International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 11, Issue 7 [July. 2022] PP: 38-42

Passive architecture - Natural cooling and warming

Vladimir Arsovskib.sc.civ.eng, prof. d-r. VangelDunovski
[1](*Architecture student, MIT University, North Macedonia)*
[2](*Dean of the Faculty, MIT University, North Macedonia)*

ABSTRACT

Architecture as a living matter changed depending on the location and time for the needs of human and his development and adaptation, undergoes drastic changes. Due to the human awareness of the progress of humanity, the Industry appears in response to the hitherto expensive and slow processes for the production of goods that were the main mover of the socio-economic status of a nation - society. The word industry means a form of production of goods by machine processing of raw materials and mass production.The benefits of the emergence of industry led to global changes in socio-economic status, initially in European and North American countries where the Industrial Revolution began, with the transformation of the then feudal economies.
Due to the awareness of the negative impacts of industrial buildings in urban areas and their abandonment, while creating landscapes in decay. The need for their conversion and proper integration in space is necessary. A world trend where neglected parts of the city, occupied by decaying buildings grow into cultural - social places.

KEYWORDS -Awareness, Conversion, Industry, Society, Space.

Date of Submission: 26-06-2022 Date of Acceptance: 08-07-2022

---

1. INTRODUCTION

Biomimicry (bio-life; mimic-imitate) is a new branch of science that deals with the study of the best designs and conceptual solutions that can be found in nature. These ideas and procedures are then imitated and used to solve various problems in other branches of science (medicine, energy, etc.). Biomimicry can simply be described as a set of innovations inspired by nature. The basic idea behind biomimicry is that nature, resourceful when needed, has solved many of the problems facing modern society today. Animals, plants and microbes have found solutions that work and, most importantly, that are sustainable for the planet Earth. After 3.8 billion years of evolution, that is, research and development by trial and error, nature has come up with ingenious solutions that we find all around us. The task that humanity must learn from nature is the path to sustainable development. The name biomimicry appeared in 1982, and was popularized in 1997 with the publication of the book Biomimicry: Innovation Inspired by Nature by Janine Benyus.

Subject of research
The subject of the research covers the urban transformation of abandoned industrial complexes situated in the downtown area. Which, as polluters and pests of the environment turn into a positive movement of socio-economic and economic growth and development of the population with positive impacts on the environment.

Purpose of the research
The aim of the research is the revitalization of these industrial complexes that would enable the creation of a new urban transformation of the abandoned parts of the city, a new representation of the existing entities and their integration into the architectural landscape, while creating new city sights.

