

Reorganization of industrial territories in the context of urban development

Eugenia Taubert, Anastasia Pavlova

*Faculty of Biotechnologies (BioTech), ITMO University
191002, Russia, St.Petersburg, Lomonosova str., 9*

The area of St. Petersburg is about 144,000 hectares, of which industrial areas occupy 24% of urban land. The historical center of the city is surrounded by the so-called "gray belt", which is a zone of industrial enterprises that are unsuitable for further use for their intended purpose and that have come to an emergency condition [1, 2]. It was formed in the following way: enterprises were moved to the outskirts of the city, and when the development of the residential zone within the "belt" became impossible, urban development continued beyond its borders. This type of industrial development is typical for most large cities over 200 years old. Many foreign cities and towns of Russia, to varying degrees, have faced the problem of reorganizing such territories. St. Petersburg continues to develop and accept new residents, but it needs an urgent transition from extensive growth to building a model of sustainable urbanization and improving the quality of infrastructure.

The purpose of this work is to provide research results that consider the effectiveness of methods for reorganizing industrial areas in urban development on the example of one of the buildings of this "gray belt" and its transformation into a public urban "green" zone. The investigated object is the main gas-holder of the "Society of Capital Lighting" and it is located in the Moscow district of St. Petersburg. Since 2001, the gas-holder has been under federal cultural site control. Since March 2019, it has hosted Planetarium №1 - the largest private, commercial planetarium not only in the country, but worldwide.

The weak point of the Planetarium №1 building is the slight thermal insulation of the outer overlays, which is a consequence of the significant energy consumption for heating and cooling the premises. At the same time, the procedure for changing the structures of the building is difficult, since it is an object of federal cultural heritage.

The proposal to improve the quality of the renovation of the gas-holder is a roof extensive greening. Extensive greening doesn't imply a significant weight on the roof, due to the thickness of all six layers of the green roof (anti-root film; moisture-accumulating mat; reinforcing drainage element; substrate; anti-erosion jute mesh; sedum vegetation layer) [4]. Thickness of selected layers will not exceed 400 mm, they are made from recycled materials and certified by ETA Green Roofs.

The advantages of roof greening Planetarium №1 are as follows:

- additional thermal insulation of the building and electricity costs decrease;

- protection of the roof from the destructive effects of the urban environment;
- reducing the load on storm sewers;
- aesthetically pleasing, due to the vegetation layer is selected not only based on resistance to the climate of St. Petersburg and growing conditions on the roof, but also on flowering throughout the spring and summer seasons;
- collecting and filtering storm and melt water - "gray water" - for its reusing;
- fulfillment of 11 out of 53 possible criteria of BREEAM International Non-Domestic Refurbishment 2015 in 7 out of 9 possible areas (the most important criteria will be related to Ene ("Energy"), Hea ("Health and well-being"), Mat ("Materials")) [3];
- compensatory greening of urban space and the creation of recreational zone;
- attracting investors and additional advertising (important point for commercial projects).

The calculation by mythologies [5,6,8] showed that roof greening of the gas-holder would reduce the annual heat loss of the building by 24.3%. The average index of reducing the energy consumption of a building for roof gardening, adopted in the EU countries, is about 15% [7].

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