BUILDING REFURBISHMENT – APPROACHING SUSTAINABILITY IN A EUROPEAN CONTEXT: CASE STUDY OF ORADEA CITY, ROMANIA

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ABSTRACT

The Covid-19 pandemic changed the world forever and all the limits imposed against spreading the virus, determined changes in humankind's perspective and behaviour: concerns on health increased, and so did the needs to explore and live in the moment. Definitely, the latter perspective is prone to higher consumption, and so the high demand impacts inflation levels, as well. Since the pandemic started, Romania faced increasing prices, but the last gas price is the ultimate challenge affecting even more the living standards. The need to reduce consumption and save energy is evident more then ever, and this challenge should be considered as an opportunity for highlighting the importance, and shaping sustainable consumption behaviour. Nowadays energy efficiency measures are a must in reducing greenhouse gas emissions, and also the import costs of energy, improving the security of supply, and achieving a sustainable energy supply. This paper focuses on implementing the European Green Deal's objective in Romania, on building refurbishments. These and retrofitting are very popular practices around Europe, used in improving households' comfort and reducing heating bills; these are the direct effects the population perceives, but there are a lot more concerning energy resources and pollution. The present paper assess them focusing on Oradea, a Western Romanian city. Our research involves direct observation of investments and heating consumption's level, and our first findings prove a positive impact of these strategies on consumption, even if the pandemic changed the way of living and working, and so the whole consumption level was affected.

KEYWORDS: *building refurbishments, cost reduction, energetic independency, European Green Deal, greenhouse emissions*.

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1. INTRODUCTION

Nowadays the European economy faces turbulent situations due to the last years Covid-19 pandemic, Brexit, the rising prices of the fossil fuels, and even more, the conflict between Russia and Ukraine. The pandemic hit hardly the European economy and during the resilience period when each member of the European Union (EU) implemented various strategies for economic recovery, and now, the energetic crisis hits those efforts. Gas and oil prices rose in the 2021's autumn determining higher heating and electricity costs for European households and industries, leading to a rising inflation and also to a lowering living standard. This situation and also the war between Russia and Ukraine - two important providers of gas for the European countries - enhanced the importance of implementing the European Green Deal's policies in order to meet much faster the aimed reduced fossil fuels dependency (European Commission, 2021) even if in the last years, the

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efficiency policy promoted by the European Union decreased the general energy demand (Furfari & Mund, 2021).
The European Green Deal is much more ambitious, targeting several aspects related to climate neutrality, reduced emissions of CO2 and greenhouse gas, sustainable usage of resources, green economic growth, creating new green jobs and also improving Europeans' quality of life (European Commission, 2019; Eckert & Kovalevska, 2021). The current paper focuses on meeting the goals of reducing CO2 and greenhouse gas emissions, besides reducing gas consumption for heating through buildings refurbishments, analysing the financial implications and effects of refurbishing residential flats in Oradea, Romania.
In this regards, the present paper consists in five sections: the first one consists in reviewing the literature related to the European Green Deal and building refurbishments; the second one presents the research methodology used in designing this paper; the third section is dedicated to present examples and implications of building refurbishments; the following section - the fourth - presents the city of Oradea, the investments in building refurbishments, and also some effects of those investment. In the end, we highlight the most important findings and conclusions of our research.

