THE PLACE OF GREEN CERTIFIED BUILDINGS IN THE HOUSING MARKET: AN ASSESSMENT OF PRICE AND SUPPLY DYNAMICS

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ABSTRACT

THE PLACE OF GREEN CERTIFIED BUILDINGS IN THE HOUSING MARKET: AN ASSESSMENT OF PRICE AND SUPPLY DYNAMICS

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Climate change threatens the built environment by increasing the frequency and severity environmental disasters. At the same time, buildings contribute to the climate crisis, accounting for 37% of global energy consumption. This mutual interaction reveals the need for sustainable solutions in the housing sector. Therefore, green building certification systems stand out as a critical tool to reduce environmental impacts. However, the potential at the urban scale is shaped not only by environmental concerns but also by market conditions, production processes and user behavior.

This study analyzes the position of green certified housing in Türkiye’s housing market through the lens of price and supply dynamics. Within the scope of the research, certified and non-certified houses in Ankara, İstanbul and İzmir are compared in terms of sales- rental prices, as well as property advertisement density. Statistical indicators such as standard deviation and coefficient of variation are utilized to assess price stability and market uncertainty. The analysis aims to contribute to the affordability debate through indirect indicators.

The findings show that green-certified homes are concentrated in specific locations and projects. Internationally, such homes are often positioned in the luxury segment, whereas in Türkiye, a stable price level has not yet been established. While prices are high in some projects, in others they are similar to those of non-certified homes. The study concludes that the current price and supply structure remains insufficient to support an affordable and balanced housing stock aligned with sustainable urban development goals.

Keywords: Green Certified Housing, Housing Market, Pricing, Supply Structure, Housing Affordability

ÖZ

KONUT PİYASASINDA YEŞİL SERTİFİKALI BİNALARIN YERİ: FİYAT VE ARZ DİNAMİKLERİ ÜZERİNE BİR DEĞERLENDİRME

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İklim değişikliği, çevresel felaketlerin sıklığını ve şiddetini artırarak yapılı çevreyi tehdit etmektedir. Aynı zamanda, binalar da küresel enerji tüketiminin %37'sini oluşturarak iklim krizine katkıda bulunmaktadır. Bu karşılıklı etkileşim, konut sektöründe sürdürülebilir çözümlerin gerekliliğini ortaya koymaktadır. Bu nedenle, yeşil bina sertifikasyon sistemleri çevresel etkileri azaltmayı hedefleyen kritik bir araç olarak öne çıkmaktadır. Ancak kentsel ölçekte potansiyel sadece çevresel kaygılarla değil, aynı zamanda piyasa koşulları, üretim süreçleri ve kullanıcı davranışlarıyla da şekillenmektedir.

Bu çalışma, Türkiye'deki yeşil bina sertifikalı konutların konut piyasasındaki konumunu, fiyat ve arz dinamikleri açısından analiz etmektedir. Araştırma kapsamında, Ankara, İstanbul ve İzmir'deki sertifikalı ve sertifikasız konutlar, satış-kira fiyatları ve emlak ilan yoğunlukları bakımından karşılaştırılmıştır. Fiyat istikrarı ve piyasa belirsizliğini değerlendirmek için standart sapma ve varyasyon katsayısı gibi istatistiksel göstergeler kullanılmıştır. Analiz, erişilebilirlik tartışmasına dolaylı göstergeler aracılığıyla katkıda bulunmayı amaçlamaktadır.

Bulgular, yeşil sertifikalı konutların belirli konumlarda ve projelerde yoğunlaştığını göstermektedir. Uluslararası alanda bu konutlar genellikle lüks segmentte yer alırken, Türkiye'de henüz istikrarlı bir fiyat düzeyi oluşmamıştır. Bazı projelerde fiyatlar yüksek seyrederken, bazıları sertifikasız konutlarla benzer seviyededir. Çalışma, mevcut fiyat ve arz yapısının, sürdürülebilir kentsel gelişim hedeflerine uygun, uygun fiyatlı ve dengeli bir konut stokunu desteklemek için yetersiz olduğu sonucuna varmıştır.

Anahtar Kelimeler: Yeşil Sertifikalı Konutlar, Konut Piyasası, Fiyatlandırma, Arz Yapısı, Konut Erişilebilirliği

To the memory of my mom and dad,
whom I have always felt to be with me…

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LIST OF ABBREVIATIONS

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BEST	Ecological and Sustainable Design in Buildings: B.E.S.T. Residential and Commercial Certification
BRE	Building Research Establishment
BREEAM	Building Research Establishment Environmental Assessment Method
ÇEDBİK	Çevre Dostu Yeşil Binalar Derneği
GBRT	Green Building Rating Tools
LEED	Leadership in Energy and Environmental Design
ROI	Return on Investment
YeS-TR	Türkiye's National Green Building and Green Settlement Certification System
USGBC	United States Green Building Council
WGBC	World Green Building Council

CHAPTER 1

INTRODUCTION

“The green building movement will mean
significant progress in decoupling economic growth
from climate change, poverty and inequality.”
– *World Green Building Council*

The consequences of climate change are becoming increasingly apparent on the built environment, as evidenced by the rising frequency of environmental disasters and the increasing consumption of resources. Considering that approximately 37% of global energy consumption originates from buildings, the development of sustainable solutions in the building sector has become a priority in the fight against the climate crisis (Neo & Zhou, 2024). In this context, green building certification systems are considered as critical instruments in promoting not only energy and resource efficiency but also achieving sustainable urban development objectives.

However, the potential of these systems to go beyond their environmental benefits and engender transformation on an urban scale is largely shaped by their interaction with market dynamics, production processes and user behaviors. In particular, the economic and social dimensions such as pricing structures, supply density, affordability and location decisions of green certified buildings in the housing market have received insufficient attention in the extant literature. Even in developed countries, these issues remain at a secondary level, while in the Turkish context, the lack of information in this area is much more evident.

Therefore, in order to develop sustainable housing policies at the urban scale and to promote green building practices, it is of great importance to analyze the issue not only in terms of environmental aspects but also in terms of market-based indicators such as price levels, supply patterns, affordability and accessibility. In this context, the issue of affordability cannot be resolved simply by increasing the production of green housing. It is also crucial to consider which income groups the housing appeals to and to what extent it is accessible.

This study aims to fill this gap by analyzing dynamics such as price levels, supply intensity and market stability of green certified houses. Given that housing functions not only as a physical unit of shelter but also as a space where socio-economic inequalities are reflected (Ahn et al., 2014; Peverini et al., 2023), it is necessary to understand the effects of green building certification on market structure in order to endure the viability of sustainability policies.

Therefore, this initial chapter delineates the basic components that determine the conceptual framework and orientation of the study. The scope of the study, the problem area it addresses, its methodological approach and data sources are presented in a holistic structure in this chapter. Concurrently, it clarifies why the study focuses on green certified buildings, the place of this topic in the existing literature and which gaps the study aims to address.

1.1 Significance of the Subject

The environmental impacts of green building practices and their contributions to energy efficiency have been comprehensively documented on a global scale (Wen et al., 2020). However, analyses of the economic positioning of these structures in the housing market are limited (Bond and Devine, 2016). Particularly in developing countries, fundamental questions surrounding the market presence of green certified housing remain unanswered in the extant literature. Such questions include the price levels at which such housing is offered, the geographical distribution of its availability, and its accessibility to different demographic groups (MacAskill et al., 2021; Yeganeh et al., 2021). In Türkiye, empirical studies in this area remain quite limited.

This deficiency creates a significant gap in terms of evaluating the effectiveness of sustainable housing policies. The extant literature predominantly concentrates on the technical performance and environmental compliance of green buildings, while economic dynamics such as the valuation of these structures in the housing market, their investment attractiveness, price stability, supply trends and especially their affordability levels are not sufficiently addressed. Nevertheless, such indicators play a pivotal role in the implementation of sustainable urban development goals.

In this context, the present study undertakes a comparative analysis of green certified residential properties in Türkiye with projects that exhibit analogous physical characteristics but lack certification. The analyses are based on various market indicators, including sales prices, rental prices, maintenance fees, amortization periods and price stability. It is evident that the quantitative findings obtained from real estate listing data facilitate a comprehensive evaluation of green housing production. This evaluation encompasses the scale of production, the position of housing units within the market, their accessibility level and the investment potential. It is evident that sustainable housing production is addressed comprehensively in this study. This is evident in the fact that the issue is explored from multiple angles; not only is it approached from the perspective of supply, but also affordability and market balance are considered (Figure 1.1).

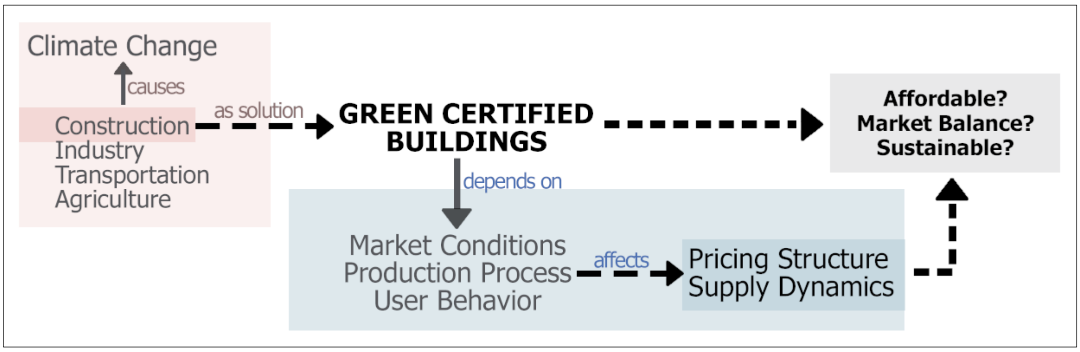

Figure 1.1 Understanding the Market Structure of Green Certified Buildings: Conditions, Pricing and Affordability (Produced by the Author)

For the purpose of this study, metropolitan cities such as Ankara, İstanbul and İzmir offer suitable sample sites for such an analysis, both as areas where green certified projects are implemented, albeit limited, and as cities that host the most dynamic examples of the housing market. The selection of the three major cities was made without any regional bias, based solely on the availability of data and the concentration of green-certified housing listings that could be analyzed in these cities. In this respect, the geographical scope of the study was shaped based on data availability and determined with representativeness in mind.

Research on green certified housing in Türkiye mostly focus on technical performance or environmental evaluation criteria and neglect economic dynamics such as the place of these buildings in the housing market, price stability, investment valuation, supply trends and affordability levels.

1.2 Aim of the Research and Research Questions

The main objective of this study is to analyze the place of green certified buildings in the housing market in Türkiye, with particular reference to price structures and supply dynamics. A comparative evaluation of certified and non-certified housing in Ankara, İstanbul and İzmir was conducted in order to ascertain whether green housing can offer a balanced and accessible alternative in the context of sustainable urban development. These cities were selected due to the relative availability of data;

in many other provinces, certified green housing projects are either absent or lack sufficient market information for comparative analysis.

In order to achieve this objective, the study goes beyond technical and environmental performance indicators and also analyzes the economic characteristics of green housing through market-based indicators such as sale and rental prices and advertisement density. In this context, indicators like price stability, market volatility and supply density are examined using basic statistical tools such as standard deviation and coefficient of variation. In doing so, the study evaluates the indirect effects of green building practices on affordability and contributes to filling the gaps in the literature within the Turkish context.

In this context, the primary research questions that the study seeks to address are as follows:

- How do the sales and rental prices of green certified buildings compare to those of non-certified buildings?
- To what extend is the price structure of green certified houses stable across different projects and locations?
- Does the existing price and supply structure support the development of an accessible, sustainable and balanced stock of green housing?

1.3 Methodology and Structure of the Thesis

In this thesis, a quantitative research approach is adopted to understand the reflections of green building certification systems on the housing market. The main objective of the study is to analyze the price structure, supply density and affordability levels of green certified housing. To this end, three major metropolises of Türkiye; Ankara, İstanbul and İzmir, have been selected as the study area and market data on certified and non-certified houses in these cities has been evaluated comparatively. These data are obtained from property advertisement platforms and include basic variables such as floor area (gross square meters), sales and rental prices, location and frequency of advertisements. The fact that the data directly reflect market dynamics provides an up-to-date and empirical basis for the research.

In the analyses conducted on the dataset, basic statistical indicators such as standard deviation and the coefficient of variation are utilized to assess price stability and uncertainty levels in the housing market. These measures are important for revealing the extent to which green certified housing is subject to price fluctuations, how concentrated the supply is and whether the market demonstrates a homogeneous or heterogeneous structure. Moreover, access to green housing depends not only on its physical availability but also on which income groups can afford the price levels. Therefore, the issue of affordability is examined through indirect indicators. Consequently, the study offers a multifaceted evaluation that incorporates technical, environmental, economic and social dimensions of sustainability.

The structure established in the thesis study is designed to ensure a systematic presentation of the study and at the same time to facilitate that a holistic approach is adopted in addressing the research questions. With this aim, the thesis is comprised of five main chapters. In the first chapter, the basic framework of the research is delineated. In this section, the rationale behind the study’s significance, the nature of the problematic it seeks to address, its overarching objectives and the manner in which its research questions have been formulated is elucidated. In addition, the general characteristics of the methodological approach used are introduced and the limitations of the research are also included. The objective of this chapter is to provide a comprehensive overview of the research scope and orientation.

The second chapter includes a thorough literature review, with a particular emphasis on green building certification systems. In this section, firstly, the definition and historical development of the concept of green building is discussed; then, the basic criteria of certification systems such as LEED and BREEAM, which are widely used internationally, are explained. In the context of Türkiye, the structure and implementation processes of national certificates such as YeS-TR and BEST are analyzed. In the subsequent sections of the chapter, the effects of these certification systems on the housing market are analyzed and how they are evaluated in the literature, especially in terms of price, return on investment, rental value and demand trends.

The third chapter provides a detailed exposition of the methodological infrastructure of the study. In this chapter, the cities in which the study was conducted, how the housing advertisements were collected and which criteria were taken into consideration during the sample selection stage are explained in detail. Furthermore, the data sources employed, the variables analyzed and the statistical evaluation methods (e.g. standard deviation and coefficient of variation) are all detailed.

In the fourth section, the findings obtained from the analysis of the data are presented and these findings are evaluated in comparison with existing studies in the literature. The trends of green certified houses in terms of sales and rental prices, price stability, advertisement density and accessibility are comprehensively discussed in this section. In addition, the implications of the findings for the formulation of sustainable housing policies are deliberated.

The fifth and final chapter of the study contains the general evaluation and conclusions. In this chapter, the current status and potential of green building practices in Türkiye are analyzed in the light of the findings of the study. In line with the results obtained, the effectiveness of existing policy instruments within the framework of the principles of affordability, social justice and sustainability is called into question; suggestions are presented regarding the structural arrangements to be made in this field and possible directions for future research.

1.4 Limitations

This study has certain limitations that may affect the scope and generalizability of the findings. First of all, the dataset utilized in the study was obtained exclusively from online property advertisement platforms. This indicates that the study is constrained to publicly available advertisement data, thus failing to embody the comprehensive nature of the housing market. The information contained in property advertisements is not standardized as it is entered by the individuals or institutions that create the advertisement. Furthermore, the data is mostly limited to basic variables such as floor area, sale or rental price and location. However, detailed information regarding technical specifications, energy performance, material quality, interior features and the certification process is largely absent. Consequently, the environmental performance of green certified dwellings cannot be directly assessed. Instead, only market behavior can be analyzed through indirect indicators.

