An Analysis of the Geothermal Employment Landscape, its characteristics and challenges

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ABSTRACT

Employment in the geothermal sector is both growing and changing. This paper, originally published on the KnowRES website (http://www.knowres-jobs.eu/en/), presents the outcomes of a survey carried out between September 2015 and February 2016 on the existing skills in the market and on the needs of employers. Looking at the gaps between these two elements, it looks at how training should be developed to ensure a sustainable market.

The study concludes that the volatile nature of the geothermal business makes it difficult for companies to plan and predict the competencies they will require. In any case, flexibility is a key skill to successfully adapt to the evolving needs of the customers and to the changing environment. Moreover, being able to speak the local language is also crucial to reduce the existing cultural divide when working in new markets. Additionally, the survey suggests that, because SMEs have limited capacity to train their staff than larger companies, the creation of a platform could be envisaged to pull synergies and funding for common training in areas such as health and safety or O&M.

1. INTRODUCTION

Geothermal energy in Europe is growing slowly but continuously, not only in traditional areas but also in areas with low-medium temperature resources through the utilisation of binary plant technologies in the power sector and to various technological developments for direct uses.

There are 88 operational power plants with a total installed capacity of 2.1 GW. The installed capacity in the European Union is about 1 GW, with 52 plants in operation, most of which in Tuscany, Italy. In 2014, the production of geothermal power in the EU was 6.2 TWh. (EGEC, 2016). The projections in the national renewable energy action plans estimate a geothermal electricity production in the EU-28 of 11 TWh in 2020.

According to the GEOELEC resource assessment, in 2030 the economic potential of geothermal power in the EU amounts to 34 TWh. Thanks to economies of scale, innovative drilling concepts and cost reduction, the economic potential in the EU grows to approximately 2570 TWh in 2050 (potentially covering as much as 50% of the projected electricity produced in the EU) and more than 4000 TWh including Iceland, Turkey and Switzerland. This at ≤100 EUR/MWh all costs included (GEOELEC, 2013).

Regarding the deep geothermal heat sector, this is the most dynamic market segment. In Europe there are 257 district heating plants in operation with a total installed capacity of 4.7 GW. 23 new district heating plants were commissioned in 2014 and 2015, with a total new capacity of 281.84 MWth (EGEC, 2016).

As a result of the above-mentioned developments, employment in the sector is both growing and changing. This paper presents the findings of a survey carried out within the framework of the KnowRES project and provides information on recruitment trends, forecasts and "most wanted profiles" including key competences in the deep geothermal sector. The report represents a "snapshot" of the sector job market by identifying the profiles that companies are looking for and providing critical information on required core and soft skills that make a successful matching between a candidate's profile and a job's requirements. Finally, the report also highlights the expertise and competences that are lacking and/or need to be further developed.

This sectorial report is addressed to the industry, job candidates, education and training actors. Additionally, it may also be of relevance to a broader audience such as policy makers seeking specific employment data or recruitment firms interested in job content information and trends.

2. JOBS IN THE DEEP GEOTHERMAL SECTOR

Geothermal energy direct jobs can be broken down into different types, from geologists and engineers, drillers and workers in equipment factories to project

managers. Geothermal energy also generates indirect jobs, for example with suppliers of raw materials and induced jobs. In Annex I we report a list of profiles required in the different phases of a deep geothermal project.

Measuring the actual amount of geothermal jobs is a difficult task. According to the REN21 Renewables 2015 Global Status Report (REN 21, 2016), in 2014 about 150.000 people were estimated to be employed in the geothermal power sector worldwide (for an installed capacity of 13 GWe). Regarding the EU-28, an employment study carried out under the GEOELEC project framework estimated around 3000 jobs directly related to geothermal electricity in 2013. The estimated total number of geothermal power jobs in 2013 was 10.000 jobs. Based on the projects under development and under investigation as well as new installed capacity in the deep geothermal sector, job creation is expected by 2020 in Italy, Hungary, Greece, Portugal, France, Germany, Netherlands, UK, Iceland, Turkey, Belgium, Slovakia and Switzerland. By 2030, more than 100 000 people should be employed in the sector. This low number stems from the little new installed capacity in the geothermal power sector, which has caused a concentration of jobs mainly in O&M, traditionally requiring only a few workers. However, the development of a significant number of new projects should trigger a real boom in labour intensive activities such as exploration, drilling, construction and manufacturing.

