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METHODOLOGY FOR REAL ESTATE APPRAISAL OF GREEN VALUE

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Abstract

Green buildings are considered a quick and effective approach to protect the environment by slowing down the consumption rate of primary energy resources and by reducing greenhouse gas emissions. In Europe, appraisals of properties should take into consideration this new feature of buildings by implementing data from Energy Performance Certificates (EPC) into real estate assessment. With this respect, a methodology is proposed and analyzed to be considered in the sales comparison real estate valuation process. The originality of the methodology consists of considering the expected costs of the so-called wasted/saved energy as a proxy for depreciations/appreciations of the value of the building due to the obsolete/better energy efficiency. Wasted/saved energy is considered to be the difference between the energy demand of a reference building and the energy demand of the subject property.

Key words: certificate of buildings, Directive 2002/91/EC, energy efficiency, energy performance, property valuation

1. Introduction

Energy efficiency approached as policy, strategy and legislation, determines the quickest and most effective reduction in greenhouse gas emissions, by slowing down consumption rates of primary energy resources and increasing in the same time the security of supply. According to the EC document named "Doing more with less. Green paper on energy efficiency" (Green Paper, 2005), the EU could save at least 20% of its present energy consumption in a cost-effective manner, equivalent to EUR 60 billion per year, or the present combined energy consumption of Germany and Finland.

In other words, an average EU household could save between 200 EUR and 1000 EUR per year, depending on its energy consumption level, by an energy efficient mentality regarding design, construction, equipment and exploitation. Although considerable investments are needed to harness these potential savings, results are worthy since it leads to an increased competitiveness and better living conditions for EU citizens.

The report, "2020 Vision: Saving our Energy" (2020 Vision, 2007), estimates that 27 % of the energy used in the buildings sector could be saved until 2020 in Europe. In residential buildings, retrofitted walls and roof insulations offer the greatest opportunities to save energy, while improved energy management systems are important for commercial buildings. Legislation promoted by the Directive 2002/91/EC (EPBD) requires that, by 2009 at the latest, all large public buildings in the EU display an Energy Performance Certificate (EPC) for the visiting public. Consequences on the real estate market are expected soon; therefore energy assessment work should be correlated with real estate assessment work.

The main objective of the IMMOVALUE project, funded within the Intelligent Energy Europe program, is to identify methodologies appropriate for consideration of European Energy Performance Certificates into real-estate appraisals. (Bienert et al, 2008). With this respect, this paper proposes a novel methodology to be considered in the sales comparison approach of real estate valuation. It is expected that the results would contribute to energy saving by making the building users more responsible for how

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they cover their energy needs. Moreover, the new approach represents a more appropriate property valuation that could highly contribute to the evolving of a new real estate policy that emphasizes the benefits of owning highly energy efficient buildings.

2. Building energy efficiency linkage to its market value

Accurate valuations are very important for households, firms, and government agencies, since they represent the basics for many economic/financial decisions. There are three main procedures for real estate appraisal: cost approach, income capitalization approach, sales comparison approach. The choice of the approach to use in the valuation process depends mainly on the type of building and on the data at hand. The cost approach is recommended in valuing new or nearly new improvements and properties that are not frequently exchanged in the market. In the cost approach, the value of the building is derived from the current cost of constructing a reproduction or replacement for the improvements and then subtracting the amount of depreciation in the structures from all causes. The income capitalization approach is considered the most applicable valuation technique for income-producing properties, while the present value of the future benefits of property ownership is measured.

There are two methods of income capitalization: direct capitalization and yield capitalization. In direct capitalization, the relationship between one year's income and value is reflected in either a capitalization rate or an income multiplier. In yield capitalization, the relationship between several years stabilized income and a reversionary value at the end of a designated period is reflected in a yield rate. The most common application of yield capitalization is the discounted cash flow analysis.

The sales comparison approach is possible if similar properties have recently been sold or are currently for sale in the subject property's market. The sales of properties similar to the subject are analyzed and the sale prices adjusted to account for differences in the comparables to the subject determine the value of the subject. The appraiser's work consists in estimating the degree of similarity or difference between the subject property and the comparable sales by considering various elements of comparison. Adjustments are then applied to the known sale price of each comparable property to derive an indicated value for the subject property.

