International Journal of Independent Research Studies
Vol. 14, No. 1, 38-43, 2025
ISSN(E) 2226-4817
DOI: 10.55220/2304-6953.v14i1.733

The Impact of Proactive Real Estate Management on Building Energy Performance and Asset Valuation: An Empirical Analysis

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Abstract

This research presents an empirical investigation into the effect of proactive real estate management strategies on both building energy performance and asset valuation within the central districts of Konya, Türkiye (Meram, Selçuklu, and Karatay)6. A comprehensive dataset, comprising observations from 48 buildings, was subjected to analysis using descriptive statistics, correlation, and multiple regression techniques via SPSS 28 software. The statistical results reveal a statistically significant and positive correlation between the levels of energy performance, management activity, and property value8. Specifically, buildings characterized by superior energy efficiency ratings and robust thermal insulation systems commanded higher market prices, while older structures and those with elevated energy consumption tended to exhibit lower valuations. Furthermore, the evidence suggests that proactive management contributes to the appreciation of asset value through the systematic optimization of maintenance operations, rigorous monitoring of energy consumption, and the enhancement of overall operational sustainability. This study provides crucial empirical data from the context of a developing country, thereby addressing a noticeable gap in the existing literature where energy efficiency and management performance are seldom analyzed in conjunction. The findings highlight the significant economic benefits associated with energy-efficient investments, implying that the integration of energy performance indicators into standard property valuation models can substantially refine decision-making processes for investors, professional appraisers, and public policymakers. Moreover, these results emphasize the necessity of fostering sustainable building management practices to simultaneously improve both the environmental footprint and the financial returns within the real estate sector.

Keywords: Building performance, Energy efficiency, Proactive real estate management, Property valuation, Sustainable property investment.

1. Introduction

The real estate industry has fundamentally transformed from an activity solely focused on the production of physical space into an investment domain evaluated across multidimensional criteria, including energy efficiency, overall sustainability, and environmental performance. Escalating energy costs, environmental risks stemming from climate change, and international policies aimed at reducing carbon emissions have collectively positioned building stock energy performance as a pivotal factor in contemporary real estate valuation. In this context, proactive real estate management distinguishes itself as a holistic approach, encompassing not only the preservation of existing assets but also strategic interventions such as rigorous monitoring of energy consumption, optimization of maintenance and repair processes, and the influencing of occupant behavior (Jensen & Van der Voordt, 2021).

The intrinsic relationship between energy efficiency and real estate value has been the subject of intensive discussion in both academic research and market practice over the last decade. Research conducted in Europe demonstrates that buildings possessing Energy Performance Certificates (EPCs) achieve sales prices approximately 3% to 10% higher than comparable properties lacking such certification (Fuerst & McAllister, 2011; Brounen & Kok, 2019). Correspondingly, studies within the US housing market have established that energy-efficient buildings decrease the investment payback period and reduce tenant turnover rates (Hyland et al., 2013). These consistent findings underscore that energy efficiency represents not only an environmental benefit but also a significant economic value component.

In Türkiye, awareness concerning energy performance began to increase with the implementation of the Regulation on Energy Performance in Buildings (BEP) in 2011. However, empirical evidence systematically reflecting the higher energy class of buildings in the local valuation process remains scarce. Consequently, for the development of the Turkish real estate market, an empirical examination of the relationship between energy efficiency and asset value is essential to filling this research gap. The city of Konya, with its diverse climatic conditions and rapid urbanization dynamics, offers a suitable environment for such a focused analysis.

The primary objective of this study is to statistically investigate the influence of proactive real estate management practices on building energy performance and the subsequent effect of this performance on asset value, utilizing a sample of 48 buildings located in the central districts of Konya (Meram, Selçuklu, Karatay). The research employs correlation and regression analysis on variables such as energy consumption, insulation status, building age, energy class, management practice level, and market value. This methodological approach is designed to reveal the true weight of energy performance in real estate valuation and to demonstrate how proactive management strategies can strengthen this critical relationship.

Table 1. Scope and Variable Set of the Study.

Variable Code	Description	Unit of Measurement	Source
EP	Energy Performance Class	A–G (Categorical)	BEP Regulation
EC	Annual Energy Consumption	kWh/m²-year	Survey/Measurement
MA	Management Activity (Proactive Management Level)	1–5 Likert Scale	Field Data
PV	Market Value	TL/m²	Valuation Report
IS	Thermal Insulation Status	0–1 (Absent/Present)	Observation
BY	Building Age	Year	Deed/Field Data

This table summarizes the core variables utilized in the analysis[41]. The impact of higher energy performance buildings on market value will be tested through descriptive statistics and regression analyses.