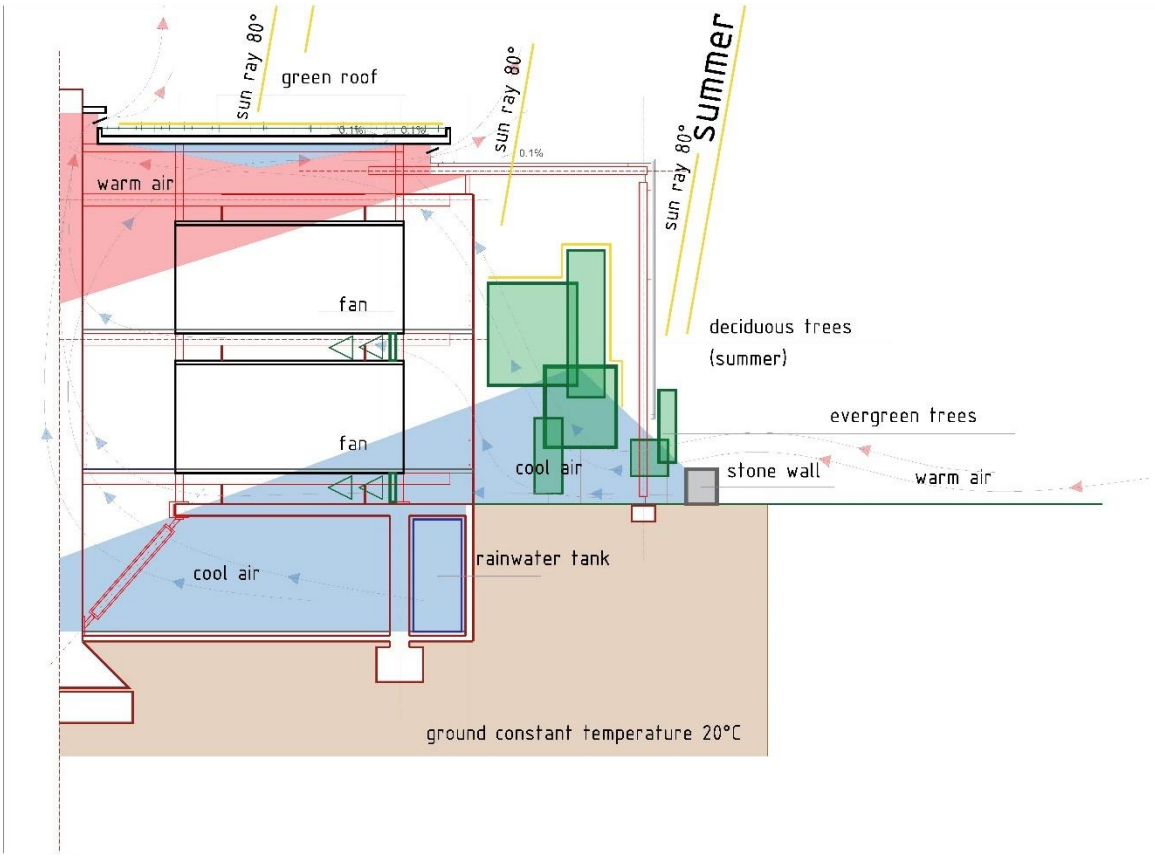
Research methodology
Reinterpretation of existing sites, transformation of abandoned industrial complexes, while revealing the reasons that led to such degradation of a space through the Case Study method.
A case study is a research methodology that explores contemporary phenomena in a real-life context, and especially in cases where the boundaries between the research question and the context cannot be clearly defined. The case study provides more depth, in terms of the breadth of the research. Allows enrichment of the theory, but not confirmation (testing) of it.

Expected results
To find a solution to the problems that arise from such locations, without disturbing their industrial culture, as well as to pay attention to their environment and the history they convey.

