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Housing and climate change-related disasters: a study on architectural typology and practice

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Abstract

Climate change has become one of the greatest challenges in the XXI century. Complete picture of this phenomenon can be formed only by understanding the meaning and scope of both combating methods - mitigation and adaptation. A lot of attention in recent time has been given to residential architecture that contributes to climate change mitigation. On the other hand, adaptation refers to design approaches that are closely connected to the term 'resilience'. By reviewing various architectural examples, this paper studies and classifies housing units that alleviate social implications of climate change-related disasters caused by extreme weather conditions. By comparing these new examples with common everyday practice and the overall socio-environmental context, it can be concluded that there is a need for systemic solutions which integrate both sustainable and climate-resilient design.

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1. Introduction

The Earth's climate is constantly changing: by the beginning of the industrial revolution, climate change was a result of changes in nature. Today, however, the term climate change is linked to the events occurring from early

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twentieth century and refers to the consequences of anthropogenic influence, massive use of fossil fuels and the accumulation of carbon dioxide in the atmosphere.

Climate change manifestations have become one of the most important environmental problems in the XXI century, and are therefore subject to a large number of debates and research. It is difficult to define the issue of climate change within only one area. Therefore, this topic, together with environmental problems, extends through all areas of human activity: from the socio - political field and the economy to the field of culture, spatial and urban planning, and architecture. Climate change reinforces existing and create new risks, and has a huge impact on people and ecosystems, posing a threat to sustainable development. Limiting the risk of climate change relies on trained management structure and improved ability to respond to the problem (IPCC 2014) [1] in different spheres of human activity. It is expected that the implementation of the new global Paris Agreement (from the Conference in Paris, November 30 to December 12, 2015) will establish a long-term climate change mitigation through reduced greenhouse gases emissions.

A complete picture of the climate change phenomenon can be formed only by understanding the meaning and scope of both combating methods - mitigation and adaptation. The architectural contribution to climate change mitigation is based on design and construction of environmentally friendly buildings/structures which during their entire life cycle have reduced negative impact on the environment, including reduction in the emissions of carbon dioxide gas. The architecture that contributes to climate change mitigation is above all energy efficient, based on the use of renewable energy resources and materials with a reduced amount of embodied energy. Adaptation measures refer to new approaches which include either the achievement of structures' resilience or the planning and design of structures that, after a disaster occurs, can be quickly installed on a safe terrain with the purpose to accommodate population relocated from the affected areas.

2. Residential architecture and climate disasters

Exploring the most accurate definition of the term disaster, Bell et al. (2001) proposed the inclusion of social dimension in the meaning. A natural disaster, hence, must disrupt the functioning of the community, and same is the case with disasters caused by anthropogenic factor. According to the authors, the climate change, provoking in the built environment the disasters originally caused by natural extreme situations, can be intensified or mitigated depending on human factor [2].

The consequences of disasters are numerous: a) health - death, injury, impairment of health and epidemics; b) social - the impoverishment of the segments of affected society; c) psychological - experienced stress leads to mental disorders; d) economic - material damage results in the reduction of national income; e) environmental; and others. In 1989, Chambers defined vulnerability as "exposure to cases, stress and difficulties experienced by some communities while coping with unpredictable events and stresses" [3].

The concept of urban and architectural planning and design should be directed to the complex requirements of the 21st century and an adequate response to the always present question of whether the buildings are able to provide protection in extreme conditions/events.

In addition to the application of new technologies and the implementation of passive and active techniques necessary to reduce energy requirements and improve the comfort of users, it is necessary to devote additional attention to the habits and requirements of building users. In setting the recommendations and guidelines for the design, aimed at reducing the negative consequences of the climate and the environment, characteristics of a particular social, cultural and economic context should be considered, with the flexibility of the entire system. In order to get the right answer to the challenges of climate change, we need to create an environment that is both comfortable and sustainable for all users.

2.1 Typology

The typology of housing units, which will adequately respond to conditions created by climate change manifestations in the form of extreme weather events, may be established on the basis of:

type of disaster, its certainty and the general geographic and climatic conditions,

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