Jana Tanmia Resources

FACILITY & ENERGY ENGINEERING

Our Specialization: District Cooling System

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District Cooling Establishment in Malaysia

Malaysia has increasingly adopted district cooling systems (DCS) as a sustainable and energy-efficient solution to meet growing urban cooling demands. This innovative technology has contributed significantly to reducing energy consumption and greenhouse gas emissions while delivering economic advantages through the integration of Thermal Energy Systems. Several successful implementations across the country demonstrate the positive impact and long-term benefits of district cooling in supporting sustainable urban development.

District cooling is particularly suitable for large-scale developments with high and continuous cooling demands, such as commercial business districts, government complexes, airports, hospitals, educational institutions, mixed- use developments, and smart city projects. By serving multiple buildings from a single centralized facility, DCS reduces the need for individual chillers, cooling towers, and associated maintenance requirements, resulting in lower energy consumption and operating costs.

As Malaysia continues to pursue sustainable urbanization and carbon reduction goals, district cooling is expected to play a greater role in supporting the development of energy-efficient and resilient cities.

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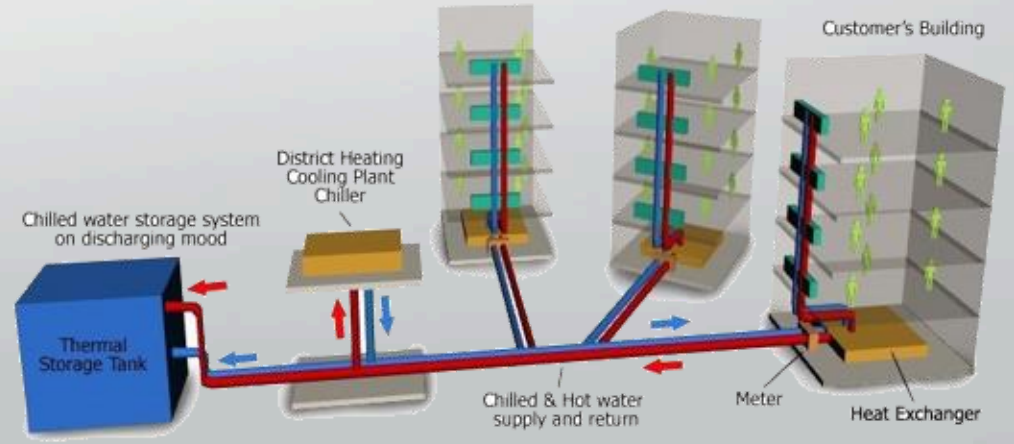
District Cooling System

A district cooling system (DCS) works by producing chilled water at a centralized cooling plant and distributing it to multiple buildings through a network of insulated underground pipes. Instead of each building operating its own air-conditioning chiller system, the centralized plant supplies cooling to an entire district, improving overall energy efficiency and reducing operating costs.

The process begins at the district cooling plant, where large-capacity chillers cool water to a low temperature, typically between 4°C and 7°C. The chilled water is then pumped through a distribution network to connected buildings. Inside each building, the chilled water passes through heat exchangers or air-handling units, where it absorbs heat from indoor spaces and cools the circulating air used for air- conditioning.



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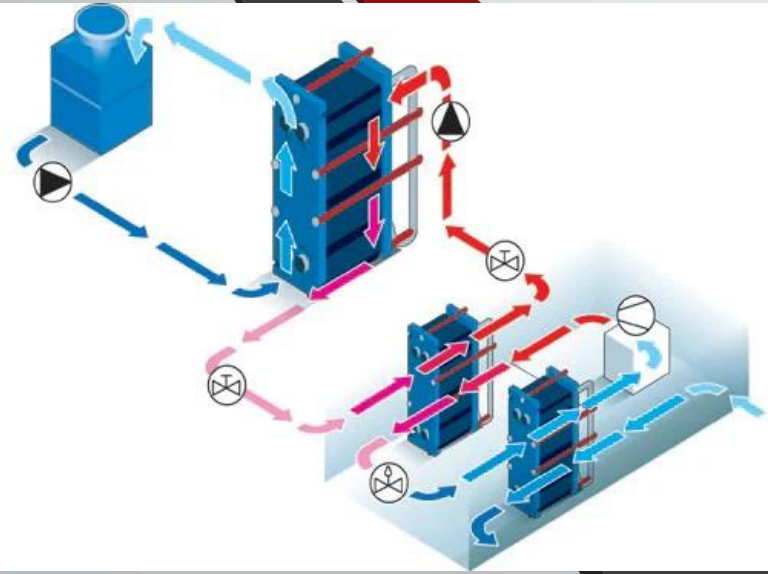
District Cooling System

As the chilled water absorbs heat, its temperature increases and it returns to the central plant through a separate return pipeline. At the plant, the water is recooled by the chillers and recirculated through the system, creating a continuous cooling cycle.

Many district cooling systems also incorporate Thermal Energy Storage (TES), where chilled water or ice is produced and stored during off-peak hours when electricity demand is lower. The stored cooling energy can then be used during peak periods, reducing electricity consumption, lowering operating costs, and easing strain on the power grid.



By centralizing cooling production and serving multiple buildings simultaneously, district cooling systems achieve higher efficiency, lower greenhouse gas emissions, reduced equipment maintenance requirements, and improved reliability compared to conventional standalone air-conditioning systems.

