TO CHAPTER 3

THE USE OF BIOCLIMATIC PRINCIPLES AND GEOTHERMAL ENERGY SOURCES IN DESIGNING THE HOTEL "ANA" IN KANJIZA SPA

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ABSTRACT The detailed urban plan of Kanjiza beside the two existing hotels at the grounds assigned for the development of the Institute of Special Medical Rehabilitation "Kanji'a Spa" comprises a plan to build a third hotel. An urbanistic solution of the complex was found, (positioning of the hotel) based on a bioclimatic study in which bioclimatic elements both in the analysis of the location and in the architectural design were taken into account.

The bioclimatic study started by considering the elements of climate and the conditions of the location. All the relevant parameters were analyzed with the aim to reduce the energy consumption and to protect the environment. The object was designed so as to use, to the maximum possible extent, the recoverable energy sources available at the location (geothermal and solar energy).

The use was foreseen of the thermal water for medical and sanitary purposes, as well as for heating and air-conditioning including the heat-pump principle. Direct capturing of the solar energy by a passive system is used - green-houses which are introduced in several forms as e.g. a lobby, wintergarten, patisserie...

Part of this study is subject of this paper.

1 Introduction

The design of the Hotel with its accompanying facilities was based on bioclimatic principles. The thermal water and solar energy were used as alternative sources of energy. Orientation, geographic and climatic conditions were taken into consideration while determining the main masses of the Hotel complex. The use of all the favourable features of the location and the protection of the Hotel complex against unfavourable effects resulted in excess energy as well as in an authentic architectural design which, in addition to the climatic principles, was based on elements of regional architecture, especially with regard to the choice and preparation of building materials.

The Hotel covers an area of 16 480 m^2 and includes, besides accommodation (248 + 60 beds), medical facilities, open-air and indoor sports facilities, conference halls, shops and restaurants, thus representing an autonomous entity.

2 Urban and architectural design concept

The Kanjiza Spa is directly linked to the town of Kanjiza. It is 500 meters away from the town center. The location of the Spa, 300 meters from the river Tisa, is set within the National Park, surrounded by a green area.

According to the Main plan of Kanjiza, in addition to the existing hotel, within the area planned for the development of the "BANJA KANJIZA", the construction of a third hotel is foreseen. Based on the propositions of the Main plan, the land development requirements were defined and the preliminary design prepared.

The Hotel area covers 3.0 ha (200 m x 150 m) and is linked to the plot of the existing "Akvamarin" Hotel. The entrance to the existing hotel is 150m away from that of the "ANA" Hotel. The connection between these two hotels is established through a small overhead bridge providing a protected (warm) link.

The "ANA" Hotel, for which the preliminary design was prepared, consists of two basic units: the hotel facilities and the sports facilities in orthogonal disposition to each other (Fig.1). The basic hotel unit is parallel to the existing "Akvamarin" Hotel providing a favourable south-east and north-west room orientation. The Programme of the Hotel is designed to satisfy the required activities such as rehabilitation, accommodation, sports, recreation, and entertainment. Its facilities are additional to the basic spa offer, meant for spa guests but also for a broader range of users from surrounding areas.

