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SEOUL METROPOLITAN DISTRICT HEATING NETWORK

The Korea District Heating Corporation (KDHC) is the largest district heating company in Korea. It was established in 1985 as a public corporation. As of 2008, KDHC has the main office and fifteen branch offices nationwide with a total of 1,091 employees and supplies heating and cooling to 1,028,574 households, 1,853 customers of commercial and public buildings (the total heat sales of 12,360 GWh.) with a 1,433 km distribution network.



Fig.1 Schematic diagram of district heating service areas and networks in Seoul Metropolitan region

SEOUL METROPOLITAN TRANSMISSION NETWORK CONNECTING SIXTEEN DISTRICT HEATING PLANTS

Fig. 1 shows district heating service areas and networks in the Seoul Metropolitan region operated by KDHC and other private companies. As shown in figure 1, KDHC has constructed Seoul Metropolitan transmission network linking sixteen district heating plants from PAJU to HWASUNG for the purpose of increasing the energy-use efficiency of each plant and a continuous supply to the customer. It has a length of 105 Km with a pipe dimension of 600 mm ~ 850 mm and as of 2008, in the Seoul Metropolitan region, KDHC supplies 10,604 GWh of the district heating and cooling to 832,000 households, 1,661 customers of commercial and public buildings with the aid of the Seoul Metropolitan transmission network.

Korea's district heating system was first established at JUN-GANG area in Seoul. At the time the Korean government renovated DANGIN-RI power plant which had operated since 1930 to the combined heat and power plants (CHP), KDHC started to receive surplus heat from Korea Electric Power Corporation, who operated its CHP, and supply district heating to those areas in which KDHC first began.

Beginning in 1990, the government started to build new towns around Seoul such as BUNDANG, GOYANG and SUWON to decrease a high population density of Seoul. At that time, a few CHPs were constructed as heat sources for the new towns and so KDHC started to expand the district heating supplying area.



Fig. 2 The view of GOYANG (left) and SUWON (right) plants

In the meantime, because of the government policy to expand the Seoul area, GANGNAM and SUSEO area were also developed as housing sites and KDHC started to supply district heating to those areas with the heat only boiler (HOB) and the incinerator.

Since late 2000, KDHC has started to build and own big CHPs. The construction of HWASUNG CHP was completed and the building of PAJU, PANGYO, SAMSUNG and GWANGGYO CHPs are expected to be completed in the near future.

District heating plants that are connected by the Seoul Metropolitan transmission network are incinerators, CHPs and HOBs. Among them, incinerators are the most economical heat sources. However, their capacity to produce heat is very limited, so CHPs become the most economical heat sources. The economical feasibility of CHPs and HOBs depends on which kind of fuels are used, such as LSWR, B-C, Kerosene, LFG, and

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LNG and the per unit price of heat production is the lowest in CHPs using LSWR as a fuel, which is located in GOYANG and BUNDANG. For this reason, it becomes economical for KDHC to deliver surplus heat produced in the above mentioned CHPs to adjacent regions whenever possible, while the HOBs located in YONGIN and KANGNAM should be used primarily as peak load boilers.

From > To	Delivered heat (GWh)
GOYANG > JUNGANG	226
SANGAM > JUNGANG	148
JUNGANG > KANGNAM	30
BUNDANG > KANGNAM	668
BUNDANG > YONGIN	663
SUWON > YONGIN	625
HWASUNG > SUWON	1,114

Table 1 Heat delivered from region to region in 2008

THE CURRENT STATUES AND FEATURES OF KDHC PIPELINE NETWORK

1. Single pressure system

The European pipe network has various kinds of pressure systems such as 40 bars, 25 bars, 16 bars, 10 bars and so on, but Korea only has 16 bar pressure system(10 bar pressure system in the customer side), which gives the advantage of erecting a technical standard and developing district heating facilities.

2. Low heat loss resulting from supplying heat to big apartments and buildings

Korean district heating system is normally applied to high population density areas where apartments and buildings have more than 20 floors. This gives KDHC a great opportunity to lower the investment and operating cost of district heating facilities and reduce heat loss. KDHC's annual heat loss is 4 ~ 5 %. However, supplying heat to high population density areas requires the installation of large dimensional pipes, which has some disadvantages for KDHC, because it is difficult to excavate large areas in an existing city. As of 2008, 40% out of KDHC's total network (KDHC's network is composed of 100 % pre-insulated pipe) is larger than 300 mm.

