INTERNATIONAL CONFERENCE AND EXHIBITION

ON ARCHITECTURE

CONFERENCE PROCEEDINGS

strand
Sustainable Urban Society Association
Belgrade, 2013

IMPRESUM

Title
ON ARCHITECTURE
International Conference and Exhibition
Conference Proceedings

Publisher
STRAND – Sustainable Urban Society Association, Belgrade

Acting on behalf of the Publisher
Ružica Bogdanović
STRAND – Sustainable Urban Society Association

Editor
Ružica Bogdanović

Reviewers
Ružica Bogdanović
Jelena Guga
Nataša Danilović Hristić
Tatjana Mrđenović
Dijana Milašinović Marić
Mila Nikolić
Mila Pucar
Aleksandra Stupar
Dragana Vasilski

Cover Illustration
Bogdan Maksimović

Design and layout
Feel Free Design

Belgrade, 2013

ISBN 978-86-89111-04-0

CONTENTS

III Technology and Architecture

NEW AESTHETICS OF BIOCLIMATIC ARCHITECTURE

Igor Marić[1], Božidar Manić[2], Tanja Bajić[3]
[1]Phd, Architect , [2]MSc, Architect, [3]M.Arch.

INTRODUCTION

Architecture in itself contains a series of postulates, out of which the basic include: defining and building a space for a specific purpose using physical means; ensuring the functioning of this space; creating a more stable and comfortable environment: thermal, acoustic, natural light; as well as aesthetic shaping. In other words, architecture implies the protection against different impacts - internal and external, natural and created, physical and psychological, in an aesthetically shaped form. It should be mentioned that the corpus of architecture is also characterized by other activities in the domain of humanitarian and technical fields of human activity. The adaptation of a given limited space to its needs has always been aimed at the protection of the man, at enabling him to perform certain activity, but also at the creation of a harmonious and beautiful space through an artistic superstructure. Artistic expression in architecture has two basic codes. One of them refers to exclusively dealing with architectural elements - shape, full-empty relation, structural elements, light-shadow relation, dimensions, etc., while the other code implies, in its widest sense, a synthesis of architecture and other arts, most frequently sculpture and painting. All this, like in other arts, is subject to macro and micro plan, rhythm, dynamics, narration, decoration, contrast, color, and temporality.

Attributes of architecture today - bioclimatic, green, ecological, sustainable, are not new in their essence and meaning, but in a form and intention of technological improvement. Architecture has always implied a principle of sustainability because it is one of the basic motives of its emergence, while it has been built up over time through goals which have given it a series of other characteristics, such as monumentalism, deep respect, glorification, etc. Techniques of and approaches to sustainability have changed with the development of its understanding, which has influenced models of building.

Climate, availability of energy sources and culture of a human community in an area has influenced architecture the most. These influences are also present today, where the factor of globalization of technological and cultural development is significant, but also, like in the past, the element of independently achieving similar or same results under similar anthropogeographic conditions – structural systems, the use of local materials, the way of heating and ventilation, organization of space, etc.

The main goal of the today's understanding of bioclimatic architecture is to maximally reduce the use of energy generated from fossil fuels in favor of renewable energy sources, compared to the time of energy boom when they were abundantly used. The aim is to use energy as little as possible in production of building materials, construction of buildings, exploitation, maintenance and, finally, in recycling, which can be partial or complete. In this chain, the economic factor is essential. It does not manifests itself in a simple direct relationship between construction costs and sale prices, but implies the exploitation of a building, and thus also long-term effects on living and non-living things.

We can speak about the aesthetics of bioclimatic architecture only if we compare it with architecture of previous periods. For the needs of this consideration, some previous periods will be mentioned only briefly. The already mentioned attitude of previous architects towards climate and availability of building elements has resulted in buildings (mostly residential ones) with inclined or flat roofs, smaller or larger openings, thicker or thinner walls, different orientations of buildings, as well as stone, wood, brick or rammed earth walls. Different circumstances have also created different aesthetics.

The development of modern architecture and technology, as well as new valorization of vernacular architecture, has led to an increasing interest in archetypes. Frank Lloyd Wright and Le Corbusier, originators of this concept, have built their postulates on experiences from the past using new construction technologies and new auxiliary tools. The concrete has prevailed in construction,

contemporary heating and cooling systems have been introduced, but also applications (brise-soleils, new types of insulation, etc.), care has been taken of ventilation and, in particular, of the rationality of space (surface area and volume). While Le Corbusier has paid more attention to light, protection from sun and rationality, Wright has turned to forms and building materials appropriate to the climate. New aesthetics which these two important figures have promoted in their works are even today a backbone of the two, in a widest sense, current directions: the building as an organic and integral part of nature and the building as a machine.

We shall now jump to Richard Rogers and Renzzo Piano and their Cultural Center Pompidou, also known as Beaubourg (1977). Here, we should also mention Buckminster Fuller, one of the most brilliant philosophers of human environment and engineer of the 20th century, who wrote: "Hope in the future is rooted in the memory of the past, for without memory there is no history and no knowledge. No projection of the future can be formed without reference to the past. Past, present and future, memory and prophecy, are woven together into one continuous whole. In a clear understanding of the past lies the hope of our future." (Rogers, 1996, p.10).

The Center Pompidou is illustrated herein because of a brutal aestheticization of technology visible on the facade and an interior space extremely open for change (Photo 1). Contrary to Schelling's description of architecture as a „frozen music", Rogers defines architecture more as a modern music, jazz or poetry where improvisation takes it place after the non-determined architecture which contains permanency and transformation (ibid, p.46).

Photo 1. Renzo Piano and Richard Rogers, Centre Pompidou, Paris, 1977

The Jean Nouvel's Arab World Institute in Paris from 1988, with its dynamic facades, is a specific representative of permanency and transformation in architecture (Photo 2). The facades have glass squares, each having a number of photoelectric cells similar to a camera lens which, by means of photodetector, open and close thus changing light inside the building and giving rise to a shape of façade which is very similar to those found in the decoration of Arab buildings (arabesques). This solution is the most impressive blend of architecture and art in its time.