The present paper considers only the last of these approaches which is based on the idea that identical buildings/apartments should have identical prices.

Thus, the analysis of the current trials to integrate building energy efficiency information into valuation procedures led to the remark that most of the research works have been focusing on the investigation of market trends. This was expected as valuers only observe the market and are supposed to find the best tools for simulation and prognosis without influencing it.

Energy Star program developed by the U.S. Environmental Protection Agency and the U.S. Department of Energy considers that the value of green building constructions was \$36-\$49 billion during 2008, and could triple by 2013 A recent study (Miller et al., 2007) compares data on Energy Star and LEED-certified buildings (Leadership in Energy and Environmental Design) versus non-Energy Star or non–LEED-certified office property from the entire United States using the CoStar database. The analysis reveals that impact of certified Energy Star buildings produced an increase of 5.76% on selling prices and of LEED certification produced an increase of 9.94%.

A recent research report published by the Royal Institution of Chartered Surveyors (Eichholtz et al, 2009) makes a more precise analysis of the relationship between the actual energy use in buildings and the financial performance. The conclusion emphasizes that an increase of 10% in the energy utilization efficiency of a green building is associated with a 0.2% increase in effective rent. The analysis shows that a 1\$ saving in energy costs from increased energy efficiency yields a return of 18\$ in the increased valuation of an Energy Star certified building.

McGraw-Hill Construction's report for 2008 presents another real estate market analysis of green value in U.S. It points out that during 2007, commercial Energy Star rated buildings were sold for approximately 15% higher prices, had 8% more in rental income, and saved 10-20% in operating expenses (Murray, 2008).

The impact on the market of high thermal quality buildings is strongly correlated with willingness to pay for it. Banfi S. et al. (2008) analyzed the willingness to pay for some energy saving measures in residential buildings, in the context of the Swiss housing sector. Their analysis includes both renovated and new buildings, single family houses and renting apartments. The study points out a significant willingness to pay for energy efficiency attributes: between 3% of the standard case price for having an enhanced insulated façade and 8% or 13% of the standard case price for having a ventilation system in new buildings or insulated windows in old buildings, respectively.

In Europe, governments are eager to achieve environmental objectives stemming from the Kyoto protocol and their energy policies/action plans/legislation are already producing effects. Investors, property owners, and tenants show an increasing interest in building energy efficiency features. This means that changes are taking place not only in the way buildings are built/retrofitted, but also in the way that they are sold or leased. Following the EPBD requirements, most European governments have already introduced legislation that considers EPC being mandatory in every transaction starting with 2009. In this case, expert valuers are expected to take into consideration the description of the building also from the energy demand point of view.

Different terms are used all around the world to underline benefits of buildings with potential of energy saving. Terms like energy efficiency, green value or sustainability are the most commonly used. The impact of this building feature on the real estate market is not well established until now. Moreover, different studies may indicate different results depending on location, legislation of the country or just willingness of people to pay for it. The common idea is that buildings rated as being energy efficient have reduced operating costs, improved productivity, improved image, lower vacancy, less time spent for responding to complaints, increased comfort of occupants, reduced risks. On the other hand, high prices of housing services due to energy consumption tend to reduce homeownership rates (Hansen and Slak, 2008) and increase sale prices.

The problem to be solved remains how exactly do real estate valuation when including building energy efficiency information, as a good valuation means well supported differentiating criteria. The subject is complex and it becomes even more complicated when an European/international methodology is obviously needed, since even the concept about what a highly energy efficient building means is different in each country.

3. Building valuation methodology including energy efficiency input

One of the first studies on how to take into consideration the level of energy-efficiency into real-estate valuation was done in U.S in the project named „Energy Efficiency & Property Valuation” (Chao et al., 1999). The objective was how to do recognition of energy costs and energy performance in commercial property valuation. The results support the idea that green value of commercial properties is expressed as a function of reduced net operating income.