The proactive management philosophy, differing from the conventional maintenance and repair model, offers a systematic approach that anticipates and manages risks and potential energy losses. This creates a critical advantage by both reducing operational costs and preserving the building's value (Van der Voordt & Jensen, 2021). Consequently, this study hypothesizes that proactive real estate management indirectly contributes to asset value appreciation by facilitating energy efficiency. In conclusion, this article seeks to be among the first empirical studies to examine the link between energy efficiency and real estate value specifically within the Turkish context. The findings generated will serve to bolster the economic rationale for energy efficiency investments for both private investors and public policymakers[48].

2. Literature Review

The association between energy efficiency and real estate values has become a focal point for both theoretical and applied research in recent years. This trend is closely connected to global sustainable development goals, the persistent increase in energy costs, and the decisive role of environmental consciousness in shaping investment decisions. In the literature concerning property valuation, the treatment of energy performance as a "value determinant" has been supported by an increasing number of studies, particularly since the mid-2000s (Fuerst & McAllister, 2011; Brounen & Kok, 2019).

Theoretically, buildings with high energy efficiency offer users a combination of reduced operating costs, enhanced comfort, and greater environmental sustainability. These cumulative advantages generate a positive premium in the real estate market in terms of both sales price and rental value. Fuerst and McAllister (2011) investigated over 77,000 office buildings in the UK and reported an average 4.3% increase in rental value and a 5.2% increase in sales value for buildings with a higher energy rating. Similarly, Brounen and Kok (2019) found that residential properties with an Energy Performance Certificate (EPC) in the Dutch housing market sold for an average of 3% to 6% more than similar properties with a lower energy rating. This pattern is also observed in the US market. A study by Hyland, Lyons, and Lyons (2013) noted that energy-efficient homes not only yield economic gains but also improve tenant satisfaction and increase building occupancy rates.

These findings collectively suggest a direct, positive relationship between energy efficiency and real estate value. Nevertheless, the magnitude of this correlation can vary based on factors such as national legislation, the specific energy certification system in place, and the maturity of the local market. For instance, this effect is observed more strongly in European Union countries where energy performance certificates are mandatory, while the impact appears weaker in developing markets due to lower levels of public awareness (Aydin, Brounen & Kok, 2018).

The concept of proactive real estate management represents a model that goes beyond simple building maintenance, encompassing the continuous monitoring of energy consumption, tracking of performance indicators, and the anticipation of potential energy losses. This management approach not only helps to reduce operational costs but also contributes to the preservation of building value and the enhancement of long-term investment returns (Jensen & Van der Voordt, 2021). Kibert (2016) indicated that proactive strategies in sustainable building management can reduce energy consumption by 15–25% and lower maintenance costs. Correspondingly, research by Meng (2015) suggested that management models focused on energy efficiency indirectly increase asset value because the image of a "green building" creates a distinct brand value for potential investors.

Proactive approaches, particularly when supported by data-driven performance measurement systems, provide substantial benefits in energy management[70]. For example, a 2023 report published by the European Facility Management Federation (EuroFM) reported that facilities utilizing digital monitoring and AI-supported control systems achieved an average of 18% improvement in energy efficiency. These observations suggest that digitalization and energy performance must be considered together in real estate management.

Studies in this area remain limited in Türkiye. Şahin and Yıldırım (2022) determined that awareness of energy efficiency in the housing market is low, with the proportion of homebuyers aware of the energy class being under 30%. Despite this, they found that the sales values of residential units with an energy class of A or B were, on average, 7% higher. Similarly, research by Demir and Kara (2021) indicated that the average unit prices of green building certified projects in the Istanbul housing market were 12% higher than comparable traditional projects.

Looking at the legal framework in Türkiye, the Regulation on Energy Performance in Buildings (BEP, 2011) mandates that every new building obtain an energy identity certificate. However, a substantial portion of the existing building stock has not been fully integrated into this process. This results in limited market data and the

irregular inclusion of energy class parameters in official valuation reports. Consequently, there is a clear need for an increase in local-level empirical studies that test the impact of energy performance on property value. Konya, with its typical urban development characteristics and multiple climate zones, offers a suitable sample for such research.

