REBUILD UKRAINE

ENGINEERING TOMORROW

Danfoss

MODERNIZATION, RECONSTRUCTION AND SUSTAINABLE DEVELOPMENT OF CITIES

25 років Danfoss в Україні

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DISTRICT HEATING SYSTEMS. HEAT SOURCES

CHALLENGE:
Destroyed and ineffective heat sources

PURPOSE:
Preservation of district heating systems and sources diversification

SOLUTIONS

Development of district heating according to the modern 4G principles and approaches.

Transition from a highly centralized to a decentralized model.

TECHNICAL INSTRUCTION:

- The strategic planning of district heating should include: energy modeling (implemented at the country level, region and community levels), demand mapping, integration into building modernization plans and vice versa, planning and identification of the available resources and sources;
- Identify the main control points and collect the output data: heat supply zones, loads characteristics, annual heat needs, generation capacity, annual working profile, characteristics of the heating network available, heat production costs, building modernization level, current system equipment level and local heat sources available;
- District heating is a complex infrastructure. A plan for financing, project implementation, a description of the planned financing sources and key stages should be provided;
- Use different type of sources to diversify the resources.

SOLUTION 1

Large-capasity heat pumps

RESULT

- Restoration of heat supply in cities with destroyed heat sources and replacement of ineffective ones;
- Reducing dependence on fossil fuels and decreasing their imports, thus increasing energy independence and security;
- Promoting the use of the locally produced renewable energy (e.g. the use of waste heat from wastewater treatment plants, excess heat from the industrial sector or data centers);
- Combining renewable heat sources with renewable electric energy sources can play an important role for the energy system and result in the lower heat costs.

SOLUTION 2

Surplus heat of industrial processes

RESULT

- Decentralization and increasing the efficiency of district heating sector;
- Reducing dependence on fossil fuels and decreasing their imports, thus increasing energy independence and security;
- Cooperation between the industrial sector and the district heating companies. As a result, for the industrial sector, this is an additional source of income, which can become an important factor of ensuring the competitiveness of industrial products;
- Surplus heat will be used in technological processes instead of being lost. This also becomes unavailable with individual heating systems.

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SOLUTION 3

Engine power plants

RESULT

- Flexible generation with operation of gas piston units;
- The unit can use both natural gas and, in the future, 100% synthetic and carbon-neutral methane and methanol, as well as mixtures of hydrogen and natural gas;
- Highly effective cogeneration, which is one of the elements of both effective district heating systems and the energy system as a whole;
- Relatively low costs and handleability;
- Reliability of heat supply and sustainability of the electrical network;
- Quick response to daily and seasonal demand fluctuations.

SOLUTION 4

Combined Cycle Gas Turbine (CCGT)

RESULT

- High fuel efficiency (up to 60%);
- CCGT can use both natural gas and, in the future, 100% synthetic and carbon-neutral methane and methanol, as well as mixtures of hydrogen and natural gas;
- Highly effective cogeneration, which is one of the elements of both effective district heating systems and the energy system as a whole
- Reliability of heat supply and sustainability of the electrical network;
- Steam and gas stations provide the best economic performance at base load, when the system is operating at or near full load.

SOLUTION 5

Waste-to-Energy CHP plant

RESULT

- Reducing dependence on fossil fuels and decreasing their imports, thus increasing energy independence and security;
- Creation of new jobs in the cycle of waste sorting, transportation and incincineration;
- Collecting money for budgets of cities from sale of thermal and electric energy;
- Reducing the amount of waste in landfills;
- Flexible generation is used in the energy system operation.

SOLUTION 6

Fossil fuel and biomass heat only boiler (HOB)

RESULT

- Use as peak and reserve sources;
- Ease of operation and comprehensibility of the technology;
- Quick recovery of damaged equipment;
- Low installation cost and availability of components on the market;
- Possible synergy with other more efficient technologies, such as CCGT and heat pumps.