Secondly, the predominance of gross square meters in the advertisement data restricts the more precise assessment of indicators related to house size. The absence of net square meter data in the majority of advertisements makes it difficult to conduct accurate price per square meter analyses. This limitation precludes the capacity for exhaustive examination of matters such as users' housing preferences and their perceptions of value.

The geographical scope of the study constitutes a further significant limitation. According to the USGBC (United States Green Building Council) database, green certified buildings in Türkiye are located in cities such as Adana, Ankara, Eskişehir, İstanbul and İzmir. However, considering the adequacy of available advertisement data and the quality of the data, the study is limited to Ankara, İstanbul and İzmir. Therefore, the research findings are based on market trends in these three metropolitan cities and it is not possible to draw direct inferences about other cities or rural areas of Türkiye. This limitation restricts a broader perspective on regional differences and spatial inequalities in particular.

In addition, this study focuses primarily on newly built green certified housing projects. Existing residential buildings that may have undergone green retrofitting or partial certification processes were not included in the dataset due to the lack of advertisement data and standardization in classification. As a result, the findings reflect the market position of newly developed certified housing, and do not account for the potential of green transformation in the existing building stock.

Finally, the temporal dimension of the study is another limitation to be considered. The dataset under consideration encompasses advertisements that have been collected within a specified time period, as of April 2025. This limitation does not allow the study to monitor changes in dynamic market conditions in the long term. For instance, price fluctuations, changes in demand or periodic differences in supply trends cannot be evaluated within the scope of this analysis. Consequently, the findings of the study are specific to a certain time period and have a limited capacity to reflect long-term trends.

All these limitations are given due consideration during the process of interpreting and evaluating the research findings. The results must be interpreted within the framework of these limitations. Notwithstanding the extant limitations, the study aims to fill a notable gap in terms of providing a market-based comparative analysis of green certified housing in Türkiye.

CHAPTER 2

LITERATURE REVIEW

This section will review existing literature on the impact of green building certifications on the housing market. It will also examine socio-economic groups' access to such dwellings, as well as the policy and incentive mechanisms adopted by governments. Firstly, the development processes, types and evaluation criteria of green building certification systems will be mentioned. The most widely used certification types globally, namely Building Research Establishment Environmental Assessment Method (BREEAM), Leadership in Energy and Environmental Design (LEED), and the Ecological and Sustainable Design in Buildings: B.E.S.T. Residential and Commercial Certification (BEST), which is used in Türkiye and Türkiye's National Green Building and Green Settlement Certification System (YeS-TR), will be examined. Then, the subsequent discussion will explain how the certification systems implemented in different countries and in Türkiye have gained a place in the housing markets and how they affect the market dynamics. The analysis will encompass studies that evaluate the influence of these certifications on housing prices (rents and sales prices) and the impact of green buildings on housing demand. The final segment of the study will entail an examination of the access of socio-economic groups to green housing.

The current academic literature does not fully address the spatial and socio-economic consequences of green building certifications. This review aims to help fill that gap. It will concentrate on providing a detailed analysis of the effects of green building certificates within the context of the Turkish housing market, with the ultimate goal of highlighting specific research questions that require further exploration.

2.1 Green Building Certificates: Scope and Criteria

Given the wide array of climatic conditions, energy policies, construction techniques, and sustainability priorities that characterize different countries, it is unsurprising that there is a proliferation of green building certification systems, each with its own unique features and applications. These variations in certification processes are indicative of diverse sustainability policies, building standards, and user demands that are present in different regions of the world. In this section, a detailed examination will be conducted of the most commonly used global certification systems, namely BREEAM and LEED, as well as BEST and YeS-TR in Türkiye.

2.1.1 Definition and Development of Green Building

The notion of green building has emerged as a response to the escalating environmental challenges caused by accelerated urbanization and increasing energy consumption with industrialization. While urbanization, which gained momentum following the industrial revolution, contributed to the advancement of infrastructure systems and building technologies, it also caused an increase in environmental degradation. As Gökbayrak (2017) also asserted, the industrial revolution and rapid urbanization process, especially since the early 1900s, led to the rapid depletion of natural resources (notably water and raw materials), increased air and water pollution and increased energy demand. In this process, the deepening of the environmental impacts of the construction sector endangered problems such as increasing carbon emissions, urban air and water pollution and overuse of resources. This situation has necessitated the search for more sustainable and environmentally sensitive solutions in building design and has led to the development of new approaches centered on environmental concerns over time (Gökbayrak, 2017). Therefore, the green building movement is not merely a response to environmental problems, but also an expression of a comprehensive vision for a more habitable and sustainable future, shaped by the influence of political, social, economic, technological and environmental considerations (Franco et al., 2021, pp. 3-14).

In addition to environmental concerns, economic factors have also been identified as contributing to the emergence of this global movement. In particular, McGraw-Hill (2008) stated that the oil crisis in the 1970s led to a global awareness of the significance on reducing energy consumption and transitioning to alternative sources (as cited in Baştanoğlu, 2017, p. 7). This crisis, while posing a threat to energy security, has prompted countries to develop new policies to reduce dependence on fossil fuels and enhance energy efficiency. The increase in fuel prices has accelerated the transition to renewable energy sources and caused the concept of sustainability to gain more importance in the building sector (AGPOM, 2016, as cited in Gökbayrak, 2017, p. 1). As a result of this transformation, novel standards and regulations have been devised to mitigate environmental impacts and increase energy efficiency.

As a result of these developments, ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) published the first design standard on energy efficiency in 1975, thereby encouraging energy-saving practices in the design and operation of buildings (Baştanoğlu, 2017, p. 7). This standard established criteria for basic building components such as the building envelope, lighting, heating-cooling systems and ventilation, while also providing a system that could be adapted to different climate zones. However, these first initiatives on energy efficiency were only a starting point for the evolution of the green building concept.

The Passivhaus concept, which was developed in Europe during the 1980s, contributed to the development of sustainable architecture by aiming to ensure that buildings consume less energy through passive design strategies (McGraw-Hill, 2008, as cited in Baştanoğlu, 2017, p. 7). The design philosophy of this concept encompassed strategies that minimize the demand for energy and directly adapt the indoor conditions of buildings to climatic conditions. Nevertheless, focusing only on energy saving was not deemed sufficient and a more comprehensive approach including multidimensional sustainability criteria such as water efficiency, sensitivity in material selection sensitivity and improvement of indoor air quality was needed.

In this direction, certification systems that address the environmental impacts of buildings holistically, beyond energy efficiency, began to be developed in the 1990s. Green building certification systems, which started with BREEAM established by BRE (Building Research Establishment) in the UK in 1990, constituted the first systematic framework (Baştanoğlu, 2017, p. 7). First introduced to the market in 1990, it was first revised in 1993 to assess offices (Doan et al., 2017, p. 247). The methodology offered by BREEAM addressed many categories such as water efficiency, waste management, land use, transport, materials and ecological impacts as well as energy consumption in a more comprehensive and detailed manner compared to previous concepts.

At the same time, the USGBC, an independent and non-profit organization aiming to promote sustainability in the design, construction and use of buildings, was established in 1993 in the USA and the LEED certification system was implemented in 1998 (Çelik, 2009, p. 14). This system has an adaptable structure to different building types with its modular and flexible design approach, so that it can be easily adapted to buildings of various scales and functions.

The World Green Building Council (WGBC) was established in 1999 with the objective of disseminating the green building movement to a wider base on a global scale (WGBC, 2016, as cited in Uğurlu, 2022, p. 14). The increase in the number of WGBC member countries over time has facilitated the spread of the green building concept on a global scale in a short time (USGBC, 2016, as cited in Uğurlu, 2020). Presently, the number of WGBC member countries has reached 78 (Table 2.1).

Table 2.1 Member Countries of the WGBC[1] (Prepared by the Author)

Region	Country	Certification Name	Membership Level
Africa	Botswana	Botswana Green Building Council	Prospective
Africa	Cameroon	Green Building Council Cameroon	Prospective
Africa	Kenya	Kenya Green Building Society	Established
Africa	Mauritius	Green Building Council Mauritius	Prospective
Africa	Namibia	Green Building Council Namibia	Prospective
Africa	Nigeria	Green Building Council Nigeria	Prospective
Africa	Tanzania	Tanzania Green Building Council	Prospective
Africa	Uganda	Uganda Green Building Council	Prospective
Africa	South Africa	Green Building Council South Africa	Established
Africa	Zimbabwe	Green Building Council Zimbabwe	Prospective
Americas	Argentina	Argentina Green Building Council	Established
Americas	Brazil	Green Building Council Brazil	Established
Americas	Canada	Canada Green Building Council	Established
Americas	Chile	Chile Green Building Council	Established
Americas	Colombia	Colombia Green Building Council	Established
Americas	Costa Rica	Green Building Council Costa Rica	Established
Americas	Ecuador	CEES Ecuador Green Building Council	Prospective
Americas	Guatemala	Guatemala Green Building Council	Established
Americas	Mexico	Sustentabilidad para Mexico A.C.	Established
Americas	Panama	Panama Green Building Council	Prospective
Americas	Peru	Peru Green Building Council	Established
Americas	Paraguay	Paraguay Green Building Council	Emerging

[1] The author prepared this table by utilizing the data obtained from https://worldgbc.org/global-directory-of-green-building-councils/.

Table 2.1 (cont'd)

Americas	El Salvador	El Salvador Green Building Council	Emerging
Americas	United States	U.S. Green Building Council	Established
Americas	Uruguay	Uruguay Green Building Council	Prospective
Americas	Venezuela	Venezuela Green Building Council	Prospective
Asia-Pacific	Australia	Green Building Council Australia	Established
Asia-Pacific	China	China Green Building Council	Affiliate Partner
Asia-Pacific	Hong Kong SAR China	Hong Kong Green Building Council	Established
Asia-Pacific	Indonesia	Green Building Council Indonesia	Established
Asia-Pacific	India	Indian Green Building Council	Established
Asia-Pacific	Japan	Green Building Japan	Affiliate Partner
Asia-Pacific	Cambodia	Cambodia Green Building Council	Prospective
Asia-Pacific	South Korea	Korea Green Building Council	Established
Asia-Pacific	Kazakhstan	Kazakhstan Green Building Council	Emerging
Asia-Pacific	Sri Lanka	Green Building Council of Sri Lanka	Prospective
Asia-Pacific	Malaysia	Malaysia Green Building Council	Established
Asia-Pacific	New Zealand	New Zealand Green Building Council	Established
Asia-Pacific	Philippines	Philippine Green Building Council	Established
Asia-Pacific	Pakistan	Pakistan Green Building Council	Established
Asia-Pacific	Singapore	Singapore Green Building Council	Established
Asia-Pacific	Taiwan	Taiwan Green Building Council	Established
Asia-Pacific	Vietnam	Vietnam Green Building Council	Prospective
Europe	Austria	Austrian Sustainable Building Council	Established

Table 2.1 (cont'd)

Europe	Bulgaria	Bulgarian Green Building Council	Emerging
Europe	Switzerland	Swiss Sustainable Building Council	Emerging
Europe	Czech	Czech Green Building Council	Established
Europe	Germany	German Sustainable Building Council	Established
Europe	Denmark	Green Building Council Denmark	Established
Europe	Spain	Green Building Council Espana	Established
Europe	Finland	Green Building Council Finland	Established
Europe	France	Alliance HQE-GBC France	Established
Europe	United Kingdom	UKGBC	Established
Europe	Greece	Sustainable Building Council Greece	Emerging
Europe	Croatia	Croatia Green Building Council	Established
Europe	Hungary	Hungary Green Building Council	Established
Europe	Ireland	Irish Green Building Council	Established
Europe	Iceland	Green Building Council Iceland	Prospective
Europe	Italy	Green Building Council Italia	Established
Europe	Luxembourg	Luxembourg Green Building Council	Prospective
Europe	Netherlands	Dutch Green Building Council	Established
Europe	Norway	Norwegian Green Building Council	Established
Europe	Poland	Polish Green Building Council	Established
Europe	Serbia	Serbia Green Building Council	Prospective
Europe	Sweden	Sweden Green Building Council	Established
Europe	Slovenia	Green Building Council Slovenia	Prospective
Europe	Türkiye	Turkish Green Building Council	Established
Europe	Ukraine	Ukrainian Green Building Council	Prospective
Mena	United Arab Emirates	Emirates Green Building Council	Established
Mena	Egypt	Egypt Green Building Council	Emerging
Mena	Iraq	Iraq Green Building Council	Affiliate Partner
Mena	Jordan	Jordan Green Building Council	Established
Mena	Kuwait	Kuwait Green Building Council	Emerging
Mena	Lebanon	Lebanon Green Building Council	Emerging

Table 2.1 (cont'd)

Mena	Morocco	Morocco Green Building Council	Prospective
Mena	Palestinian Territories	Palestine Green Building Council	Prospective
Mena	Saudi Arabia	Mostadam (Sustainable Building)	Affiliate Partner
Mena	Tunisia	Tunisia Green Building Council	Prospective

Moreover, the WGBC considers green buildings to be structures that not only mitigate environmental impacts, but also serve as a paradigm for enhancing quality of life. According to the WGBC (2016), green buildings are defined as "A building that, in its design, construction or operation, reduces or eliminates negative impacts and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life." (as cited in Uğurlu, 2020). In order for a building to be characterized as green, its environmental impacts in the process from the design process to the completion of the operation phase must be taken into consideration.

In Türkiye, the Environmentally Friendly Green Buildings Association (ÇEDBİK) was established in 2007 as a non-profit, non-governmental organization with the objective of designing, constructing and ensuring the sustainability of buildings and living spaces with a sense of social and environmental responsibility (Çelik, 2009, p. 71). The Association operates to promote sustainable construction practices, to ensure the widespread use of environmentally friendly buildings and to support individuals and organizations working in this field. In this context, the Association conducts research, organizes conferences and aims to raise awareness in cooperation with stakeholders in the sector (Çelik, 2009, p. 72). As of June 2012, ÇEDBİK gained the "Full Council Status of WGBC" and thus assumed the role of an active umbrella organization in Türkiye. In 2013, it has established the BEST certificate type for application in new residential and commercial building projects. The objectives of this certificate are to create healthy societies, livable environment and developed economic environments. Therefore, ÇEDBİK, which has been accelerating its certification activities since 2009, has focused especially on LEED and BREEAM systems, making the necessary arrangements to make them applicable in Türkiye (ÇEDBİK, n.d.).

In addition, in 2018, the Ministry of Environment, Urbanization and Climate Change prepared a “Certificate System Guideline” within the scope of the main categories of “building” and “settlement”, which were determined to be specific to Türkiye. Based on this guideline, certificates will be issued to the relevant areas in order to disseminate energy efficient, environmentally friendly building and settlement projects at national and local scale. Concurrently, the Ministry aspires to establish an inventory of green buildings. (Ministry of Environment, Urbanization and Climate Change, 2020).

