Sustainable Cities and Society 18 (2015) 66–73

Contents lists available at ScienceDirect

Sustainable Cities and Society

journal homepage: www.elsevier.com/locate/scs

Assessment of financial potential of real estate energy efficiency investments–A discounted cash flow approach

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ARTICLE INFO

Article history:
Received 26 January 2015
Received in revised form 28 May 2015
Accepted 1 June 2015
Available online 8 June 2015

Keywords:
Energy audit
Energy efficiency
Property values
Offices
Discounted cash flow

ABSTRACT

Energy conservation in the real estate sector is claimed to possess significant possibilities for viable climate mitigation actions. Adopting the property investor's perspective, this paper focuses on financial performance of energy audit investments of existing office buildings. The study uses four property investment methods for assessing the financial performance of these investments. First, the paper adopts the traditional approach for assessing the profitability of an energy conservation investment: payback period, internal rates of returns and returns on investments of energy efficiency investments. Secondly, the scope is moved from energy investment to the property level and discounted cash flow (DCF) method is used to analyze the influence of the investments on the actual property value, something that has not been studied enough.

The results reveal genuine financial advantages of energy efficiency investments at the building portfolio level, highlighting positive impacts on the property values of *ca.* 2.5 percent on average. Yet, the benefits of energy efficiency investments are currently not easily reached nor realized by investors. This is at least partly due to the mechanisms of distributing the potential returns of the investments between stakeholders, the lack of qualified service providers and poor understanding of overall value of energy conservation investments.

1. Introduction

On global scale, buildings consume roughly one third of the total energy usage (Huovila, Ala-Juusela, Melchert, & Pouffary, 2007). According to McKinsey and Company (2009), building and real estate sector provide the most feasible opportunities for climate change mitigation. This has sparked political action, for example in the European Union, to set climate change mitigation targets for 2020 and 2050 with specific goals for built environment (European Commision Climate, 2013). Increasing energy prices combined with the increased environmental awareness with political support have led to a situation where energy efficiency actions of the built environment are gaining more interest. Moreover, responsible property investment (Pivo & McNamara, 2005; Rapson, Shiers, Roberts, & Keeping, 2007; Sayce, Ellison, & Parnell, 2008) has gained popularity.

Further, the energy efficiency improvements are promoted as one of the most cost-effective ways to achieve improved energy security, increase industrial profitability, and guarantee greater competitiveness (Hansen et al., 2009). Whilst certain body of energy efficiency actions is directed towards the construction of new buildings, it is the *existing* building stock that holds the largest potential for improvements since the building stock renews only by *ca.* 1–2 percent per annum (OSF, 2013). In addition, the new buildings stock is built to meet modern energy efficiency requirements already in the first place. All this calls for closer examination of financial performance of property energy efficiency investments.

However, while the large theoretical contribution of the energy efficiency improvements is widely recognized and accepted, a large portion of potential conservation measures are not done in practice: depending on the sector, only some 50–60 percent of the identified measures are currently conducted (Motiva, 2014a). From property investor's perspective the focus is often set on developing, maintaining and improving the rental income, not on the cost minimization actions and even less so on the energy costs as their share is only some 5–15 percent of the rental income. Furthermore, the energy conservation service providers approach the matter from a technological project perspective: energy auditors, energy efficiency investors and operators (as well as tenants) usually

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http://dx.doi.org/10.1016/j.scs.2015.06.002
2210-6707/

address the payback periods and returns of the energy efficiency investments solely, whereas property investors and appraisers should consider the energy savings' impacts at the overall property level. Hence, understanding the logic of the different stakeholders, the different levels of financial analysis and added value creation (Morrissey, Dunphy, & MacSweeney, 2014) is a prerequisite for understanding the financial performance and attractiveness of energy conservation investments in building sector.

The purpose of this paper is to analyze and understand the embedded economic gains that energy efficiency improvements of existing office buildings can provide for the property investor. This is done by expanding the traditional approach for energy efficiency investments to the property investors' perspective. The research focuses on the gains of the estimated energy efficiency improvement actions on the overall values of the properties and thus sets out the potential for decreasing properties' energy consumption. The energy efficiency improvement potential is based on actions identified in energy audit processes. The result of the study suggests positive economic gains for property owners through systematic energy conservation investments.

