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TECHNOLOGY IN ARCHITECTURE AS AN IRREPLACEABLE PHENOMENON OF LOW-ENERGY, GREEN AND SUSTAINABLE CONSTRUCTION

TECHNOLOGIA W ARCHITEKTURZE JAKO WYJĄTKOWE ZJAWISKO ZWIĄZANE Z BUDOWNICTWEM NISKOENERGETYCZNYM, EKOLOGICZNYM I ZRÓWNOWAŻONYM

Abstract

The society – ecology – energy interaction. Technology and its three principal areas in society represented by industry, transport and human settlement. Human settlements and architecture as a symbiosis of aesthetics, technology and economics. The phenomenon of technology in architecture represented by building technology. The criterion of art in architecture expressed by the Building–Climate–Energy system link. Construction and the basic categories of materials and production technology. Climate and its basic physical and chemical parameters. Energy and its renewable sources as the indispensable production technology of capital provided to humans by nature. New value of relationships in human economy. Transformation of the material sector, the energy sector and the entire economy. Low-energy construction today. Green building as an important transitional phase to the target programme of sustainable future construction.

Keywords: green construction, climate, energy, sustainable building

Streszczenie

Wzajemne oddziaływanie pomiędzy społeczeństwem, ekologią a energią. Technologia i jej trzy podstawowe sfery społeczne reprezentowane przez przemysł, transport oraz osadnictwo ludzkie. Osady ludzkie i architektura jako symbioza estetyki, technologii oraz ekonomiki. Zjawisko technologii w architekturze reprezentowane przez technologię budownictwa. Kryterium sztuki w architekturze wyrażone w związku systemowym: budownictwo–klimat– energia. Budownictwo oraz podstawowe kategorie materiałów i technologii produkcyjnych. Klimat wraz z jego podstawowymi parametrami fizycznymi i chemicznymi. Energia i jej źródła odnawialne jako nieodzowna technologia wytwórcza kapitału zapewnianego ludziom przez naturę. Nowa wartość związków w gospodarce ludzkiej. Przemiana sektora materiałowego, sektora energetycznego oraz całej gospodarki. Współczesne budownictwo niskoenergetyczne. Budownictwo ekologiczne jako istotna faza przejściowa w docelowym programie zrównoważonego budownictwa przyszłości.

Słowa kluczowe: budownictwo ekologiczne, klimat, energia, budownictwo zrównoważone

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1. The society – energy – ecology interaction

In the second half of the twentieth century, people began to address one of the most difficult long-term technical and economic problems of the world – how to ensure enough energy for the continuous development of society in its broadest conception: in industry, transport and human settlements, i.e. in areas where technology plays the leading role. Unfortunately, mankind has solved this demanding, long-term problem, associated with human economic activities, only in the **society–energy** interaction and therefore remains indebted to our planet. It is evidenced by human economic activities and emissions expressed by an increase in CO_2 concentration in the atmosphere and the rising global temperature [1]. In the 1980s, the **ecological footprint** (an ability to produce as well as absorb waste from the economic process expressed by human activities) exceeded the reproductive value of **the earth's biocapacity** (roughly 3 to 3.5 billion tons of greenhouse gas emissions) [2] – Fig. 1. Man hits the limit set by nature; man is in conflict with nature. Currently, the world produces an environmental load that exceeds the biocapacity of the Earth by about 30% (Fig. 1). Man produces **ecological debt** to the planet. If we do not stop this trend, in approximately 20 years' time (in about 2030) we will need two planets for our economic activities (Fig. 1). Since only one planet is available to mankind "so far", we have to find a solution for the repayment of our ecological debt and return to balance with nature, fundamentally in the new society – energy – ecology interaction. Solutions to this problem assume the form of long-term projections which ecologically-minded economists place in the course of the next 40 years (until about 2050) – Fig. 1 [1]. Unfortunately, mankind has not been unified in addressing this urgent problem yet (differences in the production of emissions and differences in the biocapacity of each country).