While these certification systems and regulations encourage the dissemination of sustainable construction practices, they also shape the definition and fundamental principles of green buildings. According to ÇEDBİK (2016), green buildings are defined as those evaluated within the framework of sustainability principles throughout the entire life-cycle from land selection to design, with an understanding of social and environmental responsibility (as cited in Gökbayrak, 2017, p. 1). These buildings offer ecosystem-friendly solutions that adapt to climate data and local conditions, consume only as many resources as needed, encourage the use of renewable energy, prioritize natural materials and minimize waste generation. The basic principles of green building design are based on various criteria. These include sustainable space utilization, water and energy efficiency, indoor air quality, material selection and resource management are among these principles (Table 2.2).

Table 2.2 Basic Principles of Green Buildings (Source: Gökbayrak, 2017, pp. 9-11)

Category	Principles
Sustainable Site Design	Empty spaces in existing buildings should be utilized effectively.
	The ecosystem should be protected in new development areas and green areas should be prioritized in dense urban areas.
	The location, façade and zoning of buildings should be designed in a way to support elements such as solar energy, natural light and ventilation.
	The use of bicycles and electric vehicles should be encouraged and the necessary charging infrastructure should be provided for these vehicles.
	Light colored roofs, green roof systems and permeable surfaces should be used to reduce the heat island effect.
Water Management and Protection	Water consumption should be minimized and leaks should be prevented.
	Methods such as rainwater collection and grey water treatment should be used as alternative water sources.
	High efficiency water equipment should be preferred to reduce the load on the sewerage system.
Energy Efficiency	The use of renewable energy sources (solar, wind, geothermal, etc.) should be encouraged.
	Maximum utilization of daylight should be ensured and buildings should be positioned in appropriate directions.
	Building insulation should be increased and energy efficient heating-cooling systems should be used to prevent heat losses.
	Energy saving products (LED etc.) and sensor control systems should be preferred in outdoor lighting.
Material and Resource Use	Local, recyclable and low carbon footprint materials should be preferred.
	Construction waste should be minimized and an effective waste management plan should be established.
	Life-cycle analysis of materials should be carried out and choices should be made that will not harm the environment and human health.
Indoor Air Quality	Air pollution should be controlled during the construction process and minimum dust generation should be ensured.
	Natural daylight should be utilized, openable windows and natural ventilation should be provided.
	Carpets, paints and glues that do not contain volatile organic compounds (VOC) should be preferred.

Although green building certification systems were initially centered on energy efficiency and carbon emission reduction, they have evolved over time into comprehensive assessment systems that also include elements such as water management, waste control, indoor air quality and material sustainability (Wen et al., 2020). Today, these systems have evolved into multidimensional rating mechanisms that aim to achieve a balance between environmental, social and economic sustainability (Dobias & Macek, 2014). In this transformation process, green building systems also contribute to sustainable urbanization policies in line with the following elements (Franco et al., 2021):

- Addressing climate change and disaster vulnerabilities,
- Promoting energy efficient and renewable energy technologies,
- To facilitate the processes of certification, verification and implementation of green buildings,
- To contribute to socio-economic growth and development,
- Supporting the development of other relevant technologies and innovations
- To have a positive impact on end-user behavior and perception of green buildings.

In this direction, green building rating tools (GBRTs) are one of the most common systems for assessing sustainable building performance and have become an integral part of sustainable urbanization policies, varying according to countries' climate, economy and local building regulations (Wen et al., 2020). These systems are continuously updated to assess social sustainability and occupant comfort as well as environmental impact. The majority of GBRTs comprise three main components: an indicator system that categorizes building performance, a scoring mechanism that assigns weights and scores to these indicators and a rating system that ultimately assesses overall building performance (Ali & Al Nsairat, 2009; Mohammed Usman & Abdullah, 2018; Zhang et al., 2019, as cited in Wen et al., 2020).

GBRT indicator systems are organized across four levels. The categories, which define the general requirements of buildings in terms of environmental, social and economic sustainability, are situated at the top level. Below this level, sub-categories form the main focus areas of the three sustainability dimensions. More specific assessments are made through criteria, which are linked to the final assessment level supported by measurable and quantitative indicators (Zhang et al., 2019, as cited in Wen et al., 2020).

Consequently, although certification systems developed on a global scale ensure the widespread adoption of green building practices, they vary according to local climate, economic conditions and building regulations. This process encourages practices that prioritize the use of sustainable materials, the management of water and waste management, indoor air quality and user comfort in the construction sector. In the future, green buildings will continue to offer integrated solutions that improve human life with technology and innovative designs, going beyond the scope of structures that merely reduce environmental impacts.

2.1.2 Global Green Building Certification Systems

Today, green building certification schemes play a crucial role in promoting sustainable and environmentally friendly construction, as mentioned in the previous section. These systems generally assess the environmental performance of buildings based on various criteria such as energy efficiency, water use and management, indoor air quality, sustainable material selection, and waste management. Certification systems developed and implemented in different countries vary depending on local climatic conditions, construction standards, building codes, legislation and market dynamics.

This section discusses the most widely used certification systems worldwide, namely LEED and BREEAM (Figure 2.1). In addition, the YeS-TR and BEST systems developed and implemented in Türkiye will be analyzed, with a comparison of their evaluation criteria, certification processes and certificate characteristics.

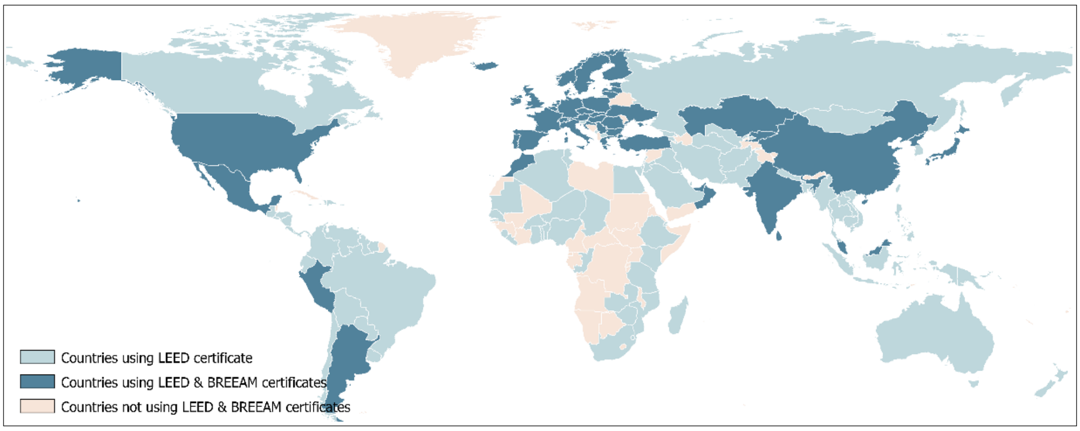

Figure 2.1 Countries Using LEED & BREEAM Certificates[2] (Produced by the Author)

This comparative review contributes to the understanding of how green building certification systems in Türkiye are positioned within the global context. By systematically revealing the similarities and differences between internationally recognized systems (LEED and BREEAM) and nationally developed frameworks (YeS-TR and BEST), the table 2.3 provides a comprehensive overview of their respective strengths, weaknesses, areas of application, and recognition levels. It also highlights the varying degrees of modularity, cost, technical complexity, and market relevance associated with each system. In doing so, it facilitates a clearer understanding of the advantages and limitations of each certification scheme, especially in relation to their applicability within the Turkish housing and construction market.

[2] The author prepared this figure via ARCGIS by utilizing the data obtained from https://www.usgbc.org/projects and https://tools.breeam.com/projects/explore/map.jsp.

Table 2.3 Comparative Overview of Green Building Certification Systems (Prepared by the Author)

Feature	BREEAM	LEED	YeS-TR	BEST
Origin/Developer	UK/BRE	USA/USGBC	Türkiye/Ministry of Environment, Urbanization and Climate Change	Türkiye/ÇEDBİK
Year Introduced	1990	1998	2014	2015
Applicability Scope	Global (Buildings)	Global (Buildings, interiors, neighborhoods, cities)	National (Buildings and settlements)	National (Buildings)
Assessment Categories	Management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution, innovation	Integrative process, location and transportation, sustainable sites, water efficiency, energy and atmosphere, material and resources, indoor environmental quality, innovation, regional priority	Integrated building design, construction and management, indoor environmental quality, building material and life-cycle assessment, energy use and efficiency, water and waste management, innovation, social and economic sustainability	Integrated green project management, land usage, water usage, energy usage, health and comfort, material and resource usage, building life, operation and maintenance, innovativeness
Certification Levels	Pass, good, very good, excellent, outstanding	Certified, silver, gold, platinum	Pass, good, very good, national superiority	Approved, good, great, perfect
Modularity/ Flexibility	Structured – adaptable by use type and region	Highly modular – adaptable to various project types and sizes	Moderate flexibility – separate for building and settlement	Simple – two programs (residential and commercial)

Table 2.3 (cont'd)

Energy Efficiency	Strong (3-30% energy savings)	Strong (18-39% reduction in consumption)	Integrated into national energy targets	Prioritizes land use and function more than energy
Recognition/ Market Value	High in Europe, moderate globally	High international recognition, boosts prestige	Recognized nationally, growing visibility	Limited to national projects
Transparency and Access to Certified Projects	High (BREEAM directory)	High (USGBC database)	Moderate – national registry being developed	Low – transparency concerns noted in literature

2.1.2.1 BREEAM Certificate System

BREEAM was developed in 1990 by the Building Research Establishment (BRE) in the United Kingdom. It is the first sustainable building assessment system to be implemented worldwide (Çelik, 2009). The system was developed to evaluate the environmental performance of buildings and promote sustainable design (Öztürk, 2015, pp. 74-75; Baştanoğlu, 2017, p. 18).

Since its inception, BREEAM has been expanded to accommodate various building types and life cycle stages. According to Howard (2019), it has developed both its technical criteria and regional adaptability over time (as cited in Ade & Rehm, 2019). It has different assessment standards for residential, office, retail, industrial buildings, and settlements. These include different assessment tools such as BREEAM In-Use, New Construction, Refurbishment, and Fit-Out (BREEAM, n.d.).

The BREEAM system rates buildings by scoring them in 10 basic categories, including energy efficiency, water use, health and comfort, material selection, waste management, ecology, and transportation (Öztürk, 2015; Gökbayrak, 2017). Each category has a specific weighting, and projects are certified at levels such as "Pass", "Good", "Very Good", "Excellent", or "Outstanding" based on the total points they receive from these categories (BREEAM, n.d.; Baştanoğlu, 2017).

Among the prominent features of BREEAM are its comprehensive set of criteria, its life cycle-based assessment approach, and its ability to adapt to regional conditions (Baştanoğlu, 2017). However, due to detailed documentation requirements, the application process can be complex for some project teams.

In this study, detailed information on the history, development process, assessment categories, and fundamental principles of the BREEAM system is provided in Appendix A.

2.1.2.2 LEED Certificate System

LEED is a globally recognized green building rating system that was developed in 1998 by the USGBC. The system aims to evaluate the environmental performance of buildings using a holistic approach and to promote sustainability in the construction industry (Doan et al., 2017; Gökbayrak, 2017).

One of LEED's most distinctive features is its modular and holistic structure, which evaluates not only individual factors such as energy or water efficiency, but also a wide range of environmental factors such as location, material use, indoor air quality, and water and energy efficiency (Süzer, 2015). This allows it to offer a system that can be applied to projects of different types and scales, from residential buildings to city-scale projects. Additionally, the digital evaluation process and simplified application process at the international level have played a substantial role in the widespread adoption of LEED (USGBC, n.d.).

The LEED system has been updated over time and expanded to include different programs such as new buildings (BD+C), interiors (ID+C), existing buildings (O+M), neighborhoods (ND), cities and communities (USGBC, 2024; Gökbayrak, 2017). These systems include customized criteria and scoring weights based on the type of project. The LEED evaluation process is conducted on a total of 110 points across sustainability categories, and four certification levels are awarded based on the score: Certified, Silver, Gold and Platinum (USGBC, 2024).

LEED's basic categories are categorized under headings such as sustainable sites, water efficiency, energy and atmosphere, materials and resource use, indoor environmental quality, innovation, and regional priorities. Each category includes specific prerequisites and opportunities to earn points.

The LEED system offers titles such as LEED Green Associate and LEED AP (*Accredited Professional*), emphasizing not only environmental performance but also the level of expertise of project teams, and conducts certification process audits through document reviews via the USGBC's digital platform (Baştanoğlu, 2017).

Also, an empirical study made by Toğan and Thomolları (2020) show that BREEAM-certified buildings have demonstrated 3–30% less energy consumption than conventional structures, while LEED-certified ones consume approximately 18–39% less energy. From an economic perspective, green-certified buildings have been associated with up to 25% increases in occupant productivity, a minimum of 14% higher return on investment, 10% higher asset market value, and 5–10% higher rental rates compared to their non-certified counterparts (Toğan and Thomolları, 2020).

Therefore, this study provides detailed information on the history of the LEED system, program types, evaluation categories, and current developments in Appendix B.

2.1.2.3 YeS-TR Certificate in Türkiye

YeS-TR is a national green building and sustainable settlement certification system developed taking into account Türkiye's climatic, structural and sectoral conditions. The system aims to evaluate buildings and settlements according to environmental, social and economic sustainability principles. Energy and water efficiency, use of renewable resources, waste management, and carbon emissions are among the key evaluation areas of the system (Ministry of Environment, Urbanization and Climate Change, 2014).

The system was initiated with the publication of the regulation in 2014 (Kılıçarslan et al., 2019). This was followed by comprehensive revisions in 2017, 2021, 2022, and 2024. These regulations made the system more inclusive, incorporated industrial structures such as organized industrial zones into the system, redefined expert authorizations, and opened the certification process to international projects. As of 2026, public buildings exceeding 10,000 m^2 will be required to obtain a YeS-TR certificate (Ministry of Environment, Urbanization and Climate Change, 2024).

The measures implemented to promote the green building certification process in Türkiye have been endorsed by the Ministry of Environment, Urbanization and Climate Change. Moreover, it is being made mandatory in order to encourage its implementation in public buildings (Ministry of Environment, Urbanization and Climate Change, 2024). Accordingly, starting from 2026, new public buildings with a total construction area exceeding 10.000 m^2 will be obligated to obtain YeS-TR certification. The overarching objective of this regulatory framework is to enhance energy efficiency, optimize water usage and natural resource utilization and to promote sustainable building practices in public buildings (Ministry of Environment, Urbanization and Climate Change, 2024).

However, in the current situation, direct financial incentives, tax exemptions or low-interest loan support for private sector investments are limited. In terms of the widespread adoption of green building practices, regulations targeting only public buildings are not sufficient, and a comprehensive incentive system is needed to ensure that the private sector is also included in this transformation. In the housing market in particular, the lack of supportive mechanisms to alleviate the costs associated with the certification process is one of the main factors limiting the prevalence of sustainable buildings. In this context, comprehensive and targeted incentive policies have the potential to increase both the number of certified green buildings and their socio-economic inclusiveness. Indeed, policy changes supported by tools such as affordable financing, tax incentives, or public-private partnerships have the potential to fundamentally transform the landscape of green housing supply in Türkiye.

