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Geothermal Reporting Code Review

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Abbreviations and definitions

AGEA	Australian Geothermal Energy Association
CanGEA	Canadian Geothermal Energy Association
CIM	CRIRSCO member for Canada
CRIRSCO	Committee for Mineral Reserves
International Reporting Standards	
EGS	Enhanced Geothermal System
GEA	Geothermal Energy Association
GEO	Geothermal energy
IASB	International Accounting Standards Board
ICMM	International Council on Mining and Metals
JORC	CRIRSCO member for Australasia
NRO	National Reporting Organisation
PERC	CRIRSCO member for Europe
UNECE	United Nations Economic Commission for Europe

Geothermal play	is used as an informal qualitative descriptor for an accumulation of heat energy within the earth's crust. It can apply to heat contained in rock and/or in fluid. It has no connotations as to permeability or the recoverability of the energy. A Geothermal Play does not necessarily imply the existence of Geothermal Resources or Reserves and quantitative amounts of energy should not be reported against it.
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EXECUTIVE SUMMARY

Whether or not there should be a specific European Geothermal Reporting Code is a question currently being discussed in the European geothermal industry. This document includes the history, basis and description of the existing Geothermal Reporting Codes, a discussion of the objectives, the pros and cons of having a specific European Geothermal Reporting Code and finally makes a recommendation for Europe.

The existing geothermal reporting codes are based upon an international reporting template used within the mining industry. Geothermal energy associations in Australia and Canada have created Geothermal Reporting Codes based upon their mining industry tradition. The Canadian version is further based to a great extent on the Australian version. Both countries are members of CRIRSCO, Committee for Mineral Reserves International Reporting Standards, and base their respective Reporting Codes on the international reporting template first issued by them in 2006. The mining industry in Europe has a PERC reporting code which is also based on the international reporting template issued by CRIRSCO. If it is decided to follow in the footsteps of Australia and Canada the basis for a European geothermal reporting code could be the PERC reporting code.

The geothermal reporting codes have a short history and their effect upon the market has not, to the authors' knowledge, been measured yet. The Australian geothermal reporting code was established 2008 and the Canadian two years later. The geothermal reporting codes give a reporting template, defined terminology and require the reports to be signed by a Qualified Person. The Qualified Person is then accountable for the results if questioned by peers. The Qualified Person is further assumed to be a person that is a corporate member of a recognised professional body relevant to the activity undertaken and with enforceable Rules of Conduct. There are no lists available of written code compliant reports so the exact amount of existing reports is not known. Neither code has been endorsed by any market nor regulator as of yet.

A Geothermal Reporting Code should foremost provide a standardised reporting form for public reporting to report geothermal exploration results and geothermal resource and reserve estimates. This is intended to facilitate trust and understanding of the geothermal industry with international investors, regulators and the general public. A Geothermal Reporting Code does not give a step-by-step guide to evaluate or assess the geothermal plays. There is however further guidance given within a lexicon that is published with the existing Australian Geothermal Reporting Code. The lexicon is still not an integrated part of the Geothermal Reporting Code. The Geothermal Reporting Code provides the framework for reporting and presenting results but it does not provide the evaluation method.

The Geothermal Energy Association (GEA) in the USA decided against creating a specific Geothermal Reporting Code. The reason is believed to be due to uncertainty about what legal obligations would be created. Instead GEA published a guide to reporting resource development progress and results to the Geothermal Energy Association called "New Geothermal Terms and Definitions" in November 2010. Unfortunately these geothermal terms and definitions are in contradiction to the definitions

agreed upon within the Australian and Canadian Geothermal Reporting Codes. This creates a difference in definitions of terms within the international geothermal industry.

Arguments against developing a special geothermal reporting code for Europe are, for example:

- The requirements of the EU market for a report template or reporting code are similar or the same as the international requirements and the two existing Geothermal Reporting Codes both state that they are applicable both locally and internationally.
- The purpose of a Reporting Code is to have comparable reports for the different geothermal plays in the international market. As There is no international umbrella association, adding a third independent Reporting Code might undermine this comparison role.
- The existing geothermal reporting codes seem not to be regulated or supervised, all is down to the integrity of the Qualified Person, and no measurement of their effect is conducted.
- Reports have been created which do not use code but still quote it.. They do not state that the reports are code compliant but imply that the work is done in similar way. This can weaken the code and does not comply with standards. Nothing in the existing geothermal reporting codes prohibits this use.
- Only a handful of companies are expected to be listed on the European stock exchange for the next years. There are today three known listed companies with two believed to be in progress, so the users of a specific European Geothermal Reporting Code are few.