2. Biomimicry – natural cooling and warming

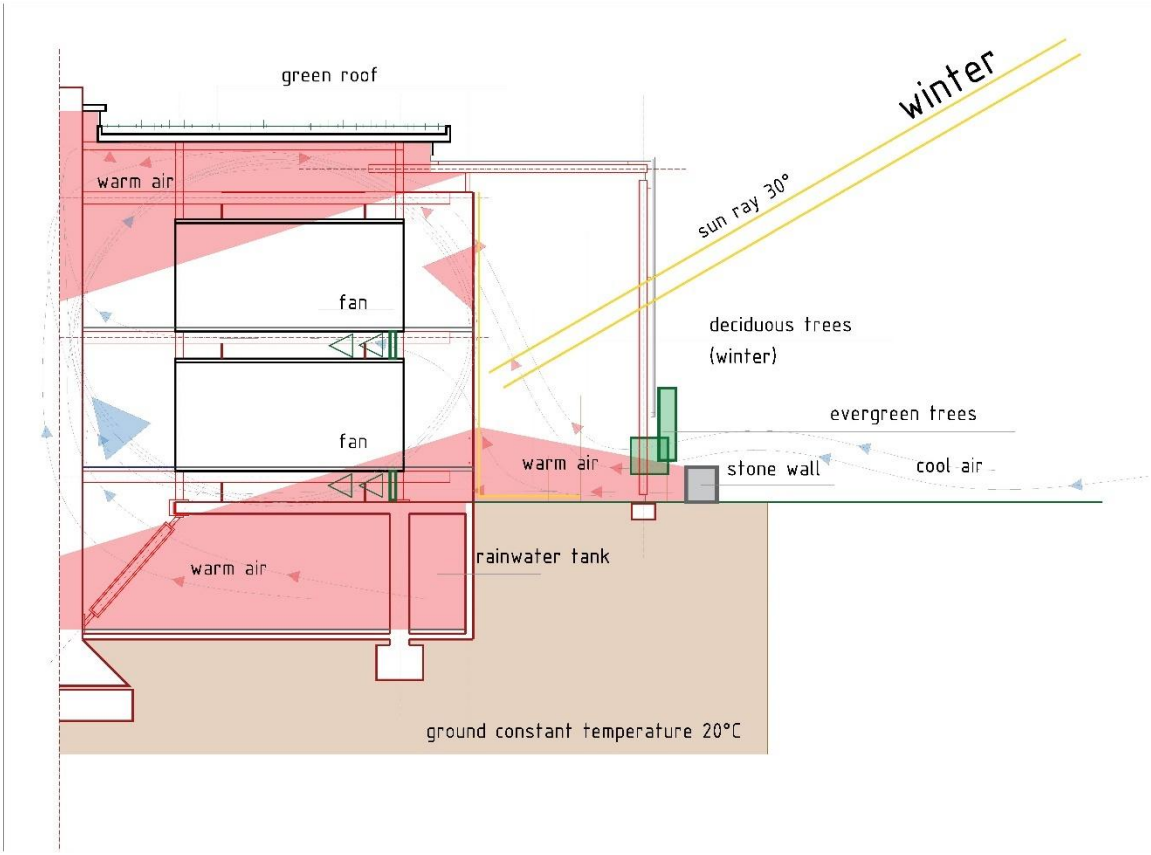
Integration - adaptation to space
Recycling material in architecture is becoming increasingly valued in order to enable the creation of sustainable projects. Certainly, transport containers are one of the elements that have gained importance in recent years for the design of private and public buildings that respect the environment. In addition to being environmentally friendly, containers are a viable choice due to their speed and ease of assembly, the option of a cleaner construction site or even the various design solutions provided by this material. With their standardized sizes, it becomes possible to create a modular structure that provides endless possibilities for intervention to suit different purposes.

Natural cooling - termites
Of course, biomimicry is not only used in architecture to design the structural system of buildings. Natural cooling systems for buildings in hot climates using termites. As termites build their nests in mud, they allow the nest to adapt to the warm weather conditions in their habitats thanks to the airways they create inside. Site facilities are designed this way. The airways created in the building provide natural ventilation and natural cooling of the warm air inside. Compared to traditional buildings, this system consumes only 10% of the energy used by a building of a similar volume. Hence, the building would save about $ 3.5 million in energy in 5 years.



Picture 1, Project solution - natural cooling system (biomimicry).

Natural warming
Cooling technology is based on the movement of air masses in the building. That is, ventilation of the hot air that accumulates in the upper - roof zone of the building due to the tendency of rising hot air, hence the roof horizontal openings that allow hot air to leave the building in summer, in winter they close which accumulate warm air.



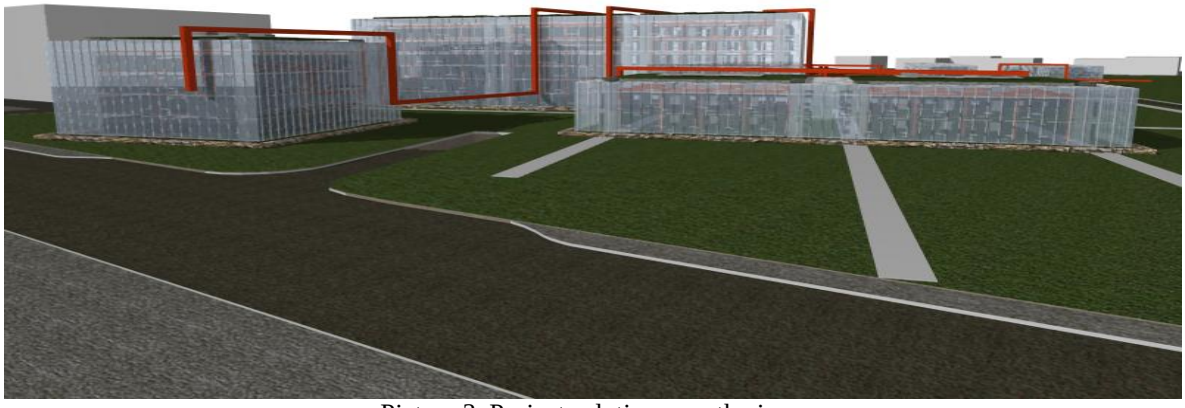
Picture2, Project solution – natural warming system (biomimicry).

