars vegar, og GEORG, kt. 430412-0350, hins vegar, með sér eftirfarandi

SAMNING UM REKSTUR SKRIFSTOFU, ÁN LAUNAKOSTNAÐAR, FYRIR SAMSTARFSVERKEFNIÐ

Rannsóknaklasi í jarðhita

með viðfangsnúmerið 1566-156305 hjá Háskóla Íslands

1. Skipulag samstarfsins

Verkefnið „Rannsóknaklasi í jarðhita“ hlaut styrk frá Vísinda og Tækiráði Íslands árið 2009. Styrkurinn nam 70 milljónum kr. á ári til allt að 7 ára. Verkefnið er rekið sem klasasamstarf og að því standa, auk Háskóla Íslands, fjölmörg fyrirtæki, stofnanir og háskólar. Yfir verkefninu er 8 manna stjórn, skipuð fulltrúum þátttakenda í samstarfinu, og er Sigurður M. Garðarsson, prófessors og deildarforseta við Umhverfis- og byggingarverkfræðideild, formaður stjórnar.

Árið 2012 ákvað stjórn samstarfsins að stofna sérstakt félag um rekstur skrifstofu verkefnisins og eru samþykktir þess að finna í viðauka I.

2. Hlutverk og skyldur GEORG

GEORG sér til þess að fyrir hendi sé skrifstofa með öllum nauðsynlegum búnaði þannig að hægt sé að reka samstarfið í samræmi við þau verkefni sem skrifstofnunni ber að vinna sbr. viðauka II, að frátöldum launakostnaði. Eins ber GEORG að standa straum af kostnaði við fundahöld, ráðstefnuhald eða aðra þá viðburði sem stjórn félagsins ákveður hverju sinni.

3. Samningstími

Samningur þessi gildir frá 1. janúar 2013 til 31. mars 2016, nema að komi til uppsagnar skv. 6. gr. þessa samnings.

4. Upphæð samnings

Vegna rekstursins greiðir Háskóli Íslands 2.000.000 kr. til GEORG við undirritun samning og síðan skv. reikningum, allt að 1.000.000 kr. í hvert skipti, út samningtímabilið en þó aldrei umfram 5.000.000 á ári nema um það sé samið sérstaklega.

5. Uppsögn og lögsaga

Hvor aðili sem er getur sagt þjónustusamningnum upp með þriggja mánað fyrirvara. Uppsögn skal vera skrifleg, dagsett og send gagnaðila með sannanlegum hætti.

Rísi mál út af samningi þessum skal reka það fyrir Héraðsdómi Reykjavíkur.

Samningur þessi telur sjö síður með viðauka. Hann er gerður í tveimur eintökum; eitt til handa hvorum aðila.

Reykjavík, 1. Janúar 2013

F.h. Háskóla Íslands

Sigurður Magnús Garðarsson

F.h. GEORG

Hjalti Páll Ingólfsson

ANNEX VII



GEORG- Rannsóknarklasi í jarðhita

Financial Statements 2013

Compiled without Audit or Review

GEORG-Rannsóknarklasi í jarðhita
kt: 430412-0350
Grensásvegi 9
108 Reykjavík

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Report of the Board of Directors and the CEO

GEORG-Rannsóknarklasi í jarðhita was founded in the year 2012 as an International Geothermal Cluster Cooperation. GEORG is a non-for-profit organisation with the purpose of bringing together players in the geothermal field and creating a strong force for rapid progress and added value in geothermal research, engineering and design. GEORG achieves its purpose by: 1) Supporting and promoting projects among the Cluster members, in the field of geothermal research and development. 2) Service its members by organizing workshops and seminars addressing the most urgent issues and challenges of each time. The members will also maintain a strong contact network among the members. 3.) Systematically promote geothermal energy and geothermal research, both domestically and abroad. The fiscal year is from 1st April to 31st March.

These financial statements are compiled in accordance with Icelandic laws and regulations regarding preparing and presenting financial statements and in accordance with other applicable laws and regulations.