Photo 2. Jean Nouvel, Arabian World Institute, Paris, 1980

All the above mentioned are actually starting points for an overview of the ENEKO Center project in Budva (Marić, Pucar, 1996), "ANA" Hotel in Kanjiža (Marić, Pucar, 1998) and Office Building on the corner of the streets Kralja Milana and Kralja Milutina in Belgrade (Marić, Manić, 2006).

THE ENEKO CENTER IN BUDVA

Elevated micro-relief, steeply sloped terrain, traditional way of planning villages in hinterland of Budva (Montenegro) and bioclimatic factors were starting motives for planning the ENEKO CENTER and the Center for Multidisciplinary Studies and Research as an organic composition of regional characteristics, based on bioclimatic principles of the use of renewable energy available on the location.

The planned fragmented physical structure has enabled a gradual construction of the Center, which is also evident in the way of emergence and development of the Paštrovići settlements. Urban design provided a free composition made as organic symbiosis of the terrain, tradition, climate and high technology, as well as intimate ambience, which is visually recognizable (Photo 3).

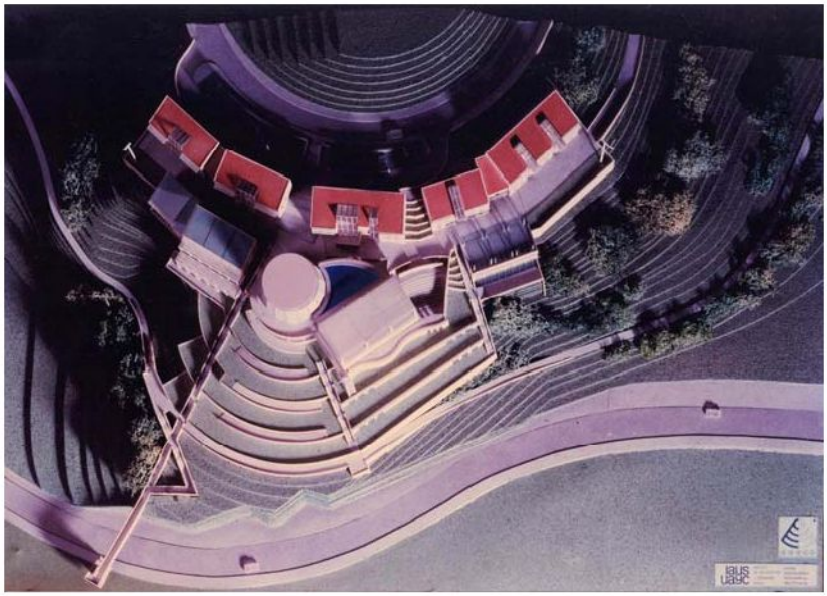


Photo 3. Igor Marić, Mila Pucar, ENEKO center, Budva, 1996. Model

The architectural concept follows the idea of organic development of the Paštrovići house and terrain inclination, also taking into account traditional ways of building houses typical for the climate of this area (Photo 4).

In terms of function, technology and form, these buildings were built according to the standards, as well as in the spirit of global tend in modern architecture. The main objective in architectural design was to achieve an adequate materialization of contents and spirit of the Center.

The urban design implied architectural heritage of Paštrovići settlements as a measure and creation of specificity and recognizability as a goal. The buildings consisting of several basic units (module 6x6m), with single-sloped roofs, make a recognizable volume of traditional raw of houses under one roof. The form derived from such architecture is emphasized by inserted glasshouses, thus making rhythmic effects of always the same shape in different materials in the silhouette of the settlement (Photo 5).

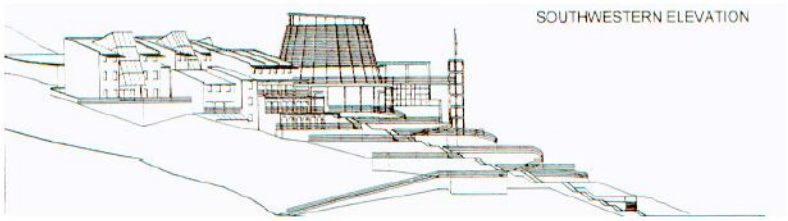


Photo 4. Southeastern elevation

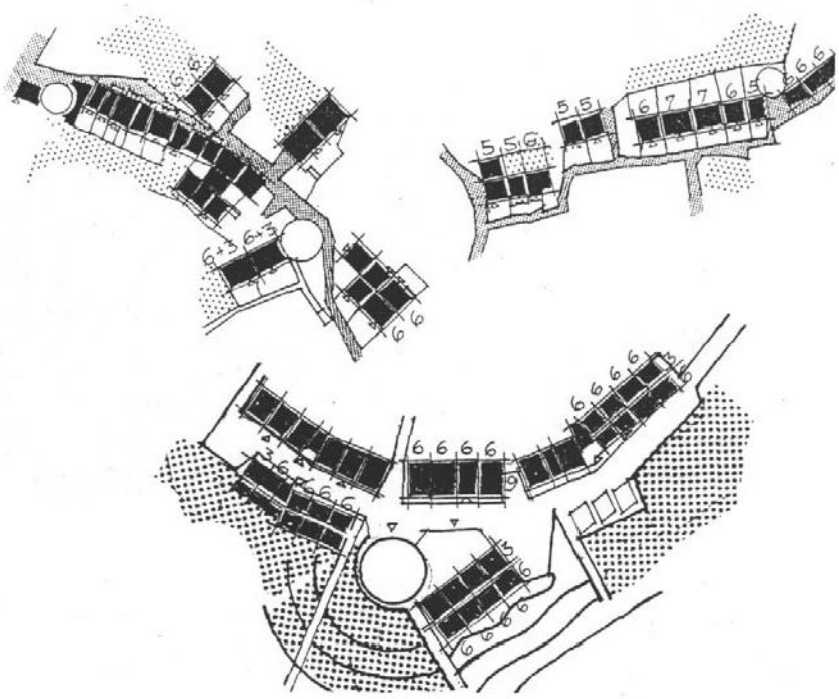


Photo 5. Schematic plan of the complex

Stone and elements of terracotta (roof tiles) were used as traditional materials, while steel, glass and plastic, as modern materials. Wall cladding, windows and doors take turns with glazed surfaces treated in several different ways using pergolas, Venetian shutters, trombe walls, etc.
The street was designed as a space bounded by buildings freely on the terrain, with retaining walls, stairs, and widened spaces.
A threshing floor touches the street and, as a central motif and focus point, symbolizes a blend of tradition and technology by an added dome of high technology and modern design (Photo 6).