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DISTRICT HEATING SYSTEMS. HEAT ACCUMULATION

CHALLENGE:
Highly centralized sources without heat accumulation

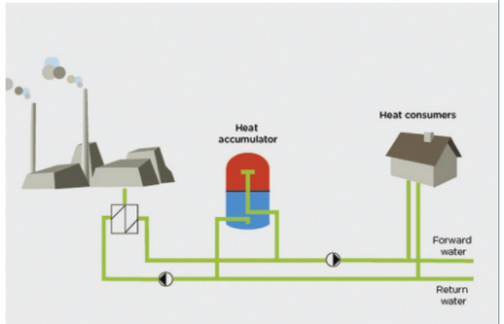
PURPOSE:
Heat accumulation

SOLUTION

Short-term heat accumulation systems (High-temperature thermal storage)

RESULT

- Increased efficiency of cogeneration systems.
- Installation of heat accumulators that can be used to store excess heat produced during off-peak load periods for heat supply during peak demand periods;
- Separation of heat generation from demand, thus increasing the operational flexibility of thermal power plants;
- Ensuring maximum electricity generation in periods when heat demand is not high;
- Increased dynamics of thermal power plants, the possibility of optimal operation in the energy market with a high share of renewable energy sources

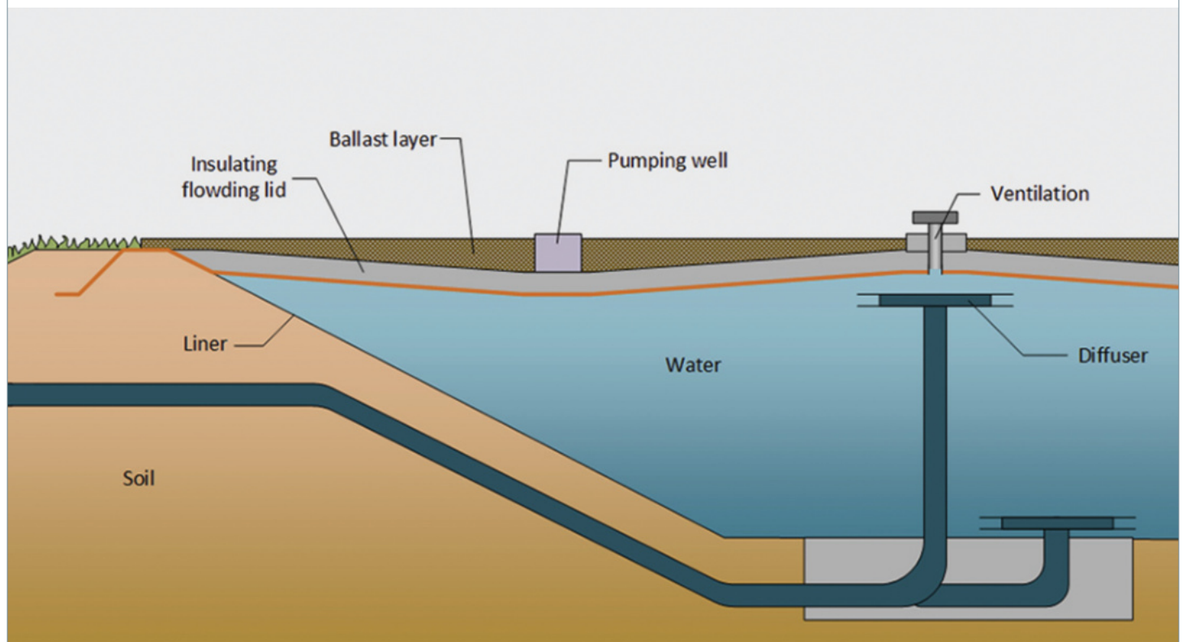


SOLUTION

Long-term heat accumulation systems (seasonal thermal energy storage or STES)

RESULT

- In energy systems in which the price of electricity fluctuates, accumulators can have available capacity from September to May, which can store heat from electric boilers, heat pumps and gas CHP without additional costs;
- Possibility of inclusion of large solar stations in the system;
- Transfer of excess thermal energy produced in summer to winter, when demand is high and supply is low;
- Different generation types can be connected to the system.



DISTRICT HEATING SYSTEMS. HEATING NETWORKS

CHALLENGE:
Destroyed heating networks in settlements affected by hostilities

PURPOSE:
Preservation of district heating, elimination of damages and increase in the overall efficiency

SOLUTIONS

Examination of pipelines using thermographic diagnostics.

Replacement of damaged sections.

