Design and Sizing of District Cooling Systems (DCS)

An Online Continuing Education Course for Engineers

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Design and Sizing of District Cooling Systems (DCS)

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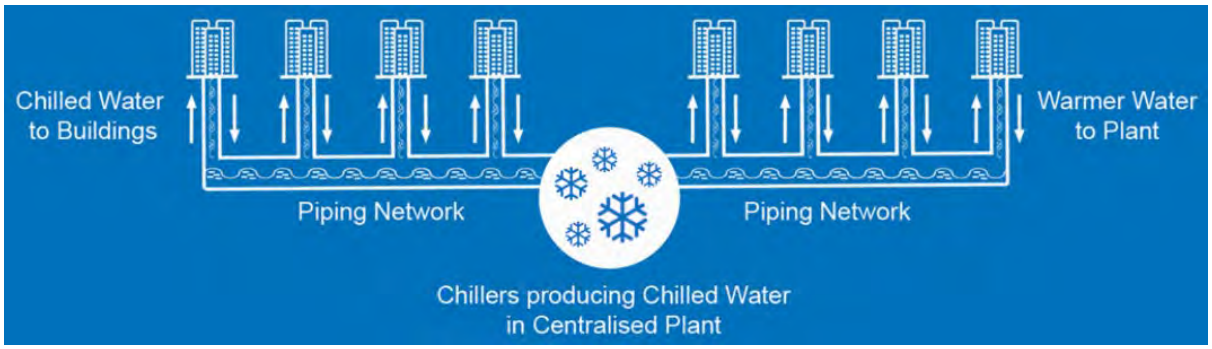
District cooling systems (DCS) are large-scale centralized production and distribution systems of cooling energy. The chilled water produced at the DCS central plant is delivered through an underground pipeline to offices, shopping malls, apartments, and other kinds of buildings that need indoor cooling. Customers of a district cooling system pay for the volume of chilled water delivered to their buildings and may pay other charges as well. DCS also refers to the local production and distribution of cooling to the needs of a large institution, business centers, airports, hospitals, universities, and public buildings.

The figure below illustrates a typical configuration of DCS.



DCS, when designed and operated properly, can be an energy-efficient alternative to conventional in-building chilled water plants and offers many benefits to the building owner, such as greatly reduced or eliminated maintenance cost, much lower space requirements, and no concerns as to plant capacity or load growth.

This course presents practical guidance in the design and sizing of District Cooling technology and discusses the benefits and challenges associated with district cooling systems. Topics covered include planning, central plant design, distribution system design, building interfaces, and costs.

The course will benefit the HVAC engineers and designers who are responsible for the specification, system design, or installation of district cooling systems, as well as owners and others who manage and operate district cooling systems.

Learning Objectives:

- Understand the fundamental processes, basic components, and equipment of the DCS central plant and the basic options
- Recognize different types of chiller systems and understand their uses and applications
- Understand the benefits and main challenges of district cooling plant vs. standalone systems
- Identifying the importance of system design, pumping arrangements, and the chilled-water distribution system
- Understand the basic methods by which a DCS may interface with the buildings and learn the major components involved and the type of connections
- Review how “low ΔT” may come about and what can be done to correct it.

Contents

1.0. Chapter 1: District Cooling System (DCS)

District Cooling is a technology in which chilled water is generated centrally in a large chiller plant and is delivered to several customers and building owners via an underground insulated pipeline. Specially designed units in each building then use this cold water to lower the temperature of the air passing through the building's air conditioning system. When the water has cooled the building, it returns to the chiller plant at a higher temperature, where it is chilled again and redistributed in a closed loop.

Individual customers purchase chilled water for their buildings from the district cooling system operator and do not need to install their own chiller plants. In some countries that have substantial heating demand, the plant can also be designed to supply hot water to form a District Heating and Cooling System (DHCS).

District cooling is measured in tons of refrigeration (TR) or Btus per hour of energy. A refrigeration ton is equivalent to a heat extraction rate of 12000 Btus/h. Theoretically, refrigeration ton is defined as the heat absorbed by one ton of ice (2000 pounds), causing it to melt completely by the end of one day (24 hours).

1.1 Why District Cooling?

Air-conditioning syste uildings. The district cooling system reduce ng demands for air conditioning, which typ . By aggregating the cooling need of a netwo nt construction costs, drive efficiency, balance t associated with fuel use, and eliminates the r evel.

1.2 Components of D

A typical DCS comprises tl

a. Central Chiller Plar
b. Distribution Netwo
c. User Station or Ene (ETS) at consumer location