Arguments for developing a special geothermal reporting code for Europe are, for example:

- The existing reporting codes can serve as framework and principles setting a standardised international reporting format acceptable to investors, regulators and the general public. What is missing is the regulation authority and supervision of the usage of the code. If the code is used in ways that could diminish its trustworthiness, there is no active supervision or instruments to fall back on for the solution. If there was a European Geothermal Reporting Code could be regulated and supervised. This would require funding.
- By having an independent European Geothermal Reporting Code the European Geothermal Industry can enter the Geothermal Reporting Code discussion with more strength and push for creating an international umbrella association with comparable reporting code requirements and definitions of terminology.

The results from the discussion indicate that:

The Geothermal Reporting Code is believed to be of best use if it is international, regulated and supervised. This would ensure that the same principles are followed worldwide within the geothermal industry. Publication, regulation and supervision of an international geothermal reporting code could be done in a similar way to what is done in the mineral reserves industry. For that an umbrella organisation similar to CRIRSCO is required for the geothermal industry. The Geothermal Reporting Code would then in all principles be the same, however tailored to the

regions in similar fashion as in the mineral reserves industry. The Australian and Canadian Reporting Codes could then be seen as the pioneer documents within the international system.

It could be relevant and necessary to have an independent European Geothermal Reporting Code in order to join the international discussion to build up an international umbrella association bit by bit. This could speed up the process of having an international geothermal reporting code and bridge the gap until then by having an existing European Geothermal Reporting Code that can be regulated and supervised. For this funding is necessary to set up a body that can write the code, update it as necessary, participate in international discussion and most importantly regulate and supervise the use of the European Geothermal Reporting Code.

On the other hand it could be argued that for Europe it is not necessary to establish a special Geothermal Reporting Code until after this umbrella organisation has been agreed upon and established. That is primarily since the existing codes are international and can be used until then. Secondly, there are very few expected users of a specific European Geothermal Reporting Code. Thirdly, to issue a third independent code in geothermal reporting would not serve the purpose of the reporting code which is establishing an environment that facilitates comparison.

The objective in the future should be toward a mutual recognition in Europe and internationally of the vocabulary used, notably in the framework of insurance schemes; it is suggested to establish a European working group to provide input to the on-going work within the UNFC-2009 towards an international classification scheme. The working group could develop a similar document as published by the GEA or the lexicons published as guidance with the existing Geothermal Reporting Codes, this could be of use for the geothermal industry. This document, guide, or lexicon, should be specifically tailored to the European market. This could be done instead of creating one more unregulated Geothermal Reporting Code. A document providing guidance in specific European situations could prove useful for professionals during assessment of European geothermal plays. The derivation of the terminology and definitions should always be done in close cooperation with the international geothermal society. This means that at least both existing code committees should be consulted during the production. The reports could then be reported under an international reporting code such as the Australian or Canadian code if required to be code compliant.

What way is chosen therefore depends on what funding can be raised and what demands are made by the market and the geothermal industry. It is believed that having a European Geothermal Reporting Code is an effective way of reaching an international geothermal reporting code and a standardised environment for reporting on geothermal plays. However, setting up a standardised reporting terminology is believed to be acceptable for at least the next couple of years. The decision can then be revisited when more users have entered the market and there is a need for a specific European Geothermal Reporting Code.

Thus, this project recommends:

- 1) A wait and see strategy regarding investment in a European Geothermal Reporting Code until more potential users have entered the market.

- 2) Establishment of a working group contributing to the UNFC-2009 work regarding standardised terminology and classification schemes in order to reach international consensus within the geothermal industry.

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Appendix I Canadian Geothermal Reporting Code

Appendix II Australian Geothermal Reporting Code

Current situation

To establish a basis for the review, a short presentation is made of the current situation, definitions, market requirements and an attempt made to establish whether there are differences between the European conditions and the conditions that existing codes are based in to justify a specific European Geothermal Reporting code.

A “Code”

What does Code stand for?

