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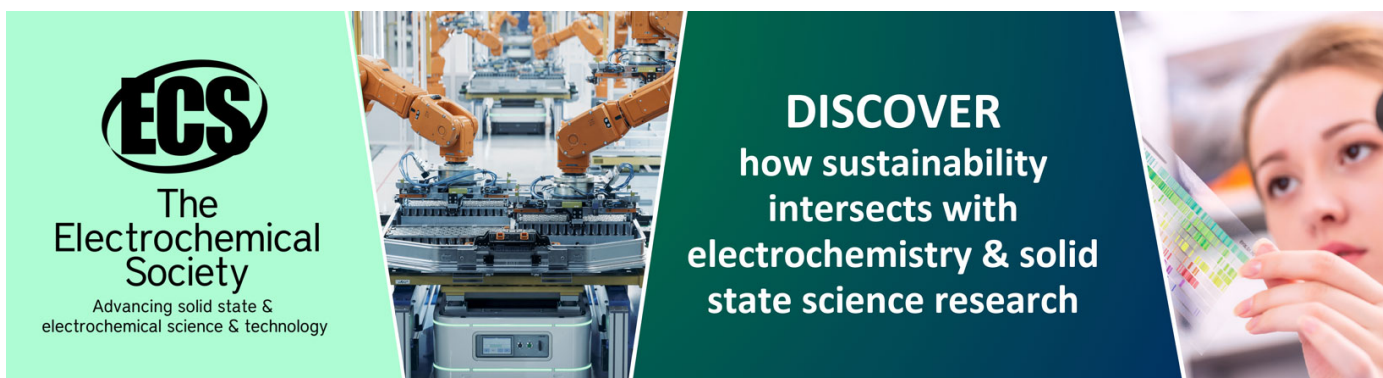
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Operating the hot water supply system problems during transferring the hostel to the apartment house status

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Abstract. The energy infrastructure modernization is a complex social and technical problem requiring an integrated approach. After analyzing the hot water system operation in a residential apartment building, being previously a hostel, the reason for the temperature regime violation was determined. In connection with the building status change, the residents number has significantly decreased, the service block, which led to a change in water consumption conditions has been eliminated. In addition, the requirements for minimum water temperature in centralized hot water systems have changed. The question of using a dead-end hot water supply system possibility, provided by the project or its reconstruction into the circulation network, was considered. The studies were conducted in accordance with the methodology described in MIC 4.3.2900-11 “The centralized hot water supply systems hot water temperature measurement”. There was a discrepancy in the temperature coolant standard indicators at the dismantling points on different floors of the building. The difference in temperature at the input (the heat meter and thermometer readings) and at the end user is associated with additional water cooling in the supply pipes of the domestic hot water heating system. When transferring the public buildings to housing stock, it is necessary to revise not only water consumption rates, but also the hot water supply scheme in general. The lack of circulation leads to waste of hot water and increases the cost to the consumer. To ensure the required temperature standards for a full day in a dead-end hot water supply system, which is provided for by the project, continuous dismantling of the water is required, which is difficult to achieve with a changed building status. The resolution of the problem is possible only when the domestic hot water heating system is switched to the circulation mode with the circulation piping and the circulation pump installation.

Introduction

In our country, housing and public utilities is one of the largest economy sectors, where about 25% of state fixed assets are concentrated, the municipal energy sector consumes more than 45% of heat and 20% of electricity. Therefore, the engineering systems modernization is a very time-consuming, costly, socially important process affecting the comfortable working and living environment of each person. At the same time, the number and scale of problems is a significant indicator of the society state [1, 4].



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The main mistake in making informed decisions is the lack of a full-scale experiment with bringing the idea of modernization to all interested parties, with the results demonstration clearly showing the energy-saving measures feasibility [7].