RESULT

- Channelless installation is possible to reduce labor time;
- Increasing the number of sites with digital monitoring of pre-insulated heating systems;
- Reduction of losses by 5-7%.

Cost (pipes/m + cost of 1 km of trench + joints):

- A pair of pre-insulated steel pipes with traditional insulation – about 31,000 euro (DN80/160 – losses of 198 MWh/year)
- Double pipes – pre-insulated – about 41,000 euro (2xDN80/280 – losses of 86 MWh/year)
- A pair of pre-insulated steel pipes with diffuse barrier – about 37,000 euro (DN80/180 – losses of 135 MWh/year)

SOLUTION 1

Thermographic systems make it possible to identify and localize pipeline insulation defects and heat leaks.

RESULT

- Combination of visual and thermographic examination can reveal a number of potentially dangerous problems;
- Repair of damages in places inaccessible for visual examination;
- Precision. Numerous points that can be used for design and calculations;
- Employees of an enterprise can take specialized courses and purchase the necessary equipment to be used on a permanent basis;
- Estimated training cost is €1,000.
  Equipment cost is €10,000 - €50,000.

SOLUTION 2

Installation of double pre-insulated steel pipes with a diffusion barrier or two-pipe systems. Systems with emergency alarm elements.

RESULT

- Modernization of the above-ground heating network section, where priority is given to double pre-insulated pipes or, if possible, replacement with an underground one;
- Possibility of changing the method of installation of individual sections is determined by the heat supply scheme or a previously developed plan for the modernization of the network section;
- Increasing the number of sites with digital monitoring of pre-insulated heating systems;
- Reduction of losses by 7-9%.

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CHALLENGE:

Leaky or non-operating shut-off valves. It is not always possible to disconnect a specific consumer, which leads to the disconnection of a group or a network section.

PURPOSE:

Disconnection of buildings and structures, if necessary, segmentation of the network. Ensuring tightness.

SOLUTION 1

Determining the current condition and critical points where replacement is required.

RESULT

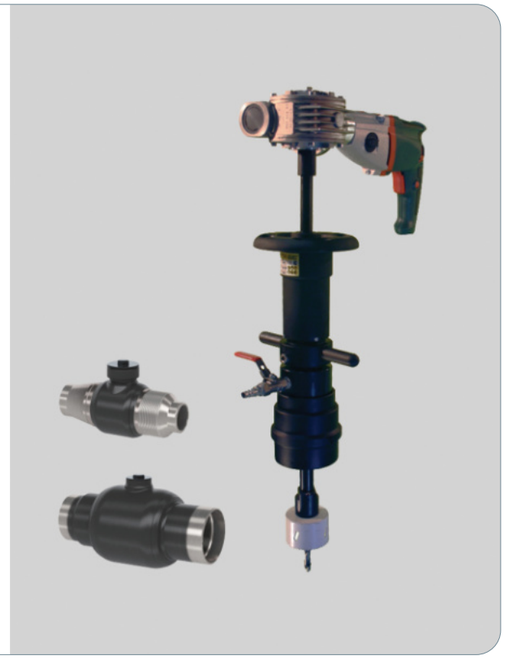
- Enabling blocking of the damaged area or disconnection of a consumer;
- High reliability of modern shut-off devices;
- The optimal flow design reduces the pressure drop through the ball valve compared to old valves;
- Reduction of pumping costs;
- Lower operating costs;
- Energy saving

SOLUTION 2

"Hot" inserts of shut-off valves are intended for expansion of district heating systems without interrupting system operation.

RESULT

- Enabling the temporary disconnection of engineering systems from the heat supply of damaged buildings;
- Possibility of connecting new and reconstructed buildings;
- Connection of restored buildings without disruption of heat supply to other consumers;
- No need to disconnect other consumers frequently;
- Quick installation of valves and connection of new consumers without stopping the system or its part;
- No need to drain the treated water;
- No difficulties with the air entering the heating system and heating network.



CHALLENGE:

Lack of data on the real-time network condition, hydraulic modes and data on the best connection points of new sources.

PURPOSE:

Creation of conditions for stable operation of heating systems.

SOLUTION 1

Implementation of a thermohydraulic modeling tool for district heating systems to support planning, design and operation processes.