The Free Online Dictionary:

1. “a systematically arranged and comprehensive **collection of laws**”
2. “a systematic **collection of regulations and rules** of procedure or conduct: a traffic code”

The online Merriam-Webster dictionary:

1. “a **systematic statement of a body of law**; especially: one given statutory force”
2. “a **system of principles or rules** <moral code>”

Dictionary.com:

1. “any **set of standards set forth** and enforced by a local government agency for the protection of public safety, health, etc., as in the structural safety of buildings (building code) health requirements for plumbing, ventilation, etc. (sanitary or health code) and the specifications for fire escapes or exits (fire code)”
2. “a **systematically arranged collection or compendium of laws, rules, or regulations**”
3. “any authoritative, general, systematic, and **written statement of the legal rules and principles** applicable in a given legal order to one or more broad areas of life”

The only known legal obligation within the Geothermal Reporting Codes, known by the author, is the one carried by the Qualified Person signing the report to their recognised professional body relevant to the activity undertaken, and then only in regards with that professional body’s enforceable Rules of Conduct.

It is therefore assumed that the interpretation ‘a system of principles or rules ‘moral code’ is the interpretation that best captures the meaning of the word Code in Geothermal Reporting Code.

That said the GEA in the USA decided not to develop a geothermal reporting code for publicly reporting exploration and development results in the United States as they were afraid to create a legal obligation out of it. The GEA instead published a thorough reporting guide in November 2010 called *New Geothermal Terms and Definitions*. This serves as a guide to reporting development results to GEA, but is not a geothermal public reporting code. (Geothermal Energy Association, 2010) They do not have the same Terms and Definitions as the Australian and Canadian Reporting Codes and communication has not been resolved on this issue.

Public Reporting

The Geothermal Reporting Code is made for Public Reporting.

What is Public Reporting?

A Public Report or Public Reporting is any report on the relevant subject prepared for the purpose of informing investors or potential investors and their advisors, or to satisfy regulatory requirements.

- Reports prepared for investors or potential investors
- Annual and Quarterly Reports
- Information Memoranda released to the public
- Websites
- Public presentations/press releases
- Stock Exchange Information Systems

(Roger Dixon, CRIRSCO, 2011)

EU Geothermal Reporting Code Discussion

The discussion for a European Geothermal Reporting Code is not advanced. It seems to be in its first stages at least according to written sources. A presentation can be found made by Miklos Antics at GPC IP in a meeting in June 11th year 2010 within the TP GEOELEC platform, after that in Dec. 8-9th 2010 at the GeoPower Europe conference and then regularly presented by Miklos Antics at various conferences.

No other presentations or articles specifically regarding a European Geothermal Reporting Code come up by searches made in search engines (e.g. google) on the web.

It is known to the author though that the topic has been discussed between peers in the geothermal industry since the geothermal reporting codes emerged in Australia and Canada.

It seems not to have been addressed by European markets, at least no public sources were found during the making of this report.

The main reason for the Australian and Canadian Geothermal Reporting Codes was to forego the stock exchanges making a Reporting Code for the industry, fearing that people unaccustomed to geothermal industry would set unreasonable demands within a Geothermal Reporting Code that would then be forced upon the industry. This seems not to be the case for Europe.

CRIRSCO and the PERC Reporting Code

CRIRSCO is the international body harmonising reserve reporting standards around the world. CRIRSCO or the Committee for Mineral Reserves International Reporting Standards has several members such as Australasian JORC in Australasia, CIM in Canada and European PERC for Europe, and similar reserves standards bodies in the USA, South Africa, Russia and Chile. The CRIRSCO International Reporting Template was first published in 2006. It is recognised by global organisations such as International Accounting Standards Board (IASB), the United Nations Economic Commission for Europe (UNECE) and the International Council on Mining and Metals (ICMM), as the key international organisation representing the mining industry on issues relating to the classification and reporting of mineral assets. (International Council of Mining and Metals, 2013)

The PERC Reporting Code or Pan European Code for Reporting of Exploration Results, Mineral Resources and Reserves is fully aligned with the CRIRSCO Reporting Template. The intent of the Code is to provide a minimum standard for Public Reporting e.g. minimum standard for any report on Exploration Results, Mineral Resources or Mineral Reserves prepared for the purpose of informing investors or potential investors and their advisers or to satisfy regulatory requirements. (PERC, 2012). PERC serves as the National Reporting Organisation (NRO) for Europe, including, but not limited to, member countries of the European Union.