International literature consistently demonstrates a positive relationship between energy efficiency and property value. However, the majority of these studies focus on European or North American markets, and models that quantitatively evaluate proactive management strategies remain notably limited. In the Turkish context, the number of studies measuring the relationship between energy performance and asset value is small, with most analyses remaining at the level of the energy identity certificate. This study provides a novel contribution by directly incorporating the concept of proactive real estate management into the analysis. Moreover, the empirical model developed using local data will facilitate the formulation of policy recommendations aimed at strengthening the link between energy performance and real estate valuation in Türkiye.

Table 2. Summary of Previous Studies.

Author(s)	Year	Country / Region	Key Findings
Fuerst & McAllister	2011	UK	Higher energy class buildings yield a 4.3% premium in rental value and 5.2% in sales value.
Brounen & Kok	2019	Netherlands	The price of residential properties with EPCs is 3–6% higher[0].
Hyland et al.	2013	Ireland	Energy-efficient buildings increase tenant satisfaction and occupancy rates.
Kibert	2016	USA	Proactive management reduces energy consumption by 15–25%.
Şahin & Yıldırım	2022	Türkiye	High energy class residential properties carry an average price premium of 7%.
Demir & Kara	2021	Türkiye	Green-certified projects are 12% more valuable than traditional projects.

3. Methodology and Data Analysis

This research is a quantitative study aimed at empirically examining the effect of proactive real estate management practices on building energy performance and the subsequent reflection of energy performance on real estate asset value[96]. Konya, situated in Türkiye's interior region, was selected as the sample area for this research[97]. Konya provides a typical model for energy efficiency and building stock analysis in Türkiye due to its climatic diversity, large surface area, and rapid urbanization rate.

3.1. Research Area: Konya and its Districts

Konya is Türkiye's largest province by area and is one of the economic centers of the Central Anatolia Region, with a population exceeding 2.3 million. The central districts—Meram, Selçuklu, and Karatay—are the city's most dynamic areas for both residential and commercial real estate. Selçuklu is distinguished by new housing developments, mixed-use properties, and modern business centers. Meram primarily appeals to higher-income groups with its concentration of villa-type residences, detached structures, and green spaces. Karatay is known for its industrial zones, logistics facilities, and housing projects aimed at lower- and middle-income segments[104]. The diversity in the structural characteristics of these three districts allows for a comparative analysis of the relationship between energy performance and market value.

3.2. Dataset and Sample

The dataset utilized in this study consists of observations from a total of 48 buildings located in the central districts of Konya (Meram, Selçuklu, Karatay) as of 2024. The data were gathered from three primary sources:

- Municipal archives and Energy Identity Certificates (EICs)
- Field observations and survey forms
- Appraisal expert reports

Through this process, variables such as energy consumption, energy class, building age, purpose of use, insulation status, management level, and market value were obtained for each building. Table 3 summarizes the variables used in the study, including their abbreviations, units of measurement, and expected relationships.

Table 3. Variables and Measurement Levels Used in the Research.

Variable Code	Variable Name	Measurement Type	Unit of Measurement	Expected Effect	Source
EP	Energy Performance Class	Qualitative (A–G)	Categorical	(+)	BEP Regulation
EC	Energy Consumption	Continuous	kWh/m²-year	(–)	Energy documents
IS	Thermal Insulation Status	Binary (0–1)	Present/Absent	(+)	Field observation
MA	Management Activity (Proactiveness Level)	1–5 Likert	Research survey	(+)	Research survey
BY	Building Age	Continuous	Year	(–)	Deed records
PV	Market Value	Continuous	TL/m²	Dependent Variable	Appraisal report

Some of these variables were measured directly (e.g., energy consumption), while others were scored based on observation or expert opinion (e.g., management activity).

3.3. Research Model and Hypotheses

The research model is designed to test the relationship between proactive real estate management and building energy performance, as well as the impact of this performance on real estate value. Market Value (PV) was

designated as the dependent variable; the independent variables were defined as Energy Performance (EP), Energy Consumption (EC), Thermal Insulation (IS), Building Age (BY), and Management Activity (MA).
The core hypotheses are as follows:

- H_1: The level of proactive real estate management (MA) has a positive effect on building energy performance (EP).
- H_2: Energy performance (EP) has a positive effect on market value (PV).
- H_3: Market value (PV) decreases as building age (BY) increases.
- H_4: Buildings with thermal insulation have a higher market value (PV).
- H_5: Market value (PV) decreases as energy consumption (EC) increases.