The Center for Research in the Built Environment at Cardiff led a project which produced practice guides designed to enable landlords and tenants of commercial buildings to incorporate a sustainable method, through the commercial lease agreement, to meet requirements of environmental legislation (Hinnels, 2008). The Royal Institution of Chartered Surveyors published in 2007 a large list of recommendations on how to achieve efficient use of energy in buildings.

Previous works on finding a solution about the impact of energy policies on valuation procedures indicates that new methodologies which accept energy efficiency level as a feature of buildings rely on calculation of the modified operation costs. Although this may or may not reflect willingness to pay more for a better energy performance, the procedure is allowed in valuation methodologies as substitute for information on market preferences and may be used until more market data is available.

The methodology proposed here for the implementation of data from European Energy Performance Certificates into real estate sales comparison valuation approach considers the current building standards for saving energy a feature to be taken into consideration in the valuation process. The methodology considers the expected costs of wasted/saved energy (*WSE*) as a proxy for depreciations/appreciations of the value of the building due to the obsolete/performing energy efficiency. *WSE* is the difference between the energy demand of the real building and the energy demand of a reference building. The reference building is a fictive construction which corresponds to the building in question regarding geometry, orientation, and terms of use, but all the building envelope elements and installations correspond to the current legal standards regarding energy features. Such two label EPC are encountered for example in England & Walles and Romania (Fig. 1). The advantage of such an approach is that one can split information into two categories: how much energy is being used and how much energy would be used if the building was new.

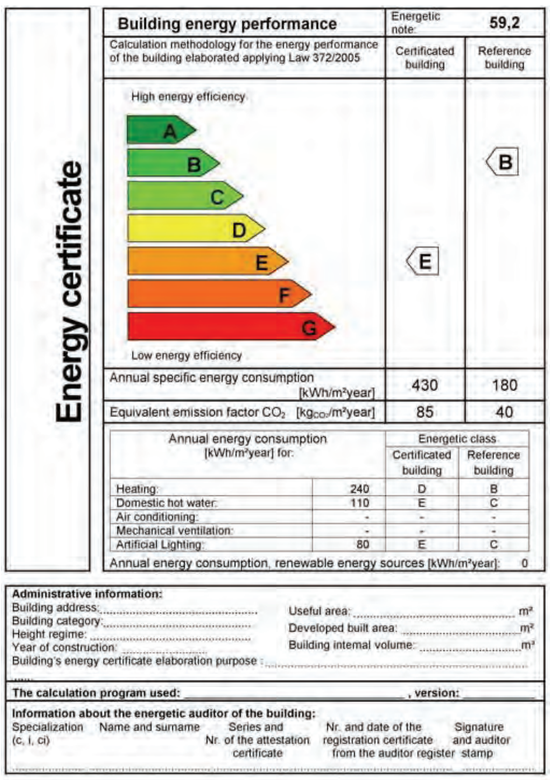

Fig. 1. Romanian EPC

If the EPC presents only one rating level (Fig. 2), useful scale references values for different types of buildings which are presented in the EPC may be used in appraisal work as reference values (Fig. 3). Necessary data to be taken into consideration as reference can also be found in different studies on energy demands of new/existing dwellings and non residential buildings (Jank, 2008; Kaan, 2006), as well as from other sources such as publications from the site of EDBD Buildings Platform regarding country reports (Wouters, 2008).

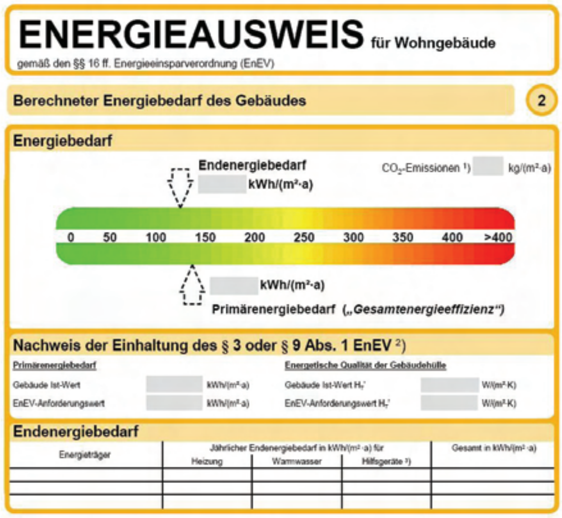

Fig. 2. Part of an EPC from Germany.