2. Theory

From the property investor's point-of-view, property is considered as an entity and the focus is set on the total property value, including (in addition to the expenses) the rental income cash flows and the capitalized value including the residual value. Depending on the investment strategy, the time span of investor can also differ from the time span of the energy efficiency improvement investments. Further, most property investors are required to report their property values on constant basis (e.g., quarterly or annually) following the principals set out in International Accounting Standards (IAS), International Financial Reporting Standards (IFRS) and international property valuation standards (IVS). Hence, such methods of financial analysis that capture the property value component should be employed when taking the investors' perspective to the gains of energy efficiency investments. This paper is among the first ones to assess the financial impacts of these investments by applying the Discounted Cash Flow (DCF) analysis appraisal approach, which is recognized in the Real Estate and Construction sector as the most popular commercial property investment valuation method both in the literature and in practice (KTI & IPD, 2012; Shapiro, Mackmin, & Sams, 2013). In addition to the DCF analysis, the traditional energy investment indicators of Payback periods, Internal Rate of Returns and Returns on Investments are calculated for the energy efficiency investments.

Previous research on the linkage of existing office buildings' energy efficiency and economic gains is twofold: a large portion of the literature on energy efficiency investments' financial impacts has applied traditional investment analysis, concentrating mainly on the Internal rate of return (IRR), Net Present Value (NPV) and Payback period (Martinaitis, Kazakevičius, & Vitkauskas, 2007; Jackson, 2010) methods of the energy efficiency investments alone. Another stream of research has concentrated on the financial impacts of building environmental certification (LEED and BREEAM for instance) (Chegut, Eichholtz, & Kok, 2014; Vimpari & Junnila, 2014). Further, some of the energy efficiency studies which have incorporated the property value aspect employ the use of sales comparison method or hedonic price models (Eichholtz, Kok, & Quigley, 2010; Nappi-Choulet & Décamps, 2013).

These approaches do not typically, however, focus on the impacts on the overall property value that the energy efficiency *improvement* investments could result in through the decreased operating expenses. Hitherto, the evidence of financial value gains of existing buildings' energy efficiency investments is to our knowledge still rather limited. A piece of research conducted by Popescu et al. is among the rare ones to consider in this context the property value impacts as well. (Popescu, Bienert, Schützenhofer, & Boazu, 2012). It does, however, concentrate on residential properties and uses sales comparison method (which is typically used in valuation of residential properties). Hence, it concentrates on a different property type and does not apply the discounted cash flow valuation method, which is commonly used in the valuation of office properties.

The European Union directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 (European Union, 2006) defines energy audit as: "'energy audit': a systematic procedure to obtain adequate knowledge of the existing energy consumption profile of a building or group of buildings, of an industrial operation and/or installation or of a private or public service, identify and quantify cost effective energy savings opportunities, and report the findings". The Energy Audit Programme (EAP) in Finland was launched in 1992 (Khan, 2006). Saving potentials for energy and water and saving measures are identified in the energy audit and companies and organizations can then decide whether to carry out the activities or not. There are also procedures developed for integrating the energy auditing with the sustainability protocols, such as LEED protocols (Dall'O', Speccher, & Bruni, 2012).

According to Motiva Ltd. (a Finnish governmental company experienced in promoting efficient and sustainable use of energy and materials), in the energy audits of office buildings in 2007–2012 an average of 12 percent energy savings potential has been identified (Motiva, 2014b). It is estimated that within the service sector some two thirds of this potential is realized (Motiva, 2014b; Motiva, 2014c). Regarding this so-called investment inefficiency, there appears to be a certain energy efficiency gap, which is discussed *inter alia* by Allcott and Greenstone (2012). At first glance, property investors appear to perform somewhat irrationally as in many instances financially sound investment potential of energy efficiency is not realized into actions. However, the matter is not as straight forward for various reasons. Firstly, one of the underlying theoretical base behind this inefficiency is the landlord-tenant agency problem (an application of the principal-agent problem) (Allcott & Greenstone, 2012): while the potential gains in property values benefit the property investor who pays the utilities, it is the actions of the tenant(s) influence at least some of the utilization levels of HVAC or lighting systems, for instance. Secondly, in some instances the property investor might not conduct the investments due to low vacancy levels and poor leasing prospects of the building: if there is no positive net cash flow expected there is hardly any reason to invest in energy efficiency but instead merely decrease the energy usage while demolishing or redevelopment awaits the building. These aspects explain at least partly why the suggested investments are not always realized into actions.

3. Study design

3.1. Study scope

This study focuses on energy conservation by concentrating on the potential of energy efficiency investments in existing office building premises in Finland. In this paper, the definition of energy efficiency by International Energy Agency is adopted: "a way of managing and restraining the growth in energy consumption. Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input." (International Energy Agency, 2015). Further, energy efficiency investment in this paper is the initial investment cost of the measures that reduce energy related costs to the investor over