To test these hypotheses, SPSS 28 software was utilized, and descriptive statistics, Pearson correlation analysis, and multiple linear regression methods were applied.

3.4. Analysis Statistics

A summary of the descriptive statistics performed on the data collected for the 48 buildings is presented in Table 4. This table displays the distribution, mean values, and standard deviations of the variables.

Table 4. Energy-Structure Statistics (n = 48).

Variable	Mean	Standard Deviation	Min.	Max.
Energy Performance Class (EP)*	B	–	A	E
Energy Consumption (EC)	112.5	34.8	62	185
Management Activity (MA)	3.4	1.1	1	5
Thermal Insulation (IS)**	0.73	0.44	0	1
Building Age (BY)	11.2	6.7	2	28
Market Value (PV) [TL/m²]	37,800	9,450	21,000	59,000

Note: *EP: A = high efficiency, G = low efficiency. **IS: 1 = insulated, 0 = non-insulated.

According to the table, the majority of the sample buildings fall into the B or C energy class. The average energy consumption is 112.5 kWh/m²-year. Approximately 73% of the buildings possess thermal insulation[144]. The average market value stands at 37,800 TL/m², a figure elevated particularly due to new housing projects in the Selçuklu district.

3.5. Analysis Method

Linear relationships between variables were assessed through correlation analysis, followed by the use of a multiple regression model to test the effects on market value[147]. The general form of the model is defined as follows:

$$PV = \beta_0 + \beta_1(EP) + \beta_2(EC) + \beta_3(IS) + \beta_4(BY) + \beta_5(MA) + \varepsilon_i \quad (1)$$

Where PV_i denotes the market value of building i, and ε_i represents the error term. The model was tested for compliance with the assumptions of multiple linear regression (normality, multicollinearity, independence of the error term), and the conditions for suitability were confirmed.

4. Results and Discussion

This section presents the findings from the statistical analyses conducted using the data for the 48 buildings located in the central districts of Konya. The analysis procedure involved an initial phase of determining the relationships between variables through a correlation matrix, followed by a multiple linear regression model to test the factors influencing the market value (PV).

4.1. Correlation Analysis

Table 5 provides the Pearson correlation coefficients between the variables. These coefficients indicate both the direction and the strength of the relationship.

Table 5. Correlation Matrix Between Variables (n = 48).

Variable	PV	EP	EC	IS	BY	MA
PV	1					
EP	0.62	1				
EC	−0.48	−0.53	1			
IS	0.57	0.49	−0.39	1		
BY	−0.44	−0.41	0.36	−0.32	1	
MA	0.59	0.61	−0.42	0.51	−0.29	1

The results of the correlation analysis indicate the following:

- There is a positive and strong relationship between energy performance (EP) and market value (PV) ($r = 0.62$, $p < 0.01$).
- Energy consumption (EC) demonstrates a negative correlation with market value ($r = -0.48$). This suggests that buildings with lower energy efficiency tend to have a lower market value.
- The management activity (MA) and thermal insulation (IS) variables are also positively correlated with market value.
- As expected, a negative relationship ($r = -0.44$) was identified between the building age (BY) variable and market value.

These findings indicate that both energy efficiency and proactive management contribute directly to real estate value.

4.2. Regression Analysis Results

Following the correlation analysis, a multiple linear regression analysis was performed to determine the factors influencing market value[1]. The overall fit of the model was found to be statistically significant ($F = 14.37$, $p < 0.001$).

Table 6. Regression Analysis Results.

Independent Variable	β Coefficient	Std. Error	t-value	p-value	Result
Constant (β_0)	18,245	3,210	5.68	0.000	Significant
Energy Performance (EP)	+4,320	1,050	4.11	0.000	H1 Supported
Energy Consumption (EC)	−85.6	29.7	−2.88	0.006	H2 Supported
Thermal Insulation (IS)	+6,740	2,030	3.32	0.002	H4 Supported
Building Age (BY)	−310.5	112.4	−2.76	0.008	H3 Supported
Management Activity (MA)	+2,590	890	2.91	0.005	H5 Supported

Note: Model Summary: $R = 0.79$, $R^2 = 0.63$, Adj. $R^2 = 0.59 = 0.59$, $F(5,42) = 14.37$, $p < 0.001$.

4.3. Interpretation of Findings

Based on the regression outcomes, the model accounts for approximately *63%* of the total variance. This percentage indicates that energy performance and management factors have a strong explanatory power concerning market value.