3. INTRODUCTION TO THE SURVEY

In order to assess companies and organisations' challenges, their recruitment needs and projections, the project designed a tailor made questionnaire (prepared by Green jobs specialist and reviewed together with the European Geothermal Energy Council). The online survey was carried out and supplemented by individual – face to face- interviews with people who are performing the job, rather than the Human Resource staff, in order to obtain as specific answers as possible. The original questionnaire is reported in Annex II.

A total of forty-four (44) companies/organizations from sixteen countries responded to the questionnaire. It resulted that over 67 per cent of participant companies have activities covering different phases and only 2.33 per cent are located at a single phase of the geothermal value chain. Based on the information collected, we can deduct that there is currently a high level of activities at the exploration phase, with many projects under development or investigation, given that the majority of the surveyed companies are involved in this critical phase in addition to the 18.60 per cent of companies fully devoted to exploration activities. R&D and O&M activities were also well represented.

In terms of size, small and medium-sized enterprises were well represented in the survey research as companies with fewer than 50 staff accounted for 52 per cent, mainly for services and engineering but also some project developers. Companies with over 500 person-strong staff accounted for 21 percent. Eleven per cent of surveyed companies had between 100 and 250 staff, nine per cent between 50 and 100 staff and seven per cent between 250 and 500 staff.

The companies surveyed entered the geothermal sector at different periods; the pioneers joined the sector at the very beginning in the 1930s and since the 1980s there has been a regular trend of companies extending or developing their activities in the geothermal sector. The sector has experienced a slow-down in the late nineties until 2005/2010, when involvement from companies peaked until 2010-2011.

4. MAIN RESULTS OF THE SURVEY

This section summarises the main results of the survey concerning perception, and main developments affecting the sector in the next few years, key competencies, recruitment trends, challenges, and channels, and potential for sills transferability.

4.1. Perception of the sector

The interviewed staff overwhelmingly expressed high confidence in their respective company/organization. When asked about the strengths of their company/organization, the following results were obtained:

- Quantity and quality of industrial and scientific expertise (88.64%)
- Employees' loyalty and commitment (50%)
- Strong Careers development possibilities (43.18%)
- Access to internal and/or external training opportunities (50%)
- Possibilities of staff exchange with academic sector (universities, research center, etc) (40.91%)

The staff positive appreciation of their respective company should translate into a low turn-over in the sector.

4.2. Developments influencing the sector in the next years

Many developments impacting the geothermal sector in the next 2 to 5 years were suggested. However, the following ones have been highlighted the most:

- Development of drilling expertise (reduction of required drilling time, reduction of drilling costs as well as improvement of safer drilling)
- More predictable legal and financial framework (reduction of governmental grants and subsidies)

- Risk mitigation mechanisms (more financial support in the early phase to mitigate resource risk)
- Identification of solutions for scaling control (development of scaling proof pump systems)
- Flexibility of the sector in keeping up with changes (development of oil & gas industry)
- More efficient communication and dissemination of technological progress
- Better training for O&M

One of the first conclusions to be drawn from this section of the questionnaire is the need to improve the image and communicate on the value of the sector to attract more investment from the private sector which will be crucial given the possible reduction of financial support from the public sector.

4.3. Key competencies critical to the success of the sector in the next years

Flexibility is the number one competence companies find critical for a candidate to possess in order to successfully adapt to changing environment, and especially to the customers evolving needs. Flexibility is also important for the staff to cope with the frequent travels and long period missions. More specifically expertise in the following fields has been cited:

- Reservoir engineering
- Project management
- Drilling expertise
- Process, chemical and material engineering
- Geophysicist
- Commercial and financial skills

Based on the responses, we can foresee that multi-discipline trained engineers (reservoir, drilling and O&M) will be in high demand in the next 2 to 5 years.