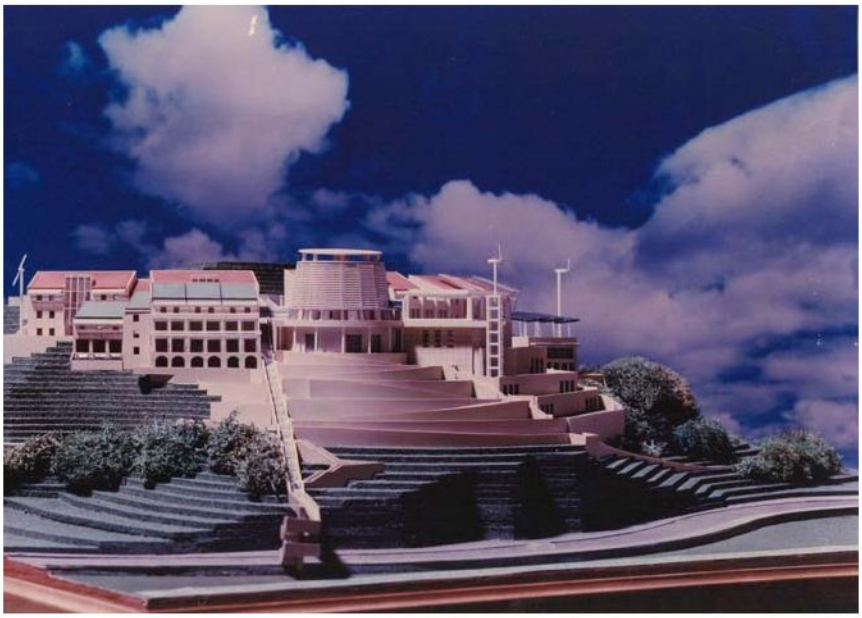


Photo 6. Southeastern view of the complex

The complex is planned to be energy autonomous and to use new and renewable energy sources for its heating, air conditioning and ventilation systems and hot water, and partially for electricity generation. Majority of buildings are partially buried in the terrain, which is very rational from the aspect of energy, thus taking advantage of protective properties of soil. (Photo 7)
The use of passive and active solar systems in buildings is envisaged, where greater accent is placed on passive systems, which is a global trend in this respect. In addition, it is also envisaged to use other renewable energy sources such as wind and water power, biomass and geothermal energy, etc.

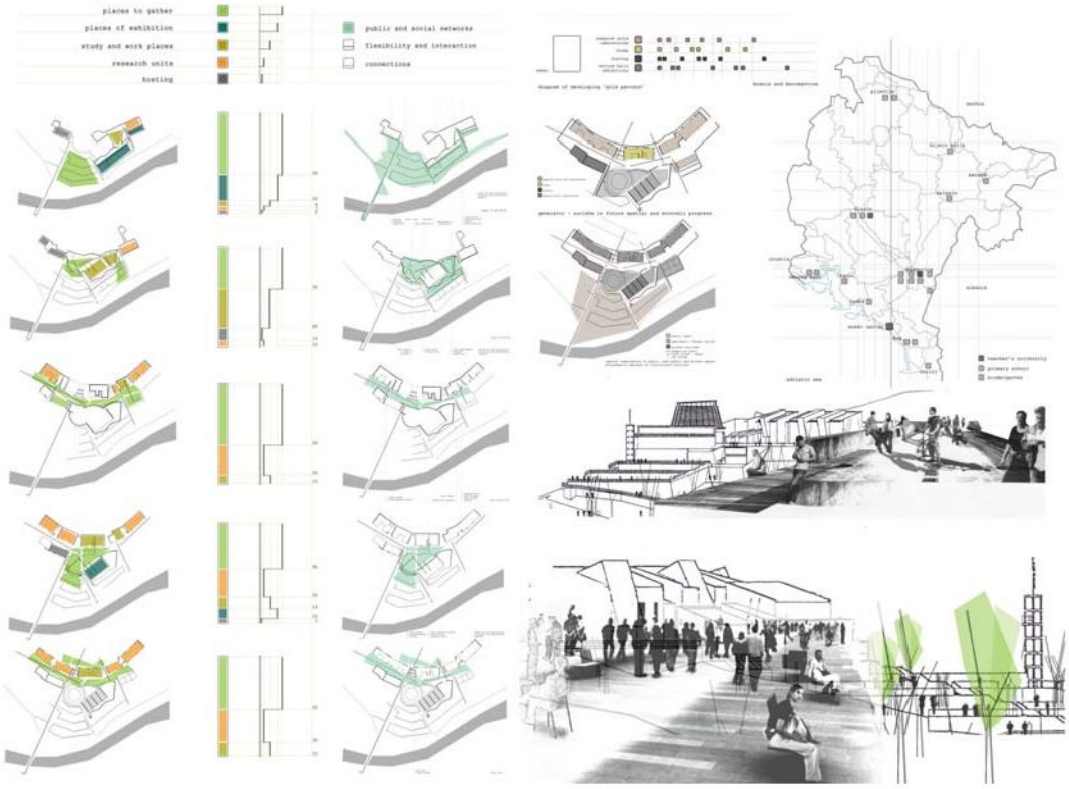


Photo 7. Bioclimatic analysis

Energy saving in passive systems is achieved using appropriate materials able to accumulate heat energy, as well as by proper orientation of buildings, large windows on the southern side of buildings and their insulation at night, smaller windows on the northern side, optimization of energy parameters in buildings, thermal insulation, thermal zoning in buildings, etc. Flexible thermal insulation is also envisaged to prevent heat losses at night. Buildings are protected against overheating by sun shields, greenery, air circulation, etc.
It is envisaged to install solar canopies over parking lots. Solar collectors would be connected to the building through an installation system and would be used to heat water. This space would be also used as a polygon for trade, bilateral and regional cooperation.
In terms of aesthetics, the static and changeability of the complex were achieved. There are changeable glazed volumes within static masonry pavilions which are adaptable to weather conditions and functions. Brise-soleils are also one of dominating elements. They are changeable, while deep shading behind colonnades is not changeable. The multi-functionality of some parts of the complex structure with technical solutions that are not much noticeable does not affect visual experience, but are functionally useful for the complex, such as pool for heating water on the roof of the central round building and large hot water tank below the building which is partially visible from the interior (Photo 8). The threshing floor as a gathering center and a center of human energy also becomes a center of natural energy, which gives more a psychical than aesthetic experience.