2. The common society – technology interaction in the material – energy – ecology system link

If technology, in general relation to society, is understood as a symbiosis of the material – energy – ecology interaction, mankind has to reevaluate its priorities in technology by transformations according to Fig. 2 for a successful solution to this problem.

3. Specific human settlements – architecture – technology interaction in the building – climate – energy system link

If technology, in a specific relation to society, that is in terms of human settlements, namely architecture, is understood as a symbiosis of building – climate (ecology) – energy, mankind has to reevaluate its priorities in the technology of architecture by transformations according to Fig. 3 for a successful solution to this problem. The most serious case is the transformation of the energy sector towards ecologically clean renewable energy which performs two functions in synergy:

1. It replaces fossil fuels and provides new capital production with the same utilitarian value – energy.
2. It significantly reduces greenhouse gas emissions and restores the assimilative capacity of the planet's biosphere.

Thus, renewable energy sources represent the productive technology of capital provided to humans by nature.

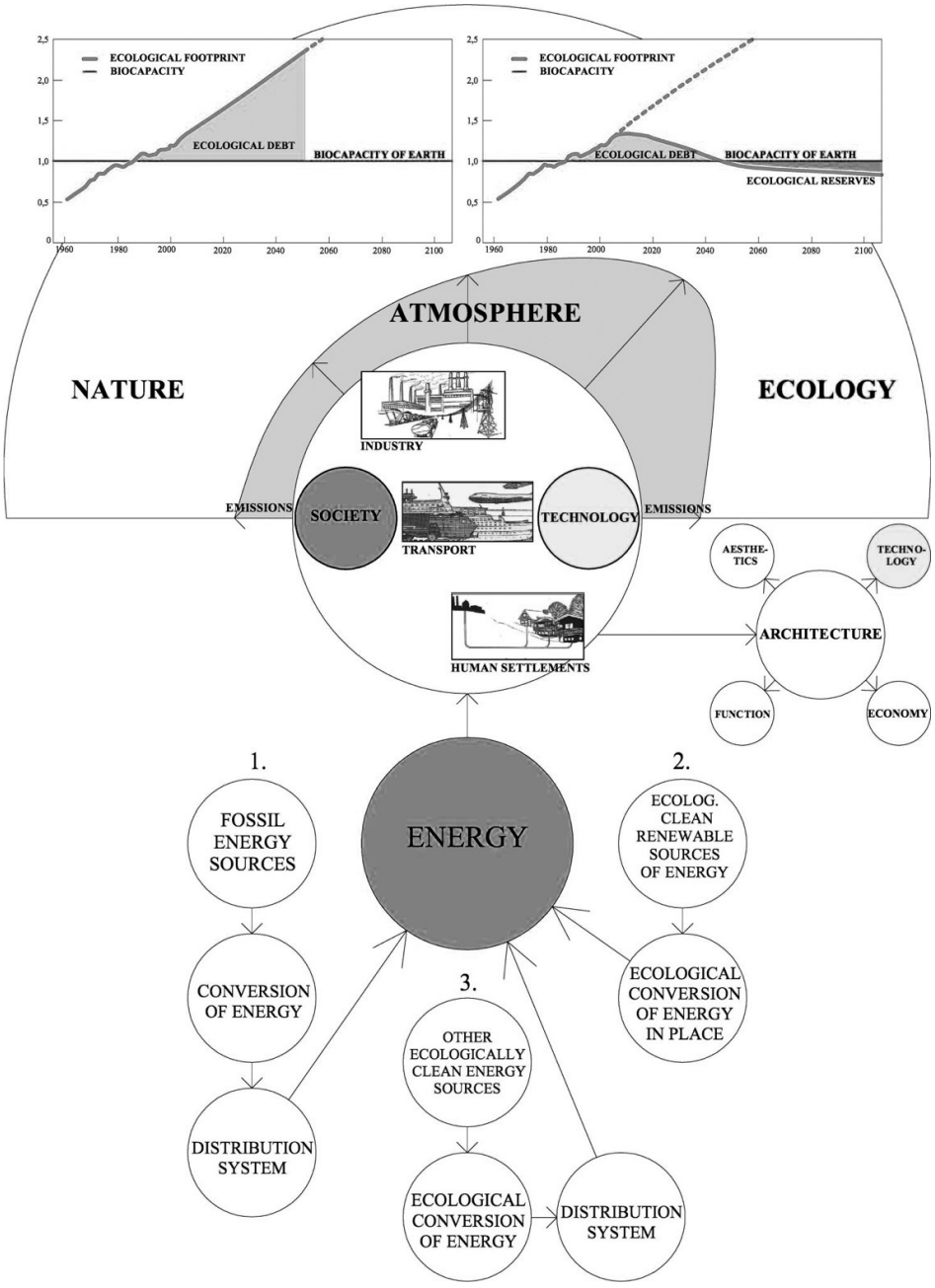

Fig. 1. Scheme for analysis of the **society - energy – ecology** interaction and the position of the phenomenon of **technology** in it

Rys. 1. Schemat analizy wzajemnego oddziaływania **społeczeństwo – energia – ekologia** oraz pozycja zjawiska **technologii**

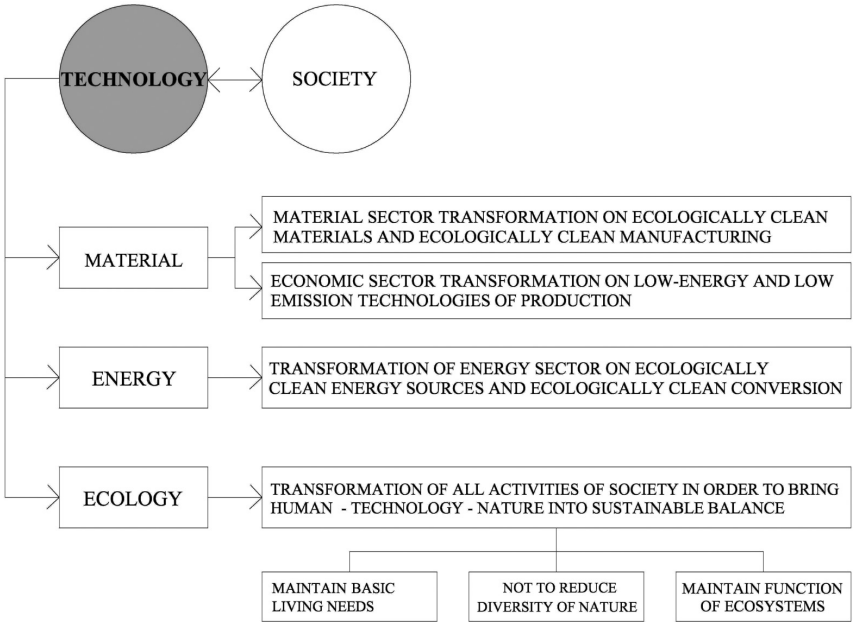

Fig. 2. Current development of the **society – technology** interaction

Rys. 2. Bieżący rozwój wzajemnego oddziaływania **społeczeństwo** – **technologia**