4.4 Recruitment challenges

While there is currently a severe lack of drilling engineers in the geothermal sector, over half of the companies interviewed (51.22%) said they never had any difficulties in finding suitable candidates. If we remove companies that are not hiring, the percentage of companies that have no hiring problem is edging closer to 44%.

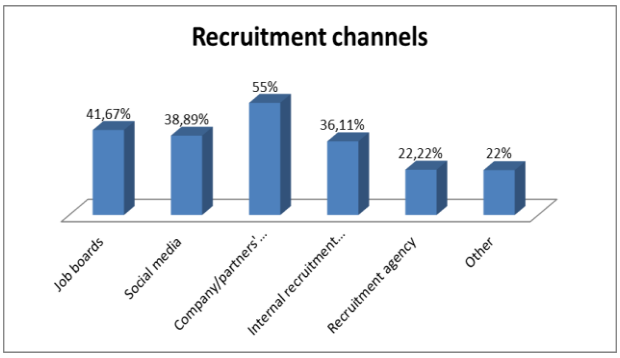
For companies that have been confronted to skill shortage and skills gaps, 12 per cent said the candidates lacked appropriate education, 19.5 per cent mentioned the insufficient professional experience and close to 5 per cent said not enough applications were received for their job vacancies.

The skill shortage in the sector is mainly concentrated at the very specific “drilling feasibility” phase of the value chain. The lack of technical skills need to be filled but finding the right combination of technical and soft skill is difficult given many of the potential suitable candidates may come from the oil & gas sector which has a higher pay level and different culture.

4.5. Recruitment channels

As depicted in Fig. 1 below, all recruitment channels are widely used from the recruiters participating to the survey. The predominant channels are the company/partners’ websites (55%) where many spontaneous applications are received. Services from recruitment agencies (36.11%) are welcome for highly demanded and scarce profiles. Other recruitment channels (22%) include newspapers, universities for attracting young graduates and professional network – including “word to mouth” as well as relevant conferences.

Figure 1: Recruitment channels



4.6. Training schemes for new staff: mainly internal on-the-job training

Two-thirds (65.9%) of the respondents confirmed their organization or firm organise training schemes for newly hired staff. Amongst them, 34.5 per cent offer internal training, 10.3 per cent organize internal and external training and 27.5 per cent do not offer any training at all.

Internal training covers different contents and the durations may vary from several days of induction courses, a 1.5-day workshop per month, 4 weeks to 6 - 12 months or continuous on the job training with the coaching of an experienced colleague.

One company (SME) based in Munich, offers a comprehensive internal and external training and career development scheme to its staff.

Many of the companies that are currently not organizing any training, are considering offering training in areas such as operation & maintenance, but the materialization of the planning will depend on upcoming projects and budget availability.

4.7. Recruitment forecasts

The volatile nature of the geothermal industry, with close links with other geosciences sectors, means that job openings are difficult to predict. Among the 70 per cent of companies that responded to the question of short term recruitment, 51.60 per cent will not be hiring. This number includes some companies that are still considering or weighing the possibility of hiring.

Among the 48.40 per cent of companies that will be hiring in the near future, the required profiles and expertise they will be looking for are the following:

- Reservoir engineers
- Drilling engineers
- Product development managers with drilling services background
- Sales engineers or technical sales
- Sales people (not necessarily technical knowledge required, get trained on the job)
- R&D (challenging to find German speaking candidates)
- Installers and service technicians
- Staff with start-up experience and O&M
- Project and plant managers
- Lab analyst for geochemical analysis
- Geo-scientists (with basic or advanced skills in numerical modelling)
- Other cross-cutting such as finance or team managers.

The above list concerns mainly new vacancies but some recruitment forecasts are mainly to replace the retiring staff.