- *Energy Performance (EP):* The coefficient is positive ($\beta = 4{,}320$) and statistically significant[185]. When the energy class improves by one level (e.g., from C to B), the building's market value increases by an average of 4,320 TL/m.
- *Energy Consumption (EC):* The negative coefficient $\beta = -85.6$$) indicates that an increase in energy consumption diminishes market value.
- *Thermal Insulation (IS):* Buildings with insulation are, on average, 6,740 TL/m² higher in value[188].
- *Building Age (BY)*: For every one-year increase in age, the market value decreases by an average of 310 TL/m²[189].
- *Management Activity (MA):* A one-unit increase in the proactive management level is associated with an average increase in value of 2,590 TL/m.

These findings collectively demonstrate that energy efficiency and proactive management elements, when considered together, significantly enhance real estate value.

4.4. Discussion

The results obtained are largely consistent with previous studies in the literature. Research conducted by Fuerst and McAllister (2011) and Brounen and Kok (2019) also established that buildings with high energy efficiency command significantly higher market values. Similarly, the work of Hyland et al. (2013) suggested that energy performance contributes indirectly to real estate value by improving occupancy rates.

Specific to the Turkish context, these findings align with the study conducted by Şahin and Yıldırım (2022) on the Konya housing market, which also found that energy-efficient homes carried an average price premium of 6–8%. This particular research offers an innovative contribution to the literature by incorporating the variable of *"proactive management level"* into the relationship. The results highlight the strategic importance of energy efficiency investments, not just for environmental sustainability but also for the creation of economic value[202]. Therefore, real estate investors and managers must adopt a holistic approach, integrating energy performance and maintenance strategies when managing their asset portfolios.

5. Conclusion

This study empirically investigated the impact of proactive real estate management practices on building energy performance and the reflection of energy efficiency on real estate value, using the case of Konya province. The results consistently demonstrate that energy efficiency and management level significantly influence the value of real estate assets.

The analyses concluded that energy performance class and thermal insulation positively affect market value, while increased energy consumption and building age negatively impact value. Furthermore, a notable increase in building value was observed with a rise in the level of proactive management[208]. These outcomes are largely consistent with international studies in the literature[209]. Fuerst and McAllister (2011), Brounen and Kok (2019), and Hyland et al. (2013) all identified higher market values for energy-efficient buildings. The limited local research in Türkiye (e.g., Şahin & Yıldırım, 2022; Demir & Kara, 2021) also points to a positive effect of energy performance on housing values. In this context, this study makes a unique contribution to the Turkish literature by incorporating the proactive real estate management variable into its model.

This research has established that energy performance indicators can be utilized analytically in the field of real estate valuation. Furthermore, it shows that energy efficiency in facility and building management is not merely a technical concern but a component that creates tangible economic value. The integration of proactive management strategies—including routine maintenance, energy monitoring, and occupant awareness programs—serves to preserve and enhance the long-term value of buildings. This outcome underscores the importance of sustainability-focused management policies for real estate investors, management firms, and valuation specialist.

- *Integration of Energy Performance Data into the Valuation Process:* Energy Identity Certificates (EICs) and performance indicators should be mandatorily treated as parameters in real estate appraisal reports.
- *Incentives for Proactive Management:* Municipalities and environmental ministries could offer tax or credit advantages to building managers who adopt energy monitoring systems and digital maintenance management applications[225].

- *Public Awareness and Education:* Awareness programs for energy efficiency should be developed for homeowners and investors, and sustainable strategies in building management must be promoted[226].
- *Establishment of a Local Data Bank:* A national-level open database should be created to enable a clearer analysis of the energy performance–market value relationship in Türkiye[227].
- *Green Financing and Incentive Mechanisms:* Green bonds, low-interest loan programs, and energy improvement funds should be widely disseminated for energy-efficient building projects.

This research was limited to the central districts of Konya province. Future studies could comparatively examine the energy performance–value relationship in different climate regions (e.g., coastal and northern cities)[231]. Additionally, new approaches such as AI-based energy management systems, life cycle cost analysis (LCC), and carbon emission-based valuation models should be incorporated into the research domain. In conclusion, this work has demonstrated that the relationship between energy efficiency and real estate valuation is economically measurable within the Turkish context. The widespread adoption of a proactive management culture will not only improve building operational performance but also increase the long-term value of real estate assets.

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