2. LITERATURE REVIEW

The European Green Deal is an ambitious plan of the European Commission aiming to make the European Union a leader in climate and environmental policy (Hass & Sander, 2020) by targeting to reduce drastically the CO2 emissions by 2030 (50-55%), and to ensure carbon neutrality by 2050 (European Commission in Furfari & Mund, 2021; Piontek, 2020). All these would decouple drastically the economic growth and development from carbon and resource consumption, this aim being proved to be achievable in the last thirty years, as in EU the greenhouse emission were reduce by 23% along with an economic growth of 61% (European Commission in Piontek, 2020).
Although the European Green Deal is not the first attempt of the EU policy makers to make the European economy greener and more sustainable – an economy which is giving back more than it consumes - in 2010 the European Commission proposed a plan to reduce CO2 emissions and to use resources more efficiently (Piontek, 2020). This time, the European Green Deal reforms the policies regarding climate and environment by encouraging and supporting consumers and businesses in changing their behaviour towards sustainability, and rational use of resources. The European Green Deal creates the framework for an economic green growth, efficient in natural resources usage, pollution and environmental impacts minimiser (World Bank in García Vaquero et al., 2021). The green growth implies job creation, as well; those jobs related to green growth are known as green jobs, belong to green sectors, such as renewable energy and energy efficiency, and consist of labour designed to preserve or to restore the environment, improve raw materials efficiency, limit the emission of greenhouse gas, reduce and minimize pollution, waste and climate change effects (International Labour Organization in García Vaquero et al., 2021).
Even if the European Green Deal emerged planning a sustainable future and ensuring energetic abundance at lower economic and ecological costs and thus pointing to a superior wellbeing and living standards, it is questioned by several academics due to possibilities of citizens' long-term suffering, and to their low adaptability, changing habits, and underestimation of their importance (Eckert & Kovalevska, 2021; Furfari & Mund, 2021; Samper et al., 2021). Also another challenge in implementing the European Green Deal is seen in the diversity and division among the member states regarding the climate policies (Haas & Sanders, 2020; Dupont & Torney, 2021).
The objectives, measures, and policies implied by the European Green Deal concern several aspects already researched by academics, such as agriculture (Montanarella & Panagos, 2021; Bartolome et al., 2022), building refurbishments (Pohoryles et al., 2020; Napoli et al., 2020; Arbulu et al., 2021; Buckley et al., 2021; Loli & Bertolin, 2021), technology (Hainsch et al., 2021), transport (Hass & Sander, 2020), urban tourism (Popescu et al., 2022), regional development (Piontek, 2020) and

economic recovery (García Vaquero et al., 2021; Kougias et al., 2021; Bongardt & Torres, 2022), etc. Building refurbishments, as a way to reduce greenhouse gas emissions and to reduce resources consumptions for heating, triggered our attention towards renovating residential flats. This direction of implementing the European Green Deal is enjoying great interest from Spain concerning the public investments made with financial support offered by the Recovery and Resilience Facility - consisting of non-repayable loans for public investments and reforms in member states – besides high investments (66%), also the most of the green jobs created belong to buildings and construction sector (Vice Presidency of the Government and Ministry of Economic Affairs and Digital Transformation in García Vaquero et al., 2021).

In the last years, the construction industry implemented various technologies and used products in line with the sustainability aims, so the new buildings and the refurbished ones had to meet not only the economic criteria, but also the environmental ones. Considering the old buildings, these are proved to consume more electricity than the new ones, so the owners face refurbishment needs (Risholt & Berker in Loli & Bertolin, 2021) in order to reduce their bills and to protect the environment and the natural resources, as well.

Building refurbishments ensure one of the European Green Deal's objectives, more exactly, reducing the external energy dependency. By using fewer natural resources in heating, also the greenhouse gas emission will be reduced. Besides the ecological aspects, we also have to consider the economic advantages brought by lower heating bills. Even more, refurbishing and retrofitting buildings injects considerable investments, both public and / or private, provides green jobs, and generates revenues, meanwhile reducing the use of gas for heating, and the dependency on the gas supplier.

3. RESEARCH METHODOLOGY

The literature review of the present paper was elaborated by presenting some of the most recent academic works indexed in the Web of Science, but not only, regarding the European Green Deal, building refurbishments, and retrofitting. Further, we presented data regarding the building refurbishment matter in Romania, more exactly regarding Oradea city and Bihor county. The empirical evidence supporting our research was retrieved from the local public institutions of Oradea municipality and various reports elaborated for the local authorities of Oradea. The data presented aims to show the efforts made in the direction of reducing energy consumption and CO2 emissions, and also some results of those efforts. In the current paper we used the observation method, but further research is planned in the direction to test statistical correlations between the investments and the energy consumption.

4. BUILDING REFURBISHMENT

4.1 Overcoming challenges of the energetic crisis

On the first hand, most of the energy consumption and greenhouse gas emissions in the EU, belong to its cities, and on the other hand, 40% of energy is used by heating buildings, resulting in 36% of EU CO2 emissions (Covenant of Mayors. Committed to local sustainable energy, 2020). Considering the magnitude of cities consumption and pollution, the implication of the municipalities and local institutions is seen as mandatory; they can implement various smart policies supporting the use of renewable energies and so, to grow less dependent on external energy sources.