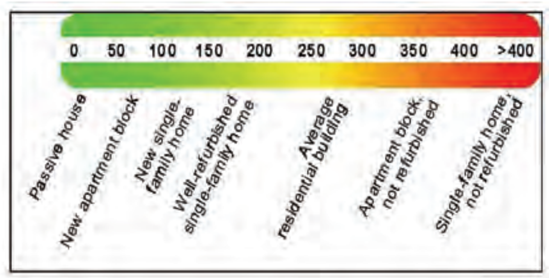

Fig. 3. Scale of reference values for residential buildings (heating and hot water) from Germany.

The value of the building calculated by the sales comparison approach is derived by comparing the property being appraised to other properties, then applying appropriate units of comparison, and finally making adjustments to the sale prices of the comparables based on the elements of comparison. The proposed methodology considers the *WSE* being element of comparison between buildings.

The energy efficiency level of buildings is strongly correlated to their age. Every country has well established valuation methodologies for taking into consideration the age of the building.

The problem is how to make comparison between properties having same age and different levels of energy efficiency. By the proposed methodology, information extracted from the EPC regarding values of *WSE* is used in appraisal of real-estate.

The wasted/saved energy of a building is

$$WSE = E_{ref} - E_B \tag{1}$$

where:

E_{ref} - annual specific heating energy demand of the reference building [kWh/m^2];

E_B - annual specific heating energy demand of the real building [kWh/m^2].

If *WSE* is positive, the building is highly energy efficient, better than the reference building. If *WSE* is negative, energy is wasted when opposed to the current legal standards. The sales comparison approach needs at least three comparable buildings for calculations of the market value of the subject property. The difference between *WSE* of a comparable building and the subject property, denoted ΔWSE points out the energy efficiency of the subject property

$$\Delta WSE = WSE_{comp} - WSE_{subject}\,. \tag{2}$$

If the comparable building has same values of *WSE* as the subject property, ΔWSE=0 and depreciations due to the new factor are null. If ΔWSE>0, the corresponding comparable property has a higher energy efficiency than the subject property while if ΔWSE<0, the comparable has a lower energy efficiency. An example is presented in section 4 dedicated to a case study.

In the sales approach comparison, the net present value of depreciations/appreciations is calculated

$$D_C = \Delta WSE \cdot C_E \left[\sum_{t=1}^{N} \left(\frac{1+f}{1+i} \right)^t \right] \tag{3}$$

where:

C_E - present energy cost [EUR/kWh];

N - study time interval [years];

f - yearly inflation rate of the cost of energy;

I - yearly inflation rate of the currency [EUR].

As it may be observed in Table 2, there is a premium for the value of the subject property if its energy efficiency is higher than comparable and a discount if the energy efficiency is poorer. The method is supposed to lead to best results if the subject property and the comparable buildings are built on same standards. The construction standards did not change very often, so it should not be a problem to find out such buildings.

4. Case study

During a valuation process, adjustments of value are according to corrections between the subject property and similar properties. An example regarding how expected *WSE* is calculated using the proposed methodology is presented in Table 1.

The subject building is a block of flats, built in 1992 which suffered only current maintenance since then. Walls are made of bricks with reinforced-concrete frame. There is no thermal insulation and the windows are double glazing with p.v.c. frame.

Table 1. Expected *WSE* is calculated using the proposed methodology

	Subject property	A	B	C
E_{ref}	80	75	80	85
E_B	260	105	230	285
WSE	-180	-30	-150	-200
ΔWSE		+150	+30	-20

The apartment denoted as comparable A is situated inside a building which suffered thermal rehabilitation of the building's envelope (external walls, roof, floor over basement, windows, external doors).