The scientific infrastructure of the YeS-TR system was developed under the coordination of the Ministry of Environment, Urbanization and Climate Change with contributions from academic institutions, expert groups and industry representatives (Özçevik et al., 2018, as cited in Koçak & Akten, 2023). The system has been designed to offer a structure that can be applied at both the building and settlement scales (Koçak & Topay, 2022).

At the building level, integrated design and management, indoor environmental quality, materials and life-cycle, energy use, water and waste management, and innovation categories are considered. At the settlement level, sustainable land use, transportation, urban design, ecology, disaster management, and social and economic sustainability are evaluated (Koçak & Topay, 2022).

The YeS-TR system consists of four certification levels: Pass (32-39 points), Good (40-54 points), Very Good (55-74 points) and National Superiority (75 and above). The evaluation process is carried out by experts, auditors and independent evaluation organizations; the certification decision is made by the Green Certification Commission (Ministry of Environment, Urbanization and Climate Change, 2024).

This study presents the historical development of the YeS-TR system, regulatory changes, evaluation criteria and application details at the building/settlement scale in Appendix C.

2.1.2.4 BEST Certificate

The BEST certification is a national green building assessment system developed by ÇEDBİK specifically for Türkiye. The system aims to create healthy communities, increase environmental sustainability, and support economic development

(ÇEDBİK, n.d.). This system is developed with particular consideration for Türkiye's geographical, climatic, and legal conditions, thus offering a more compatible, accessible, and cost-effective evaluation structure in comparison to international certifications (Eren, 2021, as cited in Ozan et al., 2022).

The system, which was established in 2015 with the first guide prepared for residential projects, is implemented through two separate programs: BEST-Residential and BEST-Commercial (ÇEDBİK, n.d.). The development of BEST was initiated under the leadership of ÇEDBİK, with the contributions from academic institutions and industry representatives. BEST is positioned as a local alternative that promotes sustainable building design in Türkiye.

The BEST certificate is based on nine key categories: integrated project management, land use, water and energy use, health and comfort, material and resource use, quality of life, operation and maintenance, and innovation. The assessments in these categories are subject to a scoring system that varies according to the type of building and its intended use (Ministry of Environment, Urbanization and Climate Change, 2019, 2020).

The certificate is awarded at four levels: Approved (46–64 points), Good (65–79 points), Great (80–99 points) and Perfect (100+ points) (BEST-Residential Certificate Guideline, 2019 & BEST-Commercial Certificate Guideline, 2020). Applicable to both residential and commercial projects, this system contributes to local sustainability goals while encouraging widespread adoption with its low-cost structure.

However, when comparing the YeS-TR and BEST systems, there are noticeable shortcomings in terms of access to information, transparency of certified structures, and certain evaluation criteria (Cenk et al., 2024). For example, while YeS-TR places greater emphasis on material and interior quality, BEST focuses particularly on land use, transportation, and functionality. However, it is observed that critical sustainability elements such as cost and biodiversity are not sufficiently addressed in either system (Cenk et al., 2024).

Detailed information on the historical development of the BEST system, its category structure and evaluation criteria is provided in Appendix D.

2.2 Impact of Green Building Certificates on the Housing Market

Although green building certificates were initially developed as tools to promote environmental sustainability, they have become increasingly prominent in the housing market due to their economic and social impacts. In recent years, the effects of these certificates on housing prices, rental values and investment decisions have been closely monitored by both academics and industry stakeholders. Houses that fulfil environmental criteria, such as energy efficiency, water management, and low carbon emissions, often command higher market prices driven by growing environmental awareness, perceptions of prestige, and expectations of long-term savings.

Although green certified buildings have a higher initial investment cost, their long-term operational benefits make them an attractive alternative option for investors. In particular, reduced energy and water consumption, lower maintenance and operating costs, and enhanced economic sustainability contribute to a shortened return on investment (ROI) period. Beyond promoting environmentally friendly practices, green certified dwellings may improve rental income, thereby further reducing ROI duration. The impact of green buildings on rental values and ROI is shaped by multidimensional economic dynamics, influenced not only by physical performance but also by amortization period, market perception, and user preferences.

In this section, an analysis of the effects of green building certificates on the housing market will be conducted through the following aspects: price dynamics, rental/ownership preferences, and user/investor requirements. In conducting this assessment, a comparative evaluation of international literature and the current situation in Türkiye will be undertaken. These analyses are critical for understanding how green certified housing is positioned within the market and which social groups have access to such properties.

2.2.1 Prices and Investment Returns of Green Certified Houses

Green building certificates have a significant impact not only on the environmental but also on the economic value creation of residential buildings. Houses that have been awarded such certifications provide a combination of environmental and financial advantages, attributable to their inherent qualities, including energy efficiency, water conservation, utilization of eco-friendly materials and carbon emission reduction. The increased environmental consciousness, shifts in consumer preferences, enhanced brand value and incentives offered by public policies have collectively led to the enhanced valuation of these properties in comparison to conventional housing (Table 2.8).

Table 2.4 Impact of Green Building Certificates on Sales Prices

Country	Certificate Type	Sales Price Increase Rate	Source
US	LEED	16	Eichholtz et al. (2010)
England	BREEAM	25-26	Fuerst & McAllister (2011)
Hong Kong	LEED	32-40	Hui & Yu (2021)
Türkiye	LEED / BEST (İstanbul)	10-15 (Approx.)	Data from Zingat, Endeksa, REIDIN and Author’s Analysis

USGBC (2024) data reveals that current certification systems, such as LEED v4.1, prioritize practices to reduce carbon emissions and provide 20-25% reduction in energy consumption and 10-15% reduction in water use. These savings demonstrate that, in comparison to conventional housing, green buildings offer approximately 24 per cent lower costs over a 10-year operating period (USGBC, 2024). This cost advantage has been demonstrated to increase the willingness to pay rent not only for investors but also for tenants.

Research undertaken in the United States has demonstrated that the presence of green building certifications in a property is associated with a substantial increase in its sale price. Specifically, studies conducted by Eichholtz et al. (2012), Reichardt et al. (2012) and Deng & Wu (2014) indicate that residential properties bearing environmental certifications are sold at prices 5% to 20% higher than those of conventional housing. This price difference is referred to as “green premium” in the relevant literature and is considered both as an economic reflection of environmental sustainability and as a result of changes in user behavior.

A comprehensive analysis conducted by Eichholtz et al. (2010) found that office buildings with internationally recognized building certifications such as LEED or BREEAM had 6% higher rental income and 16% higher sales prices. While this paper does not directly address the residential market, the outcomes support the hypothesis that similar certification systems can also create economic value in the residential sector.

In this context, it has been observed that the impact of green building certificates on the housing market is not limited to sales price but also extends to the turnover rate of properties. Reichardt et al. (2012) argue that green houses are sold in a shorter time, which has a positive impact on market liquidity. Consequently, the market value of green certified houses is considered to be an attractive investment opportunity due to their high sales price and rapid turnover.

The systematic review conducted by Leskinen et al. (2020) reveals that green building certifications are associated not only with tangible benefits such as energy savings, but also with intangible values such as brand perception, prestige value and investor confidence. The review revealed that residential and commercial buildings certified with certifications such as LEED and Energy Star experienced price increases of up to 43% in the secondary market (Leskinen et al., 2020). These findings underscore the notion that, from the perspective of major investors, such properties are regarded as low-risk investment opportunities, characterized by a predictable income stream.

Europe

In the context of European housing markets, the economic and symbolic value of green building certificates is becoming increasingly visible. The study by Sayce et al. (2010) reveals that such certificates are perceived not only on the basis of technical criteria such as energy efficiency but also as a status symbol, especially in projects aimed at upper income groups. This perception leads to significant increases in the market value of green certified dwellings. Buyers consider these dwellings to be both as an expression of their environmentally conscious lifestyles and a high-value investment instrument. Therefore, energy performance labels are not only a technical document, but also an element that strengthens the market position and investment attractiveness of the housing. This highlights the importance of socio-cultural and symbolic factors that contribute to higher sales prices for green housing in European markets (Sayce et al., 2010).

Nevertheless, the European Union's green consensus policies and strategic goals for sustainable urbanization serve to further reinforce the impact of green building certificates on the housing market. This political environment has two notable consequences. Firstly, it increases the financial value of certified buildings. Secondly, it allows them to benefit more from public incentives and support mechanisms. Thus, the preference for green housing in Europe is influenced not only by individual preferences, but also by the direction of public policy.

Asia

Research in Asian housing markets demonstrates that green building certifications have not only environmental but also economic implications. In particular, within countries that possess either developing or developed economies, such as Hong Kong, Malaysia, Singapore and China, green housing has been demonstrated to have considerable price advantages within the market.

A comprehensive analysis conducted by Hui & Yu (2021) in Hong Kong found that green certified houses provide a price premium ranging from 32% to 40%. A further salient finding in the above mentioned study is that investments made in green certified projects during the pre-construction phase (presale) yield higher returns upon completion (Hui & Yu, 2021). This finding underscores the economic value of energy efficiency and environmental performance for users. Also, it can be understood that green housing has both short and long-term profitability potential for investors. However, the level of returns obtained can vary significantly depending on the type of certificate used and the level of certification. Projects that show visible environmental performance tend to have higher market values.

A study carried out in Malaysia by Chuweni et al. (2025) found that the presence of green building certificates resulted in an average increase in house prices ranging from 3% to 5%. This finding emerged from a comprehensive analysis encompassing 861 housing units within the Selangor Region, conducted over the period from 2014 to 2022 (Chuweni et al., 2025). A particularly noteworthy finding is that this price increase is more pronounced in low- and middle-income housing units. This situation reveals that green housing is not only a luxury investment tool for high-income groups, but also a type of housing that can be preferred by wider masses when it becomes accessible.

On the other hand, some empirical studies have demonstrated significant price variations between the apartments sold prior to and following the acquisition of green certification within the same project. For instance, an empirical study conducted by Fesselmeyer (2018) in Singapore revealed a 3% price variation between the apartments offered for sale before and after receiving green building certification within the same housing project. The average selling price of apartments in green certified estates was 1,299,523 Singapore Dollars, while those without certification were realized around 1,044,886 Singapore Dollars. This price difference of approximately 24% can be attributed not only to the environmental advantages associated with certification, but also to supplementary components of green housing projects, including marketing strategies, architectural design quality, infrastructure investments and social facilities (Fesselmeyer, 2018).

In addition, above mentioned study analyzed the price differences between freehold and leasehold houses based on the duration of ownership (i.e. 99 years). According to the findings, a price differential ranging from 4% to 6% between these two housing types, despite their comparable physical characteristics (Fesselmeyer, 2018). This difference indicates that users of housing incorporate their expectations regarding the property's future tenure into its current valuation. Therefore, the value of the property is influenced not only by its physical characteristics but also by temporal perspectives.

This result suggests that the long-term benefits associated with green certified dwellings, such as energy savings, low operating costs and environmental sustainability, can be similarly reflected in housing prices by buyers. In other words, users take into account not only current quality of life or aesthetics, but also future cost savings and sustainability criteria in their investment decisions. This finding lends further evidence to the fact that the expectation of long-term benefits is a strong determinant of the economic valuation of green buildings.

Studies on the Chinese housing market also provide similar findings. In the analysis conducted by Deng & Wu (2014), it was found that green certified residential buildings are traded at approximately 11% higher prices compared to conventional buildings. It is emphasized that variables such as building age, location, building density and certification level play a critical role in explaining this difference; therefore, green building valuation should be handled with a multidimensional approach.

The findings obtained in Asian countries reveal that green building certificates engender an increase in value based on environmental qualities, as well as offering a holistic market advantage in terms of financial, spatial and social aspects. Consequently, it can be posited that buildings with sustainability criteria have evolved into a strategic factor influencing investment decisions within the housing markets of the region.

In the context of Türkiye, the extant academic research on the impact of green building certificates on house prices is quite limited. The literature is primarily based on market analyses from the private sector. Reports from sectoral data providers such as REIDIN, Zingat and Endeksa indicate that in major cities such as İstanbul, housing projects certified at LEED-Gold level are often offered at prices that are approximately 10% to 15% higher than housing with similar physical characteristics in the same location. This price difference is hypothesized to be driven not only by environmental performance, but also by differentiation in brand value, marketing strategy and user perception.

However, despite these findings, there is a paucity of academic-based empirical studies on the role of green building certificates in the housing market in Türkiye. There is a necessity for comprehensive research on the impact of certificate types on prices using quantitative methods such as structural modelling or hedonic price analysis. This situation indicates that the green housing market in Türkiye is still in the development stage and the valuation of these buildings is not yet fully established by the market actors.

Moreover, given the structural barriers to the proliferation of green housing certification in Türkiye, namely the paucity of data transparency and the lack of awareness, it can be said that the existing market analyses remain within a limited framework. Therefore, it is imperative to address this knowledge gap through the conduct of detailed field studies and spatial analyses to be conducted in Türkiye with the objective of facilitating the development of sustainable housing policies.

2.2.2 The Impact of Green Building Certificates on the Rental Housing Market

The impact of green building certificates in the rental housing market is primarily influenced by the low operating costs and high living comfort offered by these buildings. Specifically, factors such as reduced energy consumption, water conservation and enhanced indoor air quality have been demonstrated to increase user satisfaction and make these buildings more appealing. As a natural consequence of this, the rental values of green certified dwellings tend to rise and these buildings often facilitate longer-term rental arrangements.

The increase in rental values is clearly supported by international literature. A systematic review by Leskinen et al. (2020) found that dwellings with green building certification generate a premium of up to 23% in rental values. This increase is particularly evident in net lease agreements, where tenants are willing to pay higher rents in return for savings in energy and maintenance costs.

In major European metropolises, the impact of green building certificates on the market is evident beyond sales prices, manifesting also in the rental sector. In this context, the study conducted by Fuerst & McAllister (2011) in the case of London found that residential and office projects with BREEAM “Excellent” certification provide an average of 4% to 5% higher rental yields compared to similar building types without certification. The research findings reveal that green certified buildings are not only more in demand, but also that users tend to reside in these buildings for longer periods of time. This finding suggests that the reduction in basic operating costs, such as energy and water, contributes to user satisfaction, thereby positioning green buildings are more favorably positioned in the rental market (Fuerst & McAllister, 2011).

Conversely, the study by Fuerst & McAllister (2011) states that the rent premium is contingent not solely on the presence of the certificate, but also on qualitative attributes such as indoor air quality, natural light access and energy efficiency. This finding reveals that users do not prioritize the environmental certificate, but rather the quality of life and comfort elements it offers.

The meta-analysis conducted by Jayakody & Vaz (2023) provides a comprehensive evaluation of green building certificates on rental values. This analysis encompasses a substantial corpus of 47 academic publications, published between 2003 and 2021, and offers a valuable insight into the broader implications of green building certifications on real estate valuation. The analysis indicates that 77% of the studies concluded that green certified buildings increase the rental value. A further analysis of regional distribution reveals the following rent premium rates (Jayakody & Vaz, 2023):

- USA (LEED, Energy Star): 5-10%
- Europe (BREEAM, DGNB): 14-19%
- Hong Kong: 10.9%
- China: 19.5%
- South Africa: 4.5%

The differences in these rates are thought to be related to macro-level factors such as the maturity of green building practices in countries, the level of user awareness, the prevalence of certification systems and the effectiveness of government support mechanisms. In developing countries, the lack of institutionalization of green building practices tends to limit both the rent premium effect and user awareness. However, the study emphasizes that retrofitting practices to improve the environmental performance of existing buildings generate significant increases in rental income.