Any crisis is an opportunity to challenge ourselves in order to overcome whatever disturbs us, and so it is for the European cities, which are offering many examples of overcoming the energetic scarcity and threat; even if a complete energy independency is less probable to be achieved, a mix of energy resources could be beneficial, covering at least partially the energy need by using thermal

installations (Slovenia), urban wind installations (Netherlands), solar photovoltaic and biomass plants like in other countries (Covenant of Mayors. Committed to local sustainable energy, 2020). Considering these alternatives would definitely bring benefits both to the municipality, and to the population, such as cost reductions, lower pollution, and reduced energy poverty. Narrowing the problem and also the solutions, and considering only the buildings, we can notice that problems are related to how old a building is, how it was built, the preservation condition of the building, etc. The old buildings weren't built being well-insulated, and so there is a high energy consumption for heating and also, high thermal losses. The bad insulation represents the problem, but refurbishing the buildings improves the building's capacity to keep a thermal optimum, and so to reduce energy consumption both for heating, and for cooling, and so improving the resources demand and dependency, the residences health and environment and also their living standards. Besides the direct effects, we also have to highlight the economic impact which goes beyond affordable energy, and creates jobs and revenues in the constructions sector - green jobs, more exactly – and uses public and private investments with long-term economic, ecological and social impacts.
In Romania, building refurbishment is an action strongly supported by public investments from The Ministry of Development, Public Works and Administration, and the local municipalities. The refurbishment aims for thermal rehabilitation of blocks of flats, and so reducing the heating bill by 40% - the heating problem is extremely important because Romanians consume double for heating their homes than many other Europeans (Ministry of Regional Development and Housing, 2021). Besides reducing gas consumption and greenhouse gas emissions, refurbishing flats brings another essential advantage: public funding. Until 2022, the funding covered 80% of the total costs, 50% of the costs were funded by the Ministry of Development, Public Works and Administration, 30% by the local public authorities, whereas the rest of 20% was covered by the owners through the Owners' associations (Ministry of Regional Development and Housing, 2021). Anyway, the financial support was significant and 2719 flats were refurbished during 2009-2021; in the following years the impact of the financial support will increase, expecting to refurbish 4300 flats, but 100% of funding from the Ministry of Development, Public Works and Administration (Bihoreanul, 2022).

4.2 Results and discussions: building refurbishment in Oradea city, Romania

The city of Oradea is situated in Western Romania, Bihor county, 15 km away from the Hungarian border. Oradea encompasses a total area of 111 km², an area which has a total population of around 200.000 persons, and currently, it is continuously growing and expanding towards the Metropolitan Area. In the last years, Oradea faced a fantastic development due to the public investments in infrastructure, rehabilitation of the historic buildings and areas, the emergence of new residential areas, the given support to the companies to invest and open new business units in the industrial park, and much more. Oradea's economic growth brings many economic and social benefits, although the price is paid mostly by the environment and the citizens' health. Growth of any kind implies an increased consumption, and so does the growth of Oradea city; more people, more buildings to live in, not to mention their transport. And as local authorities of Oradea don't aim for growth without development, there are plans even to surpass the European objective of reducing the CO2 emissions with 55% by 2030, considering the local sources of renewable energy and to improve energetic efficiency (Fip Consulting S.R.L., Romactiv Business Consulting S.R.L., 2021). Even if the new buildings are rebuilt accordingly to the new standards, the old buildings are not, and in order to reduce both their heating resources consumption, and the CO2 emissions, there have to be retrofitted and refurbished.
In 2015 were made investments of more than 25 million euros to thermal rehabilitation of the blocks of flats in various cities of Romania, such as Bucharest (60.12%), Craiova (16.3%), Târgu Mureș (7.34%), Deva (4.04%), Ploiești (3.15%), Giurgiu (1.95%), and Oradea (7.1%), as well (Arena Construcțiilor, 2015).

