Multiple Impacts Calculation Tool

Empirical basis of Economic Impacts on the Asset Value of Commercial Buildings

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Executive Summary

The change in the asset value of commercial buildings due to energy efficiency measures implementation describes the influence of this particular factor on the total value of the building. The quantification is done using the MB:EE formula, where the only input data is the capitalised avoided energy cost:

$$\Delta AV = \frac{\sum_i ES_i \times P_i}{cr}$$

In this equation ES_i are the annual energy savings of one of the energy carriers i (electricity and gas), the price p (for each of the carriers) and the capitalisation rate cr (in this case 0.06). The capitalisation rate indicates the rate of return on a real estate investment.

Although the indicator is relevant for the implementation of energy efficiency measures in the commercial sector, the choice of a relevant calculation method is rather complex. The simplified formula used represents the currently best possible methodology, whereas there are many others described in the methodological challenge section. All of them in nature lack the complexity needed or expected, mainly with view to the multiple influences of different factors on the total asset value change. The conclusion is that the chosen method is rather conservative, as it uses only one benefit derived from energy savings.

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Scope of MI indicator

Definition

This indicator serves to describe the impact of energy efficiency measures on the value of commercial buildings. It includes benefits for the investor from the perspective of total value on the retail market, in its most simplified form.

Relevance of EU, national and/or local level

Buildings are responsible for around 40% of energy consumption in the European Union and 36% of related emissions, thus being the single largest energy consumer. In addition, most buildings in the EU (75%) are energy inefficient and the rate of renovation is rather slow (1% a year) (European Commission, 2023).

In the EU, around 25% of the floor area of buildings is non-residential, representing a significant share contributing to the high energy consumption of the building sector (European Commission, 2013). (Zancanella, Bertoldi, & Boza-Kiss, 2018) conclude from their research that for business and commercial buildings around 10% or even 20% of the sales price depends on the energy efficiency label and status. Energy efficiency measures change many aspects of the buildings and influence multiple impacts, affecting their price, like operational costs or health benefits. However, as opposed to the EU and national level, it is a much bigger challenge to have precise energy savings data from the commercial sector buildings on the local level.