These reporting codes are solely intended for solid mineral raw materials and therefore do not include non-solid energy minerals such as geothermal fluid. [<http://46.32.234.2/perc/tor.asp>] The Australian Geothermal Reporting Code follows the JORC Code in principles, framework and key concepts. The JORC Code, or the Code for reporting of Mineral Resources and Ore Reserves, is a reporting code already established within the minerals industry for Australasia and Australia. The JORC Code and thus the Australian Geothermal Reporting Code conform to the International Reporting Template (CRIRSCO, 2006) that covers the public reporting of exploration results, resources and reserves for the global mining industry. [(AGEG, 2012), (Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC), 2012)].

The Canadian Geothermal Code builds on NI 51-101 and NI 43-101 that are Canadian National Instruments on Oil & Gas Reporting and Mining Reporting respectively. Both are standardised reporting codes used within their industries to increase investor confidence. (CanGEO). CIM is the member organization for CRIRSCO in Canada.

Based on this it could be concluded that a European Geothermal Reporting Code could in fact be based upon the PERC Reporting Code as done for equivalent mining reporting codes in Australia and Canada. It could also be concluded that Reporting Codes are based upon the same framework and principals agreed upon within the CRIRSCO and represented in the CRIRSCO International Reporting Template and therefore a European Geothermal Reporting Code could look directly to that template or to any of the existing Geothermal Reporting Codes for guidance.

Requirements by the EU GEO market

The Geothermal Reporting Code should comply with other Reporting Codes accepted by the market.

The Geothermal Reporting Code should be able to report on projects within high enthalpy fields, low enthalpy fields and enhanced geothermal systems.

The Geothermal Reporting Code should satisfy the information needs of stakeholders while making every effort to provide project developers with the possibility to keep company secrets and maintain their lead over competitors.

Both existing Geothermal Reporting Codes are based on CRIRSCO and can be used to report on all types of geothermal energy projects both locally and internationally and therefore fulfil these requirements.

The discussion regarding requirements raised some more questions that remain un-answered:

1. Is there some formal framework required when a document is called a CODE? Are codes required to follow some regulations, forms like other standards? Like regulation, supervision, update requests, presentation, review etc. For example similar to other standards like EN, ISO etc.
2. Is it normal that you can refer to a code in a report without it being code compliant? The existing geothermal reporting codes do not point out this issue. It is assumed that the Qualified Person is part of a union or other legal entity with an ethical code that would penalise the Qualified Person if the code is misused in some way.
3. If it is required by the market – who is requiring it and where? When the codes were set up there was a fear that the securities exchange would have people with no knowledge of geothermal industry write a code, which would be imposed on the industry for regulation. The reason for the Securities Exchange to impose such a code was to prevent geothermal companies over quoting their resources. Is this fear present today in Europe? Are there other regulatory or securities exchange related issues that demand a European Geothermal Reporting Code today?
4. If it is required and would help geothermal energy to spread – where are the international geothermal/energy associations IGA / IEA others? It is believed that the answer is plainly that they do not have the capacity to follow up on this issue.

Listings of GEO investors

Both Australia and Canada have a strong mining tradition, and also a strong tradition in mining exploration firms being listed on stock exchanges. The Australian and Canadian Stock Exchanges represent roughly 90% of all listed mining companies globally. Therefore it is logical that most of the geothermal companies are also listed on the Stock Exchanges there. Within this report we are however focusing on Europe and according to the list presented at Islandsbanki's website (Íslandsbanki, Xignite, 2013) there are only two registered companies in Europe, Daldrup & Soehne Ag in Germany and Pannergy Nyrt in Hungary.

The venture exchange AIM in London is the biggest Stock Exchange in Europe. It is believed that if UK picks up on EGS in for example in Cornwall, then 2-3 companies will be listed in London. [Alexander Richter]

There are some indications that the list from Islandsbanki is not complete or that is not up-to-date if for example Geotermica in Sweden (Aktiedata_eng, 2010) and ABB/Siemens are considered. Also if heat pumps/heat exchange companies would be considered as part of the industry, a bigger market concerning listed companies could be expected.