RESULT

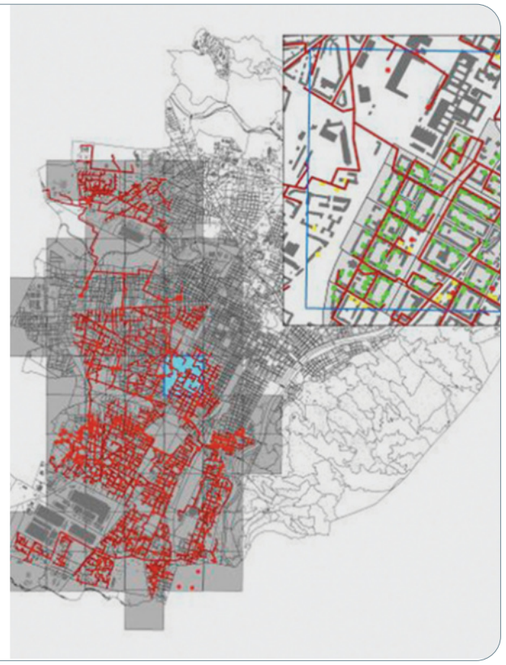
- Modeling of hydraulic and temperature conditions;
- Optimization of hydraulic conditions in the network;
- Optimization of network expansion, repair and new connections;
- Development of emergency plans;
- Network operation database.
- For damaged systems, it is recommended to carry out this work simultaneously with thermographic control.

SOLUTION 2

Simultaneously with thermal imaging surveys of the heating network and/or visual surveys, software thermohydraulic complexes with GIS tools should be implemented.

RESULT

- Calculation of optimal hydraulic parameters and their application;
- Overview of temperature, flow and pressure at any point in the network;
- Review of the composition of production sources at any point in the network;
- Modeling future conditions based on the weather forecast;
- What-if analysis for daily operational issues and critical events;
- Planning interventions with effective implementation and quality of services;
- Cost of 75 MW: 40,800 euro



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DISTRICT HEATING STATIONS AND INDIVIDUAL HEATING STATIONS

CHALLENGE:

Damaged engineering systems, regulation system mixing units and regulation systems in buildings.

PURPOSE:

Reconstruction of buildings and damaged input units with installation of modern standardized heating plants.

SOLUTION

Standardized, modern individual heating stations.

RECOMMENDATIONS:

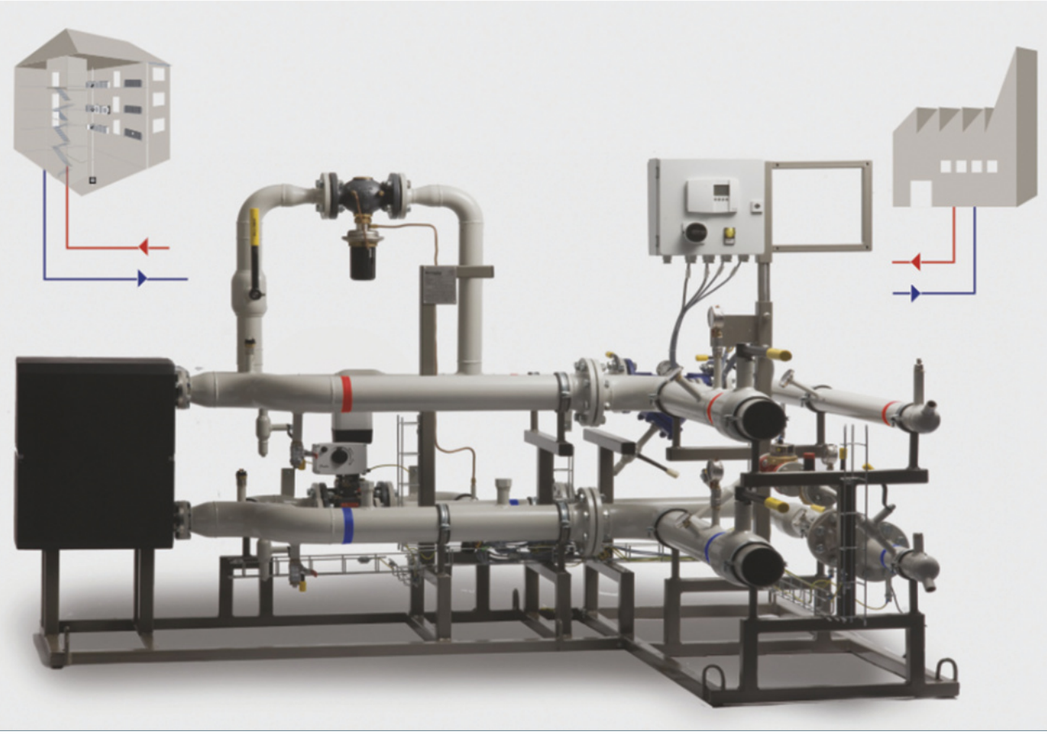
- Assess the condition of the existing heat supply units and regulation units in the building;
- If the existing heat supply unit is damaged, replace it (if possible) with a standardized modern individual heating stations;
- Ensure the necessary stock of standard regulation systems in the amount determined by the heat supply utilities of the region;
- An "independent" connection scheme is the priority;
- In case of damage of the district heating group station (CTP), modernization is carried out in case of technical necessity or the impossibility of operating the system without the CTP.
  The need for modernization of the CTP should be determined by the heat supply scheme.