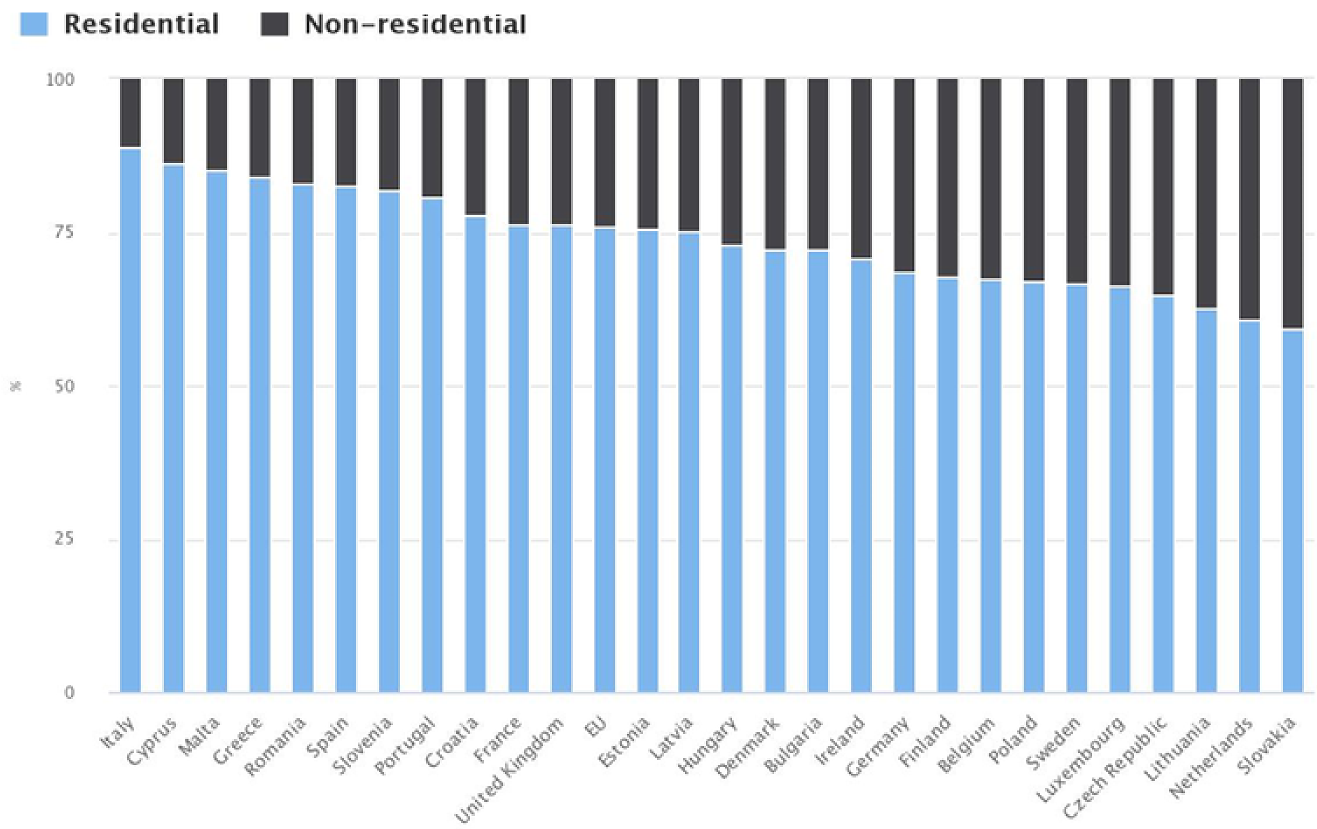

Figure 1: Breakdown of building floor area in Europe (European Comission, 2013)

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Impact pathway figure

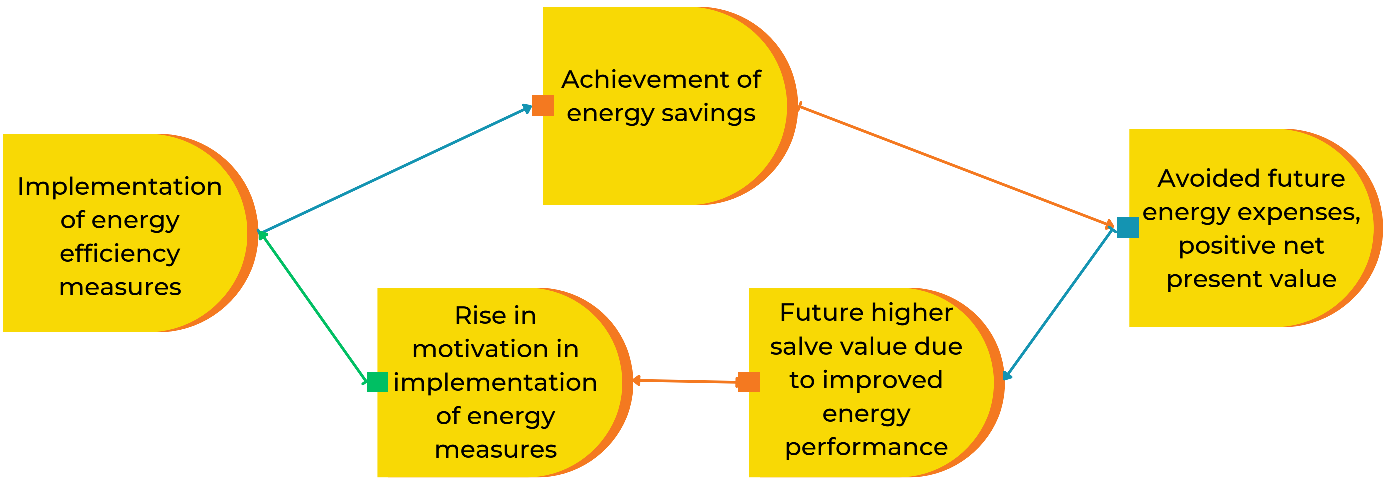

Figure 2: Impact pathway of the asset value change on the system/ portfolio level

Overlaps with other MI Indicators and potential risk of double-counting

Since this is a simplified calculation, that is accounting only the capitalization of the avoided future energy expenses, there is no risk of overlaps.

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Quantification method

Description

A review done by the JRC (Zancanella, Bertoldi, & Boza-Kiss, 2018) includes multiple methodologies that could be used for the evaluation of the asset value post energy efficiency project implementation. First of all, they start from the definition of value, which could include market or transaction value of the asset (building). Market value would be the one expected and transaction value the one actually achieved. The methodologies for valuation can be categorized by approaches. JRC uses the study of the opportunities of future higher sales calculation in the economic calculator developed by Popescu et al. (Popescu, Bienert, Schützenhofer, & Boazu, 2012) and three other resources to define possible methods: the hedonic pricing model, the method based on the direct comparison between transaction prices and the method based on the willingness to pay back investments. The hedonic pricing approach could be possibly applied for local level evaluations. However, it is the most complex and the most data intensive methodology. For the second method, we would need data on the modelled transactions to put the prices and the energy savings in relation to each other, which could be possible also on a smaller scale, where there are data available on location, age etc.. In light of the high input requirements of these two methodologies, the most suitable approach within MICAT are methods to calculate the net present values either of energy savings or of energy investments. Since the input data for the MICAT tool are savings, the calculation formula presented is:

$$NPV = \sum_{J=1}^{J}((ES)_J \times (CE)_J \times \sum_{n=0}^{tR}(\frac{1}{1+1})^n$$

