

Technical Supports and Education Programs for Geothermal Industries in Korea

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ABSTRACT

Geothermal energy is a recently introduced technology in Korea. Technical supports for geothermal energy technologies and technical trainings for geothermal energy professionals are essential for the success of geothermal energy industry in Korea. The Korean Technical Center for Geothermal Energy supports geothermal energy industry technically and trains industry professionals. It also helps geothermal energy buyers to get technical information and evaluation of their projects.

1. INTRODUCTION

Republic of Korea is one of the most densely populated countries in the world with its territory area of approximately 120,000 square kilometers and its population of about 45 millions. Bearing little energy resources within its territory, Korea imports 97 percent of energy from other countries and this makes the sixth largest oil importer of the world.

Korean government provides rebates and loans for renewable energy applications including geothermal energy projects. Renewable energy usage for public buildings is enforced, and green buildings and low energy housings are extensively promoted by Korean government. Geothermal heat pumps are considered as one of the most efficient heating and cooling technologies currently available and as one of the most attractive renewable energy for buildings.

Approximately 2.4 percent of total consumed energy comes from renewable resources. Waste energy and hydro energy account for 77.0 percent and 13.9 percent, totaling 90.9 percent of renewable energy supply. Biomass energy and wind energy are 6.6 percent and 1.4 percent, respectively. Four types of renewable energies mentioned above account for 99 percent. Geothermal energy (geothermal heat pumps) has a portion of 0.2% of renewable energy use as shown in Figure 1. (Korea New and Renewable Energy Center, 2008)

Geothermal energy resources in Korea are utilized mainly for geothermal heat pumps and balneology applications. Geothermal energy has been used in balneology for centuries. Geothermal heat pump market grows rapidly in this decade. Research and development projects are underway for high temperature geothermal energy development.

Geothermal heat pump projects in Korea started at US military bases and embassy buildings from year 2000, with the total capacity of thousands of tons. Domestic geothermal heat pump projects also started in year 2000.

The exponential growth of geothermal heat pump market is reported as in Table 1.(Korea New and Renewable Energy Center, 2008)

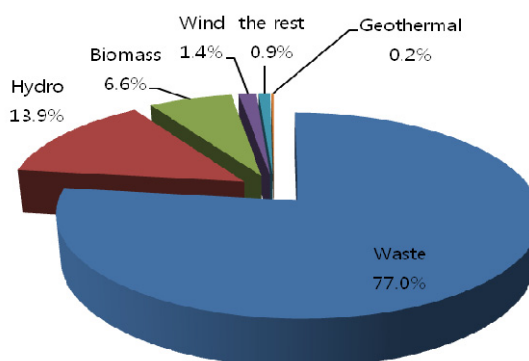


Figure 1: The Renewable energy distribution of Korea in 2007

Table 2: Growth of Installed Capacity for Geothermal Heat Pump (from 2000 to 2007)

Year	Capacity(kW)
2000	35
2001	308
2002	725
2003	2,345
2004	6,188
2005	8,159
2006	35,023
2007	20,528

2. KORGE (KOREAN TECHNICAL CENTER FOR GEOTHERMAL ENERGY)

KORGE is a non-profit organization, funded by Gangwon Provincial Government. Its objectives are to provide technical support to geothermal energy industry and support outreach program. Gangwon Province is one of the leading Provinces in renewable energy of Korea. Gangwon Province produces 35.3% of renewable energy power with area of 16.5% and population of 3%. KORGE was founded in 2006 as a result of joint effort of Gangwon Provincial

Government and International Ground Source Heat Pump Association. (IGSHPA, 2009)

Main objectives of KORGE is to provide technical support to geothermal energy engineers in technology development and dissemination of geothermal energy systems, and to provide technical support for resource exploration, project development, and application technology of geothermal energy. KORGE also works for domestic industry-university-research agency-government cooperation and also international cooperation of geothermal energy, and for providing technical information by use of publishing newsletters and other online media periodicals.