SOLUTION

Modernization of individual heating stations, modernization of district heating group stations (if transition from CTP to IHS is possible)

РЕЗУЛЬТАТ:

- Reduction of thermal energy consumption by the building;
- Reduction of the level of relative losses in the building by responding to demand;
- Ensuring the best parameters of the heat carrier;
- Protection of internal heat consumption systems from hydraulic failures (dependent scheme) in the heat supply system;
- Modernization of IHS is the priority. Modernization of CTP, if there is a possibility of transition to IHS, should not be carried out, since it is an element of outdated district heating systems, which creates difficulties in further modernization of the system.



DISTRICT WATER SUPPLY

CHALLENGE:
Damage to elements of the cold water supply system, inefficient use of electric energy by pumping stations, hydraulic imbalance.

PURPOSE:
Restoration and modernization of cold water supply systems

SOLUTION 1

Installation of frequency converters in pumping stations

RECOMMENDATIONS:

- Adapting the pressure to the actual demand using frequency converters and booster pumping stations makes it possible to achieve electricity savings of 25–40%;
- Reducing the risk of water hammer effect;
- Reducing the number of new pipe breaks by 40–55%;
- Reducing water leakage by 30-40% through new damages;
- Decrease of maintenance costs and expensive repairs;
- Increase of the network service life.

SOLUTION 2

Replacement of shut-off valves in main areas to ensure 100% tightness for quick repair work

RESULT

- Low flow loss;
- Full tightness when the tap is closed;
- No maintenance required;
- Long service life;
- Possibility of installation in any mounting position;
- Easy and quick closing/opening;
- Quick disconnection of damaged sections of the water supply network or buildings.

SOLUTION 3

Installation of a pressure reducing regulator where the pressure remains too high in the water supply network. For hydraulic balancing of these areas.

RESULT

- Reduction and maintenance of constant pressure, regardless of water consumption;
- Increasing the service life of elements of the entire system;
- Elimination of acoustic discomfort;
- Maintaining the pressure at the level acceptable for consumers;
- No pressure drops and water hammer effects;
- Stable water supply system operation.

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RESIDENTIAL BUILDINGS

CHALLENGE:

Damaged windows, insulation system of enclosures, heating system (pipes, radiators, individual heating plant, etc.)

PURPOSE:

In a short time, provide housing for citizens who have lost homes and restore social infrastructure

SOLUTIONS

Replacement of damaged windows

Restoration of the damaged insulation system of enclosures

RESULTS:

- Approximate cost of glazing is from €150 per meter
- Approximate cost of insulation is from €50 per meter

It is necessary to perform reconstruction at the building level, not at the damaged spot