In the Turkish context, a case study conducted by Uğur & Leblebici (2019) revealed that the initial investment cost of a LEED-Gold certified residential project is 7.43% higher compared to a conventional residential project. However, this cost difference is offset by reductions in energy consumption of 39.1% and water consumption of 38.3%. The study further asserts that these savings contribute 2.7% to the market value of the property (Uğur & Leblebici, 2019). While this data is not directly related to rental value, it is predicted that users may be willing to pay higher rents due to the reduction in operating costs.

In terms of ownership preferences, socio-economic differences are crucial. While higher income groups generally prefer green housing for reasons such as prestige, quality of life and environmental responsibility, access to these structures is limited for middle and low income groups due to high rent levels and restricted financing options. Moreover, these buildings present accessibility challenges for middle- and low-income users, mainly due to high initial costs and limited financing models (Uğur & Leblebici, 2019). This creates rental market dynamics that have the potential to deepen socio-economic inequalities. The limited accessibility of green housing to privileged groups also raises questions about the compatibility of sustainability policies with the principles of social justice.

In conclusion, the impact of green building certificates on rental values is based not only on physical performance but also on multi-layered dynamics such as market perception, quality of life, amortization period and user profile. The execution of qualified field studies on this topic in Türkiye will contribute to a clearer understanding of the position of certified houses in the rental market. The observation that green certified houses are traded at higher prices lends indirect support to the expectation of higher rental values.

2.2.3 Demand Dynamics: User and Investor Perspective

In recent years, there has been a notable increase in sustainability-oriented preferences within the housing market. This trend is not solely driven by environmental concerns but it is also influenced by a range of factors, including socio-demographic characteristics, income levels, and perceptions of trust and individual evaluations of the associated benefits. Housing projects that meet sustainability criteria, such as reducing carbon emissions and enhancing energy and water efficiency, are increasingly favored by environmentally conscious individuals. This gradual shift in housing preferences is expected to amplify the impact of green building certifications and foster diverse housing demand across various user and investor profiles.

Research undertaken within this paradigm has clearly demonstrated the role of environmental awareness on housing demand. For instance, the findings reported by Chuweni et al. (2025) indicate that individuals with high level of environmental awareness exhibit a stronger orientation towards green certified housing. Also, they state that social and economic motivations, including energy efficiency and indoor air quality, are the main factors driving this demand. They also emphasize that the green label is perceived by users as a value indicator, thereby reinforcing the perception of a “green premium”. These users consider measurable environmental and economic benefits to be the primary preference criteria; therefore, the demand for green certified housing is shaped not only by symbolic values but also by tangible benefit expectations. In this context, in order to better understand the demand structure for sustainable housing, it is important to consider both individual behavioral tendencies and investor strategies that affect market dynamics.

From the user’s perspective, factors such as energy efficiency, a healthy living environment, long term affordability and environmental responsibility are of particular significance. Notably, members of Generation Y and Generation Z place greater emphasis on sustainability in their lifestyle choices, and demand for environmentally sustainable housing has increased considerably among these groups. Furthermore, factors such as central location, access to public transportation, social amenities, and perceived quality have also been identified as influential housing decisions. A notable example in the literature is the study by Bond & Devine (2016), which examined the housing preferences of Generation Y (late 1970s-2000s). The study found that this demographic tends to prefer housing with convenient access to public transport, proximity to central locations, and availability of social facilities (Bond & Devine, 2016).

User trust is also a substantial factor. In Yaşaroğlu's (2024) study, a survey of 542 Generation Z participants determined that the perception of greenwashing has a detrimental effect on the intention to purchase green housing. However, it was emphasized that reliable and recognized green certificates offset this negativity, and therefore user trust is a crucial factor shaping sustainable housing preferences (Yaşaroğlu, 2024).

Similarly, Hui & Yu (2021) examined the divergent perceptions regarding green building certifications between the luxury housing market and the mass housing market. The findings reveal that mass market buyers are willing to pay a higher premium for certified projects that offer visible and measurable environmental benefits (Hui & Yu, 2021). The study also identified that factors such as the presale period and the location of the building are important factors that shape users' preferences.

Moreover, the demand for green buildings in the housing market exhibits a multi-layered structure that cannot be explained by a uniform consumer behavior. The study by Leskinen et al. (2020) reveals that user demand has a heterogeneous structure. While high income groups tend to favor green housing for reasons such as prestige, environmental sensitivity and quality of life, this demand is constrained among middle and low income groups due to factors such as accessibility problems, high initial costs and lack of awareness (Leskinen et al., 2020).

The extent to which users perceive and evaluate these certificates also plays a critical role in shaping preferences for green certified housing. Kim & Irakoze's (2023) research revealed that 72.7% of users in South Korea who has purchased green certified housing were unaware of its certification. This finding suggests that individual environmental awareness is not yet sufficiently developed and that user demand is mostly driven by the overall quality of the housing, not the "green" label. Furthermore, according to the segmentation, "visible quality" (size, new construction, transport access, etc.) is perceived as more influential than environmental sustainability in the housing market. This underscores the necessity for investors to consider not only the "green" attributes but also other attractive features in their projects.

From an investor's perspective, green building projects are distinguished by their low operating costs and high rental income potential in the long term. Projects with documented environmental performance can change hands more quickly in the market and are perceived as a prestige element, thus attracting a stronger demand among segments appealing to high income groups. International examples indicate that projects certified by prestigious green building certifications, such as LEED or BREEAM, are perceived as more reliable and valuable by investors and buyers (Jayakody & Vaz, 2023). This situation shows that investments in green building not only provide environmental benefits but also offer distinct advantages in terms of brand value and market positioning. Consequently, green certified projects are regarded as a form of "prestige investment" in segments that appeal to high income groups and are considered as both an ethical and economic choice by consumers.

In contrast, the high initial costs for low- and middle-income consumers constitute a significant barrier to accessing to such structures. This situation necessitates the development of housing policies that address not only the environmental but also the social dimensions of sustainability. This is because the initial investment costs of green certified buildings remain higher than those of conventional buildings (Uğur & Leblebici, 2019). Although this cost difference is gradually compensated during the operational phase, it poses a substantial barrier in terms of initial financing and limits access to such buildings. Additionally, the lack of sustainability criteria in social housing policies hinders the widespread adoption of such structures across broader demographic groups (Uğurlu, 2020).

In this context, it is insufficient to evaluate green housing investments only based on environmental considerations; instead, there is a need for accessibility-oriented housing policies that also emphasize social sustainability. Otherwise, green building practices may become a form of privileged housing accessible only to certain income groups. This, in turn, may prevent the integration of sustainability principles with social justice and exacerbate existing inequalities.

2.3 Affordability and Inequalities in Green Certified Housing

Despite the increase in the production of sustainable housing, the question of who can afford these buildings has become a significant area of debate in the context of social justice. The high costs, financial barriers and spatial segregation that characterize the current housing market can result in the transformation of green certified housing into a privileged type of housing that is only accessible to a certain segment of the population or sustainable with the income of some households. This poses a significant risk of incompatibility between sustainability principles and social equity objectives.

Affordability of green certified housing is subject to variation due to a number of factors, including household income level, access to finance, geographical location and the extent of public subsidies (Peverini et al., 2023, p. 27). The multidimensional nature of these inequalities necessitates that green housing policies should be addressed not only in the context of technical standards and environmental performance, but also from a social inclusion perspective.

Although green building certification offers many advantages, access to such housing varies greatly depending on household income. Evaluating housing solely based on technical or environmental standards carries the risk of overlooking the inequalities experienced by low- and middle-income groups in accessing such housing. At this point, the concepts of housing affordability and accessibility are critical to understanding the social dimension of green building policies.

The fundamental distinction between housing access and affordability provides a clearer understanding of the impact of these structures on socio-economic groups. Housing affordability refers to whether households' housing expenditure is sustainable in relation to their income level. In contrast, the concept of accessibility assesses the extent to which income-specific groups can access available housing in the market (Peverini et al., 2023). Researchers such as Sendi (2014) and Kadi (2014) emphasize this distinction, highlighting that access is linked not only to financial capacity, but also to structural market conditions (as cited in Peverini et al., 2023).

However, the existing literature reveals that despite the widespread adoption of green housing practices, the cost pressure on these structures poses a serious barrier to access, especially for low-income groups. Ahn et al. (2014) point out that despite the long-term savings potential offered by green housing, low-income groups struggle to access these structures due to high initial construction and certification costs. Similarly, Schleich's (2019) research in European countries shows that the participation rates of low-income households in energy efficiency investments are quite low. This situation highlights the decisive role played by structural inequalities in access to finance (as cited in, Peverini et al., 2023, p. 11).

Another dimension in which this inequality is further exacerbated is home ownership. According to the trend known in the literature as the “split-incentive dilemma”, the party investing in energy efficiency is the homeowner, while the savings generated by the investment accrue to the tenant. This mismatch reduces interest in green transformation projects, particularly in areas where low-income groups are predominantly tenants, and discourages homeowners from making such investments (Seebauer et al., 2019; Weber & Wolff, 2018; Chegut et al., 2016; Copiello, 2015; as cited in Peverini et al., 2023, p. 11). Thus, considering that the majority of low-income groups are tenants, this inequality becomes even more pronounced.

Yeganeh et al. (2019) show that these financial and structural limitations are not limited to Europe, revealing that low-income and minority groups in the United States mostly live in energy-inefficient, unhealthy housing, while green certified housing is concentrated in high-income areas. This finding reveals that inequalities in access to green housing are deepening not only on the basis of income but also through spatial segregation.

Yeganeh et al. (2021) approached this inequality from a broader perspective, revealing that green certification processes shaped solely around technical criteria can have destructive effects on social structures. In particular, systems such as LEED, which focus on energy and material performance while neglecting social cohesion, can lead to the breakdown of social ties, displacement, and damage to cultural identity in some neighborhoods (Yeganeh et al., 2021).

Another important factor limiting financial access is unequal access to housing loans and mortgage systems. High-income individuals have easier access to both information and incentives, putting these groups at an advantage when it comes to green building investments. On the other hand, low-income groups are excluded from financing sources due to complex application processes, high collateral requirements, and lack of information (Yeganeh et al., 2021). Ying et al. (2025) highlight the Chinese example, where bank loans do not sufficiently consider environmental criteria; as a result, green housing must be financed under the same conditions as traditional projects, which reduces its appeal in the market.

In this context, financing systems for green building investments need to be restructured to reward environmental performance. Raworth et al. (2014) and Agnolucci (2007) highlight the need to offer low-interest, long-term and more accessible credit options for projects that provide environmental benefits. However, such practices are still not widespread in many countries, and banking systems are not sufficiently developed to assess environmental risks.

However, public incentives are also among the key factors affecting the affordability of green housing. MacAskill et al. (2021) conducted a study in Australia and found that publicly subsidized Green Star-certified social housing contributes to household budgets by saving energy for low-income groups; however, the sustainability of these projects is directly dependent on public subsidies. Antoniades (2011) notes that many financial instruments have been implemented to encourage green housing investments; however, he states that these instruments have lost their effectiveness over time and their scope has narrowed.

A similar picture emerges in Türkiye. Daşdemir (2019) notes that current incentive mechanisms are limited to project-based and restricted budgets. Therefore, a systematic and comprehensive support mechanism is needed for green building investments to become widespread in the housing market. The Ministry of Environment, Urbanization and Climate Change (2024) emphasizes that green building investments should be encouraged with public support not only during the production phase but also during the transfer of ownership, rental and use processes.

In addition to all these processes, certification itself should be considered a cost item in its own right. Certification applications, consulting fees, software licenses, simulation analyses and audit processes represent a significant economic burden, especially for small and medium-sized projects. This burden limits investors' willingness to pursue green building projects and contributes to the low supply of certified housing in the market.

In conclusion, access to green certified housing is not merely a matter of environmental awareness; it is a multidimensional issue closely related to income inequality, financial access limitations, spatial injustice, and the effectiveness of institutional support mechanisms. Therefore, sustainable housing policies must be designed with a holistic approach that prioritizes not only environmental performance but also social inclusivity and financial justice. Otherwise, green housing will remain a "prestige product" accessible only to a privileged group, and sustainability goals will risk reproducing social injustices.

2.4 Summary of the Literature

The literature reviewed in this section provides a comprehensive framework covering various topics such as the historical development of green building certification systems, evaluation criteria, their impact on the housing market, and the inequalities. Firstly, it is observed that green building certifications have multidimensional objectives, such as reducing the environmental impact on the built environment, increasing energy and water efficiency, and supporting user health. Each of the systems, LEED, BREEAM, YeS-TR, and BEST, is structured in a manner appropriate to different geographical, regulatory, and cultural contexts in order to achieve these objectives. Research findings in the relevant literature suggest that the BEST system is more compatible with Türkiye's climatic and legal conditions. However, LEED and BREEAM are more widely used due to their global validity and prestige among investors (Ozan et al., 2022).

Secondly, a review of the literature on the economic effects of green building certifications on the housing market reveals that these structures are generally offered at a premium in terms of sales and rental prices. International studies have shown that this price premium is related to energy efficiency, low operating costs, environmental awareness, and prestige (Fuerst & McAllister, 2011; Bond & Devine, 2016). However, this premium is not a fixed rate but varies depending on factors such as geographical location, physical characteristics of the housing, and certification level. The limited number of studies in Türkiye indicate that green certified residential properties are concentrated in large cities and projects targeting high-income groups, and that these structures can provide advantages in terms of investment return periods (Uğur & Leblebici, 2019).

Thirdly, another theme frequently emphasized in the literature is the socio-economic and spatial inequalities that arise in the accessibility of green building practices. Factors such as the high initial costs of housing, limited access to mortgages and loans, insufficient incentives, and the “split-incentive” dilemma between tenants and homeowners significantly hinder low-income households from accessing green housing (Ahn et al., 2014; Schleich, 2019; Seebauer et al., 2019; as cited in, Peverini et al., 2023, p. 11). This situation not only creates economic access issues at the individual level but also exacerbates spatial inequalities, as green housing is typically located in high-income areas (Yeganeh et al., 2019; MacAskill et al., 2021).

When evaluated specifically in Türkiye, the limited scope of existing public support, the cost of the certification process, and the failure of financing instruments to sufficiently encourage environmental investments stand out as significant obstacles to the widespread adoption of green housing (Daşdemir, 2019). Therefore, green building policies must be designed not only with environmental benefit objectives in mind but also in line with the principles of social inclusion and affordability.

A comprehensive review of the existing literature demonstrates that green building certifications contribute to environmental sustainability and can create a certain financial value in the housing market. However, this contribution does not equally benefit all segments of society; particularly for low-income households, there are significant limitations in terms of access and affordability. This situation necessitates a stronger focus on the social dimension of green building policies.