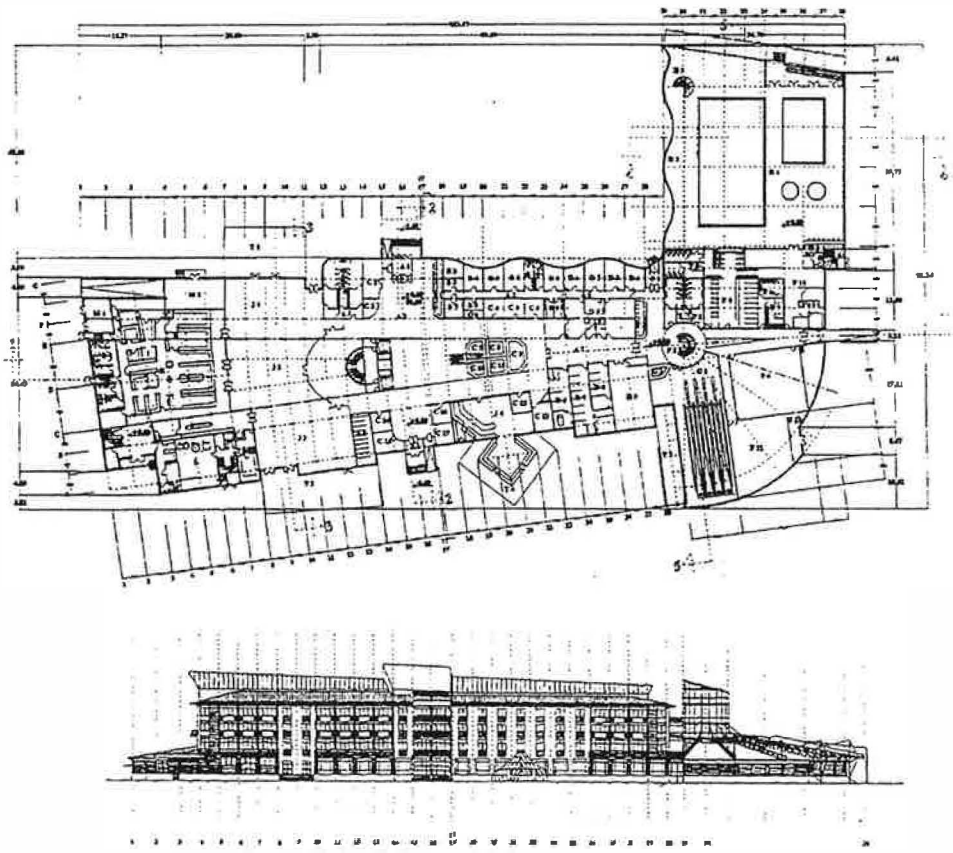

Fig.1 Ground floor and south-east elevation

3 The bioclimatic analysis of the location

The area where "Banja Kanjiza" is located together with the micro location planned for the construction of the "Ana" Hotel is situated at a latitude of 46 degrees 11' N and a longitude of 20°7' E, 87 m above the sea level. The "Banja Kanjiza" is located within the National Park complex, overgrown with dense woods and some 500 m from the center of the town of Kanjiza. On the north-east part of the plot there is an embankment and the road linking

Kanjiza with Novi Knezevac. On the other side of the embankment one comes upon a forest and the river Tisa, which is 1000 m away from the location. At the location there are radioactive alkali-acidy mineral water springs with temperatures ranging from 55°C to 67°C.

Prior to preparing the complex design, the climate and other essential conditions prevailing at the location were analysed. One of the most prominent design objectives was to provide the protection of the spa environment as a valuable resource and natural heritage, together with an adequate rational use of existing natural potentials.

3.1 Renewable sources of energy at the location

The complex is planned, so as to use optimally the renewable sources of energy, available at the location (geothermal energy, solar energy).

3.1.1 Geothermal energy

Thermal water is planned to be used for medical and sanitary needs as well as for heating and air-conditioning. In the course of temperature reduction the thermal water is to be reused as a cooling system for the heat pump. The possibilities of thermal water application will definitely add to the more economic functioning and exploitation of the complex.

3.1.2 Solar energy

The factor important for the consumption of energy is the sun. For the subject location, an analysis on the motion of the sun during the whole year was made. The analyses was later used in determination of the position of the complex on the plot taking into consideration the exposure to the sun rays both in summer and in winter in order to reduce the consumption of other forms of energy used for heating, cooling and lighting of the building (Fig.2) Solar energy is directly accumulated by using the passive system in the form of a greenhouse.

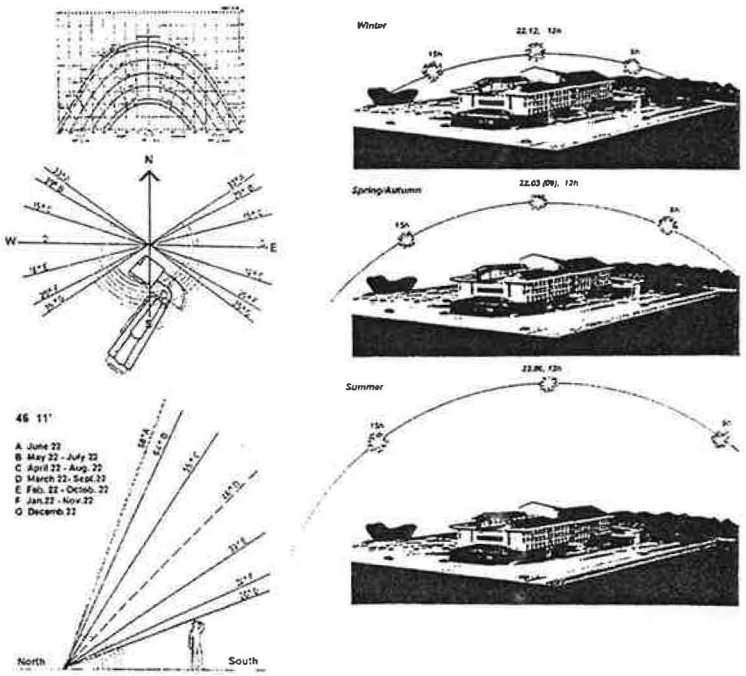

Fig.2 Positions of the sun on the location depending of the season

3.1.3 Wind energy

The shape and the design of the building were, to the utmost extent, adapted to the climatic conditions. There are neither open nor narrow passages which could create undesirable effects. In the dominant wind direction, a semi-circular segment is provided whose shape will subdue the wind gusts. The roof shape also weakens the wind's effects and the roof lanterns with side openings enable constant ventilation all year around (Fig.3).