Care for the environment

The surface that the buildings occupy or disturb the continuity of the greenery is a problem and inadequate access to the environment. Thus, from here the surface occupied by the land object is moved to the roof. That is, the functional greenery on the surface is not covered with an object, but it is transferred to a higher point than the previous one. Researchers estimate that a 100m2 roof garden can remove about 40 kilograms (PM) of airborne particles in a year, as well as produce oxygen and remove carbon dioxide (CO2) from the atmosphere. Forty kilograms (PM) of particles are approximately as much as 15 passenger vehicles will emit in one year of driving. In addition, some roofing plants used, such as Sedum album and Sedum spurium, are metal hyperacumulators, with unusually high levels of elemental metal intake and storage. A healthy environment is an irreversible resource, and we need to take care of it continuously. That is why there is no doubt for architects that roof gardens are necessary in urban areas, especially where there is a huge concentration of concrete, a lack of green space and a huge concentration of people and cars.

Improving air quality

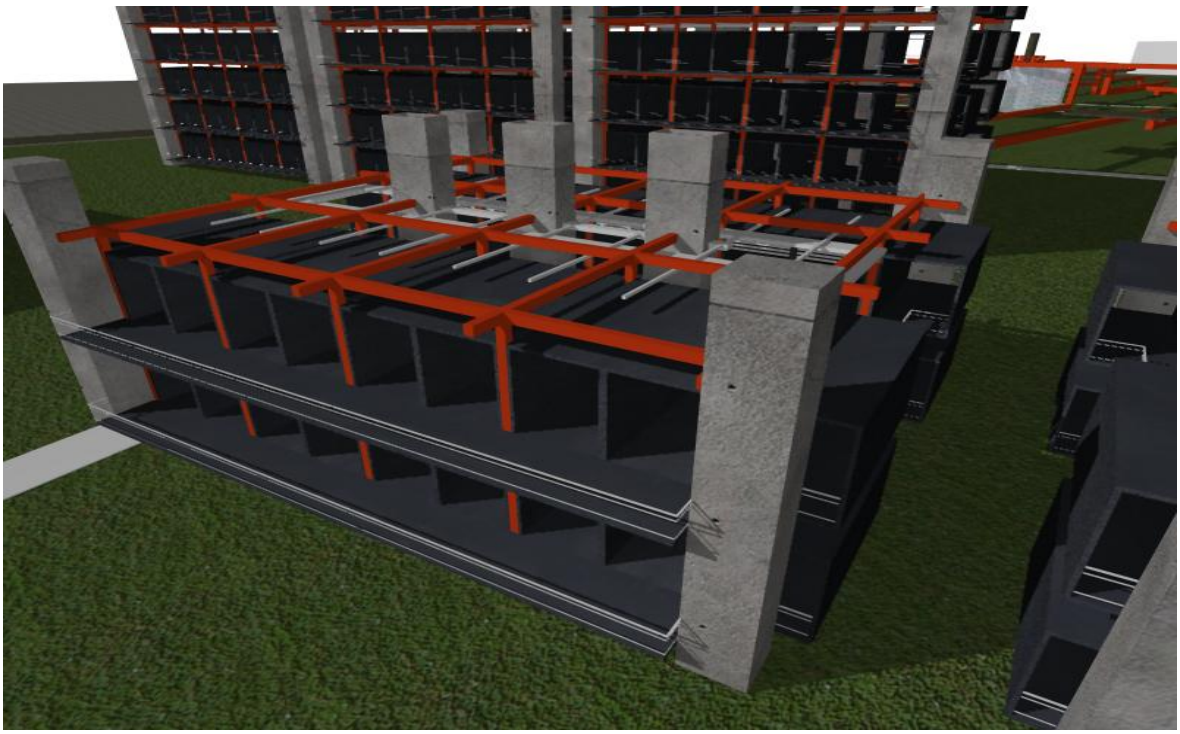
The benefits of green roofs are supported by research conducted by the US Environmental Protection Agency. Which shows: The total coverage of roof gardens in Kansas, which is more than 2 ha, results in avoiding even:
17.5 kg - Nitric oxide (reduction of nitrogen oxide compounds with a green roof is estimated to be worth 0-30 denars per square meter with a roof garden)
33.5 kg - Sulfur dioxide
27 tons - Carbon dioxide