Alterra Power Corp	Canada
Calpine Corp	United States
Chevron Corporation	United States
Contact Energy Ltd	New Zealand
Daldrup & Soehne Ag	Germany
Eden Energy Ltd	Australia
Enbridge Inc	Canada
Fellows Energy Ltd	United States
Geodynamics Ltd	Australia
Geothermal Resources Ltd	Australia
Greenearth Energy Ltd	Australia
Green Rock Energy Ltd	Australia
Hot Rock Ltd	Australia
Kuth Energy Ltd	Australia
Nabors Industries Ltd	United States
Nevada Geothermal Power Inc	Canada
Origin Energy Ltd	Australia
Ormat Technologies Inc	United States
Panax Geothermal Ltd	Australia
Pannergy Nyrt.	Hungary
Petratherm Ltd	Australia
Qualibou Energy Inc	United States
Ram Power Corp	Canada
Torrens Energy Ltd	Australia
United Technologies Corp	United States
Us Geothermal Inc	Canada
Wasabi Energy Ltd	Australia

Table 1 Listed geothermal developers and country of listing

source: <http://www.islandsbanki.is/english/products-and-services/geothermal-energy/geothermal-industry-dashboard/>

Existing Geothermal Reporting Codes

There are two existing Geothermal Reporting Codes. The Australian Geothermal Reporting Code initially published in 2008 and reviewed in 2010, and the Canadian Geothermal Reporting Code published in 2010. (AGEG, 2012) (CanGEA)

Both Geothermal Reporting Codes build upon the International Reporting Template from CRIRSCO that was first published in 2006. Key elements of the Australian Code were adopted and formed the basis of the Canadian Code.

Objective of a Geothermal Reporting Code

- Facilitate understanding, confidence and reputation in the market place with investors, regulators and the public
- Provide a standardised reporting basis of geothermal energy information that is satisfactory to investors, shareholders and capital markets
- Be applicable for all geothermal plays on local and international market

The Geothermal Reporting Code sets out to provide reports supporting the principles of:

Transparency - the reader of any public report should be provided with sufficient information, clearly and unambiguously presented, to understand the report and not be misled.

Materiality - This requires that a public report contains all the relevant information which investors and their professional advisers would reasonably require, and reasonably expect to find in the report, for the purpose of making a reasoned and balanced judgment regarding the material being reported.

Competence - This requires that the public report be based on work that is the responsibility of suitably qualified and experienced persons who are members of recognised, relevant professional organisations and subject to accountability and a professional Code of Ethics.

Utilization of the Geothermal Reporting Codes

The Geothermal Reporting Code is a reporting code that covers the way geothermal exploration results, resource and reserve assessments are classified and publicly reported. It does not cover the way assessments are made.

The Geothermal Reporting Code covers:

- all forms of geothermal energy, for example, conventional volcanic based energy, hydrothermal aquifers and hot rocks (EGS)
- all uses of geothermal energy, including geothermal thermal energy for electricity generation, direct use in industrial processes or space heating, or as supplemental energy
- the minimum and mandatory set of requirements for public reporting of Exploration Results, Geothermal Resources and Geothermal Reserves

In this way the Geothermal Reporting Code provides a framework and principles for reporting within the international geothermal industry. The Geothermal Reporting Code is however NOT a step-by-step guide to evaluate geothermal assets nor a ranking system for companies and projects. The

evaluation is based on the individual investor. The Australian committee has published a lexicon that is not specifically part of the Geothermal Reporting Code but gives guidance in the evaluation of geothermal assets.

Despite following the mining markets lead neither the Australian Geothermal Reporting Code nor the Canadian Geothermal Reporting Code have been endorsed by their countries' Securities Exchanges nor any other regulator involved in securities regulation on financial markets. Therefore the use of the Geothermal Reporting Codes by a company does not imply acceptance by regulators on the content of a report written under the Geothermal Reporting Codes.

The Australian Geothermal Energy Association has however decided that it requires its members to comply with the Geothermal Code from its release in August 2008 and the Canadian Geothermal Energy Association recommend their members to use it. The Codes are a form of industry self-regulation.