Many residents are not satisfied with the housing and public utilities services quality level and suggest that it does not match the cost. The current situation in the housing sector is characterized by a significant deterioration of the main equipment, outdated technologies, large losses of energy resources and low energy efficiency. More than 70% of the country's housing stock was built before 1980, equipment wear exceeds 60%, energy consumption is 2-3 times higher than in European countries; while in the early 1990s, the national average per 100 km of utility networks was 30–40 accidents, over the past 10 years the number of accidents increased to 180 per 100 km of water supply and 10–20 per 100 km of heat supply networks [5].

The social aspect of this problem is the industrial enterprises refusal to maintain the departmental housing stock and transfer it to the city balance, the management company or the housing cooperative [6]. For example, in the city of Tolyatti, back in 2006, the integrated dormitories of PJSC "AVTOVAZ" were transferred to the municipality in the status of multi-family residential buildings with many problems, such as privatization issues, an unknown number of people actually living there, as well as a change in the improvement degree and technical condition engineering communications.

Relevance of the work

The article discusses the reason for the discrepancy between the temperature of hot water at the apartment water intake point of a building previously being a hostel of one of the Togliatti enterprises. The building was built according to the standard project 164-80-4 "A 9-story dormitory for 537 beds with a service unit". There was laundry, dining room, households, premises in the service unit.

According to the Housing Code, residential accommodation in a dormitory is provided to citizens at the rate of at least 6 square meters of living space for 1 person. At the time of the survey, about 300 people lived in the building permanently, the maintenance block had already been liquidated.

Considering the numerous residents' complaints, it became necessary to determine the discrepancy cause between the hot water temperature at the dismantling point [11, 12]. This requires: to conduct a survey of the residential house hot water system; to measure the hot water temperature at the dismantling point; to establish the temperature non-compliance cause with the regulatory requirements [2, 3].

The hot water supply system of a 9-storey single-entrance residential building, built in 1980, is made of steel water and gas galvanized pipes GOST 3262-75. The inlet pressure is 0.56-0.6 MPa, the temperature is 58 ± 1 °C. The main pipeline is made of steel pipes, insulated with mineral wool with a covering layer of fiberglass. The isolation condition is satisfactory and, at the time of the survey, meets the requirements [8]. Connection to the risers is made in accordance with the requirements of [14]. The domestic hot water heating system is dead-end, the T4 pipeline is missing and complies with the project "9-storey dormitory for 537 beds with a maintenance unit. Model project 164-80-4" sheet VK-15 Axonometric scheme.

The following object elements were examined:

1. Entering the residential building hot water pipeline input.
2. Input unit (metering unit for heat energy and heat carrier).
3. Trunk pipeline laid in the basement.
4. Risers, internal wiring, water folding devices.

The measurements were carried out in accordance with the method described in [10]. When conducting the hot water supply system study on 09/27/2018, from 10.00 to 11.30, the selective hot water temperature measurements on the risers in the kitchen and bathrooms were carried out. The instruments used: laboratory electronic thermometer LT-300 with a measurement range from minus 50 to plus 300 °C, accuracy class 0.05; graduated glass cylinder: volume of 100 milliliters, class A, division value 1 ml, total height 256 mm, outer diameter 29 mm [13].

The sampling was carried out on different risers (from the closest to the input node to the most remote) on different floors, where measurement is possible [10 p.7.2]. Sampling was carried out in a heated heat-insulated flask after draining the water for at least 5 minutes, then every 1 to 2 minutes at a constant flow of hot water. Because the measurements were carried out from 10.00 to 11.30 during the lowest water consumption hours (Figure 1); in the absence of a circulation riser, the water temperature strongly depended on the flow rate (discharge time) [16].