In this context, the following section will present an empirical analysis based on green certified and non-certified housing projects. Comparisons based on market indicators such as sales price, rental value, maintenance fees, and amortization period aim to assess the extent to which trends defined in the literature are valid in the Turkish context. Thus, the effects of green building certification on the housing market will be demonstrated not only theoretically but also empirically.

CHAPTER 3

AN EMPIRICAL INVESTIGATION: DATA AND METHODS

This chapter delineates the methodological approach that was adopted in order to address the main research questions of the study. In the preceding chapters of the thesis, the conceptual foundations of green building certification systems and their effects on the housing market have been comprehensively discussed. Furthermore, issues such as affordability, price structure and supply density have been evaluated in the light of the extant literature. In this context, the methodology section constitutes the applied dimension of the study and provides detailed information on the data collection process, sample selection, analysis tools and statistical methods.

The research aims to examine the status of green certified housing projects within the contemporary Turkish housing market, utilizing market-based data as a primary research method. The primary objective of the study is to elucidate the impact of environmental certification systems on the valuation of housing, with a view to revealing how green certified housing exhibits price differentiation in comparison to non-certified housing that possesses similar physical characteristics. In particular, comparisons based on sales and rental prices are considered as economic indicators that indirectly affect the affordability levels of these buildings.

Despite their significance as a built environment strategy, with principles of environmental sustainability underpinning their development, studies examining how these buildings gain value in the housing market or the potential effects of this value increase on access are quite limited, especially in the context of Türkiye. The present study interrogates the notion of whether green building certification can be regarded as an economic privilege for investors and end-users, and questions this through comparative analyses based on direct market data. Thus, it is aimed to contribute to a more comprehensive evaluation of the social and economic reflections of environmental performance-oriented urban policies.

The methodological framework of the research is structured in a manner that is both compatible with the theoretical framework of the study and enables the production of analyses with high empirical validity. Accordingly, the subsequent sub-headings will provide a comprehensive overview of the research design and theoretical approach, the study area and sample selection, the data sources and data collection process and the analysis methods applied. Within each section, the scope of the research, the methodological preferences that underpin and the criteria that ensure the reliability of the findings will be explicitly presented. The overarching objective of this structure is to furnish a robust methodological basis for understanding the impacts of green building policies on the housing market, encompassing both theoretical and practical dimensions.

3.1 Research Design

In accordance with the sustainable construction targets established in Türkiye, there has been an increased level of interest in green building certification systems in recent years. This interest has been driven by both international systems (e.g. LEED, BREEAM) and national-scale frameworks (YeS-TR, BEST), which have contributed to the adoption of environmental criteria in housing production. However, despite this interest, the number of buildings in Türkiye that have received green building certification, especially at the residential scale, is quite limited (Figure 3.1). Existing practices are generally limited to large-scale and prestige-oriented projects that appeal to high-income groups. This raises questions regarding the positioning of green housing in the general housing market, the user profile to which it appeals and its affordability (Leskinen et al., 2020). The limited number of green certified housing units, coupled with their appeal to a specific demographic, necessitates a holistic examination of their market position, price heterogeneity and affordability.

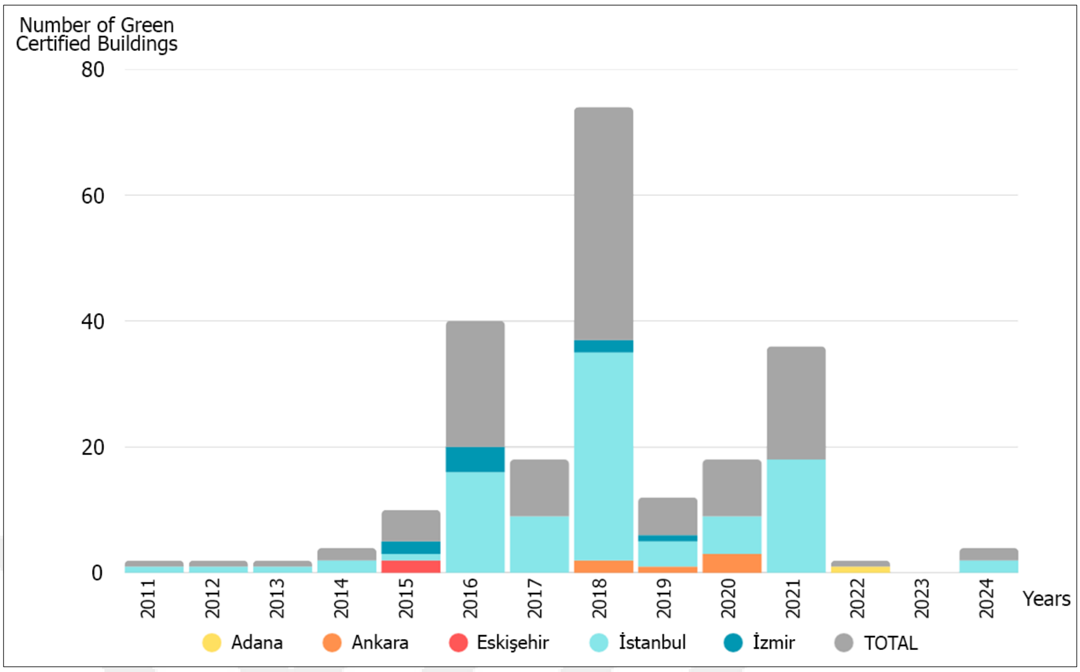

Figure 3.1 Number of Green Certified Buildings by Year (Source: USGBC Database)

Although the research design formulated within this framework is mainly based on quantitative analysis techniques, it is structured with a mixed-method approach, including qualitative research elements in order to strengthen the theoretical framework of the process. In this context, firstly, the national and international literature on the subject was reviewed in detail. The theoretical and methodological inferences obtained from studies analyzing the effects of green building certification systems on the housing market contributed to the general orientation of the research. In particular, comparative analyses on the price differentiation of green certified houses, their positioning in the market and indirectly on their affordability levels have been guiding in shaping the methodological backbone of this study (Kim & Irakoze, 2023; Yeganeh et al., 2021; MacAskill et al., 2021).

In the quantitative dimension of the study, sales and rental advertisements obtained from online real estate platforms were analyzed and comparative evaluations were made between green certified and non-certified housing projects. In this process, the data collection, data preparation, analysis and comparison of data were structured following a systematic method (Figure 3.2).

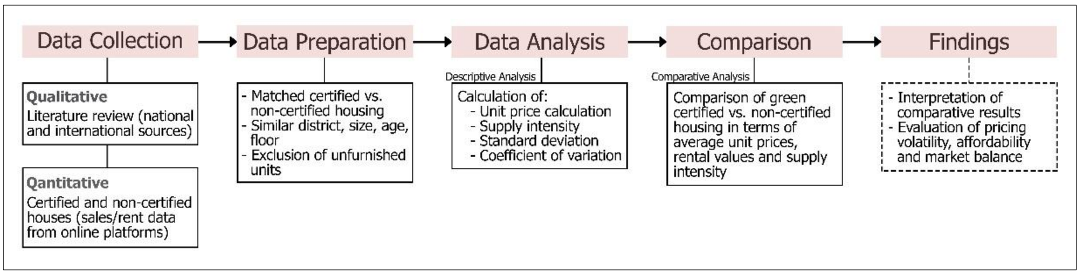

Figure 3.2 Research Process (Produced by the Author)

The analyses based on these indicators aim to assess the extent to which buildings with similar physical (size, age, number of floors) and spatial (neighborhood, district) characteristics are priced differently only due to certification differences and the effects of these price disparities on access practices in the housing market. In this respect, the study develops indirect affordability criteria based on price data rather than directly analyzing income groups or socio-economic classes. Consequently, findings on the visibility and affordability of green building certification in the housing market are obtained through parameters such as price stability, market uncertainty and supply density.

As a result, this research analyses not only the environmental performance of green building projects, but also how these buildings are positioned in the market, by whom they are accessible and how they make a difference in the housing market. This approach, which aims to concretize this relationship, which is usually discussed at a conceptual level in the literature, through data-based comparative analyses, makes a critical contribution to making the social impacts of sustainability policies visible.

3.2 Study Area and Sample Scope

This study has been conducted in selected sample areas within the cities with green building certification at the residential scale in order to reveal how green certified housing projects are positioned in the housing market in Türkiye and to analyze them comparatively with non-certified buildings with similar physical characteristics. In line with this objective, both the availability of green building certification at the urban level, as well as the level of access to relevant market data, were identified as the main criteria for the selection of the sample areas.

In Türkiye, there is a paucity of green building certification for residential buildings, with the majority of those that have been certified being awarded the internationally recognized LEED certificate. The USGBC database indicates that residential projects of this nature are predominantly situated within major metropolitan areas, including Adana, Ankara, Eskişehir, İstanbul and İzmir (USGBC Green Building Database, 2025). However, not all of these cities are included in the scope of the analysis. A key constraint of the study pertains to the accessibility of reliable and comprehensive data, which is limited to specific urban centers. In order to analyze the market data obtained from housing advertisements in a sound manner, it is important to have a sufficient number of observation units (advertisements) and to ensure that the data are up-to-date, identifiable and comparable. For this reason, the geographical scope of the research is limited to Ankara, İstanbul and İzmir, which are considered adequate in terms of the density and quality of advertisement data (Figure 3.3).

Figure 3.3 Provinces with Green Certified Building (Produced by the Author)

These three metropolises offer meaningful sampling areas for the research, not only because they are the cities where green building projects are located, but also because they have the most dynamic and differentiated housing markets in Türkiye. The existence of both market diversity and the distinctiveness of socio-spatial structures has enabled the observation and execution of comparative analyses on the effects of green certification on price structure, supply density and affordability in these cities. Although no direct conclusions can be drawn for other cities or rural settlements, the analyses conducted in these three cities aim to provide important findings on the trends that prevail at the metropolitan level.

In accordance with the objective of the study, the initial phase involved the identification of housing groups (housing complexes or multi-family housing blocks) that have obtained green building certification in Ankara, İstanbul and İzmir. Due to limitations in the available data and in order to examine the planning perspective, the analyses were conducted on certified housing groups rather than individual buildings. The following housing projects are Park Mozaik Evleri in Ankara; AND Pastel, Metropol İstanbul, Oyak Dragos, TEKFEN HEP İstanbul and Narlife Projects in İstanbul; and Soyak Mavişehir Optimus and Soyak Siesta Houses in Izmir (Appendix E). In order to assess the impact of these projects on the housing market, comparative housing estates with similar physical characteristics (such as building age, apartment size, number of floors and number of flats) and without green building certification were identified in the neighborhood where each certified project is located (Table 3.1). This matching allows for a more robust analysis of the impact of certification on house prices and market positioning. In addition, for a better understanding of the physical similarities, Appendix F presents the façade photographs, the number of flats and blocks, and project visuals of certified and non-certified projects analyzed.

Table 3.1 Certified and Non-Certified Houses Selected for the Study (Prepared by the Author)

Province	District	Neighborhood	Certification Status	Name of the Dwelling
Ankara	Çankaya	Alacaatlı	Certified	Park Mozaik Evleri
			Not Certified	Primera Alacaatlı
İstanbul	Kartal	Esentepe	Certified	AND Pastel
			Not Certified	Esentepe Avrupa Konutları
İstanbul	Ataşehir	Atatürk	Certified	Metropol İstanbul
			Not Certified	Trendist Residence
İstanbul	Maltepe	Cevizli	Certified	Oyak Dragos
			Not Certified	Nuvo Dragos
İstanbul	Esenyurt	Zafer	Certified	TEKFEN HEP İstanbul
			Not Certified	Babacan Premium
İstanbul	Maltepe	Başıbüyük	Certified	Narlife
			Not Certified	TOKİ
İstanbul	Küçükçekmece	İnönü	Certified	Nivo İstanbul
			Not Certified	Küçükçekmece Avrupa Konutları
İstanbul	Sarıyer	Maslak	Certified	Ağaoğlu Maslak 1453
			Not Certified	Mashattan
İzmir	Karşıyaka	Yalı	Certified	Soyak Mavişehir Optimus
			Not Certified	Soyak Mavişehir A-B Sitesi
İzmir	Karşıyaka	İnönü	Certified	Soyak Siesta Oxygen and Blue
			Not Certified	Soyak Siesta Energy and 1-2nd Lap

Consequently, the sample structure created in this manner enabled a comparative analysis of the price formations observed in both sales and rental housing markets.

Thus, the extent to which green certified dwellings have price differences compared to non-certified dwellings with similar physical and spatial characteristics has been systematically evaluated. In the analysis process, these differences will be analysed in detail through basic market indicators such as unit square meter sales price, amortization period and burden of dues.

3.3 Data Sources and Collection Process

The dataset utilized in this study is derived from a contemporary, market-based dataset, meticulously prepared to evaluate the position of green certified buildings in the housing market. The study was conducted through the websites of Hepsiemlak, Sahibinden, Emlakjet and Remax, which are the most widely used online property platforms in Türkiye’s housing advertisement market and provide up-to-date data. These platforms offer extensive data pools covering both sale and rental property advertisements, providing comprehensive information on numerous parameters such as pricing, size, location and fees. Furthermore, technical details such as certification levels of green building projects, certification dates and score information were accessed through USGBC and related project companies' websites.

The data collection process was conducted between 10-30 April 2025, during which the current sales and rental advertisements of each project were systematically scanned. In this context, a range of indicators compiled for each housing advertisement, including unit square meter price, total housing area, building age, floor, apartment type, dues information and location. To prevent duplicate entries, which could occur due to the same listing appearing multiple times on different platforms, duplicate listings identified as belonging to the same property were excluded from the dataset. This was done by considering distinctive features such as floor information and apartment type as specified in the listings.

The nature of housing as a commodity is characterized by its heterogeneity; that is to say, it is influenced by a multitude of variables. These include the floor on which it is located, its façade, the view from its location, interior design, construction quality, transport links and even its social environment. It can thus be concluded that no two residential properties are precisely analogous, and that direct comparison is, in theory, impossible. In this study, with an awareness of this structural heterogeneity, listings with similar physical characteristics and the same regional context were selected in order to maximize comparability as much as possible.

In addition, the dataset under consideration was created by the exclusion of advertisements that were deemed to contain incomplete or questionable information and advertisements that were not deemed to be comparable.

Thus, the analysis encompassed a total of 1,369 housing advertisements. While 848 of these advertisements belong to projects with green building certification, 521 of them represent housing projects with similar physical characteristics but without certification (Table 3.2). A total of 10 certified housing groups and 10 non-certified housing groups were selected in the three selected cities.