ES – annual energy savings
J – type of energy
i – discount rate
tR – lifetime of the retrofitting measure

Reuter et al. (2020) in their paper use an even more simplified methodology with the same presumption of value change. Using average costs of energy for building needs (primarily heating and cooling), they assess the additional average net income due to avoided energy costs, with a capitalization rate of 8%.

$$\Delta AV = \frac{\sum_i ES_i \times P_i}{cr}$$

Where data on lifetimes is available, we will use the previous methodology, whereas otherwise the one developed by Reuter et al. (2020) for the MB:EE calculator will be the default option.

Methodological challenges

The description above and the literature review highlight that the method is not taking into consideration many aspects of value asset gain and is thus not as precise. The problem is that multiple characteristics of a building influence its final worth. This includes age, location, use, but mostly general macroeconomic changes on which the real estate market is highly dependent. (Brocklehurst, 2017) did a literature review of the transactional changes in prices of buildings in cases where energy efficiency measures were either implemented or not. The results are shown in Table 17 and they are referenced in the original paper. It is obvious from the results in the table that the influences of the energy savings are rather diverse, even in a building market in the same country.

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Country	Results description
	1 % to 11 % for one category (e.g. C to D) or equivalent improvement.
	"the only significant contribution on prices is exhibited, by moving from high levels, (BC) to low levels (FG)".
	"Average variation in unit price is 3.6 % related to the increase of one step in energy rating, but it is possible to observe a greater influence among the lowest energy classes. Dwelling with a C label have a premium price of 17.4 % with respect of those with a G label, whereas between class A dwellings and those in class C, the premium prices is 4.5 %."
	If the energy requirement of a dwelling is reduced by half, the market price of the dwelling increases by around 11 % for an average dwelling in the Dutch housing market.
	There is higher price for higher category, from 15 % B to 1 % E.
	For each 1 % increase in EE the price increases 0.04 %.
	A 10 % increase in consumption will increase the price by about 0.7 %.
	An estimated 0.1 % increase in selling price has been identified for every 1 % fall in energy use per floor area.

Table 1: Summaries of results of other studies (Brocklehurst, 2017)

The other issue is a lack of precise per country cap rate data.

Data requirements

In order to evaluate the impact of energy efficiency improvement actions on the asset value, only the national IO tables (EUROSTAT) and the past energy savings (Odyssee-Mure) are necessary.

In the equation ESi, the annual energy savings of one of the energy carriers is i (electricity and gas), the price p and the capitalisation rate cr (in this case 0.06).

Reuter et al. use the cap rate in 2020 of 8%, however the newest data from commercial real estate trends and outlook (Yun, 2022) shows a decline towards 6% in 2022.

Cap Rate Outlook in 2022

	2022 Q1 / 1	2022 Forecast / 2
Apartment	4.4%	4.5%
Industrial	5.3%	5.7%
Office	6.1%	6.3%
Retail	6.1%	6.3%

/1 Source: Real Capital Analytics
/2 NAR

Figure 3: Cap rate outlook, NAR (Yun, 2022)

More data on the national level cr is available in the paper (Pat McAllister, 2016) discussing capitalisation rates in different EU cities, including some of those in the targeted countries:

- Barcelona **5.6**
- Berlin **5.24**
- Dusseldorf **5.33**
- Frankfurt **5.3**
- Milan **5.81**
- Munich **4.85**
- Warsaw **7.73**

The formula is used on a national level, where the EU level would represent an aggregation of all the included Member States, as there are no overlaps or cross-country gains.

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Impact factor/functional relationship

The quantification is done using the MB:EE formula, where the only input data is the capitalised avoided energy cost:

$$\Delta AV = \frac{\sum_i ES_i \times P_i}{cr}$$

In this equation ESi are the annual energy savings of one of the energy carriers i (electricity and gas), the price p (for each of the carriers) and the capitalisation rate cr (in this case 0.06). The capitalisation rate indicates the rate of return on a real estate investment.

Monetisation

The economic indicator is measured in kEUR. Therefore, no additional calculations are required to monetise this indicator.

Aggregation

This indicator indicates the change in asset value. This is merely relevant in case of a transaction, forfeiting the potential energy savings in return for a higher sale price. Thus, counting both in a cost-benefit analysis would result in double counting. Merely the positive effects on mortgage conditions could be interesting.

Conclusion

The change in the asset value of commercial buildings due to energy efficiency measures implementation describes the influence of this factor on the total value of the building. The calculation of the total influence is too complex for this modelling exercise due to a lack of available data. Therefore, we use an updated conservative and simplified indicator as applied in the MB:EE project.

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