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REFURBISHMENT OF DECOMMISSIONED BUILDINGS IN THE CONTEXT OF SUSTAINABLE DEVELOPMENT

BY

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Abstract. At present, it is considered that about 50% of the raw materials existing on the earth are used to raise buildings. Buildings consume approximately 40% of the total energy in the world, and are responsible for 35% of the overall CO2 emissions as well as for 50% of the total amount of waste. It is for this reason that any intervention brought to the built space by sustainable development projects, in general, and to decommissioned buildings, especially, will have a positive impact upon further energy consumption, waste production and CO2 emissions. From the perspective of the last decade, the concept of sustainable development has reached that level of strategic concern that is found worldwide.

From the viewpoint of constructions, sustainable development require a careful re-examination process of architectural concepts, the implementation of new technologies that make use of green materials and of solutions that respond to the exigencies that could “meet the needs of the present while not

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compromising the changes of the future generations to meet their own needs" (http://ro.wikipedia.org/wiki/Raport_Brundtland).

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1. Introduction

The implementation of the concept of sustainable development by revitalizing the dismantled dwelling stock aims at increasing the capacity to adapt structures and their functions to present-day requirements and needs while having a minimal impact upon the environment at the same time.The implementation of the concept of sustainable development in constructions can be made by both conceptual and technological innovation. In this way, sustainable "rebuilding" can take place in following conceptual performances regarding functions that could have a small impact upon the environment, while using recyclable materials, with higher level physical and mechanical characteristics and applying high performance constructive and technological systems.

2. Principles of Sustainable Development in the Context of Refurbishment

The actions performed aim at developing a strategy for the use and promotion of:

a) the ecological building materials;

b) the energy efficiency in buildings;

c) the management of the construction and demolishing originating waste.

According to SR ISO 21931-1:2011: the principles of sustainable for reclaiming the functions of a construction concern a new analysis of the functional and architectural concepts of a building from the viewpoint of the use of green materials, energy efficiency and the promotion and implementation of new design and service notions.

The notion of ''sustainability of the decommissioned built environment" implies: sustainable materials, structural concepts (mechanical, physical, chemical, biological), as well as sustainable functional and economic and financial concepts (Fig.1).

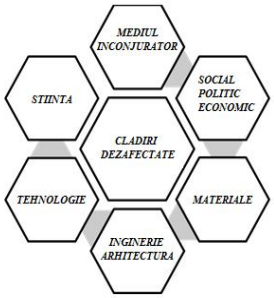

Fig. 1 – Structural concepts in sustainable development.

Irrespective of the field of application, sustainable development considers the economic, social and ecologic aspects (Fig. 2) (http://planningoradea.blogspot.ro/2011/04/dezvoltare-durabila.html).

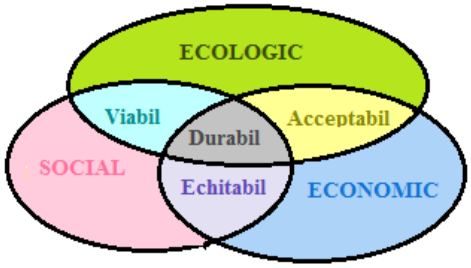

Fig. 2 – Pillars of sustainable development.

2.1. Stages in the Refurbishment of a Building from the Viewpoint of Sustainable Development

From the engineer's point of view, sustainability requires using efficiently energy and natural resources, reducing losses to minimum, recycling and reusing materials, making a financial and environmental estimate for the entire life-length of the building.

The operations of conversion that initially consisted only in repairs and in upgrading the buildings so that they are adapted to present-day comfort norms (concerning space, hygiene, insulation) and stability standards have gradually extended from the reorganisation of the inner space towards extension and reconversion works so that in the case of decommissioned buildings the initial function is replaced by a new one.

Using again the existing structure, recycling materials, diminishing the amount of waste resulting from reconversion, the reasonable used of the natural resources through new processing technologies that generate less waste form an integral part of the principles of sustainable development.