Table 3.2 Number of Property Advertisements for Certified and Non-Certified Housing Blocks (Prepared by the Author)

Province – District – Neighborhood	Name of the Dwelling	Number of Property Adverts
Ankara – Çankaya – Alacaatlı	Park Mozaik Evleri	20 (13 for sale, 7 for rent)
	Primera Alacaatlı	10 (8 for sale, 2 for rent)
İstanbul – Kartal – Esentepe	AND Pastel	52 (31 for sale, 21 for rent)
	Esentepe Avrupa Konutları	30 (17 for sale, 13 for rent)
İstanbul – Ataşehir – Atatürk	Metropol İstanbul	71 (34 for sale, 37 for rent)
	Trendist Residence	32 (23 for sale, 9 for rent)
İstanbul – Maltepe – Cevizli	Oyak Dragos	13 (9 for sale, 4 for rent)
	Nuvo Dragos	21 (11 for sale, 10 for rent)

Table 3.2 (cont'd)

İstanbul – Esenyurt – Zafer	TEKFEN HEP İstanbul	57 (47 for sale, 10 for rent)
	Babacan Premium	40 (32 for sale, 8 for rent)
İstanbul – Maltepe – Başıbüyük	Narlife	25 (19 for sale, 6 for rent)
	TOKİ	11 (9 for sale, 2 for rent)
İstanbul – Küçükçekmece – İnönü	Nivo İstanbul	68 (41 for sale, 27 for rent)
	Küçükçekmece Avrupa Konutları	61 (23 for sale, 38 for rent)
İstanbul – Sarıyer – Maslak	Ağaoğlu Maslak 1453	450 (393 for sale, 57 for rent)
	Mashattan	188 (166 for sale, 22 for rent)
İzmir – Karşıyaka – Yalı	Soyak Mavişehir Optimus	39 (18 for sale, 21 for rent)
	Soyak Mavişehir A-B Sitesi	12 (9 for sale, 3 for rent)
İzmir – Karşıyaka – İnönü	Soyak Siesta Oxygen and Blue	16 (8 for sale, 8 for rent)
	Soyak Siesta Energy and 1-2. Lap	18 (9 for sale, 9 for rent)

Building indicators include sale and rental prices (MacAskill et al., 2021), average size (m^2) (Chegut et al., 2016), number of storeys (Fuerst & McAllister, 2008), age of the building (Das & Wiley, 2014), fees (Yeganeh et al., 2021) and LEED certification degree and score (Uğur & Leblebici, 2019). Among these data, sales and rental prices, average size (m^2) and LEED certification degree and score are considered as the main factors determining the market value of the housing. In particular, sales and rental prices are considered as the primary determinants in understanding the economic differentiations in the housing market, while indicators such as size, building age, number of floors and dues reveal the sustainable use costs of the housing. Conversely, LEED certification constitutes the environmental sustainability dimension of the analyses, as the principal component demonstrating the environmental performance of the housing.

At the neighborhood level, indicators such as average sale/rent price (Fuerst & McAllister, 2008), average price per square meter (Yeganeh et al., 2021) and amortization period (MacAskill et al., 2021) were used. These data are obtained from market analysis platforms such as Endeksa and reflect the micro-level economic context in which the houses are located. They provide a significant reference for analyzing the relative position of the buildings within the neighborhood. The amortization period was utilized as a metric for evaluating the economic viability of green certified dwellings, ascertaining the potential return on investment.

The following table provides a comprehensive overview of the data sources for all variables utilized in the study, along with the extant literature on which they are based and their intended application in the analysis (Table 3.3). This configuration serves to enhance the validity of comparative analyses and provides a clear presentation of the theoretical and methodological context of each indicator.

Table 3.3 Information on the Data Used in the Study

Data Name	Reference	Retrieved From	Explanation
Structure Indicators			
Sale/Rent Price	MacAskill et al. (2021)	Hepsiemlak, Sahibinden, Emlakjet, Remax	It has been used as a benchmark indicator to analyze differentiations in the housing market.
Average Size (m^2)	Yeganeh et al. (2021)	Hepsiemlak, Sahibinden, Emlakjet, Remax	It was utilized in unit price calculations, and similar sized dwellings were matched.
Number of Floors	Fuerst & McAllister (2008)	Hepsiemlak, Sahibinden, Emlakjet, Remax	It was used to define the physical characteristics of the dwelling and to determine the type of building.
Building Age	Das & Wiley (2014)	Hepsiemlak, Sahibinden, Emlakjet, Remax	In terms of its effect on the value of the buildings, it is considered as a control variable in the analysis.
Dues	Yeganeh et al. (2021)	Hepsiemlak, Sahibinden, Emlakjet, Remax	It was evaluated as the monthly sustainable usage cost of the dwelling and used in comparative analyses.

Table 3.3 (cont'd)

LEED Certificate Degree and Score	Uğur & Leblebici (2019)	USGBC Project Database	It was used to define the environmental sustainability level of the housing.
Neighborhood Indicators			
Average Sale/Rent Price	Fuerst & McAllister (2008)	Endeksa	It was used as a reference value to analyze the position of the house in the market.
Average m^2 Price	Yeganeh et al. (2021)	Endeksa	Unit square meter prices are based on sales price and used as a basis for both internal and market comparisons.
Amortization Period	MacAskill et al. (2021)	Endeksa	This indicator, defined as the ratio of sales price to annual rent, is analyzed as the return on investment.

The green certified dwellings in the dataset were selected only from projects certified according to the LEED system and were selected from the multi-family residential typology. In order to verify the environmental performance of these projects, USGBC's green certified building database was analyzed for each project. Thus, it is ensured that all of the green building projects in the study are officially certified buildings.

In the course of the data collection process, only those houses which had been actively advertised within the specified date range were taken into consideration. In this particular context, records with expired advertisement dates, archived or missing content, were excluded from the analysis. Each property advertisement to be used in the analyses was systematically recorded according to various indicators reflecting the basic physical characteristics and market value of the building. The indicators under scrutiny were selected and structured with the aim of taking into account both the specific characteristics of the building and the environmental context in which the property is located.

The following building indicators have been identified: sale and rental prices (MacAskill et al., 2021), average size (m^2) (Chegut et al., 2016), number of floors

(Fuerst & McAllister, 2008), age of the building (Das & Wiley, 2014), fees[3] (Yeganeh et al., 2021) and LEED certification degree and score (Uğur & Leblebici, 2019). In the context of the analysis, the primary factors influencing the market value of residential properties are considered to be sales and rental prices, average size (m^2) and LEED certification, both in terms of degree and score. In particular, sales and rental prices are considered as the primary determinants in understanding the economic differentiations in the housing market, while indicators such as size, building age, number of floors and dues reveal the sustainable use costs of the housing. Conversely, LEED certification constitutes the environmental sustainability dimension of the analyses, as the principal component demonstrating the environmental performance of the housing.

3.4 Analysis Method

In this study, quantitative and comparative analysis techniques are employed to evaluate the economic position of green certified houses in the market. The methodological structure applied is not only limited to examining price levels, but also provides a multi-dimensional analysis framework through indicators such as the burden of dues, return on investment and price stability.

The basis of the research is to determine whether there is a systematic difference in the price structure between green certified and non-certified housing projects. In this context, market indicators such as the total sales price, the cost of dues, unit square meter prices for rent and for sale were calculated for each housing project. Basic statistical measures such as average, median, standard deviation (SD) and coefficient of variation (CV) were used for the calculated variables (MacAskill et al., 2021; Yeganeh et al., 2021).

[3] A payment collected to cover various expenses such as maintenance, repair, cleaning and security of common areas within an apartment building or complex.

3.4.1 Comparative Analysis of Sales and Rental Values

Within the scope of this sub-heading, the differences between the sales and rental values of green certified housing projects and non-certified projects with similar physical characteristics have been systematically analyzed. In the analysis, the average value differences between the groups were determined based on both total sales prices and unit prices calculated on a square meter basis for each housing group. In this way, the impact of green certification on the market value of housing has been evaluated with concrete data.

Furthermore, the analyses were conducted not only at the project level, but also by comparing the average price indicators of the neighborhoods where the houses are located. This approach enables the elucidation of the positioning of both certified and non-certified projects within the local market context, and the price differential engendered by certification at the neighborhood scale.

3.4.2 Assessment of Dues' Burden

The sustainability of housing is contingent not only on the initial investment cost, but also on the regular expenses incurred during the utilization process. For this reason, the analysis compares the monthly fees for green certified and non-certified dwellings and evaluates the usage costs by taking into account the dues' burden per unit square meter. This indicator is intended to ascertain whether projects that claim environmental efficiency also offer economic sustainability for the user.

3.4.3 Return on Investment Period (Amortization) Analysis

The return on investment period of a residential property is a crucial economic indicator from the perspective of an investor. This ratio is calculated by dividing the sales price of a house by the annual rental income, thus expressing the investment potential of the property quantitatively. Within the scope of the analysis, amortization periods are calculated based on the average sales prices and annual rental income of certified and non-certified housing projects.

Preliminary calculations, based on the total prices, indicate that the return periods are significantly higher than the prevailing market averages. This situation suggests that the high sales values are not proportionally balanced with the current rental income. Conversely, the restriction of advertisement data is limited in number and limited to certain projects has also been effective in such high amortization periods. The limited data structure may result in the rental values not to being fully reflected, consequently leading to calculations that are higher than expected.

Despite these limitations, in order to provide a more reliable comparison, the analysis was conducted again on square meter-based prices. The amortization periods, which are calculated by dividing the unit sales prices by the annual unit rental income, are more reasonable and show that green certified houses are in a more advantageous position in terms of investment. This finding reveals that sustainability-oriented houses offer a strong value proposition in the market in terms of both prestige and rental income.

3.4.4 Price Variation and Stability Analysis

In order to comprehend market stability, it is imperative to consider not only the mean level of house prices, but also the dispersion of this data. Therefore, the standard deviation and coefficient of variation (CV)[4] values of certified and non-certified housing groups are calculated and compared. As CV demonstrates the extent to which prices are distributed relative to the mean, it facilitates the analysis of the level of stability or volatility observed in the market (Kim & Irakoze, 2023). The present analysis aims to assess whether houses with environmental certification

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[4] The coefficient of variation was calculated by dividing the standard deviation by the unit average price per square meter.

have a more homogeneous structure in terms of price stability (Yeganeh et al., 2021; Fuerst & McAllister, 2008).

CHAPTER 4

FINDINGS AND DISCUSSION

The present chapter conducts an analysis of the economic differentiation between green certified and non-certified housing projects on the basis of various market indicators. The findings are then discussed in comparison with existing studies in the literature. The analyses are based on 1,369 advertisement data points from 10 green certified housing projects and 10 non-certified housing groups with similar physical and spatial characteristics located in Ankara, İstanbul and İzmir. For each project, a comprehensive comparison was made by taking into account indicators such as sales and rental values, dues burden, return on investment period (amortization) and price variation.

The findings are structured on a city and project basis, and under each subheading, the impact of green building certification on the housing market for a specific project is presented with the help of statistical measures. It is evident that this structure facilitates the analysis both general trends and local variations with a high degree of detail. The results demonstrate that, in the majority of cases, green certified houses are positioned at a higher market value. However, this situation is shaped by different dynamics in each project and city context. Furthermore, comparative market analyses presented in studies such as Fuerst and McAllister (2008), Yeganeh et al. (2021), MacAskill et al. (2021) and Kim & Irakoze (2023) are utilized to evaluate these findings, and points of consistency and divergence with similar findings in the literature are discussed.

4.1 Ankara – Park Mozaik Evleri & Primera Alacaatlı

The analysis of Park Mozaik Evleri, located in the Alacaatlı neighborhood of Çankaya District of Ankara, aims to evaluate the position of green certified buildings in the housing market compared to non-certified projects with similar physical characteristics. The Primera Alacaatlı Project, which is located in the same neighborhood but does not have a green building certificate, is considered a comparison group.

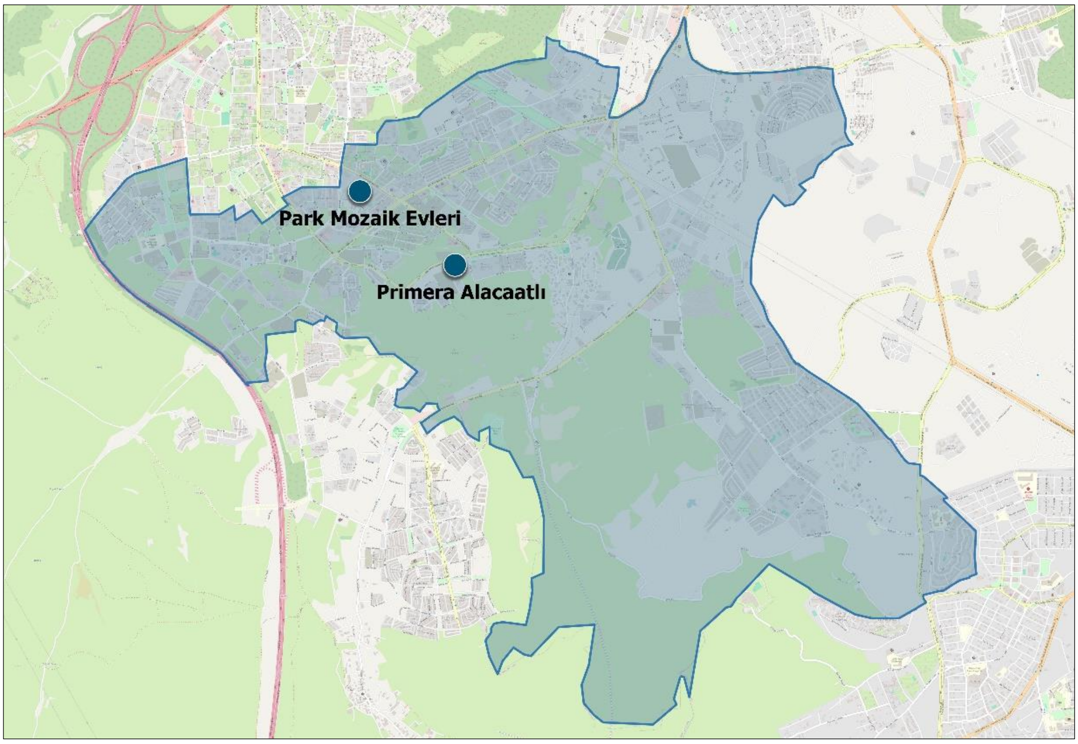

Figure 4.1 Locations of Park Mozaik Evleri and Primera Alacaatlı (Produced by the Author

4.1.1 Sale and Rental Values

In Table 4.1, a comparative analysis is conducted on the sale and rental values of the Park Mozaik Evleri and Primera Alacaatlı Projects.

Table 4.1 Sale and Rental Values of Park Mozaik and Primera Houses

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Park Mozaik (Certified)	185.55	163.80	20,542,153.85	85,714.29	111,595.49	455.24
Primera (Non-certified)	252.10	219.90	20,484,375.00	69,000.00	79,900.05	293.62
Neighborhood Average	195.00	-	14,158,95.00	47,802.00	72,610.00	339.00

With regard to sales prices, although both projects have similar total sales prices, the average unit square meter sales price of Park Mozaik Houses is considerably higher than Primera Alacaatlı (79,900.05 TL) at 111,595.49 TL. This finding indicates that Park Mozaik Evleri is positioned at a premium in the market with a higher price per square meter despite its smaller unit size. There is a similar trend in rental housing. While the average rental price per square meter of a certified property is 455.24 TL, this value is only 293.62 TL for a non-certified property.

This difference reveals that green building certification has a direct influence on market value, impacting factors such as prestige, environmental credibility, and energy efficiency. Furthermore, while the average rental value for Park Mozaik is 85,714.29 TL, this value is only 69,000.00 TL in the comparative group.