[(CanGEA) , (AGEG, 2012)]

There is no published record of code compliant reports neither with AGEA nor CANGEA. This is however a list of known code compliant reports:

- From 2008 until June 2009 – six companies deliver reports according to the Australian Geothermal Reporting Code (ThinkGeoEnergy, June 5th 2009, <http://thinkgeoenergy.com/archives/1804>)
- Maule, Chile. Prepared by SKM for Magma. July, 2009.
- Charlton-Lemont, Tasmania. Prepared by Hot Dry Rocks Pty Ltd for KUTh Energy. August, 2009.
- Penola project and Tirrawarra Project, Australia. Panax Geothermal. 2009
- Svartsengi, Reykjanes peninsula, Iceland. Prepared by Mannvit for Magma/HS Orka, December, 2009.
- Despoblados geothermal resource, San Juan, Argentina. Prepared by Geothermex, Inc. for G4G Resources Ltd., March 2010
- Chaves Geothermal Prospect, Resource Evaluation, Portugal. Prepared by Geothermex, Inc. for Galena International Resources Ltd, April 2010
- Mariposa, Chile. Prepared by SKM for Magma. August, 2010.
- Island of Efate, Republic of Vanuatu, KUTh Energy (Australian Geothermal Reporting Code, ThinkGeoEnergy Oct. 5th 2010)
- North Perth Basin, Australia, prepared by Hot Dry Rocks Pty Ltd for GreenRock Energy, October 2010
- Soda Lake, USA. Prepared by GeothermEx for Magma. 2010
- Copahue resource, Argentina. Prepared by SKM for Australian Earth Heat Resources, May 2011 (Canadian Geothermal Reporting Code)

- 2 areas, Tasmania, KUTh Energy (Australian Geothermal Reporting Code, ThinkGeoEnergy Nov. 25th 2011)
- Truckhaven Geothermal Area, Resource Assessment, Nevada USA. Prepared by Mannvit for Nevada Geothermal Power Inc., June 2012
- UK – the whole of UK, Prepared by SKM for GT Energy, 2012 (http://www.gtenergy.net/news/uk-geothermal-potential-identified-in-2012-report/?searched=Reporting+Code&advsearch=oneword&highlight=ajaxSearch_highlight+ajaxSearch_highlight1+ajaxSearch_highlight2)

Reports that are believed to be under construction:

- island of Savo, Solomon Islands, Kentor Energy (ThinkGeoEnergy March 12th 2012)

A Geothermal Reporting Code for Europe

Objective of a European Geothermal Reporting Code

The objectives of having a Geothermal Reporting Code for Europe are the same as listed for other Reporting Codes. It is the standardised data presentation that makes it easier to validate geothermal energy projects. A validation of geothermal energy projects both for size or production of the energy plant and expected cost of the energy is vital for the development of the geothermal industry within Europe. The validated values can then be used to validate predictions for example on whether EU 20/20 goals for geothermal energy are realistic and to give investors a basis for comparison of projects.

The geothermal industry is not a particularly big industry and based upon the resources at hand it will never be one of the larger industries in the world. Geothermal energy investors are therefore often international players even though operators of the geothermal energy plants are often local due to the projects local dependence. International investors will always need to compare investment projects in geothermal energy at various locations globally. Getting a standardised reporting form is therefore important to provide investors with reports that are comparable throughout the geothermal market. One way is to follow the same standardised approach in a Geothermal Reporting Code.

For a European Geothermal Reporting Code it is therefore important to fulfil the demands of the European market but also to be compatible with other Geothermal Reporting Codes to ensure the participation of international investors within the European geothermal market.

Application of Existing Geothermal Reporting Codes

It is possible for the European market to utilise the existing Geothermal Reporting Codes within geothermal energy projects in Europe. The Geothermal Reporting Codes especially state that they are for all types of geothermal energy projects and applicable in international markets. They have furthermore been used for resource assessments in international projects, e.g. in USA, Iceland, Portugal, Argentina.

The question is therefore whether companies listed in European markets can use the existing Geothermal Reporting Codes. None of the Geothermal Reporting Codes has yet been endorsed by a securities exchange within a country or by any regulator in the financial market. The sole purpose

today therefore seems to be to give investors a common basis to compare projects. This is best done following one standard, or one Reporting Code, for all projects under comparison. This favours one international standard. The two existing codes follow the framework and principles of the CRIRSCO International Reporting Template. Based on this the European listed companies should be able to utilise the existing standards.

