DANISH DISTRICT HEATING SYSTEMS IN SOUTH KOREA

FOCUS DANISH TECHNOLOGIES ABROAD

As a highly technologically developed nation with deep concerns about energy resources and environmental aspects, district heating has for many years been a natural choice in South Korea. During the last twenty years a large number of networks have been established primarily based on CHP production, and the number of ongoing and planned projects is enormous. Being a nation of curious and adventurous people it has been a natural thing for Korean district heating experts to investigate, how district heating is implemented in other countries, and when it comes to gathering inspiration and discussing various solutions, focus has naturally been on Denmark.

By Jeppe Hastrup, Project Manager, Rambøll

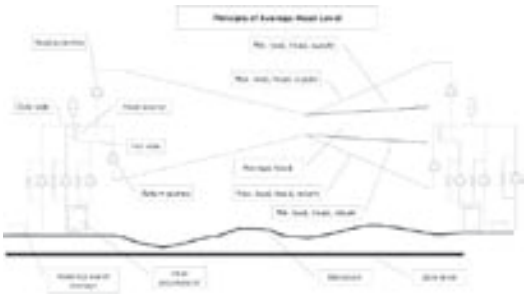
During the last five to six years Ramboll has carried out a number of study projects together with staff from the major Korean District Heating Company (KDHC) and the related Korean District Heating Engineering Company (KDHEC). The studies have involved a number of visits from Korean district heating experts, including inspections of district heating installations not only in Denmark but also in Holland and Germany.

The general concept for district heating in Korea is one production unit connected to one network. A heat accumulator at the production unit takes care of the pressurization of the network - just like in many Danish small-sized and medium-sized district heating systems. In Korea the systems are situated in closely related areas, and many of the systems are equipped with heat exchanger-based interconnections to the neighbouring system. This way a certain load dispatch may take place but it involves some temperature loss, and operation of the heat exchanger station will not allow for a completely free distribution of the heat.

At present a new transmission line is being designed between the Paju area and the Samsong area in Seoul. The project includes two new combined cycle CHP plants - one in each area.

The transmission line will supply heat to new areas, and it will also be connected to the district heating area in the south related to the Koyang Plant. This connection will be established by a heat exchanger in the Kintex area, but in the future other transmission lines may be connected directly to the Paju-Samsong line, thereby avoiding the temperature loss and operational difficulties related to heat exchanger-based connection points between transmission systems.

For this project the Korean experts realized that the traditional district heating concept based on heat storage tanks used for pressurizing of the network would cause some problems, when more power plants, each equipped with heat accumulators, were to supply heat to the same transmission system. Therefore, the Korean experts decided to implement the concept with a fixed average heat level and accumulator tanks operating at a lower pressure. This is the concept of the large district heating transmission system in Denmark: in Copenhagen, in Aarhus and in the Triangle-area. The principle is shown in figure 2.



The Korean district heating experts found that this concept is very flexible regarding load dispatch and expansion possibilities with many possibilities for optimizing the production of heat and power and thereby reducing primary energy consumption and CO2 emission. Ramboll was invited to participate in the basic concept design with focus on hydraulic issues, such as specifications of valves and pumps for the heat storage and design of regulator concepts for the pumps and valves for the

storage tanks. As part of this work a quasi stationary simulator was set up in order to study how the flow to and from the heat storages may be controlled in order to ensure a stable operation of the total system.

A large transmission system like the Paju-Samsong line should always be subject to water hammering analyses, and especially in this case high differences in ground level may result in undesirable situations in the case of pump trips. A number of water hammering calculations were carried out in order to reveal the problems and to suggest solutions.

