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Zeroenergy Design
architecture of tomorrow
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DLA Thesis

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Abstract

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Oil-era architecture is over, energy-guzzling, environment-polluting properties are out of time, they are not sustainable any more. The way out of this dead-end street is the paradigm shift towards sustainable architecture. The change has already begun, low-energy properties of 21st century architecture are characterized by passive houses, zero emission, zero energy buildings. Zeroenergy design is termed as architecture characterized by full comfort and high level of energy efficiency with combination of renewable energy sources, resulting zero annual energy balance of a building, operating in a sustainable, environment friendly way. This solution requires high performance buildings with energy efficient building shell and other features ensuring that buildings can be operated with sustainable energy supply. There are passive and active techniques, state-of-the-art engineering, renewable sources and integrated design to facilitate this. The past age of individual star architecture should be replaced by simpler, more communal oriented, more environmentally friendly solutions. Sustainability is a complex set of requirements which will fundamentally reshape our views on architecture. Sustainable architecture integrates economic, social and environmental considerations in the design and construction. The need for integrated design requires easy to use energy modelling softwares and life cycle analysis tools. In my research I briefly overview the history of zeroenergy architecture, focusing especially on the Hungarian and European legislation and interpretation of the issue. I attempt to define the concept of zeroenergy design, and its different aspects (aesthetic, technical, cultural, regulatory, economic, etc.). I introduce the pioneers of zeroenergy design, and sample exemplary contemporary international and domestic projects. In my research I discuss possibilities of present and future energy supply, and give recommendations for zeroenergy building design. Based on four years of user experience I analyze the economic implications of Hungary's first certified Passive House, which can be regarded as one of the first near zero energy buildings in Hungary, and report on what to do with the existing building stock. In my master work I present a zeroemission, near zeroenergy building, designed and built according to the design principles of zeroenergy design. Kőröshegy bridge maintenance centre is one of the first Hungarian near zeroenergy buildings. Built as an office building, the realized example employs zeroenergy design principles, highly efficient building shell and various renewable sources. Customer experience has demonstrated their viability and benefits. My zeroenergy design research summarizes theoretical knowledge and practical experience of the past 10 years of my praxis. The actuality of the topic is indicated by the forthcoming EU directive of nearly zeroenergy building standard in effect from 2020.

Thesis

- 1. The built environment is the biggest consumer of raw materials and energy. Creation and operation of buildings and cities destroys natural environment, current practice is not sustainable in a world of limited resources.**

The built environment contributes to global warming and climate change a great portion. Population doubled in the last 50 years, majority of people now live in urban settlements, humanity consumes its own future. A paradigm shift is needed, one of its elements is zeroenergy design.

- 2. We deal with the problem, but culture is changing slowly, and it is questionable if sustainable architecture will have a significant effect because of the time pressure.**

Built environment was more or less sustainable in traditional societies. Oil-era has changed world, relationship of Nature, and architecture. We need a new holistic approach, architecture should recognize its role in current world. New institutions and initiatives are needed in order to facilitate successful innovation, transformation, adaptation and evolution, to avoid the risk of failing.

- 3. Zeroenergy design offers a practical solution to the critical resource problem, the energy crisis.**

There are many possible solutions, based on general principles, such as energy efficiency, recycling and the use of renewable sources. Such a transformation of the practice would be extremely useful for society and the economy as well as to the profession.

- 4. The path is walkable, the solution is reachable.**

The world is beyond the experimental phase. After 40 years of the first oil-shock and first experiments, and 20 years of the first passive house there are proven systems and solutions to adapt, in order to renew our culture.

- 5. The world of architecture is undergoing a fundamental change.**

Invention of the fire or the wheel, and the industrial revolution are comparable to the scale of changes humanity faces today. Sustainable architecture is a megatrend, determining architecture in the near future. Two options are possible: evolution or collapse.