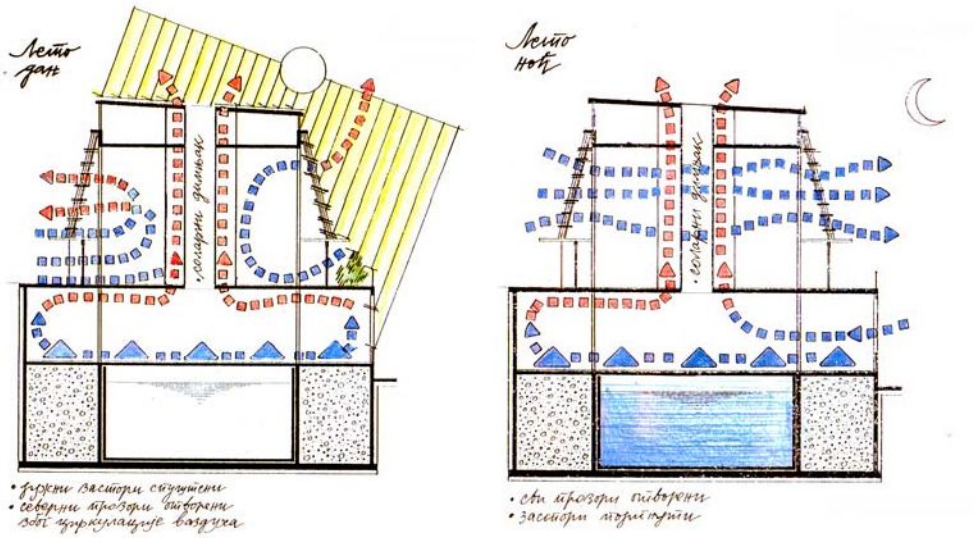


Photo 8. Bioclimatic rotunda

„ANA" HOTEL IN KANJIŽA

A completely different ambience, purpose and climate relative to the previous project yielded a different result. Permanency and changeability are also contained in a basic positioning of this building. Changeability is achieved through opening and closing of roof elements, as well as through play of light and shadow. Compared to the threshing floor of the ENEKO Center, the central motif of the „Ana" Hotel is a street in layers along the vertical axis with transparent side facades and sky visible through the glass roof (Photos 9 and 10). Brise-soleils and openable grazed surfaces are also dominating elements of this building.

Photo 9. Igor Marić, Mila Pucar, Hotel ANA, Banja Kanjiža, 1996

Photo 10. Internal street

The complex is planned so as to enable optimal use of renewable energy sources available on the location (geothermal energy, solar energy) (Photo 10). It is envisaged to use thermal water for medical and sanitary needs, as well as for heating and cooling, for the purpose of more cost-effective functioning and exploitation of the complex. Solar energy would be directly accumulated using passive system in the form of glasshouse (Photo 11).

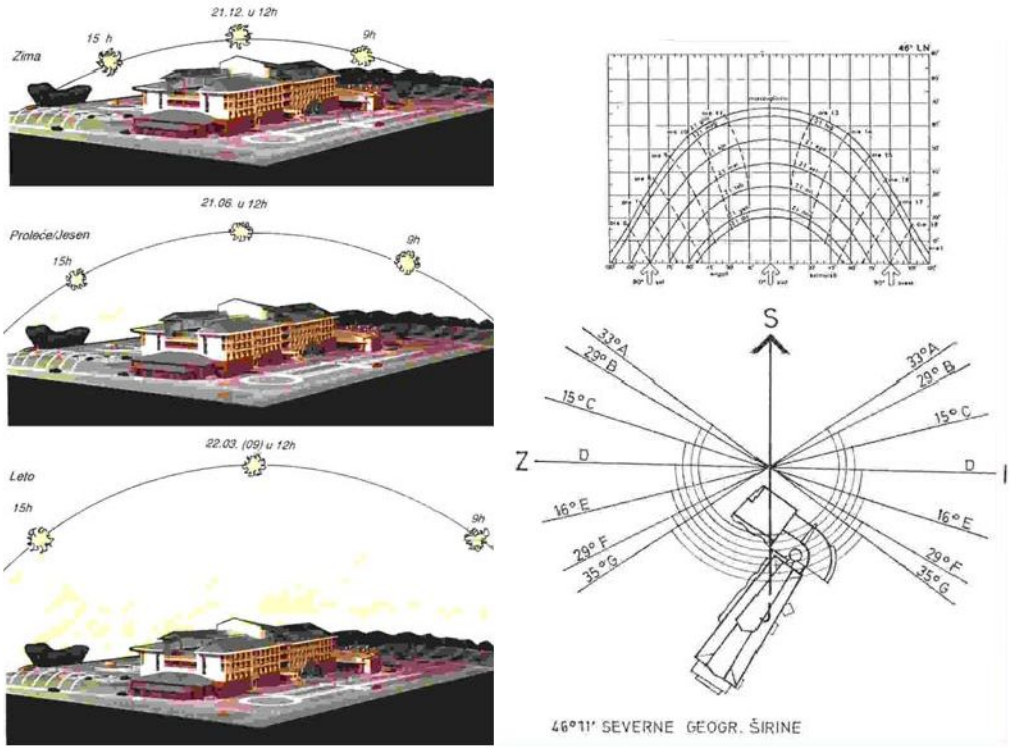


Photo 11. Bioclimatic analysis

The form and design of the building are mostly adjusted to climatic conditions. The complex is located in such way to enable natural ventilation. There are no open or narrow passages which could contribute to undesirable effects. A longitudinal element which shape mitigates gusts of wind was designed. The shape of the roof also weakens the wind, while roof lanterns with side openings enable permanent ventilation all year round. Main pedestrian passages, main entrance and exit into the zone with sports facilities are designed to avoid dominant wind direction, but are also protected by the building and trees. The embankment on the southeastern side of the complex also contributes to reducing wind speed.

