Info-package 2

Optimisation of existing District Heating and Cooling

Energy

Introduction

Description

Many of the DH&C systems in operation nowadays were built around or before the 80s. During this time, technology has been developing at a staggering speed while these DH&C networks remain inefficient and obsolete. The aim of this info-package is to gather different possibilities for the optimisation of a DH&C in an overall approach, not only with the purpose of improving its performance, but also to obtain environmental benefits, due to the arising awareness in nowadays society towards energy and greenhouse gases emissions reduction. In this context, several measures are described in order to pursue goals as CO_2 emissions reduction, lead to energy and economic savings, increase end users comfort and supply security.

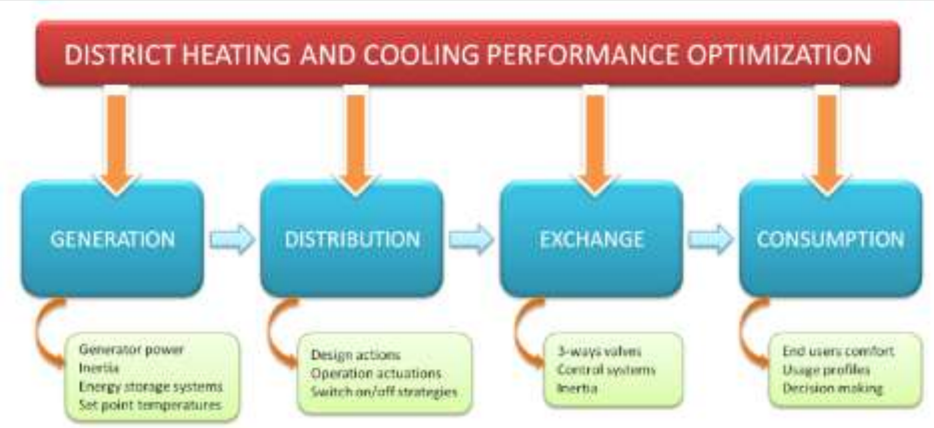
Several strategies to comprise the customer needs could be coordinated at the main energy transformation levels within a DH&C system: generation, distribution, heat exchange and consumption. All the strategies are approached in a general way and they can be applied in every DH&C, giving replicable and systemic solutions.

Regarding the generation system, boilers and energy source could be changed aiming to increase inertia, reduce energy consumption and achieve the stabilization of the energy price. At energy distribution level, there can be distinguished between two different actuations: design actions to reduce heat losses and pressure drops, and operation actions as control strategies to adjust different parameters to adapt to real energy needs stabilising network loads.

In order to optimise the energy exchange in the buildings substations, it is essential to coordinate the generation and distribution to the end users consumption profiles, while at end users consumption level, it would be appropriate that they could adapt their energy consumption according to their desired comfort level.

The following figure shows a scheme of the main energy levels above mentioned and different actuation fields within these in order to optimise a DH&C.

Figure



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Goals

- Minimise the investment costs in the generation plant, by the optimisation of the generation power. Simulations of the energy demand together with real data and determining a global profile optimise the generation equipment. In addition, back-up boilers from the original generation system could be maintained to supply peak loads.
- Optimise the generation by the installation of energy storage systems that smooth the demand profile, and reducing the flow temperature set point. A low return water temperature enables an efficient use of energy sources, increase the transmission capacity, reduce heat losses and reduce pumping energy demand.
- Minimise GHG emissions by the use of at least 50% of renewable sources of energy. It is possible to use biomass, waste thermal energy from already working plant or integrate solar energy in the circuit.
- Reduce 15% heat losses in the distribution system by the layering in thermal storage tanks, and pressure drops by actions in the distribution system during the design phase which comprises the optimal design of the pipelines layout. Switch on/off strategies reduce thermal losses in the distribution and generation power minimising peaks in demand.
- Increase the efficiency of the system at least in a 5% of the performance and reduce the district energy consumption by adapting the energy distribution and production to end users real demand by the use, among others, of variable flow pumping system.
- Adapt the operation conditions to the real heat needs by control strategies to adjust different parameters as the supply temperature and the flow rate, keeping constant one of the two variables alternatively.
- Integrate a smart centralised control and monitoring system that ensures that the system responds to the demand. With this measure we manage to optimise the energy balance between the network and the substations.
- Achieve an appropriate coordination of the generation, distribution and energy exchange control strategies in order to anticipate the response to the variations in the demand profile. The substations constitute a connection point between the overall optimisation strategies for the generation and distribution levels and the end users demands.

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Progress

The demonstration of the above described measures for the optimisation of existing DH in Valladolid is fully considered in the design phase in all the energy levels (generation, distribution, energy exchange and end users), and would be implemented in the coming months.

In Nottingham, the DH system is being used to supply Low Temperature District Heating; this is optimisation of DH using the return heat on the system at a lower temperature and using it in conjunction with a new efficient distribution system to extend the network to customers with a lower energy demand.

In Tepebaşı demo site, the DH system was supplied by individual heating via combi boiler at each building. However, optimised system provides low temperature central district heating (45-55 °C). In addition, energy source optimisation is ensured by using renewable electric energy and organic waste (pellet) instead of using natural gas.

Lessons learnt

01	It is feasible to optimise an existing District Heating and Cooling network.
02	It is possible to optimise a DH&C partially by implementing measures regarding only some of the energy levels, taking into account that the decisions made in one of the energy levels, inevitably would influence in the rest of them.
03	In order to obtain the higher impact by the optimisation of the DH&C it is advisable to implement measures in every energy level.
04	The optimisation of a DH&C is a process which is highly recommended to be considered during the whole life of the network.

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