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Rainwater Management: A Case Study of Residential Reconstruction of Cultural Heritage Buildings in Russia

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Abstract : Since 1990, energy-efficient development concepts have constituted both a turning point in civil engineering and a challenge for an environmentally friendly future. Energy and water currently play an essential role in the sustainable economic growth of the world in general and Russia in particular: the efficiency of the water supply system is the second most important parameter for energy consumption according to the British assessment method, while the water-energy nexus has been identified as a focus for accelerating sustainable growth and developing effective, innovative solutions. The activities considered in this study were aimed at organizing and executing the renovation of the property in residential buildings located in St. Petersburg, specifically buildings with local or federal historical heritage status under the control of the St. Petersburg Committee for the State Inspection and Protection of Historic and Cultural Monuments (KGIOP) and UNESCO. Even after reconstruction, these buildings still fall into energy efficiency class D. Russian Government Resolution No. 87 on the structure and required content of project documentation contains a section entitled 'Measures to ensure compliance with energy efficiency and equipment requirements for buildings, structures, and constructions with energy metering devices'. Mention is made of the need to install collectors and meters, which only calculate energy, neglecting the main purpose: to make buildings more energy-efficient, potentially even energy efficiency class A. The least-explored aspects of energy-efficient technology in the Russian Federation remain the water balance and the possibility of implementing rain and meltwater collection systems. These modern technologies are used exclusively for new buildings due to a lack of government directive to create project documentation during the planning of major renovations and reconstruction that would include the collection and reuse of rainwater. Energy-efficient technology for rain and meltwater collection is currently applied only to new buildings, even though research has proved that using rainwater is safe and offers a huge step forward in terms of eco-efficiency analysis and water innovation. Where conservation is mandatory, making changes to protected sites is prohibited. In most cases, the protected site is the cultural heritage building itself, including the main walls and roof. However, the installation of a second water supply system and collection of rainwater would not affect the protected building itself. Water efficiency in St. Petersburg is currently considered only from the point of view of the installation that regulates the flow of the pipeline shutoff valves. The development of technical guidelines for the use of grey- and/or rainwater to meet the needs of residential buildings during reconstruction or renovation is not yet complete. The ideas for water treatment, collection and distribution systems presented in this study should be taken into consideration during the reconstruction or renovation of residential cultural heritage buildings under the protection of KGIOP and UNESCO. The methodology applied also has the potential to be extended to other cultural heritage sites in northern countries and lands with an average annual rainfall of over 600 mm to cover average toilet-flush needs.

Keywords : cultural heritage, energy efficiency, renovation, rainwater collection, reconstruction, water management, water supply
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