3. Difficult situation for guaranteeing good quality control of network construction

Almost half population of Korea lives in the Seoul Metropolitan area, so it has a high population density, 17,000 inhabitants per square kilometer. In addition, the volume of traffic is increasing day by day, so it is a trend that infrastructures such as roads, subways and other modes of transportation are constructed underground. Therefore, KDHC is struggling to deal with finding the right route for the pipeline and meeting terms for pipeline construction. This often produces friction between KDHC and the local government. In the future, KHDC may be facing an even harder task if the volume of traffic and population densi-

ty continues to increase. KDHC must strive to sustain uniform codes and good quality network construction.

4. KDHC efforts to improve pipe construction techniques for 10 years

Up to the beginning of 1990, there were many pipe construction failures because pre-insulated pipe construction was just recently introduced to Korea and construction skills were too low to assure a good quality pipe construction.

Investigation of pipe construction failures based on KDHC pipe repair data during 5 years showed that 51% and 21% out of total construction failures were caused by loose casing joints and the use of improper materials, respectively. Therefore, KDHC made tremendous efforts to improve the quality of pipe construction for the next 10 years through adopting European advanced technology, improving pipe construction skills and developing new tools and materials. These new skills gave KDHC the ability to maintain and sustain good quality pipe construction.

KDHC uses a leak detection system (measuring resistance value method of poly-urethane insulation in pre-insulated pipe) which enables KDHC to locate "defaults." When KDHC installs pipeline, it also uses the leak detection system for maximum quality control. As of 2008, KDHC has 6,600 loops in its network.

5. District cooling through heat supplying network

In Korea, district cooling is supplied to commercial and public buildings. The basic concept of district cooling, as it is shown in figure 3, is using warm water from heat sources, heat supplying network, absorption refrigerators and cooling towers on the customer side.

As of 2008, KDHC supplies district cooling to 278 customers of commercial and public buildings. Nowadays KDHC strives to expand the district cooling business and expects to supply district cooling to residential apartments in the near future.

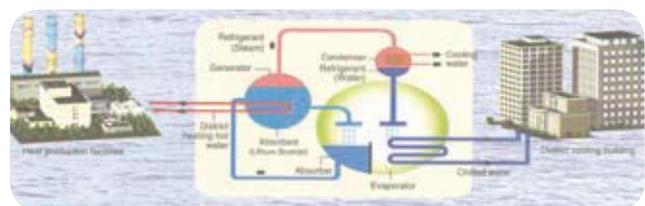


Fig. 3 The concept diagram of district cooling using warm water in Korea

6. KDHC's biggest concern in the network aspect is to identify the right repair and replacement time and method

300 km of pre-insulated pipelines of KDHC's total network are around 20 years old, which constitutes 20% out of the total. Unfortunately, like it is mentioned in section 4, pipelines installed 20 years ago were lacking in sufficient quality con-

trol, so the leak detection system is not working well with those pipelines. Therefore, KDHC has tried hard to locate "defaults" through "Thermal graphic camera", "Injection gas to pipelines" and other means to prevent a pipe accident, but KDHC believes that it is valuable to investigate remaining network lifetime and establish correct repair and replacement time to make mid- and long-term repair and replacement plan.

FUTURE PROSPECTS

Since district heating and cooling was introduced to Korea, it has contributed to increasing energy-use efficiency, improving national life and environment. In recent days, as keeping a clean environment becomes more important issue, district heating and cooling becomes the most popular and its business is expanding.

With the rapid growth of district heating and cooling business, KDHC pays attention to following items in the network aspect.

- First, the development of new methods to produce more rapid pipe construction while sustaining good quality
- Second, increasing insulation capacity to improve energy efficiency and the development of new material which enables KDHC to deliver more heat capacity than one of the water currently used in district heating system
- Third, accurately measuring the remaining network life span and establishing a pipe repair and replacement plan

KDHC is committed to focus their efforts in the future to resolve these issues and to co-operate with European companies concerning above matters.

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