As far as sustainable development is concerned, the conversion of a construction should follow more steps, such as:

a) materials selection;

b) waste management;

c) reuse and recycling of components;

d) efficient use of water and energy;

e) flexibility in space use, to reduce the application of operations with high resource consumption during reconfiguration.

From the ecological, economical and social viewpoint, by reusing and recycling waste from constructions and demolishing, the amount of stored waste is reduced and saving in raw materials is made. Recycling is profitable when its cost is smaller than that of storing waste, and when the recycling costs are higher than those related to storing, the trend goes towards storing.

The introduction of the concept of sustainable development in constructions has followed an evolution going in parallel with the concept itself development.

In the world, there are recognised several environmental quantification systems, such as:

a) the Anglo-Saxon BREEM system;

b) the USA- LEED system of quantification;

c) northern countries (local) systems;

d) a system origination from the adaptation of the SB Tool (Canadian);

e) HQR- the French system;

f) DGNB – the German system.

The differences between the environmental quantification systems have their origin in the way in which sustainable development is defined and the weight given to the parameters in use. It is necessary to identify those models that have more adaptability power and are more suitable for the location of implementation.

In Romania, the BREEM and LEED systems are used to certify the performance of a construction. Practices and technologies aiming at reducing and finally eliminating the negative impact of the building upon the environment are joined together in use.

3. Renewable Energy Sources

The capitalization of the potential of renewable sources of energy provides actual premises for fulfilling the strategic objectives regarding increased safety in energy supply, by diversifying sources and reducing the weight of energy resource imports, respectively increasing sustainable development in the energy sector and protecting the environment.

Because of energy consumption, buildings also produce a high amount of CO_2 emissions. Consumption is mainly reflected in the energy necessary to heat and cool buildings, in the losses of energy because of low energy efficiency in building materials and equipment used (for instance boilers, reservoirs, air conditioning devices, etc). The reduction of energy consumption through measures making consumption more efficient and using renewable sources of energy represents a solution for diminishing the greenhouse effect gas production, energy consumption and making energy use more efficient.

To valorise the economic potential of renewable energy resources it is necessary to adopt and implement specific policies, instruments and resources.

Renewable sources of energy concern forms of energy resulting from naturally regenerating sources, in which the production cycle occurs in interval of times comparable to their consumption intervals. Hence, solar light energy, wind energy, river energy, biomass and geothermal energy ca be captured through various procedures. Other sources of energy also include the nuclear energy and burning of fossil fuels, such as oil, coal and natural gas. The latter resources, however, are limited to the amount of raw materials in the ores and are seen as not renewable.

In general in all constructions and mainly in decommissioned buildings, a special attention should be paid during refurbishment to the use of renewable sources of energy, of which the main sources are:

i) solar energy;

ii) geothermal energy;

iii) biomass.

Solar panels are more and more used as main/secondary sources for producing electric current for buildings. Solar installations can be of two kinds: thermal and photovoltaic. The photovoltaic equipment produces electrical energy directly, the thermal systems help save other fuels (wood, gas) in a percentage of 75% per annum. A building provided with both types of solar equipment (with photovoltaic and vacuum thermal panels) can be regarded as energetically independent as the energy collected during daylight in batteries is then sent through the network and used, as necessary (Fig. 3) (http://www.green-report.ro/casa-care-stocheaza-surplusul-de-energie-solara-pe-care-o-produce/; http://www.robotics.ucv.ro).

Fig. 3 – Solar equipment.

Geothermal energy makes use of equipment that collects the heat of the earth in the soil or underground water, through a system of pipes buried in the ground or a pool. The water travelling through the network helps increasing heat and generates heat in the house, (Fig.4) (http://www.my-energy.ro/index.php).

