Investigation of District Heating and Cooling (DHC) Plant in the Tokyo Area

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With the Kyoto Protocol coming into force in February 2005, Japan is obliged to reduce greenhouse gas emissions in the 5 years from 2008 to 2012 (First Commitment Period) by an average of 6% based on the quantity in 1990.
On the other hand, the level of CO_2 generation in 2002 showed an increase of 1% in the industrial sector, 22% in the transport sector, and 28% in the residential sector. As energy consumption in the residential sector shows an increasing tendency, energy saving and CO_2 reduction measures in urban areas where energy demands are concentrated are extremely important.
With regard to energy saving measures in the residential sector, district-scale energy use has been discussed as an energy & CO_2 saving measure in urban areas, together with modification of the building system according to a "top runner method." The District Heating and Cooling (DHC) system is considered a possible central part of district-scale energy use.
For further utilization of the DHC system, it is necessary to shift from the present system, which is a mere aggregate of heat source facilities, to a heat supply network as a new urban system. Connecting existing DHC plants and unused energy to this heat supply network will facilitate further utilization of each DHC plant.

In this study, we investigated and analyzed the actual conditions of the steam-based DHC plant in 38 areas in central Tokyo, to clarify the enhanced effects of the DHC by formation of the heat supply network. First, we clarified the scale, methods, *etc.*, of each DHC plant. Next, we selected the specific districts to analyze heat production, heat supply, and operation status of heat source equipment, demonstrating the possible effects of formation of a heat supply network.
Throughout the investigation, we confirmed that the plant system COP of a plant using CGS exhaust heat was high, the seasonal peak of steam generation of each plant appears at a different time depending on the composition of heat source equipment (especially the freezer type), although the annual heat demand fluctuations were similar in these plants. This result implies that establishment of a heat supply network will enhance the operation rate of boilers that produce steam. Each plant has redundancy in heat resource capacity and the average annual operation rate is low. This implies that networking of DHC facilities will enable expansion of customers for cooling/heating energy supply. And the annual heat loss rate was high, it is necessary to secure heat demands throughout the year.
We present basic analysis on the assumption of the energy supply network. The simultaneous use rate showed a substantial effect, the boiler redundant capacity is large and possible expansion area was about twice the current state. With a heat supply network, we can expect a greater effect, because the load factor and operation hours corresponding to the total load can be improved by load levelling, capacity separation of heat resources, and adjustment of the operation patterns.