The municipality of Oradea proved a continuously growing interest in development through various types of retrofitting, refurbishment, and rehabilitation of buildings, both historical and blocks of flats, or of the district heating system. This interest in developing ecologically the city is proved by the total investments in various projects funded by the Large Infrastructure Operational Program and the Regional Operational Program, as Table 1 presents below.

Table 1. Investments in refurbishing buildings and the district heating system in Bihor county

Values / Year	2009	2016	2017	2018	2020	2021
RON (million)	350.03	165.90	727.09	244.51	102.05	26.35
EURO (million)	82.61	36.94	159.17	52.54	21.10	5.35

Source: Ministry of Investments and European Projects. The centralized situation of the signed contracts. Available online at: https://mfe.gov.ro/wp-content/uploads/2021/10/4a8962bd098b49a3f939060b181f3ec6-3.xlsx [Accessed 28 August 2022]

As we can see, the last years are marked by the awareness of the environmental problems, and so the investments were substantial and continuous of course, there were large differences from one year to another but we should mention that the local authorities of Bihor county, and especially of the Oradea city, conducted over the last years significant urban development projects (infrastructure, leisure areas, heritage).

Considering the city of Oradea, these investments projects are crucial for its environment because currently, 40% of the total energy consumption is used in buildings: 55% for heating, 21% for water heating, 14% for lighting, and 10% for cooking, washing and other activities (Fip Consulting S.R.L., Romactiv Business Consulting S.R.L., 2021).

During 2016-2020, a number of 45 blocks of flats were refurbished with an investment of more than 25 million RON (approximately 5 million euros), aiming to save 40% of the previous heating consumption, to decrease greenhouse gas emissions by 35%, and also to reduce the heating bills (ZMO, 2017).

However, the returns of the investments weren't late to be noticed in the total energy consumption, even if during these years the residential areas of Oradea were continuously expanding and building new homes, we can see a significant reduction in the total consumption in the following table:

Table 2. Energy consumption for heating in Oradea city (Gcal / year)

Consumer / Year	2017	2018	2019	2020
Households	465 203	452 874	444 244	473 803
Businesses (public and private)	34 162	31 037	35 171	27 325

Source: District Heating Oradea in Fip Consulting S.R.L., Romactiv Business Consulting S.R.L., 2021

The household heating consumption faced a favourable evolution due to the continuous decreases until 2020, a year marked by de Covid-19 pandemic which led to a lockdown and so it forced the population to spend most of their time at home, even teleworking became the normal way of working for those days full of panic and distress regarding the virus and the illness. So it is no surprise that the heating consumption increased significantly for the households, and the pandemic being the cause is also proved by the low heating consumption of the business sector; related to the business heating consumption we cannot say the same for the former years, as the usage faced variations, although the sector did benefit from the district heating rehabilitation the refurbishment of various public institutions.

5. CONCLUSIONS

The rising levels of energy consumption are correlated to the European economic growth of the last years, but the threat comes from the decreasing trend of energy production; the European Green Deal aims to reduce the threat of energy poverty, to lower energy costs and so to improve its citizens living standards, by using energy more efficiently, both for saving resources, and to reduce pollution, by mixing the energy sources and so lowering the dependency on the fossil or external energy supply and improving the European Union's competitiveness. While complete energy independence is hard to achieve, a diversified energy mix is important and can make cities, countries, the EU more resilient in the future.

However, even if the plan aims to ensure a lower dependency on fossil and external energy resources, to rely more on renewable energies, to reduce greenhouse gas emissions, and so to improve the Europeans' lives, there are many who are questioning the aimed advantages and their costs supported obviously by the population.

The European Green Deal implies more actions directed towards its objectives, one of them being building refurbishments. This process consists in building rehabilitation, renovation in order to ensure a higher thermal comfort, reduce heat losses, and so reducing heating consumption and also, the greenhouse gas emissions. Even if the process implies high investments, there are several funding sources for these projects (European, national) implying in the past minimal efforts from the owners (25% of the investment), or currently, none at all – 100% non-repayable funding.

Romania is aligning with the EU's environmental policies, as the large amounts of money invested in the building refurbishments prove. Considering the investments in Oradea's buildings and district heating, we could notice a direct correlation between the investments and the reduced energy consumption; although the emergence of the Covid-19 pandemic determined a higher household consumption of heating energy, and lower one for the public and private business sector.

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