The main pedestrian passages, the main entrance and the entrance to the sports facilities are designed so as to avoid the dominant wind direction, but are also protected by the building and trees.

The embankment on the south-east side of the complex also partly weakens the wind.

On the other side the natural ventilation of the whole complex is provided for. The complex is located so as to enable free natural ventilation.

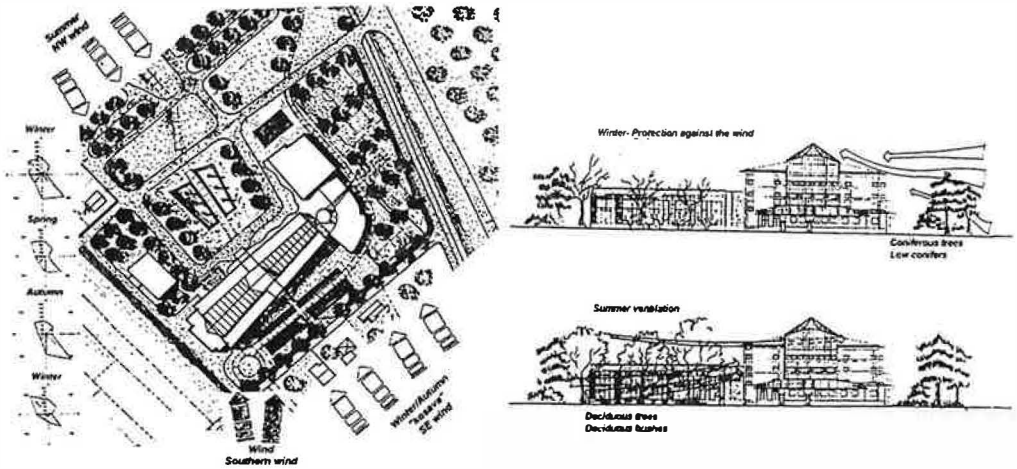

Fig.3 Influence of the wind in the building and open areas and protection measures

3.1.4 Vegetation

Given the purpose of the complex, the character of the Spa tradition and the significance of the whole complex, special design attention was given to vegetation. The green areas and water surfaces form a significant natural surrounding to the complex. This was taken into account while planning the ventilation, filtration and the air exchange provisions as well as the cooling system. To weaken the gusts of wind in winter, it is planned to plant trees and dense evergreen vegetation on the south-east side, forming a natural barrier.

It is also planned to plant additional trees closer to the building on the south and south-east side. High trees provide a significant shadow on surrounding spaces in the summer, whereas during the winter, while leafless, they allow the penetration of direct sun light into the building.

4 The bioclimatic analysis of the architectural design

The building is designed according to principles of bioclimatic architecture aimed at the reduction of energy consumption and at environmental protection.

4.1 Bioclimatic elements of the design - the passive solar design

The Design resulted from the pursuit of the following principles:

- the largest percentage of the glazed surfaces should be oriented south-eastwards;
- the planned construction method should provide a high degree of accumulation;
- a high thermal insulation level is planned;
- flexible heat insulation preventing great heat losses during the night is to be provided;
- in summer the building is to be protected against overheating with curtains, vegetation, air ventilation, etc.

The greenhouses are planned so as to accumulate solar energy which will also be used for halls, winter gardens, patisserie and providing mostly natural light in rooms. Some parts of the building get the necessary heat through the greenhouses.

4.2 Orientation

The aim of the design was to achieve maximum solar accumulation in winter and to reduce overheating in summer to a minimum. The greenhouses, to which special attention was given both with regard to their function and shape, are oriented mostly towards the south and south-east. The orientation of most rooms is towards the south-east, this being considered favourable as regards the use of energy.

The protection system against direct sunrays is planned using an automatic control throughout the whole complex.

The windows in the basement are protected with lightly structured pergolas, hoods or wooden grillwork with suitable species of vegetation to be planted for this purpose. Balconies, loggias and hoods are used as protection against intensive afternoon sun rays thus realising easy regulation of the heat comfort. In cases where there are no hoods in front of windows, they are protected with mobile curtains having adjustable vertical and horizontal sun shields and Venetian shutters with varying angles depending on the position of the Sun.