What would need to be done:

- State that the European Geothermal Industry will use the existing Geothermal Reporting Codes
- Initiate and continue formal collaboration with AGEA and CANGEA in development of the Geothermal Reporting Codes and their utilization

PROS

- Less work invested
- The requirements by the EU market of a report template or reporting code are similar or the same as the international requirements and the two existing Geothermal Reporting Codes both state that they are applicable both locally and internationally.
- International approach to have few flexible International Geothermal Reporting Codes with the aim of having only one

CONS

- The existing geothermal reporting codes seem not to be regulated or supervised, all is down to the integrity of the Qualified Person, and no measurement of their effect is conducted.
- There have been reports not done by the code that still quote the code. Not stating that the reports are code compliant but implying that the work is done in similar way. This can weaken the code and is often not allowed in standards. Nothing in the existing geothermal reporting codes prohibits this use.

Development of New Geothermal Reporting Code

What would need to be done:

- Comparison with demands for the PERC Reporting Code
- Comparison with European market requirements, collaboration with Securities Exchanges if necessary
- Collaboration with existing Geothermal Reporting Code committees to ensure global approach and international compatibility within the Geothermal Industry (ease way for international investors)
- Collaboration with industry organisations in Europe to guarantee an applicable code for project developers

PROS:

- If there was a European Geothermal Reporting Code it could be arranged to have it regulated and supervised. The existing reporting codes can serve as framework and principles to set a standardised international reporting format acceptable by investors, regulators and the general public. What is missing today is the regulation authority and supervision of the usage of the code. If the code is used in ways that could diminish its trustworthiness there is no active supervision or instruments to fall back on for the solution.
- By having an independent European Geothermal Reporting Code the European Geothermal Industry can enter the Geothermal Reporting Code discussion with greater strength and push for creating an international umbrella association with comparable reporting code requirements and definitions of terminology.

CONS:

- Cost and work required
- There is no international umbrella association and adding a third independent Reporting Code might undermine the comparison purpose of having a Reporting Code. The purpose for having a Reporting Code being to have comparable reports for the different geothermal plays on the international market.
- Only a handful of companies are expected to be listed in European stock exchanges for the next years. There are today 3 known listed companies and 2 believed to be in progress. So the users of a specific European Geothermal Reporting Code are few.

Recommendation

The Geothermal Reporting Code is believed to be of best use if it is international, regulated and supervised. This would ensure that the same principles are followed worldwide within the geothermal industry.

Publication, regulation and supervision of an international geothermal reporting code could be done in a similar way to what is done in the mineral reserves industry. For that a similar umbrella organisation as CRIRSCO for the geothermal industry is required. The Geothermal Reporting Code would then in all principles be the same however tailored to the regions in similar fashion as in the mineral reserves industry. The Australian and Canadian Reporting Codes could then be seen as the pioneer documents within the international system.

It could be stated relevant and necessary to have an independent European Geothermal Reporting Code in order to join the international discussion to build up an international umbrella association bit by bit. Strong presence in the international discussion could speed up the process of having an international geothermal reporting code. Also having an existing European Geothermal Reporting Code that can be regulated and supervised could bridge the gap until the international association can take on that role. For this funding is necessary to set up a body that can write the code, update it as necessary, participate in international discussion and most importantly regulate and supervise the use of the European Geothermal Reporting Code.

On the other hand it could be argued that for Europe it is not necessary to establish a special Geothermal Reporting Code until after this international umbrella organization has been agreed upon and established. That is primarily since the existing codes are international and can be used

until then. Secondary, there are very few expected users of a specific European Geothermal Reporting Code and thirdly, to issue a third independent code in geothermal reporting would not serve the purpose of the reporting code which is establishing an environment that facilitates comparison.

The objective in the future should be toward a mutual recognition in Europe and internationally of the vocabulary used, notably in the framework of insurance schemes; it is suggested to establish a European working group to provide input to the on-going work within the UNFC-2009 towards an international classification scheme. The working group could develop a similar document as published by the GEA or the lexicons published as guidance with the existing Geothermal Reporting Codes, this could be of use for the geothermal industry. This document, guide or lexicon, should be specifically tailored to the European market. This could be done instead of creating one more unregulated Geothermal Reporting Code. A document providing guidance in European specific situations could prove useful for professionals during assessment of European geothermal plays. The work started within the GEOELEC project in form of the Resource Assessment Protocol could serve as a starting point for preparing the guidance document. This terminology and definitions should always be done in close cooperation with the international geothermal society. This means that at least both existing code committees should be consulted during the making of it. The reports could then be reported under an international reporting code such as the Australian or Canadian code if required to be code compliant.