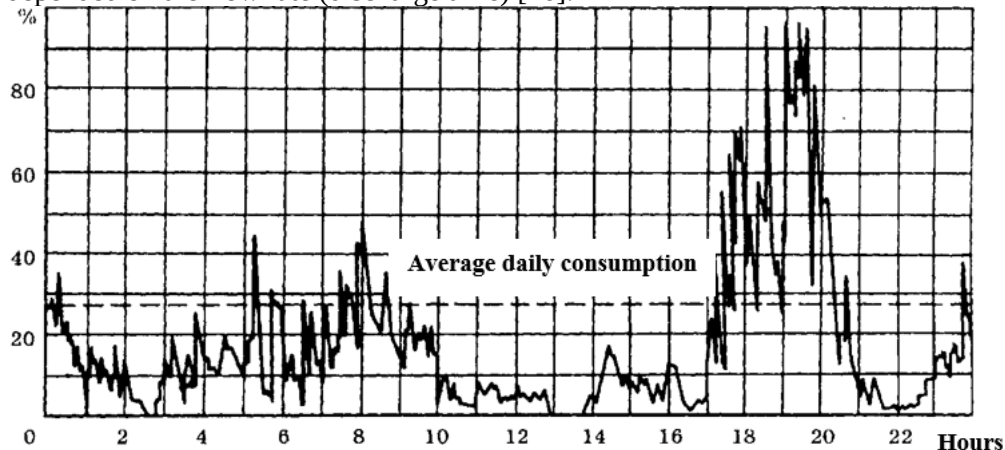


Figure 1. Water consumption daily schedule in the apartment buildings.

The hot water supply pipelines (some sections) have been in operation since 1980, they show signs of corrosion, which leads to an increase in hydraulic resistance and a decrease in the flow rate on water-folding devices [18, 19].

Figure 2 shows a temperature measurements ($^{\circ}\text{C}$) graph constructed from the experimental data.

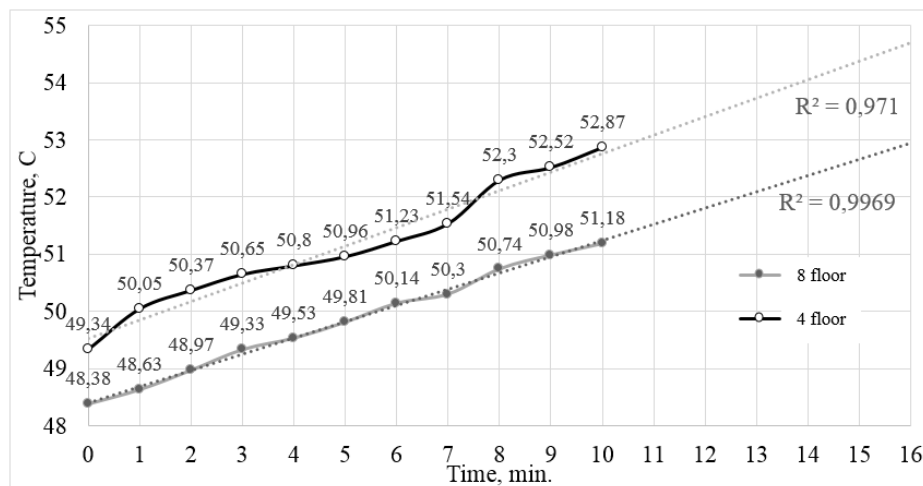


Figure 2. The temperature measurements graph at the water folding devices.

The dashed line shows the forecast (up to 16 minutes) of temperature change with further water discharge. Pearson's R^2 criterion shows the measurement results distribution probability degree, with the number of measurements more than 10 R^2 criterion > 0.95 , which confirms the closest to the results linear distribution [17].

The report on the hourly parameters of heat supply obtained from the VKT-7 heat calculator shows that during the greatest water consumption hours, the temperature regime meets the requirements [11 p.2.4]. However, the average values for the period of 09/24/2018 - 09/27/2018 are lower than the normative values by 1 - 2 $^{\circ}\text{C}$.