Total Revenues for the year 2012 amounted to ISK 1.981.443 and deferred revenues amounted to ISK 1.538.967. Total revenues over expenditures for the financial year were none. Assets total were ISK 1.886.417 at financial year end.

We, the board of directors and CEO, of GEORG-Rannsóknarklasi í jarðhita hereby confirm that we are responsible for the preparation and presentation of these financial statements and we hereby ratify these financial statements for the financial year of 1.4.2012-1.3.2013 with our signatures.

Reykjavík, 14 May 2013

Auditor's Compilation Report

To the board of directors of GEORG-Rannsóknarklasi í jarðhita.

We have compiled, on the basis of the information provided by management, in accordance with the International Standard ISRS 4410, these financial statements of GEORG-Rannsóknarklasi í jarðhita as of December 31, 2012 and statement of income and cash flows for the year then ended.

We have not performed an audited or reviewed these financial statements and accordingly we express no assurance thereon.

Reykjavík, 14 May 2013

Sveinbjörn Sveinbjörnsson
löggiltur endurskoðandi



Íslenskir endurskoðendur Bíldshöfða slf
Bíldshöfða 14, 110 Reykjavík

Statement of Activities 1.4.2012-31.3.2013

	Note	1.4.2012- 31.3.2013
Revenues		
Operational grants		461.033
Other grants		1.520.410
		<u>1.981.443</u>
Expenses		
Grants awarded		670.000
Other expenses		1.293.573
		<u>1.963.573</u>
Financial income and (expenses)		
Interest revenues and exchange differences		1.243
Financial income taxes	(248)
Bank related service fees	(18.865)
		<u>(17.870)</u>
Increase in Net Assets		0
Excess of revenues over expenditures		<u><u>0</u></u>

Statement of Financial Position

Assets

Note 31.3.2013

Current assets

Receivables:

Cash and cash equivalents 1.886.417

Current assets 1.886.417

Total assets 1.886.417

31 March 2013

Equity and Liabilities

	Note	31.3.2013
Net assets		
Permanently restricted		0
Temporarily restricted		0
Unrestricted		0
Total net assets	3	<u>0</u>
Current liabilities		
Deferred income		1.538.967
Accounts payable		347.450
Total liabilities		<u>1.886.417</u>
Total net assets and liabilities		<u><u>1.886.417</u></u>

Statement of cash flows

	Note	1.4.2012- 31.3.2013
Operating activities		
Net income (loss)		0
Changes in operating assets and liabilities:		
Short term payables, change		347.450
		<u>347.450</u>
Changes in operating assets and liabilities		<u>347.450</u>
Net cash from operating activities		<u>347.450</u>
Financing activities		
Other payables, change		1.538.967
Net cash flow from financing activities		<u>1.538.967</u>
Increase in cash		1.886.417
Cash at beginning of year		0
Cash at year end		<u>1.886.417</u>

Notes

Accounting principles

1. These Financial Statements of GEORG-Rannsóknarklasi í jarðhita for the fiscal year 1.4.2012-31.3.2013 have been prepared in accordance with applicable Icelandic laws and regulations and in accordance with generally accepted accounting principles pertaining to non-for-profit organizations.
2. Revenues are recorded at the time of grant decisions made.

Net assets

3. Changes in Net Assets:

	Permanently restricted net assets	Temporarily restricted net assets	Unrestricted net assets	Total
Increase in Net Assets	0	0	0	0
Net Assets 31.3.2013	0	0	0	0

Itemizations

1.4.2012-
31.3.2013

Grants awarded

MarkMar	280.000
Gekon ehf	140.000
Víðfari Best á Íslandi	250.000
	<hr/>
	670.000
	<hr/>

Other expenses

Rent	697.628
Other services purchased	148.592
Computerized IT systems	12.235
Paper, printing and other office supplies	56.964
Meetings and conferences	322.762
Advertising and marketing costs	50.392
Founding related expenses	5.000
	<hr/>
	1.293.573
	<hr/>