What way is chosen therefore depends on what funding can be raised and what demands are made by the market and the geothermal industry. It is believed that the way of having a European Geothermal Reporting Code is a more effective way of reaching an international geothermal reporting code and a standardised environment for reporting on geothermal plays. The latter way described of only setting up a standardised reporting terminology is though believed to be acceptable for at least the next couple of years. The decision can then be revisited when more users have entered the market and there is a need for a specific European Geothermal Reporting Code. Thus this project does not recommend the immediate investment in a European Geothermal Reporting Code but a wait and see strategy until more potential users have entered the market.

Standardised terminology and classification schemes

The recommendation of standardising the vocabulary for public reporting and for example within insurances within geothermal energy projects brought this analysis to the work within the UNFC-2009. Their work to integrate geothermal energy within international standardised classification scheme and terminology has started.

UNFC-2009 stands for United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources. A group of experts or the Renewable Reserves Working Group concluded in 2012 that the UNFC could be set up to include renewable energy sources such as geothermal energy.

Standardised terminology and classification schemes suggested by UNFC-2009 has been analysed and compared with the existing Geothermal Codes and terminology documents by other authors this year within articles such as (Beardmore, 2013), (Segneri, 2013), and (Falcone, 2013). The articles concur on the need to standardise terminology and classification schemes to aid public reporting and facilitate prosperous environment for development of geothermal projects. They further show the necessity to advance the discussion and reach an international consensus. A step in that direction is to find an international organisation that has the will to set up a standardised terminology and

classification scheme in addition to the funding to maintain and regulate it. Next step would be to involve international experts within that work. Europe could aid on-going work by establishing a working group to support the work within UNFC-2009 and by that ensuring that also the voice of the geothermal energy industry within Europe is strong within the international arena.

Bibliography

AGEG. (2012, 12 28). *Geothermal Reporting Code*. Retrieved 01 21, 2013, from Geothermal Energy: http://www.pir.sa.gov.au/geothermal/ageg/geothermal_reporting_code

Aktiedata_eng. (2010, 12 31). Retrieved 01 21, 2013, from Geotermica: http://www.geotermica.se/Aktiedata_eng.html

Beardsmore. (2013, February). *global-review-of-geothermal-reporting-terminology*. Retrieved May 2013, from IEA-GIA: <http://iea-gia.org/global-review-of-geothermal-reporting-terminology/>

CanGEA. (n.d.). *Code & Media*. Retrieved 01 21, 2013, from CanGEA: <http://www.cangea.ca/ccpr/code-media/>

Falcone, G. H. (2013). Classification and reporting requirements for geothermal resources. *European Geothermal Congress 2013* (pp. EGC2013_MA-14). Pisa, Italy: EGC2013.

Geothermal Energy Association. (2010, November). *New Geothermal Terms and Definitions January 2011*. Retrieved 01 21, 2013, from Geothermal Energy Association: http://geo-energy.org/pdf/NewGeothermalTermsandDefinitions_January2011.pdf

International Council of Mining and Metals. (2013). *Committee for minerals reserves international reporting standards*. Retrieved 01 21, 2013, from <http://www.criresco.com/welcome.asp>

Íslandsbanki, Xignite. (2013, 01 18). *Geothermal industry dashboard*. Retrieved 01 21, 2013, from Íslandsbanki: <http://www.islandsbanki.is/english/products-and-services/geothermal-energy/geothermal-industry-dashboard/>

Joint Ore Reserves Committee of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and Minerals Council of Australia (JORC). (2012). *JORC code 2012*. Retrieved 01 21, 2013, from JORC: [http://www.jorc.org/docs/jorc_code2012\(2\).pdf](http://www.jorc.org/docs/jorc_code2012(2).pdf)

PERC. (2012). *PERC*. Retrieved 01 21, 2013, from 46.32.234.2: <http://46.32.234.2/perc/>

Roger Dixon, CRIRSCO. (2011, October 31). *News items*. Retrieved 01 21, 2013, from CRIRSCO: http://www.criresco.com/news_items/2_public_report_and_CP.pdf

Segneri, J. Y. (2013). Geothermal codification impacts on geothermal development and investments. *Thirty-Eighth Workshop on Geothermal Reservoir Engineering*. Stanford, California: Stanford University.

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