

Improvement in the Efficiency of District Heating and Cooling (DHC) with a Regional Steam Network of CHPs and Municipal Incineration

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District Heating and Cooling system (DHC) is energy efficient system as they can supply chilled and heating water/steam effectively by integrating heating and cooling demand of neighboring buildings. The DHC system is usually operated by expert engineers making highly efficient operation management and maintenance possible. In 2007, over 150 DHCs are operating in Japan.

On the other hand, the possibility for further improvement of energy efficiency of DHC has been discussed. Each DHC system is operated independently even if heat supply area is adjacent each other. There also exists abundant unutilized energy in Tokyo such as exhaust heat from municipal incinerators, heat of river water and sewage water. Utilizing these waste heat sources combined with integration of adjacent DHC systems may significantly improve thermal efficiency and reduce CO₂ emission of DHC systems.

In this study, the effect of such flexible use of heat and electricity in integrated DHC systems are examined. The main object is to raise total thermal efficiency and reduce CO₂ emission. The investigation was conducted by the following four phases.

Phase 0: Conventional DHC systems supplying chilled and heating water/steam.

Phase 1 : Expansion of supply to the neighboring large buildings within DHC area.

Phase 2: Connect chilled and heating water/steam pipes of DHC systems and electric wire each other. Operate integrally both DHC systems. Introduce high efficiency CHPs to DHCs and utilize waste heat for heating and cooling.

Phase 3: Connect DHC system to the regional steam network and utilize waste heat from municipal incinerators and CHPs

The results of the study showed significant reduction of primary energy consumption and CO₂ emission by 12 to 36%. In addition, various side contributions to urban environment and city function were suggested such as mitigation of urban heat island, improvement of business continuity plan (BCP), electric-load leveling and improvement of city landscape.