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GEOTHERMAL HEAT PUMPS IN CHINA – PRESENT STATUS AND FUTURE DEVELOPMENT

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ABSTRACT

Geothermal heat pumps have been widely used in China for the last ten years. With the support and promotion of the government, geothermal heat pump projects have been initiated in 31 provinces all over in China. More than 500 geothermal heat pump projects had been completed in Beijing at the end of 2007. In the Shenyang areas 18 million square meters are so heated.

Investigations of shallow geothermal energy are carried out for both regional plans and geothermal heat pump projects. It is a comprehensive procedure for assessment of shallow geothermal energy. First suitable areas for ground heat exchanger systems and groundwater systems are delineated. The heat exchange power efficiency could be confirmed using tests. The shallow geothermal energy capacity of the development area is calculated with a reservoir assessment method. Numerical methods are used for the heat balance evaluation. Environmental and economical evaluations are the essential components. Assessment of shallow geothermal energy is carried out for a geothermal heat pump project and regional plan.

A lot of cities have a program for developing geothermal heat pumps in future years. In Shenyang city and Beijing city their number will increase in the future. The area heated by geothermal heat pumps used for house heating will reach 240 million square meters at the end of 2010. Some issues must be considered in connection with the GHP development. The projects must be compatible with the geological conditions. The field heat exchanger system, the heat pumps and the heat feeding system must be well-knit. A general design is necessary. The regional GHP planning management is also important especially in intense GHP utilization areas.

1. PRESENT STATUS

The use of geothermal heat pumps use for house heating and cooling instead of fossil fuels is an effective measure for saving energy and decreasing greenhouse gas emissions. The utilization of geothermal heat pump has developed quickly in urban areas of China during the last ten years. With support and promotion of the government, the ground source heat pump is being used in many big cities. The geothermal heat pump projects have been started in 31 provinces all over in China. Progress has been made in the technology especially in the heat exchange system. The greatest

development has taken place in Beijing and Shenyang cities. More than 500 geothermal heat pump projects had been completed in Beijing at the end of 2007. The area of house heating and cooling covers more than 10 million square meters and in Shenyang are 18 million square meters. At the 29 Olympic sites in Beijing and the world exposition sites in Shanghai, the GHPs have become the highlights of environmental protection. GHPs are supported by the regional government. There is also financing for renewable energy. The enterprise could be providing loans at low interest to many big cities in China.

2. SHALLOW GEOTHERMAL ENERGY INVESTIGATIONS

The GHP are used the shallow geothermal energy that is one modality of heat energy. It is part of geothermal energy and an important factor of eco - environment. The heat sources of shallow geothermal energy would be analysis for both natural and artificial conditions. For the development in reason and sustainable, the investigation and evaluation are necessary.

Investigations on shallow geothermal energy are for both regional plans and geothermal heat pump projects. The temperature differences for GHP usage are general 5-15°C. They are various in difference regions in China. Assessments on shallow geothermal energy are the basis for GHP project and regional plan in urban area. It is a comprehensive procedure for assessments on shallow geothermal energy. First the suitable areas for ground heat exchanger system and groundwater system are distinguished. The pump and reinjection test would be take place in the area suitable for groundwater system. The Recycle groundwater yields need to be confirmed. And the fields on-site thermal conductivity tests are involve the area suitable for ground heat exchanger system. The heat exchange efficient power could be confirm with these tests. The heat energy in summers and cooling energy in winters are accounted with the exchange efficient power and the space heating period or space cooling period. The shallow geothermal energy capacities in the development area are calculated with reservoir assessment method. The numerical methods are used for the heat balance evaluation. The temperatures situation in the underground soil and groundwater could be forecasted. So the heat energy in summers and cooling energy in winters could be validating. The environmental evaluation and economical evaluation are the essential content during the evaluation. Assessments on shallow geothermal energy are for geothermal heat pump project and regional plan. It could provide the basis for the geothermal heat pump sustainable usages.

3. FUTURE DEVELOPMENT

There is a plan for shallow geothermal energy investigation and evaluations in the urban area in China. For the climate characters are various in the large countries. In the most north part there are no needs for cooling house in summer. And in the most south part there not needs for house heating in winter. A national suitable area for geothermal heat pumps will be detected. And with the hydrogeological condition, the suitable area for ground exchange system, groundwater heat exchange system and surface water heat exchange system would be determinate in urban region. The investigation on projects of geothermal heat pumps must be taken for evaluating the shallow geothermal energy.

A lot of cities have a programming for developing geothermal heat pumps in the future years. In Shenyang city, the areas for house heating with GHP will reach 65 million square meters in the end of 2010. It will take 32.5% for all house heating areas. There is office under the leadership of Shenyang municipality government with responsibility for GHP. There are also promoted polices for develop GHP in many other cities. The areas for house heating with GHP will reach 30 million square meters in Beijing at the end of 2010. The house heating is the human well being for most part of China. Uses the renewable energy have been put in the national plan in China. The Geothermal heat pumps used for house heating will reach 240 million square meters in the end of 2010.

Some issues must consider during the GHP development. The projects must suitable for the geological condition. The field heat exchanger system, the heat pumps and the feed heat system must be well-knit. A general designing is necessary. And the management for the regional GHP planning is also important especially for the intense GHP utilization areas.

REFERENCES

China academy of Structure sciences, Technical Code for ground-source heat pump system [M], Structure Industry Publishing House of China, 2005 (in Chinese)

Kuang Yaoqiu, Huang Ningsheng, Zhu Zhaoyu, et al. Influence of the terrestrial heat flow on the evolution of the surface ecosystem and environment [J].Geology in China, 2002, 29 (1): 86-95, (in Chinese with English abstract)

Ministry of Land and Resources, Shallow Geothermal Energy- Proceedings of National Symposium on Development and Utilization of Shallow Geothermal Energy[M], Geological Publishing House of China, 2007.1(in Chinese)

R.Curtis, J.Lund, B. Sanner, I. Rybach, G. Hellstrom, 2005, Ground Sources heat pumps- Geothermal Energy for everyone, anywhere: Current worldwide activity. Proceedings World Geothermal Congress 2005

Wang Jiyang, Ma weibin, Gongyulie, Techniques of Geothermal Usage [M], Chemical Industry Publishing House of China, 2005.2. (in Chinese with English abstract)

Zhu Jialing, et al. Technique on Geothermal Energy Development and Utilization [M], Chemical Industry Publishing House of China, 2006 (in Chinese)