District Heating

HIGHLIGHTS

PROCESS AND TECHNOLOGY STATUS – District heating (DH) systems provide heat for space heating and hot water to residential, commercial and service buildings, and to industrial users. In DH systems, heat is generated centrally or derived from an existing heat source, and distributed to consumers by pipelines, mostly in the form of hot water. The DH heat sources include cogeneration plants producing both heat and power (CHP), different types of boilers, industrial facilities producing waste heat, geothermal heat sources, solar heat, heat from waste incinerators, heat pumps. In 2008, DH met about 12% of the heat demands in residential and service buildings in EU27. In Northern, Central and Eastern European countries, DH often accounts for above 50% of the heat market. On average, more than 80% of heat provided by DH is based on renewable sources or waste heat from industrial processes and electricity generation. Therefore, DH contributes significantly to reduce the CO_2 emissions in Europe, and studies indicate further CO_2 reduction potentials from increased use of DH.

PERFORMANCE AND COSTS – DH offers significant energy savings as it can utilize geothermal, renewable heat, or waste heat from industrial processes and electricity generation. However, large centralised DH systems involve significant heat losses due to the heat distribution network. The cost of a DH system includes the heat generation cost (or collection cost, if heat is derived from an existing source) and the heat distribution cost. Both these costs consist of capital cost and operation and maintenance costs. In general, the capital cost accounts for more than half of the distribution cost. The heat loss of the distribution system also is an important element for the distribution cost. An important parameter to assess the cost effectiveness of a DH system is the linear heat density which is defined as the ratio of the annual heat delivered to the total length of the DH piping and network. High linear densities increase the cost effectiveness of the DH system.

POTENTIAL AND BARRIERS – DH is widely used in dense populated areas (cities) located in cold climate regions. In these regions DH offers competitive prices for supplying space heating and hot water. DH is highly adaptive to a variety of fuels and heat sources. This results in energy diversification opportunities and reduced dependence on imported fossil fuels, which translate into competitive and stable prices [4] for residential and industrial customers. The most important barriers to further deployment of DH systems include the capital cost of the distribution network and the cost for complementing heat-generation plants to meet peak demand [5]. In addition, the economic competition in the DH market is currently modest. DH providers are often energy companies which hold monopoly in heat production and distribution, and grid operation at local or regional level, and deregulated DH markets where different operators provide heat to customers have not been implemented yet. In terms of potential, as the global heat demand for space heating in the residential sector is projected to reduce due to the global warming, in regions with mild climate and low heat demand the economic competitiveness of DH could decline over time [6].

PROCESS AND TECHNOLOGY STATUS

District heating (DH) is a way to supply residential and commercial buildings, and industrial users with heat for space heating, hot water and process heat, through a heat distribution network. The distribution system is fed with heat from one or several heat sources such as dedicated heat production plants based on renewable energy and fossil fuels, or waste heat from industrial facilities. Large DH systems can meet the heat demand of large urban areas and include a number of heat production facilities, transmission pipelines and distribution grids connecting thousands of heat consumers.

Compared with decentralized, on-site heat production, DH offers advantages, but also has some disadvantages. Positive aspects include:

- The joint production of electricity and heat in highly-efficient cogeneration plants;
- The low specific cost of large-scale, centralized heat production plants (due to economy of scale);
- The flexibility of DH systems which can use low-cost, low-quality fuels such as municipal solid waste (MSW), forestry residues, and industrial waste heat;
- The low environmental impact of DH, and the improvement of the energy supply security.

Negative aspects include:

- The heat losses associated with the distribution network;
- Possible establishment of local monopolies and customer lock-in;
- The need to size the system based on the peak load or to provide peak generation capacity

The DH system can be divided in three subsystems, namely the heat sources or heat production plants, the heat distribution system, and the customer interfaces [3].

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