4.8. Transferability of skills from other sectors to the geothermal sector

There is a high level of skill transferability from oil & gas, mining and in general the hydrocarbon industry. There is a high potential for oil and gas or mining experience transfer to the geothermal sector. New entrants to the geothermal sector from oil and gas or mining would provide essential additional supply chain capacity. The skill transfer is especially high in the following phases of the value chain: exploration, drilling, and construction. Indeed, larger companies often from the oil and gas sector are capable of offering a full service covering environmental, geophysical, geotechnical surveying

4.9 The most wanted profiles in the geothermal sector

According to the results of the survey, the most wanted profiles companies/organisations in the geothermal are currently looking for are the following:

- Drilling engineer (supervisor). This function is located at the geothermal power development phase of the value chain. This is a key position given that feasibility drilling aims at examining the financial and technical feasibility of a project.
- Project manager (drilling & construction) This is a highly qualified position requiring a minimum of 10 years work experience with high level of responsibilities including the planning, execution and monitoring of all aspects of a project (technical, financial, risk assessment, reporting...)
- Plant manager (O&M). The maintenance manager provides direct supervision to the maintenance personnel, ensures the efficient, reliable operation of the facility, and ensures compliance with safety and environmental standards.

5. CONCLUSIONS AND RECOMMENDATIONS

Geothermal is a highly volatile industry which makes job forecasts very difficult. When hiring, companies would rather hire multi-disciplines engineers and provide them with thematic and on the job training depending on the type of projects they will be working on. This explains why Flexibility is a key competence needed in the sector.

Between the end of 2014 and the beginning of 2016, the shortage of technical skills has improved thanks to the surplus of workforce from oil & gas, that can be to a certain extent absorbed by the geothermal sector. However, finding the right set of technical and soft and language skills remains a major recruitment challenge for companies in the geothermal sector.

Following the findings of our survey, the following recommendations are put forward:

- More efficient communication to attract private investments

The legal and financial framework conditions will have a strong impact on the geothermal sector in the next 2 to 5 years. Given the expected decrease of governmental financial support, the challenge is to attract more private investment. To that end more efficient communication on the value and potential of the sector should be enhanced.

- Importance of job intelligence to help close skills gaps and shortage

The volatile nature of the industry makes it difficult for the companies to plan and predict the competencies they will require. At the same time, to find a job in the sector can prove to be a daunting experience for the newly graduated candidate or a more experienced professional coming from another sector. Therefore, providing accurate and concrete job intelligence is crucial to bridge the information gap between what is needed from the industry and competencies new entrants are bringing to the market.

- Focus on soft and language skills

Beyond technical skills, the focus should be put on soft and language skills that are specifically relevant to the geothermal sector. Each geothermal plant, each location has different characteristics: this is why flexibility is a key competence to successfully adapt to the evolving needs of the customers and to the changing environment. Moreover, being able to speak the local language is also crucial to reduce the existing cultural divide when working in new markets.

- Synergies on training

SMEs have less capacity to train their staff than larger companies. However, some training topics such as health and safety or O&M could benefit the sector as a whole. Therefore, the creation of a task force or platform could be envisaged to pull synergies and funding for common training.

Finally, this sectoral report represents a “snapshot” of the job market at a particular moment (the year 2016 in this case) but for it to remain relevant and useful it requires the commitment and regular feedback of all stakeholders (industry, training institutions and public sector).

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ANNEX I

Start-up	**Exploration**	**Drilling**	**Production and Construction**	**Operation and Maintenance**
•Geologists •Biologists •Hydrologists •Archeologists •Lawyers •Paralegals •Environmental engineers	•Geologists •Geophysicists •Geochemists •Engineers •GIS specialists •Exploration drillers •Sample analysts •Consultants	•Drilling engineers •Rig hands •Mud loggers •Drilling fluids personnel •Cementing personnel •Casing crews •Directional drillers •Rig transportation •Fuel transportation •Welders •Safety managers •Geologists •Construction personnel	•Engineers •Power plant designers •Document controllers •Project managers •Construction managers •Project engineers •Reservoir and Field engineers •Safety managers •Welders •Steel erectors •Concrete placers •Assembly mechanics •Inspection personnel	•Plant managers •Engineers •Plant technicians •Site operators •Service repairmen
Enabling activities: IT professionals, Human resource professionals, Health and safety consultants, Administration, Insurer representatives, Management, Government office workers, Educators and trainers, Accountants, Auditors, Financers, Publishers and Science writers				

ANNEX II: SURVEY QUESTIONNAIRE

1. Name, address, contacts details of the company/organisation
2. Where do you locate your firm/organization in the geothermal value chain (more than one option is possible)?