The Government Decree of the Russian Federation of 06/05/2011 N 354 (amended on 03/27/2018, amended of 10.07.2018) “On the public services provision to the owners and users of premises in apartment buildings and residential houses” (paragraph 5; Annex 1) prescribes “the hot water temperature permissible deviation at the point of dismantling from the hot water temperature at the point of dismantling that complies with the requirements of the RF legislation on technical regulation: at night (from 0.00 to 5.00 hours) - not more than 5 degrees Celsius; in the daytime (from 5.00 to 0.00 hours) - no more than 3 ° C”.

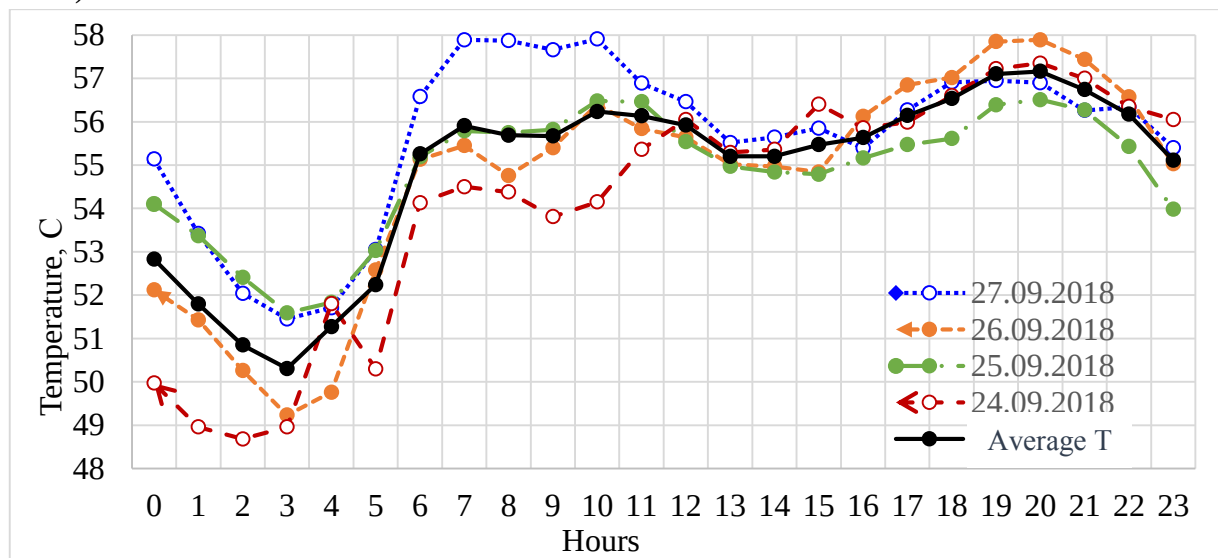


Figure 3. The hot water temperature distribution by day hours.

The difference in temperature at the input (readings of the heat meter and thermometer) and at the end user is associated with additional cooling of water in the risers of the domestic hot water heating system, since the water temperature in the dead-end hot water system depends on the water consumption intensity (similar to the graphs of Figures 1 and 3), while ensuring the temperature required for the standards for a full day is possible only by organizing the circulation [20]. Work on the temperature regime normalization in the domestic hot water heating system refers to capital works, i.e. involves the disassembly and revision of the entire system in order to identify the hidden deficiencies and assess the residual resource [15].

Summary

When transferring public buildings to housing stock, it is necessary to revise not only water consumption volumes, but also the hot water supply scheme in general. The lack of circulation leads to waste of hot water and increases the cost to the consumer.

The reason for the discrepancy between the hot water temperature at the point of dismantling is a significant hot water cooling at a low water level and the absence of the circulation pipe T4 under the project. A significant decrease in hot water consumption was due to the dormitory transfer to the residential house status, a decrease in the number of tenants, and the elimination of the maintenance unit from the laundry and dining room.

It is possible to normalize the temperature regime in the domestic hot water heating system by installing a T4 circulating pipeline from TsTP-57 (option - installing a heat exchanger in the residential building itself), as well as with an obligatory installation of the T4 internal circulating pipeline.

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