SOLUTION

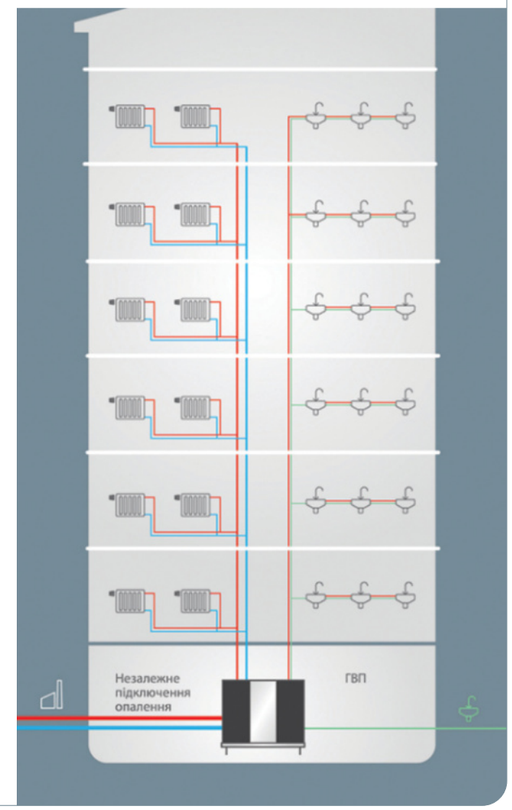
Designing a two-pipe system instead of the available one-pipe system should be considered if possible.

If there is no such possibility, the available one-pipe heating system should be reconstructed:

- Reconstruction of existing individual heating stations or installation of new ones;
- Replacement and insulation of pipes;
- Installation of automatic balancing valves;
- Replacement of heating system radiators;
- Installation of radiator thermostats;
- Implementation of individual heat metering.

RESULT

- 25–40% reduction in energy consumption
- Equipment cost is from 50 € per meter
- Term of execution is 3 to 9 months
- Achieving by building "C" energy efficiency class



The heating system design project should be developed.

The complete set should correspond to the specification of the design project documentation.

Settings of all automatic control valves should be made according to the design project.

After installation and adjustment, a service maintenance contract should be concluded.

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PUBLIC BUILDINGS

CHALLENGE:
Damaged heating systems (pipes, radiators, individual heating plant, etc.), hot and cold-water supply system and engineering systems

PURPOSE:
Provide heating and water supply in buildings, improve energy efficiency

SOLUTIONS FOR HEATING SYSTEM

Designing a two-pipe system instead of the available one-pipe system should be considered if possible.

If there is no such possibility, the available one-pipe heating system should be reconstructed:

- Reconstruction of existing individual heating plants or installation of new ones;
- Replacement and insulation of pipes;
- Installation of automatic balancing valves;
- Replacement of heating system radiators;
- Installation of radiator thermostats;

RESULTS:

- 25–40% reduction in energy consumption
- Equipment cost is from 40 € per meter
- Term of execution is 3 - 9 months
- Achieving by building "C" energy efficiency class

SOLUTIONS FOR HOT AND COLD WATER SUPPLY SYSTEM

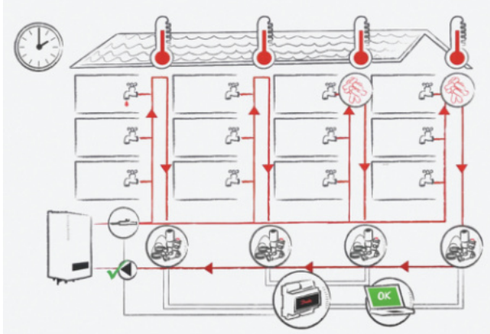
- Replacement and insulation of pipes
- Installation of frequency converters at pumping stations

District hot water supply
- It should be restored where possible
- Reconstruction of existing individual heating station or installation of new ones
- Installation of automatic thermostatic balancing valves on recirculation systems
- Installation of pressure regulators

Cold water supply:
- Installation of pressure regulators

RESULT

- 15–40% reduction in energy consumption
- Equipment cost is from 10 € per meter
- Term of execution is 3 - 6 months



SOLUTIONS FOR ENGINEERING SYSTEMS

- Installing security systems – snow melting on roofs and stairs
- Installing systems ensuring microclimate and comfort – warm floors, walls
- Installing air quality assurance systems (recuperation)

RESULT

- Public buildings as an example/showcase of an energy efficiency approach
- Term of execution is 3 - 9 months
- Achieving by building "A" or "B" energy efficiency class

SOLUTIONS FOR ENGINEERING SYSTEMS

- Installation of snow melting and de-icing systems where required by building standards (roofs, entrance groups, ramps).
- Installation of climate systems (HVAC) where required by building standards.
- Installation of supply and exhaust units with recuperation.