4.3 Materials

For the hotel complex and the landscape design, as a rule, local natural materials are planned, commonly used in this region's traditional construction techniques (brick products, stone, wood, glass).

The face walls are of a "sandwich" type with the face bricks on the external side and thermal insulation on the inside, satisfying the regulations valid for this climatic region. The facade is partly ventilated. The part of the roof covered with ceramic tiles is also ventilated. The wood is a material appearing both in the interior and on the exterior of the building complex.

The high technology of the structures enabled great spans which provided maximum glazed surfaces between constructive elements of the assembly. Various kinds of glass are planned. Transparent glass is used for glazing all surfaces of the external patisserie walls, the entrance segment up to the roof and the facilities in the basement used by hotel guests. The remaining parts are glazed with reflective glass. For vertical glazed surfaces of the winter garden and the patisserie pyramid a low emission glass is planned.

One of the few materials not originating from this region is the high-tech material under the trade name of "lexan", with an excellent performance regarding durability and easy maintenance. Because of its toughness and good thermal characteristics it was used for covering the lanterns in the halls and the swimming-pool.

4.4 Glazed spaces

Generally speaking, not only spaces for specific purposes, used in certain periods, but also highly frequented spaces provided for social gatherings are suitable for glazed surfaces. The glazed space is the most suitable element of the passive solar architecture. In addition to the accumulation of energy, it represents a unique interaction with the external space and because of its favourable performances it contributes to the realisation of multifunctionality. Together with protection against the sun and the necessary ventilation, they are economical in many ways enabling the heating of the spaces by using natural energy sources during the entire year. Instead of planning special technical installations and active systems for the accumulation of solar energy in this Hotel complex, preference is given to extensive, favourably orientated glass surfaces.

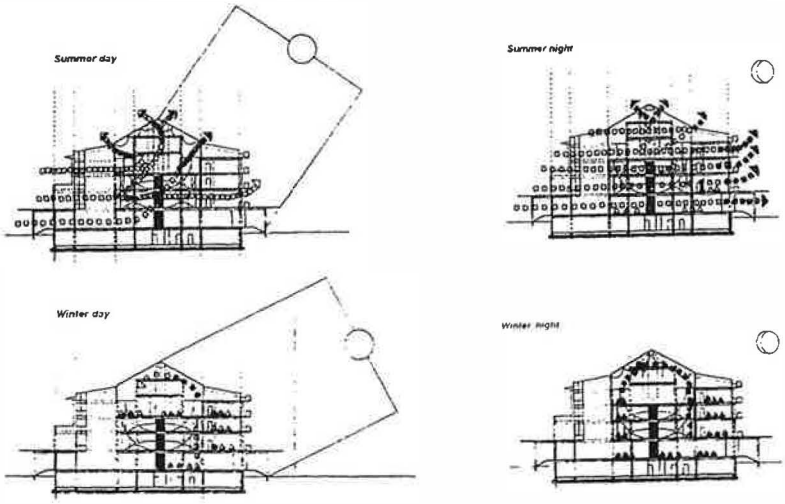

Fig.4 Hall - summer and winter, day and night

The greenhouse, as an element of bioclimatic architecture is given essential importance. It represents a system of passive solar architecture and can occur in various forms and sizes, such as: a hall (Fig.4), winter garden, patisserie, swimming - pool (Fig.5).

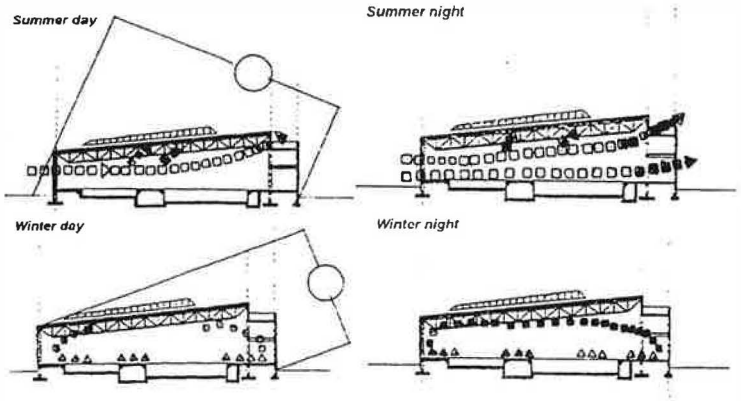

Fig.5 Swimming pool: summer and winter, day and night

5 References

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