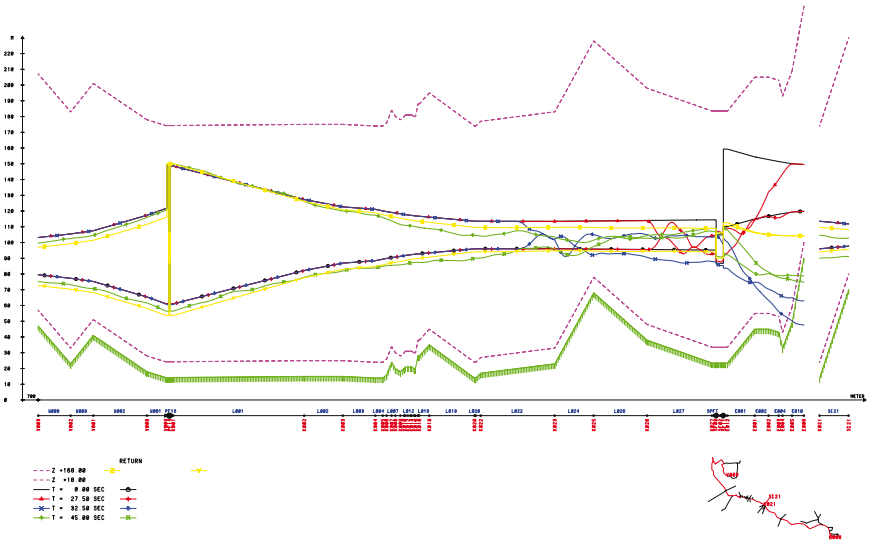
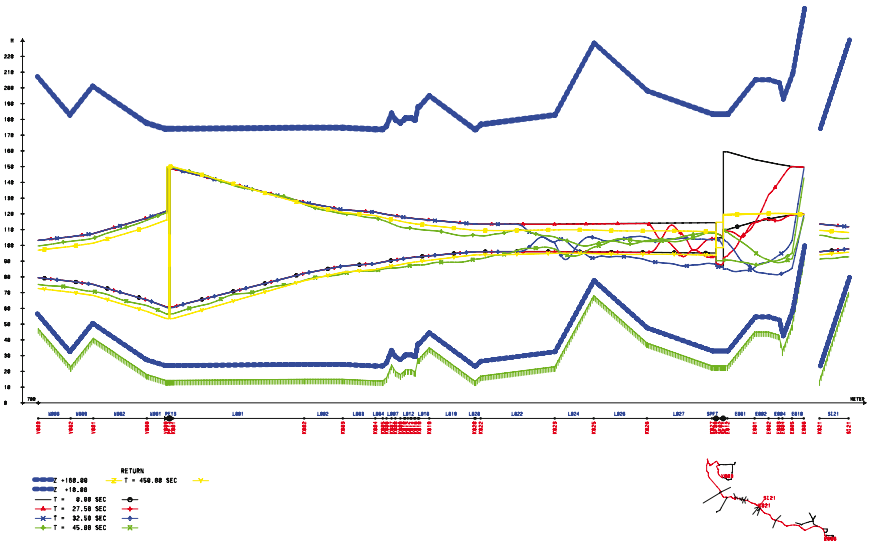


Figure 3 shows a profile of the transmission line. The heavy green line indicates the ground level and it is noticed that in the area to the right there are some particularly high peaks. Apart from the ground level the figure shows the pressure in the flow and return pipes at various moments. The plot indicates what will happen, if a pump trip occurs in the area to the right of the Samsong plant. It is seen that during the pump trip the pressure lines will go below the ground level indicating that an undesirable vacuum will occur in this area. The risks of such situations can be reduced by implantation of a pressurized vessel in the network. This is indicated in figure 4, where it is seen that the pressure line will stay above the ground level after implementation of the vessel.



The above-mentioned water hammering example is only one out of many subjects where fruitful and interesting discussions have taken place between Korean and Danish district heating experts. It is most likely that also in the future there will be many subjects to discuss between Korean and Danish district heating experts related to district heating and cooling and the related proper utilization of renewable energy. Around the world there is an increasing focus on energy consumption and environmental aspects, and in many cases district heating has proven to be an efficient and feasible way of reducing these problems. There is every probability that in the near future not only Denmark but also South Korea will be the place to go, if you want to study state-of-the-art within district heating systems.

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DBDH has just signed a Memorandum of Understanding with the Korean District Heating Corporation.