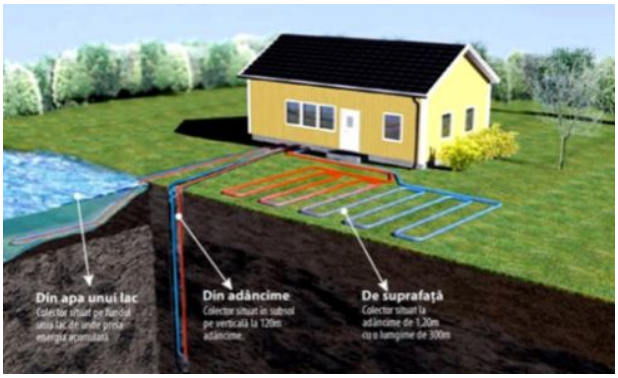

Fig. 4 – Geothermal energy equipment.

Earth energy is used to: heat dwellings, educational spaces, trade spaces, hospitals, etc. preparation of household water, and electrical energy.

In Romania, the geothermal resources with the highest enthalpy was identified in BaileTusnad. Five locations there have a temperature over 100°C, (Fig. 5) (http://add-energy.ro/tehnologii-de-obtinere-a-energiei-din-surse-geo-termale/).

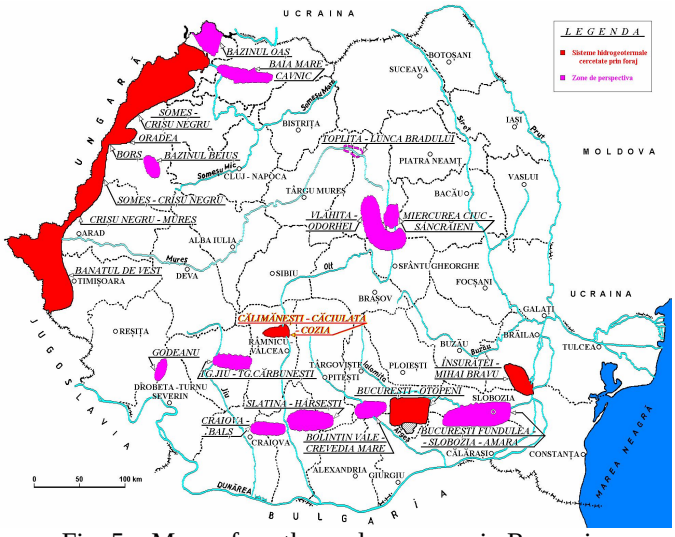

Fig. 5 – Maps of geothermal resources in Romania.

Biomass represents the most abundant renewable resource on the planet, and for Romania it is a promising source of renewable energy from the point of view of potential and opportunities of use, Fig. 6 (http://arhivawww. uoradea.ro).

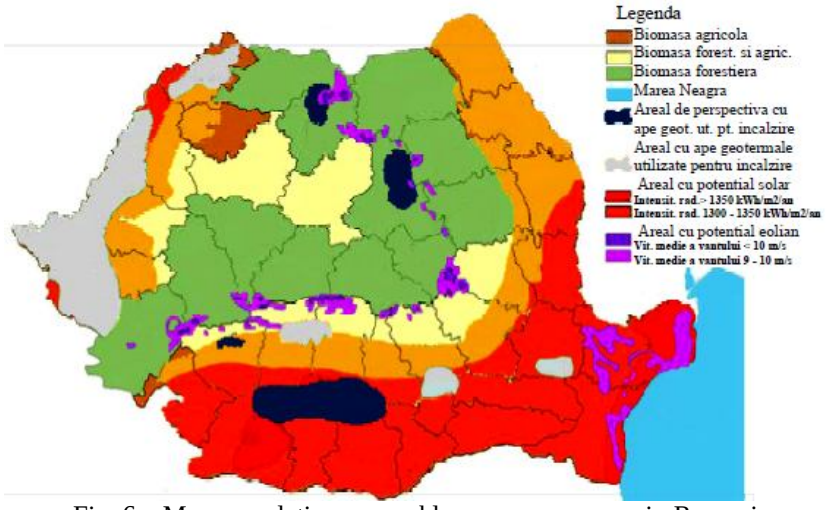

Fig. 6 – Map cumulative renewable energy resources in Romania.