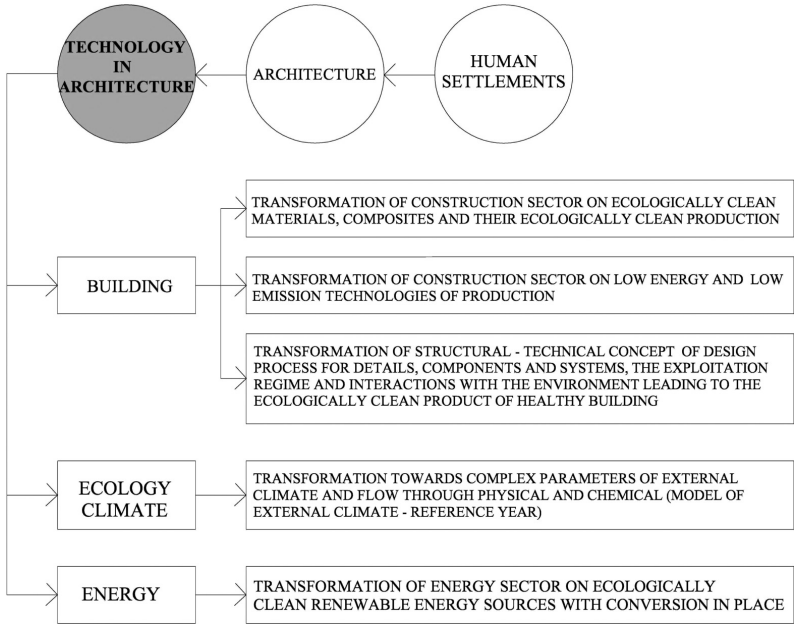

Fig. 3. Current development of the **human settlements – architecture – technology** interaction

Rys. 3. Bieżący rozwój wzajemnego oddziaływania **osady ludzkie – architektura – technologia**

4. The development of technology in architecture

The development of technology in architecture can be correctly interpreted only in the building – climate – energy system link (Fig. 4). The quantification of climate is a determinant for this development [3]:

1. If the climate is quantified only by physical parameters, we get to low-energy architecture whose product is a low-energy building. It is characterized by energy savings or rational utilization of energy resources and the production of emissions (Fig. 4A).
2. If the climate is quantified by physical and chemical parameters, we get to green architecture whose product is a green building. It is characterized by energy savings and rational utilization of material, energy and water resources and by a tendency towards ecological orientation in their selection as well as optimal reduction of emission production (Fig. 4B).
3. If the climate is quantified equally by complex parameters, we can get to the target programme of sustainable architecture whose product is a sustainable building. It is characterized by the application of the principle of ecologically clean material, energy and water resources and zero-emission production (Fig. 4C) [4].

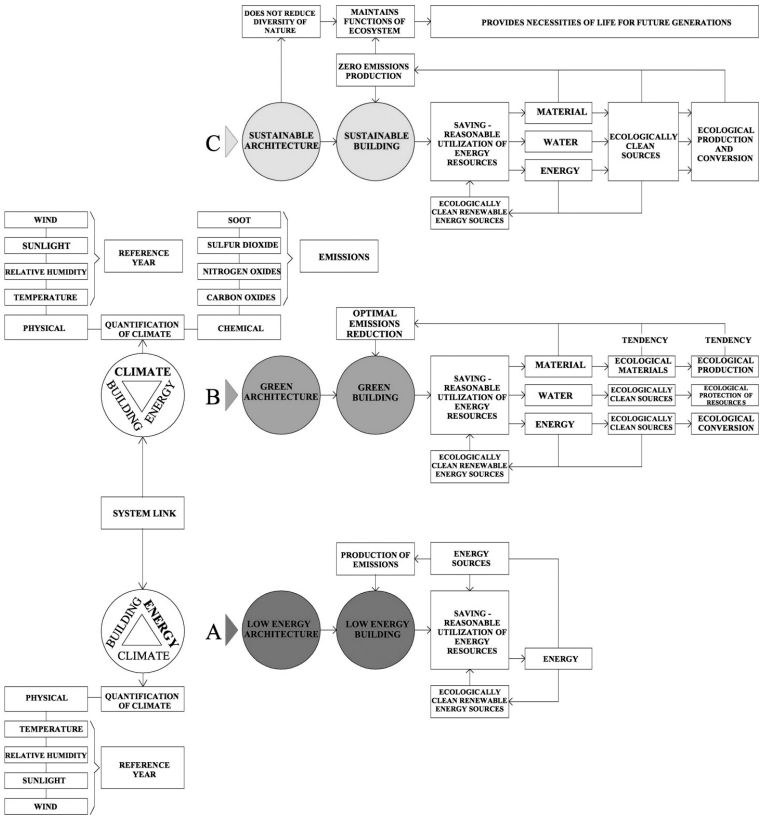

Fig. 4. Development of technology in architecture

Rys. 4. Rozwój technologii w architekturze

5. Conclusions

The parameter of the share of renewable energy sources also represents the share of energy freedom and security in a society. It is one of the indicators of the future economic development of an ecological society as well as an indicator of the development of human settlements with a higher utilitarian value that the architecture of the information age must provide for.

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