Chapter 2
Architectural Form and Energy Integration:
The Impacts of Renewable Energy Use on Configuration of Form in Architectural Design

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ABSTRACT

The energy problem experienced on a global scale is among the main problems in the field of architecture, as it is in every field. The fact that fossil-based energy, which is mostly consumed in buildings, will be depleted in the near future and is creating environmental problems necessitates the effective use of renewable energy. At this point, solar and wind energy come to the front as renewable energy sources that can be used more effectively in architectural designs. The use of solar and wind energy as a design data in buildings is effective in shaping the architectural form. In this context, within the scope of the study, it is aimed to analyze the renewable energy-architectural form relationship through design practices. By analyzing the effects of the use of renewable energy in buildings on configuration of architectural form and its in return for current design practices, it is aimed to be a source of information for the studies to be done on this subject in the future.

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INTRODUCTION

Along with the industrial revolution, the developments in the field of technology have brought along urbanization and related urban problems, as well as many positive effects. Industrialization has increased its orientation towards cities. Thus, the population density in the cities and the improvement in living standards brought along more resource consumption. In particular, the amount of energy consumed has increased in parallel with the changing living conditions. Accordingly, the energy problem has taken its place among the main problems in the world.

The energy consumed in the buildings is obtained from non-renewable sources causes environmental pollution and irreversible damage to the ecological balance in the world. In addition, the fact that fossil energy sources will be depleted in the near future necessitates the use of renewable energy sources in buildings.

The fact that most of the energy consumed in the world is used in buildings increases the necessity of using renewable energy in buildings and the importance of energy efficient building designs. Minimizing the energy used in buildings in a way that will enable the use of renewable energy sources with the building form and building design features is one of the measures to be taken against environmental pollution in the world. In terms of ensuring the continuity of life in a healthy environment, the use of renewable energy sources in buildings is important.

In the context of sustainable architecture, the use of renewable energy in buildings is an important parameter that affects the shaping of the architectural form. Sustainable architecture, which is formed with the knowledge of the place, needs the knowledge of environmental technology (eco-technology) in the life process. In this context, the ways of making sense of sustainable architecture can be perceived within a complex network of relations. Sustainable design works with the climate rather than against it, in collaboration with nature. Thus, it generates organic and natural forms of structure shaped according to climate and location, cultural forms emphasizing cultural diversity, and forms that represent its own essence and for its own benefit, with the expression of technological innovations (photovoltaics, greenhouse). The form of the sustainable structure is a part of the passive energy source (Ekim, 2004).

Various factors, criteria and constraints affecting architectural design are effective when making the form decision. In addition to many determining factors such as investment objectives, functional requirements, user trends, land, environmental and climate data, technology, financing, resources, standards, supervisory and regulatory rules; Factors such as the architect's knowledge, culture, talent, worldview, value judgments, purpose and psychology also play an important role in making form decisions (Onat, 2020).

In this context, the use of renewable energy sources in buildings is one of the factors affecting the shaping of the architectural form. By evaluating the climatic