Picture 3, Project solution - south view.

Modular architecture

The modular unit is the container itself, with almost 15 square meters of indoor space. Using this system saves a lot of money, time and energy compared to traditional construction methods. Its durability and structural design facilitate both its foundation and its spatial configuration. Their diversity makes them adaptable to the most diverse scales and needs, individual and collective homes, shopping malls, offices, schools, hotels, restaurants, shelters, laboratories and works of temporary architecture. In this case, those containers are used that are generally accepted for widespread use, but also those that are most common in the waste. Due to minor damages, they lose the high criteria for transport of goods and usually end up in waste. The transport containers that are accepted in this project have the following dimensions: width 2.40 m, height 2.70 m and length 5.90 m. They favor the environment due to the process of recycling the transport container. They are strong and safe, much less dangerous for the environment than traditional construction because they do not create permanent changes in the land. That is, the transport containers are placed on a steel skeleton structure with a mezzanine empty space for natural ventilation.



Picture4, Project solution - modular architecture.

Container architecture is a method of construction for solutions for housing, cultural - educational and commercial - business spaces, which is a new trend in construction, with new forms of use and increasingly bold designs. In addition, they represent an advancement in the concept of recycling and sustainability. Constructive method based on assembling modular elements. The peculiarity is that these modular units are really containers for freight transport. They are well-known "containers" used in maritime and rail transport for the safe storage and transport of all kinds of products.

Greenhouse effects

Storing heat during the day Different materials need different amounts of energy to heat themselves (it takes a long time for a stone to heat up), a feature known as heat mass. The higher the density of the material, or the more it is packed together, the more energy is needed to raise the temperature of that material. So, density materials can store a lot of heat. Examples of high density materials include:

• Stone
• Brick
• Water

Greenhouses are a great alternative to growing plants in the winter months or even in the summer. By capturing light and converting it into heat, these ingenious creations keep plants nourished and warm. Adding elements such as brick and stone along with water can help trap heat on cold nights. Comes with single glazing or double glazed. All glass in greenhouses should be tempered glass. This is a safety glass that will wrinkle when broken to protect people from being cut. During the winter all the plants bloom in the greenhouse. It is also planned to install polycarbonate in the roof while fully retaining the glass side walls - glass curtains. You get protection and insulation of the roof while the horizontal view remains clear and clean.

References:

[1]. Ashton, S.T, 1948. The Industrial Revolution (1760-1830). Oxford: Oxford University Press.
[2]. Mokyr, J, (2019). Industrial Revolution, Second, Encyclopedia of Modern Europe: Europe 1789-1914: Encyclopedia of the Age of Industry and Empire,
[3]. https://fr.art1lib.org/g/Hatuka,%20Tali
[4]. https://www.mainfreight.com/romania/en-nz/info-point/ocean-freight-containers
[5]. https://www.fieldsintrust.org/News/green-spaces-on-former-industrial-land-providing-a-platform-for-nature
[6]. https://www.designcurial.com/news/making-change-repurposed-industrial-buildings-6213046/
[7]. https://divisare.com/projects/316066-vandriessche-architecten-conversion-of-old-factory-de-porre-to-city-park-ghent