RESULT

- Public buildings as an example/showcase of an energy efficiency approach
- Term of execution is 3 - 9 months
- Achieving by building “A” or “B” energy efficiency class

SOLUTIONS FOR HEATING SYSTEM

Designing a two-pipe system instead of the available one-pipe system should be considered if possible.

If there is no such possibility, the available one-pipe heating system should be reconstructed:

- Reconstruction of existing individual heating station or installation of new ones;
- Replacement and insulation of pipes;
- Installation of automatic balancing valves;
- Replacement of heating system radiators;
- Installation of radiator thermostats;

RESULTS

- 25–40% reduction in energy consumption
- Equipment cost is from 45 € per meter
- Term of execution is 3 - 9 months
- Achieving by building “C” energy efficiency class

PRESCHOOL EDUCATIONAL INSTITUTIONS

SOLUTIONS FOR HEATING SYSTEM

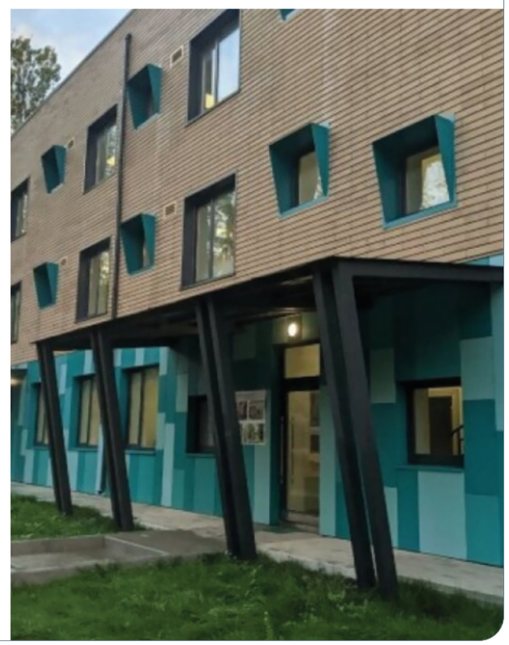
Designing a two-pipe system instead of the available one-pipe system should be considered if possible.

If there is no such possibility, the available one-pipe heating system should be reconstructed:

- Reconstruction of existing individual heating station or installation of new ones;
- Replacement and insulation of pipes;
- Installation of automatic balancing valves;
- Replacement of heating system radiators;
- Installation of radiator thermostats;

RESULTS

- 25–40% reduction in energy consumption
- Equipment cost is from 45 € per meter
- Term of execution is 3 - 9 months
- Achieving by building "C" energy efficiency class



SOLUTIONS FOR ENGINEERING SYSTEMS

- Installation of snow melting and de-icing systems where required by building standards (roofs, entrance groups, pathways).
- Installation of underfloor heating (water or electric) in playrooms.
- Reconstruction of the hot water supply system
- Installation of climate systems (HVAC) where required by building standards.
- Installation of supply and exhaust units with recuperation.

MEDICAL INSTITUTIONS

SOLUTIONS FOR HEATING SYSTEM

Designing a two-pipe system instead of the available one-pipe system should be considered if possible.

If there is no such possibility, the available one-pipe heating system should be reconstructed:

- Reconstruction of existing individual heating station or installation of new ones;
- Replacement and insulation of pipes;
- Installation of automatic balancing valves;
- Replacement of heating system radiators;
- Installation of radiator thermostats;

RESULTS

- 25–40% reduction in energy consumption
- Equipment cost is from 45 € per meter
- Term of execution is 3 - 9 months
- Achieving by building "C" energy efficiency class

SOLUTIONS FOR ENGINEERING SYSTEMS

- Installation of snow melting and de-icing systems where required by building standards (roofs, entrance groups, ramps).
- Installation of underfloor heating or warm walls in rooms with special requirements for cleanliness.
- Installation of the hot water supply system.
- Installation of climate systems (HVAC) where required by building standards.
- Installation of supply and exhaust units with recuperation.
- Installation of cooling systems with the possibility of disposal of waste heat.

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Danfoss Ukraine
Address: 04080 Kyiv, Vikentiia Khvoiky 15/15/6
Customer service center: **+380 800 800 144**
https://www.danfoss.com/uk-ua