Taking into consideration the purpose of the complex, character of spa tradition and importance of the entire complex, special attention was given to vegetation. Green and water surfaces create a significant natural environment of the complex, which was taken into account in planning vegetation, filtration and air exchange, as well as in planning a heating system. In order to weaken gusts of wind in winter, it was planned to plant different kinds of vegetation including dense evergreen vegetation on the southeastern side of the complex in order to form a natural barrier. It was also planned to plant additional trees closer to the building on the southern and southeastern sides. High trees provide deep shade to surrounding space in summer, while in winter, leafless trees allow sunlight to penetrate into the building (Photo 12).

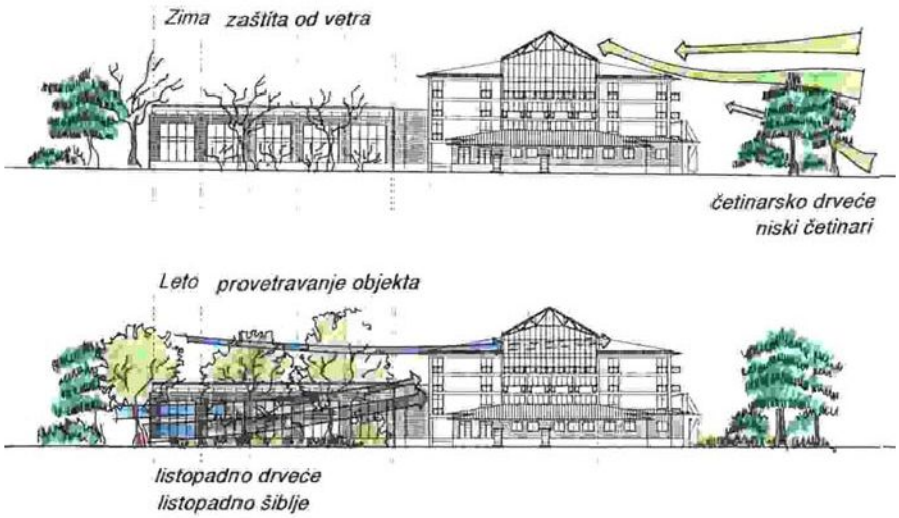


Photo 12. Protection against wind

The building was designed in accordance with principles of bioclimatic architecture, which goal is to reduce energy use and protect the environment (Photo 13).

The design is a result of the implementation of the following principles:

- Orienting the most percentage of glazed surfaces towards the southeast;
- Providing high level of energy accumulation using planned methods of construction;
- Planning high-level thermal insulation;
- Providing flexible thermal insulation which would prevent high heat losses at night;
- Protecting the building against overheating in summer using brise-soleils, vegetation, ventilation, etc.

Glasshouses were planned so as to accumulate solar energy which will be used for heating halls, winter gardens, pastry shop, and for providing mainly natural light in rooms. Some parts of the building admit heat from the glasshouse. The objective of the design was to achieve maximum solar energy accumulation in winter and to reduce to minimum the overheating in summer. Glasshouses, to which special attention was given in terms of their function and shape, are mainly oriented towards the south and southeast.

Most of the rooms are oriented towards the southeast, which is considered favorable from the aspect of energy use.

The protection against the sun's direct rays was planned through an automatic control for the entire complex. Windows in the basement are protected by pergolas, canopies or wooden grids, with adequate species of plants which would be planted for this purpose.

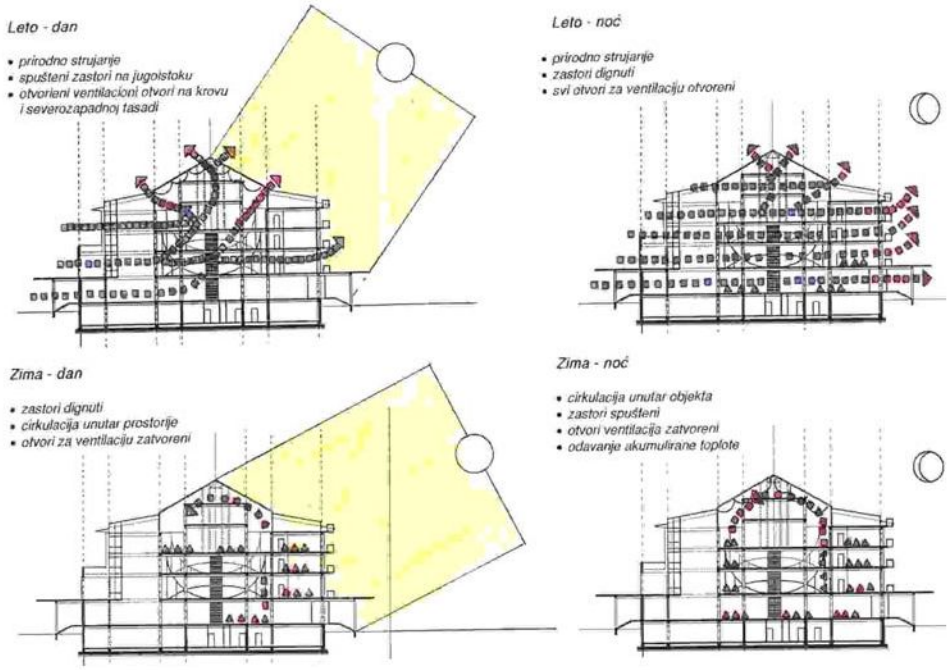


Photo 13. Elements of bioclimatic design

Balconies, loggias and canopies are used as the protection against strong sun's rays in the afternoon, thus providing a simple regulation of thermal comfort. The windows without canopies are protected against sun's rays by movable and adjustable vertical and horizontal blinds and Venetian blinds with adjustable spacing slats to admit or exclude light.