The use of these sources in building erection contributes to diminishing the greenhouse effect gas emissions generated during the production and consumption of energy.

4. Representative Constructions

If, in the past, the conversion of the buildings did not take into account their history and character, today, any building assessment is made starting from the awareness of the building past:*"by old buildings I understand not only old buildings of museums… but also a multitude of aedificies with no heritage value even their ruins''*J.Jacobs, Death and Life of a Great American Cities (http://www.revistaconstructiilor.eu/index.php/2011/10/18/...).

Energy crisis, economic recession, micro and macroeconomic losses helped society become aware of the necessity to save resources (both belonging to the natural field and to the built stock) by refurbishing decommissioned buildings or buildings that cannot be used anymore.

All over the world, and mainly in developed countries, many factories, warehouses, docks were transformed into dwelling buildings, offices, trade spaces, schools, theaters or other types of constructions. Several examples are given below:

1º In 1896, the authorities from Vienna decided to invest in public buildings erection , namely in Gasometers.

At the moment of their construction, they were the tallest in Europe. They remained active until 1986. Later on, the compound was decommissioned and only four tanks were kept. The proposal was to change them into dwelling spaces and public spaces. The cylindrically shaped tanks are fully built with brick masonry, at a height of 30 m, a diameter of about 65 m, in a volume of 3.000.000 m^3. Initially, they used to story there the gas made from coal, and then, after 1984, natural gas. In the reconversion project of the gasometers, four famous architectural offices joined their forces: Jean Nouvel - body A, Coop Himmelblau - body B, Manfred Wehdorn - body C, atelier Holzbauer - body D, Fig. 7 (http://sir.datawave.ro/fise-bibliografice/gazometrele-din-viena-austria. html'). Structures were renovated and transformed in 615 flats, a student hostel, offices, a daycare centre, over 70 shops, restaurants, bars and cafeterias, rooms for variousevents and the headquarters of the National Archive of Vienna, Fig. 8 (http://sir.datawave.ro/fise-bibliografice/gazometrele-din-viena-austria. html').

2º The former "Libertatea" Furniture Factory from Cluj- today called Liberty Technology

Park Cluj is such a conversion example, in which an old building was brought to new functional parameters. In 1870 "Libertatea" Factory which was set up by the Vienesecraftfman Franz Triska, began to produce pianos. In 1949 it turned into a furniture factory and in 2010 the building was abandoned. At present, it is subjected to he reconversion process and the solution proposed for it was that of a Technological Park, (Figs. 9 and 10) (http://www.libertytechpark. com).

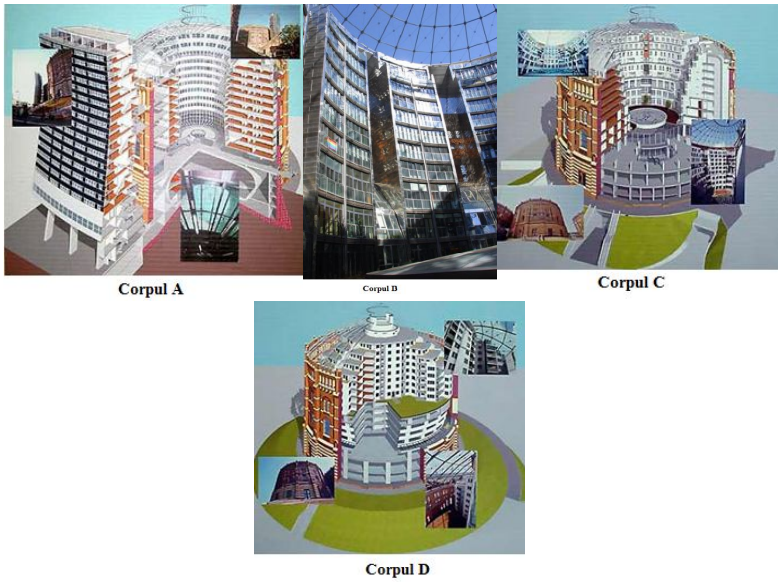

Fig. 7 – Reconversion of Gasometers.

a *b*

Fig. 8 – a – Gasometers before; *b* – after reconversion.