The level of energy efficiency for the reference building was not reached, because heating installations were not changed and the general maintenance is poor. The cost of the rehabilitation was 11500 EUR.

The comparable B has not insulated walls, but the windows are triple glazing and an individual performing heating system was installed. For the replacement of old wood windows with modern solutions 1200 EUR were spent. The cost of the new heating system including installations is 1500 EUR.

The apartment from building C did not suffer any improvement since it was built. There is no insulation on the walls, windows are double glazing with wood frame and the radiators are the old.

Table 2. Market value calculated by direct comparison approach

Comparison elements	***Subject property***	***Comparable assets***		
		A	***B***	***C***
Price (EUR)		*105000*	*110000*	*112000*
Used surface (mp)	77.63	77	80	78
Correction		+859	-3259	-531
Adjusted price		*105859*	*106741*	*111469*
Property rights	Integral	Integral	Integral	integral
Correction	0	0	0	0
Adjusted price		*105859*	*106741*	*111469*
Conditions of financial	Market	Market	Market	Market
Correction		0	0	0
Adjusted price		*105859*	*106741*	*111469*
Market conditions	04. 2009	03. 2009	03. 2009	03. 2009
Correction		0	0	0
Adjusted price)		*105859*	*106741*	*111469*
Age	1992	1987	1988	1995
Correction		+5610	+4569	-3511
Adjusted price		*111469*	*111310*	*107958*
Floor/ height conditions	2/10	3/8	6/7	4/7
Correction		+2117	+7472	+5573
Adjusted price		*113586*	*118782*	*113531*
Location	same	same	same	same
Correction		0	0	0
Adjusted price		*113586*	*118782*	*113531*
Improvements				
Special sandstone+ tile	No	Yes	No	Yes
Correction		-500	0	-500
Adjusted price		*113086*	*118782*	*113031*
Special front door	No	yes	yes	yes
Correction		-200	-200	-200
Adjusted price		*112886*	*118582*	*112831*
Wood floor: natural wood	yes	no	yes	no
Correction		+300	0	+300
Adjusted price		*113186*	*118582*	*113131*
E_{ref}/E_B	80/260	75/105	80/230	85/285
WSE		+150	+30	-20
Correction		-11102	-1894	+1231
Adjusted price		*102084*	*116688*	*114362*
Total net correction		-2916	+6688	+2362
Total net correction (% sale price)		2.77	6.08	2.64
Total gross correction		20688	17394	11846
Total gross correction (% sale price)		19.7	15.81	10.57
Number of corrections		7	5	7
Selected compared value	**114362 EUR**			
Because is the price of the offer a correction of 3% is added for the transaction				
EUR x 0.97	**110931 EUR**			

Part of a Romanian appraisal report with the proposed methodology implemented is presented in Table 2. Cost of thermal energy is 0.107 EUR/kWh, period 6 years, inflation rate of the tariff of energy f = 0.07, inflation rate of the Euro currency i = 0.01.

As it may be noticed valuation of wasted/saved energy is pretty close to valuation of improvements for better energy efficiency.

This is very important because there will not be willingness to pay more on investments if there are no chances for paying back the extra-investment for lower operating costs.

5. Conclusions and perspectives

The paper presents and develops a methodology for implementation of data from European Energy Performance Certificates into real estate appraisal. The main idea is to include expected costs of wasted/saved energy as a distinct input factor in the real property assessment procedure.

The proposed methodology is very simple and in accordance with usual property assessment procedures. The data needed to apply it are the energy demand of the real building, the energy demand of the reference building, the price of energy, the inflation rate of the currency and the inflation rate of the price of energy. The method is highly recommended for countries with two label EPC. It may be extended for countries that have EPC with only one label.

Real effects of the impact of EPC implementation can be studied only after a wide range of buildings will be energy certified. The market is the only one to indicate the willingness to pay for high energy efficient buildings. Our intention is to continue this work by using further data for statistical studies using tools such as regression analysis and Artificial Neural Networks in order to find the coefficients that reveal the influence of the energy performance as input factor on the market value as output factor.

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