3. TECHNICAL SUPPORT

3.1 Support for Geothermal Energy Customers

Technical support to those interested in geothermal energy technologies is provided by KORGE. It ranges from pre-feasibility study to troubleshooting, including feasibility study, economic analysis, and equipment selection assistance.

3.2 Support for Geothermal Energy Industry

KORGE provides technical support to companies involved in geothermal energy. It ranges from closed loop geothermal heat pump to geothermal power generation including ground cooling tubes, various geothermal heat pump technologies, direct use and power generation.

3.2 Symposia and Workshops

Annual technical symposia and technical workshops are organized. Topics of symposia and workshops cover various areas of geothermal energy and hybrid uses of geothermal energy.

4. EDUCATION PROGRAM

4.1 Trainings for Installers

International Ground Source Heat Pump Association (IGSHPA)'s three-day Accredited Installer Workshop trainings are held twice a year. Trainers accredited by IGSHPA conduct training with materials developed by IGSHPA. This workshop is a self-contained geothermal heat pump workshop for residential application, and covers installation of closed loop ground heat exchanger, heat pump units, purging, flushing and startup. This workshop is not targeted for designers of commercial scale geothermal heat pumps but for engineers new in this field or involved in small scale or residential projects.

4.2 Trainings for Designers

Designer training covers design of geothermal heat pump systems, hydronic system, pumping and piping. Design of ground heat exchanger is a part of this training. The accurate energy calculation of the building is the essential for the sound design of the ground heat exchangers. The designers need knowledge of installation process, making an installer's training a prerequisite.

4.3 GHP Academy

In order for advanced geothermal heat pump engineers to understand the geothermal heat pump systems, knowledge of various fundamental engineering subjects such as fluid mechanics, heat transfer, and groundwater engineering and so on. Geothermal Heat Pump Academy is intended for advanced leveled and experienced engineers and is

composed of twenty-day training with six hours each day totaling 120 hours

Table 2: Subtitles and Contents of GHP Academy trainings

Titles	Contents
1. Fundamentals	
2. Thermal System Design	Thermoeconomic Analysis
3. Heat Transfer	
4. Thermodynamics	Refrigeration & Heat Transfer
5. Soil and Rocks	Thermal Response Testing
6. Groundwater	
7. GHX ³ Types	Resource Evaluation
8. Drilling & Grouting	Grouting Materials
9. Heat Pump Sizing	Equipment Specification
10. Building Energy	Load and Energy Calculation
11. Pipes & Piping	Pipe Fusion, Pressure Drop
12. GHP ⁴ System Design	System Level Design
13. GHX ³ Design	Closed Loop GHX Design
14. Pumping & Hydronics	Antifreeze
15. System Control	
16. System Optimization	System Parameter
17. Measurement & Verification	Performance Testing
18. Hybrid GHP ⁴ System	
19. Site Visit & Tour	
20. Project Presentation	

³GHX: Ground Heat Exchanger

⁴GHP: Geothermal Heat Pumps

4.4 Additional Trainings

In addition to trainings for installers and designers, training programs for auditing and commissioning engineers are planned. Shorter versions of training programs for general public will be delivered.

5. FUTURE PLAN

For success of geothermal industry success, technical support is essential for geothermal heat pump industry (installation, design, commissioning engineers and contractors), geothermal heat pump customers (architects, developers and owners), and general public which has interest in the technology. Successful projects are to be documented with engineering features, and their performances and special features will be known to the industry and general public.

International cooperation with forerunner organizations in geothermal energy and other parties will be enhanced to promote geothermal energy worldwide.

6. CONCLUSION

Technical supports for industries are essential for the success of the young and immature geothermal energy in Korea. Korean Technical Center for Geothermal Energy provides technical support to geothermal energy industry and provides technical training to industry professionals. It also helps geothermal energy buyers and general public to get technical information and to get their projects evaluated.

Technical support programs and international cooperation will be strengthened.

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