Fig. 9 – Overview of the technology park.

Besides the spaces for offices, the new building provides a full range of services and facilities, among which customized interior design, IT, video, telecom infrastructure adaptation, office access control, server and telecommunications services configuration in two alternating routes; professional services for supplying the electrical network and for digital video monitoring twenty four hours a week.

a *b*

Fig. 10 – *a* – Building before; *b* – after reconversion.

Technology Park Cluj respects the concept: ”An ecological approach for a sustainable future”, is the first building in Romania to receive a BREEAM Major Refurbishment certification , with the – qualification “Very Good”.

5. Conclusions

Refurbishing a building in the light of sustainable development involves numerous advantages:

a) economic benefits;

b) benefits for the surrounding environment;

c) social advantages;

d) impact upon building industry.

Decommissioned buildings (often possessing a remarkable architectural potential) are let to gradually damage or are demolished to use the land for other investments. This phenomenon is still perceived as taking place because of lack of interest in the values of our past and because of ignorance in so far sustainabi8lity, conservation and reuse of resources are concerned.

In present-day conditions, when materials recycling, the rational use of natural resources form important factors for the observation of the principles of sustainable development, the recovery of decommissioned buildings (by reconversion) represents an efficient measure as it provides the chance of making buildings survive and reintegrate in the public circuit and contributes to the reviving of the social and economic life.

REFERENCES

* * * http://ro.wikipedia.org/wiki/Raport_Brundtland, martie 2014.
* * * *Dezvoltare durabila in constructii. Cadru de lucru pentru metode de evaluare a performantei de mediu pentru lucrari de constructii.* Partea 1:Cladiri, SR ISO 21931-1:2011.
* * * http://planningoradea.blogspot.ro/2011/04/dezvoltare-durabila.html.
* * * http://www.green-report.ro/casa-care-stocheaza-surplusul-de-energie-solara-pe-care-o-produce/
* * * http://www.robotics.ucv.ro
* * * http://www.my-energy.ro/index.php
* * * http://add-energy.ro/tehnologii-de-obtinere-a-energiei-din-surse-geotermale/
* * * http://arhivawww.uoradea.ro
* * * http://www.revistaconstructiilor.eu/index.php/2011/10/18/in-actualitate-recon-versia-functionala-a-cladirilor
* * * http://sir.datawave.ro/fise-bibliografice/gazometrele-din-viena-austria.html'
* * * http://www.libertytechpark.com.

REFUNCȚIONALIZAREA CLĂDIRILOR DEZAFECTATE ÎN CONTEXTUL DEZVOLTĂRII DURABILE

(Rezumat)

In prezent, se consideră că aproximativ 50% din materiile prime care există pe planetă suntutilizate pentruconstrucții. Clădirile consumă aproximativ 40% din energia totală la nivel mondial, sunt responsabile pentru 35% din totalul emisiilor de CO_2 şi 50% din totalul deşeurilor produse. De aceea, orice intervenție adusă spațiului construit, în general şi clădirilor dezafectate în special, prin proiecte de dezvoltare durabilă va conduce la un impact pozitiv în viitor, în ceea ce priveşte consumul de energie, producerea de deşeuri şi emisiile de CO_2. Privit din perspective ultimului deceniu, conceptul de dezvoltare durabilă a atins un punct strategic al preocupărilor actuale, fiind acceptat şi sprijinit pe plan mondial.

Din perspective construcțiilor, dezvoltarea durabilă presupune un proces de reexaminare a concepțiilor arhitecturale, implementarea unor noi tehnologii folosind pe scară largă material ecologice si alte soluții menite să răspundă exigențelor conform cărora este posibilă „satisfacerea nevoilor prezentului, fără a compromite posibilitățile generațiilor viitoare de a-şi satisface propriile nevoi".