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Thermal Energy Storage (TES) Technology

TES works by producing cooling energy during off-peak hours and storing it in a storage medium. During peak cooling periods, the stored energy is discharged to meet building cooling demands, reducing the need for chillers to operate at maximum capacity. This load-shifting capability helps lower peak electricity consumption and enhances the overall performance of the cooling system.

There are three main types of TES technologies used in cooling applications:

Sensible heat storage- stores thermal energy by changing the temperature of a storage medium without changing its phase. Chilled water storage is the most common example in district cooling systems. Water is cooled during off-peak periods and stored in large insulated tanks. During peak demand, the chilled water is supplied to buildings, reducing the load on chillers.

Latent heat storage- stores energy through a phase change process, most commonly using ice. During charging, water is frozen into ice using chillers. During discharge, the ice melts and absorbs heat from the return water, providing cooling energy.

Thermochemical storage- utilizes reversible chemical reactions to store and release thermal energy. Although still emerging in commercial cooling applications, this technology offers very high energy storage density and minimal energy loss during long-term storage.

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TES in Malaysia's District Cooling Applications

In Malaysia, TES technology is increasingly being integrated into district cooling developments, particularly in commercial districts, airports, government complexes, hospitals, and mixed-use developments. The country's tropical climate results in high and relatively constant cooling demand throughout the year, making TES an effective solution for managing peak loads and improving energy efficiency. By combining TES with advanced technologies such as magnetic bearing chillers and smart energy management systems, district cooling operators can achieve significant energy savings, lower operating costs, and improved environmental performance.

As Malaysia advances its sustainability and carbon reduction initiatives, TES technology is expected to play a critical role in optimizing district cooling systems and supporting the development of low-carbon, energy-efficient urban infrastructure.

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Benefits of TES in District Cooling Systems

The integration of TES into district cooling systems provides several operational and economic benefits :

1. Reduces peak electricity demand and demand charges
2. Improves chiller operating efficiency by allowing chillers to run at steady, optimal conditions
3. Enhances grid stability by shifting energy consumption to off-peak periods
4. Reduces capital costs by lowering the required installed chiller capacity
5. Provides backup cooling capacity during equipment maintenance or emergencies
6. Supports sustainability goals by reducing overall energy consumption and carbon emissions
7. Facilities integration with renewable energy sources by storing excess energy as cooling capacity

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Optimization of the District Cooling Centre's reliability and operational efficiency:

The use of magnetic bearing chillers in District Cooling Systems (*DCS*) represents a strategic approach to achieving higher energy efficiency, greater operational reliability, and enhanced sustainability.

Unlike conventional chillers that rely on mechanical bearings lubricated with oil, magnetic bearing chillers use electromagnetic forces to suspend and rotate the compressor shaft without physical contact. This oil-free operation minimizes friction losses, reduces maintenance requirements, and improves overall system performance.

The oil-free design also improves heat transfer efficiency within the evaporator and condenser, leading to higher system performance and lower electricity consumption. Additionally, magnetic bearing chillers generate less noise and vibration, making them suitable for installation in urban environments where occupant comfort and environmental considerations are important.

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When used in district cooling, magnetic bearing chillers can be smart, multi-chiller setup :

- **Chiller Sequancing** - Automatically runs the optimal numbers of chillers based on system load
- **Variable Primary Flow (VPF) -** Used variable speed pumps to reduce pumping energy
- **Thermal Energy Storage (TES) -** Stores chilled water or ice at night (low tariff periods)
- **BMS / AI Optimization -** Predicts demand and adjusts chiller loading for maximum COP

Key Features of Magnetic Bearing Chillers

01

Low Noise & Vibration

The lack of mechanical friction & the absence of a gear or oil pump system & result is quieter & ideal for noise-sensitive environments

02

Higher Reliabilty

With fewer moving parts & no oil-related failures, magnetic bearing chillers offer enhanced reliability & longer operational life

03

Increased Energy Efficiency

Eliminating the lubricating oil prevents it from hindering heat transfer, which can improve system efficiency

04

Lower Maintenance Cost

The oil-free design removes the need for oil-related maintenace like filter replacements, oil changes & associated labor

05

Compact & Flexible Deisgn

Magnetic bearing chillers have a more compact footprint, making them suitable for retrofitting existing system & saving spaces

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Overall advantages of District Cooling System

- **Energy Efficiency -** Centralized chillers operate at higher efficiencies and optimized loads
- **Reduced Peak Electricity Demand -** Thermal energy storage allows load shifting
- **Space Savings -** Buildings no longer need individual chillers or cooling towers
- **Enviromental Sustainability -** Reduced refrigerant use and CO_2 emissions
- **Operational Realibility -** Centralized maintenance and redundancy improve uptime
- **Lower Life Cycle Cost-** Economies of scale in operation and maintenance

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OUR SPECIALIZATION

- *SUSTAINABLE FACILITY MANAGEMEENT*
- *SUSTAINABLE CONSTRUCTION*
- *ENERGY MANAGEMENT ENERGY EFFICIENT SYSTEM*
- *CLEANROOM OPERATION THEATER, BIOSAFETY LAB, GMP LAB*
- *RENEWABLE ENERGY (SOLAR WIND BIOMASS)*
- *ENERGY EFFICIENT HVAC/ACMV SYSTEM*

- *BUILDING IAQ, IEQ, HUMIDITY & MOLD CONTROL*
- *MEDICAL GAS PIPELINE SYSTEM*
- *HOT WATER & STEAM SYSTEM*
- *DISTRICT COOLING SYSTEM*
- *SETTING UP OF NEW PRIVATE HOSPITAL*

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