For the hotel complex and open spaces, it was planned to use, as a rule, local natural materials usually used in traditional construction techniques in this area (masonry products, stone, wood, glass).

Facades are of sandwich type, with external brick walls and internal thermal insulation of the envelope, in accordance with current regulations for this area's climate. The façade is partially ventilated. A part of the roof coated with ceramic tiles is also ventilated.

Wood is used both in interior and exterior of the complex.

High technology of structures enabled large spans which allowed maximum use of glazed surfaces between structural elements of the complex. The use of different types of glass was planned. Transparent glass was used for glazing all surfaces on exterior walls of the pastry shop, in entrance part up to the height of roof and in basement part with facilities intended for hotel guests. Other parts are glazed with reflective glass. Low-e glass was used for vertical glazed surfaces of winter garden and for pyramid of pastry shop. For other spaces (kitchen, laundry room, rooms for administration, sanitary block), double-glazed surfaces with insulation (thermopan) was envisaged.

Lexan, the high-tech building material with excellent performances in terms of its durability and easy to maintain, is one of the building materials not originating from this region. Due to its strength and good thermal properties, it was used for covering lanterns above halls and pools.

Stone, marble and granite were also used as building materials, primarily for paving public spaces. Ceramic tiles and softwood flooring were planned for different surfaces, depending on their purpose.

In principle, the attitude of architects was to use durable materials which do not require high maintenance costs.

A glazed space is the most suitable element of passive solar architecture. In addition to energy accumulation, it also provides a link with outer space and contributes to achieving the multi-functionality owning to its favorable performances.

OFFICE BUILDING ON THE CORNER OF THE STREETS OF KRALJA MILANA AND KRALJA MILUTINA IN BELGRADE

Motives which have influenced the building form were: southern orientation of a greater front towards the street of Kralja Milana which directly touches the building, as well as contemporaneity of expression. The main idea was to fit the building in the existing setting of the given space and create a building which will at the same time stand out as a recognizable and new event in the space (Photo 14).

Photo 14. Igor Marić, Božidar Manić, Business Complex KMKM, Belgrade, 2007

A double-skin facade was proposed on the southeastern and southwestern sides towards the streets of Kralja Milana and Kralja Milutina. In this way, better protection against heat, cold and noise is achieved, while movable wing-like sunscreens of brise-soleils on the interior facade enable the protection against sun glare (Photos 15 and 16). The transparency of glass skin is different, from 30% tinted glass to completely transparent parts revealing green galleries and interior of the building. The element of greenery is important in the design concept because it also appears on the street-facing and courtyard facades. Courtyard facades are not double-skin facades, but the facades of a smaller number of buildings that are oriented towards the south and with deep different colored glass shading panels that are shifted.

Introduction of passive systems into the bioclimatic architecture (ventilated facade, ventilation of a building, greenery, brise-soleils, etc.) was a proposal through which a new and contemporary architectural expression was introduced into a diversity of the street front of the Kralja Milana street as a sign of the time in which the building will be built (Photos 17-19). On the side towards the existing buildings in the block, another „hard" facade plane with stone cladding and pronounced plastic and shading is prominent.

Photos 15 and 16. Facades


Photo 17 and 18. Greenery on the street-facing and courtyard facades

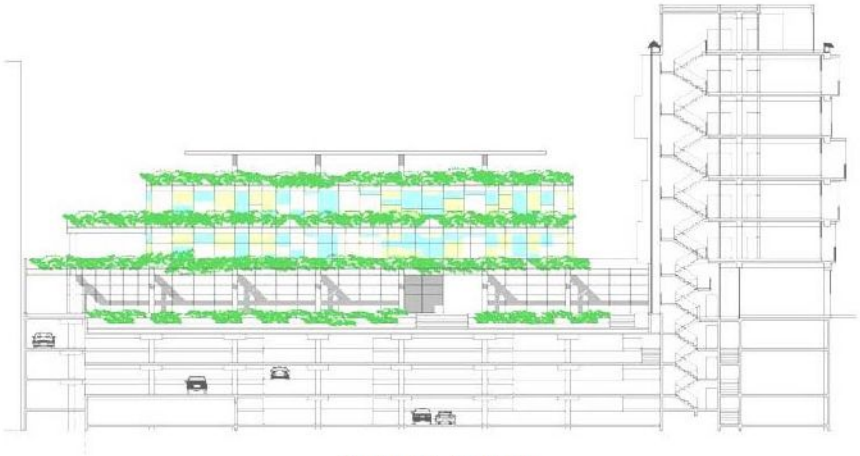


Photo 19. Section

Through the gradation of building membranes from stone, tinted glass, to completely transparent ones, together with elements of typical canopy and colonnade, a dynamic and multilayered concept was proposed which was rather incompact, based on gradation, rhythm and order, similar to the structure of a musical form of a fugue, where several melodies interweave to form a harmonious whole.

In the context of the current trend in architecture characterized by an aspiration towards dematerialization, easiness of expression and visual continuity, all buildings designed according to the concept which emphasizes the transparency, for which glass as a material is the most referent element, are forerunners of double-skin facades. The development of this concept, which high achievements were announced by expressionist visions of Paul Scheerbart, was enabled by Industrial revolution and intiated at the time when the "glass architecture" first emerged (Paxton's Crystal Palace in 1851). This concept has continued ever since then, based on general social and technological progress.

The topicality of glass as a building material which can express contemporary architectural concepts is not becoming obsolete. At the beginning, it was appreciated because of its transparency, effect of non-materiality and lightness effect, to develop over time in a high-tech material with a wide range of uses and possibilities of expression. Besides its transparency, glass also plays a role of communication and symbolic medium which makes its visual aesthetic potential more complex, transferring it to a sphere of digital media and, in this connection, contemporary aesthetics.

Glass facades have emerged as intelligent membranes reactive to external impacts, thus giving them a changeable visual expression. All elements which make up this system equally influence visual effects of double-skin facades due to the transparency of the front envelope.

