Siberian Researchers to Improve Municipal Heating System

Scholars from Siberian Federal University jointly with colleagues from Omsk State Transport University designed a statistical method based on Big Data analysis to increase the efficiency of the municipal heat supply system. At the approbation stage, the initial costs for the heating networks reconstruction have already been reduced by more than a quarter.

An improvement of urban heat supply systems is essential for the advance the Russian municipal heat supply systems to implement the so-called fourth-generation system concept (a second-generation heat supply system is currently operative in Russia). Along with a decrease in the design temperatures of the heat-transfer fluid, fourth-generation systems imply an increased energy efficiency of buildings, the use of non-traditional and renewable sources and thermal energy accumulators.

"The idea is quite promising, but a potential investor is not ready to invest in public infrastructure without a clear understanding of whether this amount is the minimum necessary to obtain the desired result. By this, we mean the energy (in MWh of electricity and Gcal of heat), economic, and environmental effects leading to the reduction of greenhouse gas emissions. The project carried out in close cooperation with production will accelerate the development of the thermal power industry in the region and give an additional impetus to public-private partnerships in pricing using the method of environmentally friendly alternative boiler house," said **Andrey Zhuykov**, head of the training and research laboratory of the Department of Heat Engineering and Fluid Dynamics, Siberian Federal University.

Upon the research results, the scientists managed to reduce the initial costs for the heat networks reconstruction by more than a quarter. The consideration of both calculated and actual indicators within the business plan can reduce the total cost of the project and result in significant savings that can be instrumental for the development and support of other investment projects. This project adopts the statistical method based on Big Data analysis considering the actual consumption of heating energy, outdoor air temperature, and heating water in direct and return pipelines. Though the processing of operational data and specific patterns for calculating the coefficient of hydraulic friction (Weisbach-Darcy and Colebrook-White formulas) require significant computing power, they allow estimating the distribution of heat carrier flow and pressure losses more reliably than was previously possible.

"Our study is based on thermal-hydraulic modelling of dynamic processes occurring inside the district heating system using advanced Russian software and calculation systems, in particular, ZuluThermo by Polyterm company. Our method allows solving the tasks in time, applies to any settlements, and easily adjusts to scale. In general, the results of the study should contribute to the further scientific work within advancing the heating networks of Russian settlements," said **Stanislav Chicherin**, postgraduate student of the Department of Heat Power Engineering (School of Electric Transport and Energy Supply Systems, Omsk State Transport University).

The research results are published in Energy peer-reviewed journal (Q1, journal impact factor 1.96 — SJR; impact factor 7.147 — JCR Science Edition).

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