- Start up
- Exploration
- Feasibility drilling
- Drilling and construction
- Operation and maintenance
- Other cross-cutting/enabling activities

3. How many staff does your company have?

- Less than 50
- Between 50 and 100
- Between 100 and 250
- Between 250 and 500
- Over 500

4. Since when is your company active in the geothermal industry?
5. What are the strengths of your company/organization?

- Quantity and quality of industrial and scientific expertise
- Employees' loyalty and commitment
- Strong Careers development possibilities
- Possibilities of changing position internally
- Possibilities of staff exchange with academic sector (universities, research center, etc)
- Access to internal and/or external training opportunities
- Other (please specify)

6. Does your company have a training scheme for new staff?

- Yes, internal training (please indicate the title and duration of the training)

- Yes, outsourced training (please indicate the title, duration and training institutions)
- No

7. What do you think will be the biggest developments that will influence the geothermal industry in the next 2 to 5 years?
8. Taking into account these expected changes, what would you consider as the key competencies critical to the success of your company/organization and to the geothermal industry today and for the coming 2 to 5 years?
9. Companies' recruitment challenges: What are your top 3 priorities and/or concerns related to the staffing of your company/organization?
10. Do you anticipate new job opening in the future? If yes, which profiles, skills/competencies are you particularly looking for?
11. In the past years, did your companies come across any difficulties in finding suitable candidates?

- Yes, the candidates did not have the appropriate education
- Yes, the candidates had insufficient professional experience
- Yes, too many applications were received and not enough time to review them adequately
- Yes, not enough applications were received

- No
- Other (please specify)

12. Through which channel do you advertise new job positions?

- Job boards
- Social media
- Company/partner websites
- Internal recruitment channel
- Recruitment agency
- Other (please specify)

13. What occupations/jobs are the most difficult to fill with qualified workers?

Start up

- Geologists
- Biologists
- Hydrologists
- Archeologists
- Lawyers
- Paralegals
- Environmental engineers

Further comments:

Exploration

- Geologists
- Geophysicists
- Geochemists
- Engineers
- GIS specialists
- Exploration drillers
- Sample analysts
- Consultants

Further comments

Feasibility drilling

- Drilling engineers
- Rig hands
- Mud loggers
- Drilling fluids personnel
- Cementing personnel
- Casing crews
- Directional drillers
- Rig transportation
- Fuel transportation

- Welders
- Safety managers
- Geologists
- Construction personnel

Further comments:

Drilling and construction

- Engineers
- Power plant designers
- Document controllers
- Project managers
- Construction managers
- Project engineers
- Field engineers
- Safety managers
- Welders
- Steel erectors
- Concrete placers
- Assembly mechanics
- Inspection personnel

Further comments:

Operation and maintenance

- Plant managers
- Engineers
- Plant technicians
- Site operators
- Service repairmen

Further comments:

Other cross cutting/enabling activities

- IT professionals,

- Human resource professionals
- Health and safety consultants
- Administration, Insurer representatives
- Management
- Government office workers
- Educators and trainers
- Accountants
- Auditors
- Financers
- Communication & Marketing
- Science writers

Further comments:

14. What specific information (regarding jobs) would interest your company/organization?
15. In the context of the current skills shortage, from which sectors would you consider searching for competencies and skills that could be transferable to the geothermal electricity sector?
16. Would you be interested in collaborating with the academic world on shaping education/training programmes?

Yes, please send me more information by email at

No

For your information, an Experts meeting will take place during the Geo THERM conference in Offenburg (25-26th February 2015) where the survey research results will be presented. Recruitment consultants will be available for bilateral interviews/meetings and to provide careers advice. THANK YOU!