According to the effect of the type of substructure on facade appearance, the following cases can be distinguished:

1) Dot-like fastened outer membrane – dot-like distributed elements "spiders" – in a regular rhythm on the facade producing almost an ornamental effect;

2) Substructure carrying glass is linearly formed, using structural metallic elements which follow the edge of outer glass panels – in terms of shaping, the priority is given to materiality of the structure, while glass is in the background; and

3) The front glass membrane is fastened to the main structure using glass abutments which follow the edge of outer glass panels, fastened to a load-bearing structure of the building using metallic header joists – in this way attempting to avoid an excessively technicistic appearance owing to the transparency of the structure in visual sense.

Concerning the inner and outer membranes in terms of visual effect, the following can be distinguished:

1) Double-skin facades in which division of inner membrane corresponds with the division of outer membrane – the most frequent case is in facades where visual potential of outer membrane is neglected, while division of inner wall-curtain is emphasized; and

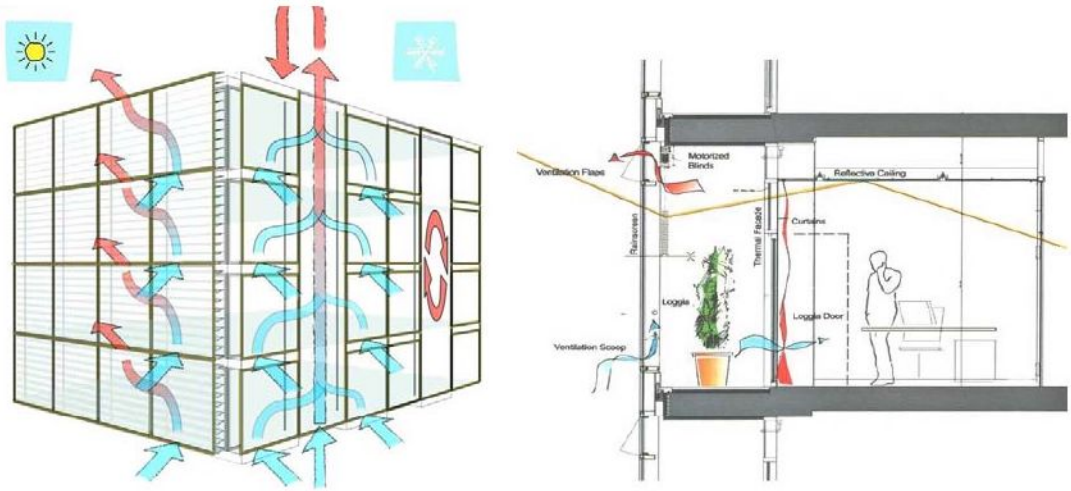
2) Rhythm of division of inner and outer membranes is harmonized, but does not correspond with each other – in this way even stronger effect of separation of the envelope is achieved and the existence of the front membrane, depth and multilayerness of plans is visually emphasized.

In materialization of the business complex on the corner of the streets of Kralja Milana and Kralja Milutina, glass was chosen as a material appropriate to a visual expression of contemporary office buildings which, as one of the basic materials, emphasizes the concept of transparency. Glass also enables architects to achieve visual multilayerness of facades by designing a solid structure behind a front transparent membrane, which is in continuation of neighboring buildings of traditional character in a spatial setting. The possibility of making more complex expressiveness of materials is open by selecting special types of glass, which primarily depends on the finally adopted concept of the facade, availability of materials on domestic market and financial standing of investors.

Different heating and cooling systems using effects of double-skin facade, as well as ventilation system and protection against gusts of wind and noise, are envisaged in the complex. Ventilation will take place from floor to floor to prevent overheating of upper floors. The use of greenery in facade segments is a new element in Serbian architecture and should point out the possibility of space-humanization, but also symbolize urban architecture and greenery in a new way which is already used in other environments. (Photos 20 and 21)

A system of heat energy generated from sources of heat in the building itself will be applied: different generators, heat emission from human bodies, the use of repeatedly heated or cooled air, etc., as well as systems which, through monitoring, enable the shifting of warm/cold regime and partially regulate microclimate in the building.

It is also envisaged to illuminate a shady part of the piazzetta by sunlight bounced off mirrors installed on higher parts of the building (Photo 22).



Photos 20 and 21. Details of double-skin facade – ventilated facade and green cascades

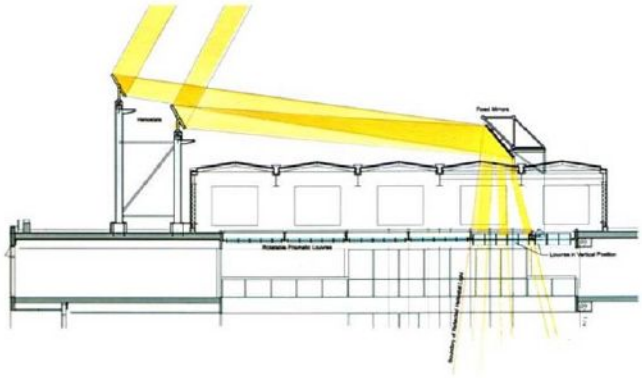


Photo 22. Mirrors for directing the sun rays

CONCLUSIONS

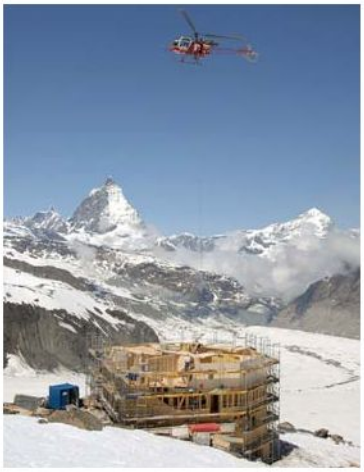
Concerning a new aesthetics which would result from bioclimatic architecture, it is difficult to tell whether a bioclimatic approach or the development of technology initiate new research. Has the experiment of Beaubourg been successful in terms of aesthetics or functionality if we know that after 20 years of its existence almost 50% of its basic costs had to be invested into its reconstruction? Similarly, the facade of the Arab World Institute has not been functioning according to its original concept for already 50 years.

Double-skin facades make sense under extreme conditions such as winds or extreme noise, but there are traditional solutions even for such cases. One could rather say that bioclimatic architecture with all its solutions has influenced aesthetics in a limited sense, and that technology and contemporary building materials are those factors which also bring new aesthetics.

To support this thesis, let's take two diametrically opposite examples. One example is a small residential house in a hot Australian area designed by Glenn Murcutt from 1980 which was inspired by Australian vernacular architecture and which is made of wood and metal, using traditional stone fireplace for heating and natural ventilation for cooling, like in colonist houses (Photos 23 and 24). The basic creative procedure is based on new materials and design, but, on the other hand, also on centuries-long experiences (Fromont, J. 1995).

Photo 23. (left) Traditional Aboriginal Dwellings
Photo 24. (right) Glenn Murcutt, Nicholas House, Mount Irvine, New South Wales, 1980

Another example is the Monte Rosa Hut, a mountain hut built in 2009 at the foot of Monte Rosa, Switzerland (Photos 25 and 26), with multilayered walls, small openings, small volumes, and small energy losses. On the other hand, a sophisticated technology enables a creative and not a typical design. Does bioclimatic architecture as a separated corpus exist? One would say that this syntagm is overemphasized, and it is difficult to speak about a separate aesthetics of such architecture. Bioclimatic factor is a basic factor in architecture and should not be singled out as something new in its essence or form, because architecture has, since time immemorial, sublimed in itself a comfort, rationality, aesthetics and contemporaneity.



Photos 25 and 26. Monte Rosa Hut, 2009

This issue should also be considered from the other side. What are new elements of bioclimatic architecture that have influenced the building appearance: brise-soleils, double-skin facades, canopies, different types of sunshades and photosensitive lenses, solar and photo panels, greenery in different forms: climbing plants, jardinières, grass roofs and terraces, water curtains? Other elements are invisible, such as: trombe walls, heat pumps, passive thermal insulation, natural ventilation, etc.
All abovementioned elements significantly change the aesthetics of architecture. We deem that only some new conditions of living, communication, diet, work, and physical abilities can change some characteristics of the current lifestyle, and then also architecture.
Futurists of all directions of thinking have tried their hand at these fields starting from Jules Verne as a writer, members of Archigram as architects (Photo 27), and many others. Current trends will certainly continue and will bring improvements, thus also bringing new solutions. Automation and nanotechnology will even more contribute to adaptability and flexibility in architecture.

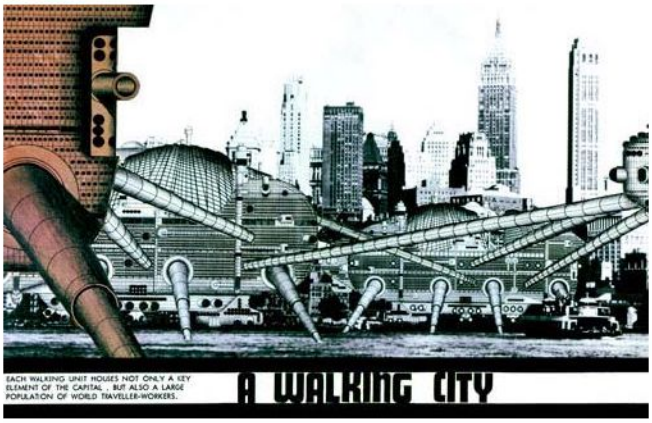


Photo 27. Archigram, Walking City in New York, 1964

Architecture, which is primarily humanistic in its essence, will always follow cultural trends and technology and, in its today's development still sublimes, and not singles out, the syntagm of bioclimatic architecture, although this syntagm is not to be neglected if one insists on an increased awareness of sustainability, and only then we could allow ourselves to also speak about its new aesthetics which will follow the technological development.

REFERENCES

1. Fromonot, F., 1995. *Glenn Murcutt, works and projects.* London: Thames & Hudson Ltd.
2. Marić, I., Pucar, M. 1996. Mediteranski centar za energiju i ekologiju, Eneko-centar i Centar za multidisciplinarne studije i istraživanja u Budvi. (Mediterranean Energy and Ecology Center, Eneko Center and the Center for Multidisciplinary Studies and Research in Budva) *Arhitektura i urbanizam*, 3: 57-64.
3. Marić, I., Pucar, M. 1998. The Bioclimatic Hotel in the Spa of Kanjiža. *Spatium*, 4: 41- 45.
4. Marić, I., Manić, B. 2006. Održiva arhitektura na primeru projekta za objekat na uglu ulica Kralja Milana i Kralja Milutina u Beogradu (Sustainable architecture on the example of the complex on the corner of the streets of Kralja Milana and Kralja Milutina in Belgrade). *Arhitektura i urbanizam*, 18/19: 51 - 52.
5. Marić, I., Manić, B. 2007. Dvostruke fasade u funkciji održive arhitekture - Analiza projekta poslovnog kompleksa u Beogradu (Double-skin facades in the function of sustainable architecture – Analysis of a business complex in Belgrade). *Arhitektura i urbanizam*: 20/21: 25- 36.
6. Rogers, R. 1996. *Arhitektura: Modernistički pogled* (*Architecture, a modern view*). Belgrade: Keystone.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

72.01(082)(0.034.2)

INTERNATIONAL Conference and Exibition On Architecture (2013 ; Beograd)
Conference Proceedings [Elektronski izvori] / International Conference and Exibition On Architecture, Belgrade, [9-16 December] 2013, ; [organization] STRAND - Sustainable Urban Society Association ; [editor Ružica Bogdanović]. - Belgrade : STRAND - Sustainable Urban Society Association, 2013 (Belgrade : STRAND - Sustainable Urban Society Association). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovnog ekrana. - Tiraž 200. - Beleške o autorima uz svaki rad. - Napomene i bibliografske reference uz tekst. - Bibliografija uz svaki rad.

ISBN 978-86-89111-04-0
1. STRAND - Sustainable Urban Society Association (Beograd)
а) Архитектура - Интердисциплинарни приступ - Зборници

COBISS.SR-ID 203293708