These findings are consistent with those reported in studies such as MacAskill et al. (2021), which indicate that green certified houses are priced at a premium in the market. On the other hand, the observation that price differences are more pronounced in Ankara suggests that local variables, including regional income levels, user profiles and project prestige, may have a significant impact on pricing.

4.1.2 Amount of Dues

A notable disparity in dues' burden is evident when comparing the Park Mozaik Evleri and Primera Alacaatlı Projects. The mean cost in Park Mozaik Evleri, a development that boasts a green building certificate, is 4,702.67 TL. By contrast, this value is 2,500.00 TL in Primera Alacaatlı. The finding that the dues for the certified project are almost double those of the non-certified project indicates that the costs of maintaining advanced technology systems used in green building projects, the quality of common area services, and the quality of site management are reflected in the dues. This situation is consistent with the extant literature on the subject, which demonstrates that the systems employed in order to ensure environmental efficiency result in high initial and operating costs (Antoniades, 2011).

However, high dues should not always be regarded as a detrimental indication. It should also be taken into account that the cost of dues in these projects can be balanced with sustainable living components such as energy and water saving, waste management and other related fields. This approach has the potential to yield economic benefits for users over time. Consequently, the discrepancy in dues should be evaluated not solely in terms of its financial implications, but also in relation to the range of services provided and their sustainability value.

4.1.3 Return on Investment Period (Amortization)

According to the calculations, the average amortization period of the certified housing group is approximately 20.7 years, while the average amortization period of the non-certified housing group is 22.3 years. This difference indicates that the houses with environmental certification are in a more advantageous position in terms of rental income. This ratio between sales price and rental income demonstrates that environmental performance in green building projects is associated with both the prestige dimension and the economic return potential.

The results show that the implementation of standards for environmental sustainability can result in such standards becoming an economic privilege for investors. The increased rental values and reduced repayment periods of certified houses have been shown to increase the value of these buildings in the market, thus rendering them a robust option for long-term investment decisions.

4.1.4 Price Variation and Stability

In the analysis of Park Mozaik and Primera Houses for sale, it is seen that the standard deviation (SD = 14,024.66) and coefficient of variation (CV = 0.176) values of the non-certified housing group are higher than the certified housing group (SD = 9,452.11 TL, CV = 0.085) (Table 4.2). This indicates that non-certified housing units are spread over a wider price range, indicating a more heterogeneous market structure. On the other hand, the fact that certified houses are concentrated in a specific price band suggests that this group is operating within a more controlled, limited and relatively homogenous market. Indeed, as Fuerst and McAllister (2008) explain, the fact that green certified houses meet certain quality standards and appeal to a narrower user profile is the reason for this situation.

Table 4.2 Price Distribution of Park Mozaik and Primera Houses

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Park Mozaik (Certified)	19,900,000.00	80,000.00	9,452.11	26.38	0.085	0.058
Primera (Non-certified)	19,940,000.00	69,000.00	14,024.66	6.02	0.176	0.021

However, the situation is different in the rental market. In this segment, the standard deviation (26.38) and CV (0.058) values of the rental prices of the certified housing group are higher than those of the non-certified housing group (SS = 6.02; CV = 0.021). This phenomenon reveals that the prices of green certified rental houses exhibit greater fluctuations in proportion. This variability in prices may be attributed to the limited number of samples in the dataset, as well as the differences in equipment, social facilities, location advantages and site management services among these houses in the luxury segment. In addition, this findings suggest that the certified rental housing market may not yet be fully established (Yeganeh et al., 2021).

It has been observed that green certified houses have a more stable and homogeneous price structure within the sales market. Conversely, in the rental housing market, these buildings are distributed across a wider price range. This reveals that the influence of green building certification on the market structure is not only limited to the price level, but also affects structural elements such as stability and segmentation.

4.2 İstanbul – AND Pastel & Esentepe Avrupa Konutları

This analysis of AND Pastel, located in Esentepe Neighborhood of İstanbul's Kartal District, aims to evaluate the position of green certified residences in the housing market, compared to non-certified projects with similar physical characteristics. Avrupa Konutları Project, which is located in the same neighborhood, is considered a point of comparison as it does not have a green building certificate.

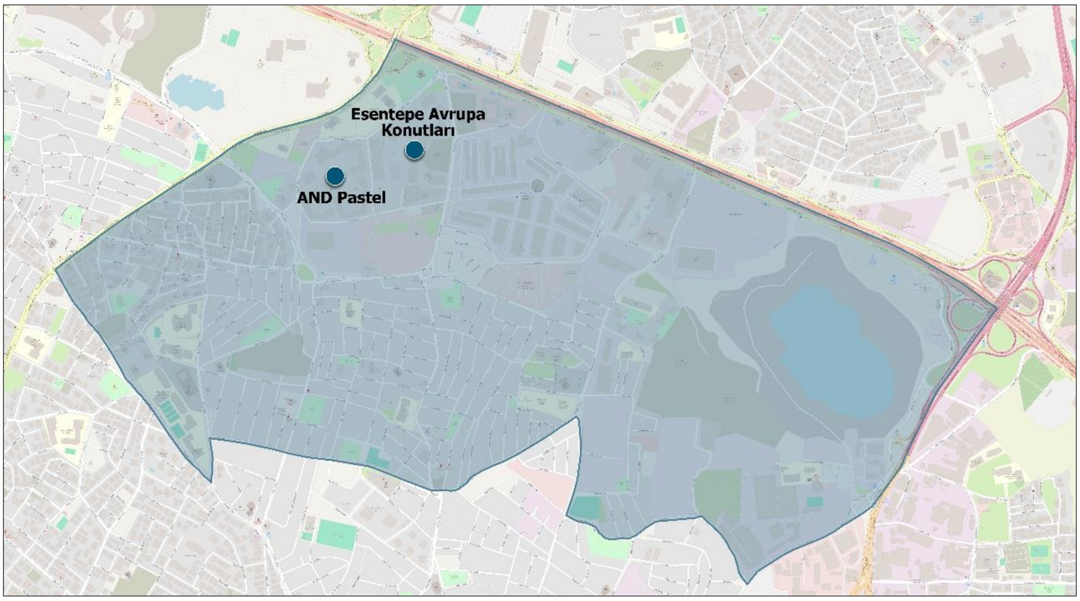

Figure 4.2 Locations of AND Pastel and Esentepe Avrupa Konutları (Produced by the Author)

4.2.1 Sale and Rental Values

According to the data, the average sales price of the AND Pastel is approximately 11,520,064.52 TL, with a sales price per square meter is 87,187.99 TL (Table 4.3). In contrast, the average selling price of the non-certified residential group is TL 13,972,941.18 TL, with a selling price per square meter of 105,432.76 TL.

Table 4.3 Sale and Rental Values of AND Pastel and Esentepe Avrupa Konutları

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
AND Pastel (Certified)	113.87	77.15	11,520,064.52	40,249.76	87,187.99	463.15
Avrupa Konutları (Non-certified)	132.17	101.07	13,972,941.18	64,076.92	105,432.76	486.57
Neighborhood Average	107.00	-	6,657,647.00	34,371.00	62,221.00	386.00

A similar trend can be seen in terms of rental prices. The average rental price for certified houses is calculated as 40,249.76 TL, while the average rental price per square meter is calculated as 463.15 TL. For non-certified housing group, these figures are 64,076.92 TL and 486.57 TL respectively. Again, the difference in the total rental price is largely depends on the size of the dwelling. Both housing types have rental values that are significantly higher than the neighborhood average of 386.00 TL/m². This indicates that both certified and non-certified properties are positioned in a higher price compared to the general housing market of their neighborhood.

4.2.2 Amount of Dues

According to the obtained data, the average cost of dues is calculated at 5,589.29 TL for the housing group with green building certification and 5,160.00 TL in the non-certified housing. Although the difference in dues is relatively small, it is ban be seen that this cost is slightly higher in projects with environmental certification. This may be due to the maintenance costs of the technical infrastructure used to meet sustainability standards, the more advanced social facilities or the difference in the level of service management.

On the other hand, the limited difference in dues may indicate that green building certification does not create an additional financial burden for users. It is considered that energy and water-saving systems can offset this cost in the long term, and sometimes even provide a financial benefit. In this context, the cost of the certification should be considered not only as a financial expense, but also as part of quality of life and sustainability performance.

4.2.3 Return on Investment Period (Amortization)

According to the findings, the amortization period for the certified housing group is calculated as 15.7 years, compared to 18.1 years for the non-certified group. This difference indicates that projects with green building certificates are more attractive to investors. The shorter repayment period indicates that the rental income from these properties exceeds the sales price, making them a more attractive investment option.

The advantage of certified housing is supported by more than just rental income; it is also driven by the marketing value of sustainability practices and increased user preferences. In particular, factors such as energy efficiency, prestige and lower operating costs increase the investment potential of these buildings. In conclusion, amortization period data demonstrates that green building certification offers strong environmental and economic value.

4.2.4 Price Variation and Stability

In the analysis of houses for sale, the standard deviation values are similar, but the coefficient of variation (CV) differs (Table 4.4). The CV is calculated as 0.092 for the certified housing group and 0.067 for the non-certified group. This indicates that certified houses have relatively greater variability in sales prices. This fluctuation in sales prices may be due to green building projects being located in the luxury segment and including apartments with different levels of equipment or marketing strategies determined in line with user preferences.

Table 4.4 Price Distribution of AND Pastel and Esentepe Avrupa Konutları

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
AND Pastel (Certified)	10,800,000.00	34,500.00	7,986.84	60.00	0.092	0.130
Avrupa Konutları (Non-certified)	15,240,000.00	60,000.00	7,109.69	34.70	0.067	0.071

This difference is even more pronounced in the rental housing market. The CV value of 0.130 for rental prices in certified housing is almost double that of the non-certified housing group, at 0.071. This suggests either that the market is not yet fully established or that rental housing is significantly differentiated according to equipment, square meters, and service levels. However, this variability may also be related to the limited number of samples in the dataset or the relatively low supply of green rental housing (Yeganeh et al., 2021).

In general, these projects are characterized by stable in sales prices and highly variable rental prices. The fluctuations observed in the rental market, especially in certified housing, suggest that this segment has not yet become fully institutionalized or that rental conditions vary depending on the level of standards.

4.3 İstanbul – Metropol & Trendist Residence

In this sub-section, the Metropol İstanbul Project located in Atatürk Neighborhood of Ataşehir District of İstanbul and Trendist Residence Projects located in the same neighborhood, which do not have a green building certificate, are analyzed comparatively. Although both projects display comparable physical size and location characteristics, only Metropol İstanbul has LEED certification.

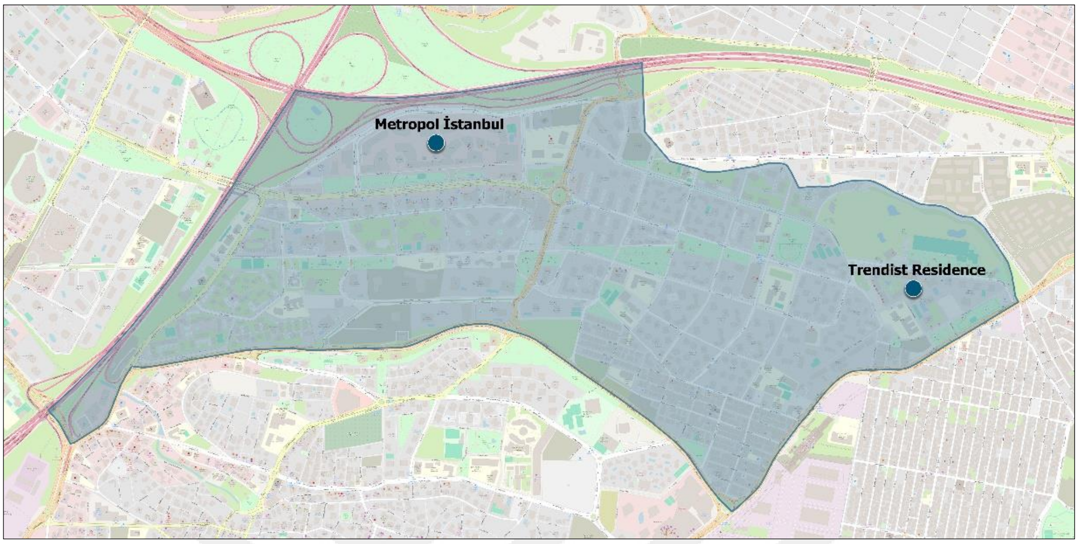

Figure 4.3 Locations of Metropol İstanbul and Trendist Residence (Produced by the Author)

4.3.1 Sale and Rental Values

Upon analysis of Table 4.5, the average sales price of Metropol İstanbul is determined to be 16,847,058.82 TL, with the sales price per square meter is 148,663.38 TL. By way of contrast, the values for Trendist Residence are 18,607,826.09 TL and 124,196.17 TL, respectively. The difference indicates that the green certified housing is positioned in the market with a higher unit price.

Table 4.5 Sale and Rental Values of Metropol İstanbul and Trendist Residence

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Metropol (Certified)	109.49	76.56	16,847,058.82	72,524.86	148,663.38	684.37
Trendist (Non-certified)	137.38	103.34	18,607,826.09	68,666.67	124,196.17	650.53
Neighborhood Average	129.00	-	12,990,171.00	53,275.00	100,699.00	493.00

With regard to total sales prices, the higher price of the non-certified housing is attributable to the fact that the apartment size (Average gross m²: 137.38) is considerably larger than in Metropol İstanbul (Average gross m²: 109.49). However, a comparison of the price per square meter reveals that certified housing is valued at a higher unit price. This finding indicates that the attainment of green building certification can result in a price premium in residential property valuation, irrespective of the property's size. In summary, it can be posited that a house of reduced size yet superior in terms of environmental impact and aesthetic value can be sold at a higher price per square meter. This finding is consistent with the "green premium" effect mentioned by MacAskill et al. (2021).

In relation to the rental market, while the average rental value of Metropol İstanbul is 72,524.86 TL and the unit square meter rent is 684.37 TL, these values for Trendist Residence are 68,666.67 TL and 650.53 TL, respectively. Both housing groups are well above the neighborhood average (493.00 TL/m²). The findings indicate that both certified and non-certified projects are positioned within the luxury housing segment. However, green certified housing are distinguished in the market due to their higher square meter rental values.

4.3.2 Amount of Dues

According to the data, while the average dues in Metropol İstanbul is 9,858.11 TL, this value is calculated as 8,445.00 TL for Trendist Residence. As evidenced by the case studies of Park Mozaik Evleri and AND Pastel, the elevated dues of green certified projects may be related to the operational and maintenance costs of components such as advanced building technologies, energy efficiency systems, central automation infrastructures and extensive social facilities.

Moreover, as in the previous examples, it should not be directly assumed that this difference means a negative impact on the investor or the user. This is because green building practices offer a structure that can compensate for this fee cost in the long term, especially thanks to the efficiency they provide in energy and water consumption (Antoniades, 2011). In conclusion, the high level of dues in Metropol İstanbul should be evaluated in conjunction with the environmental and managerial opportunities offered by the project. It is imperative that dues levels are regarded not solely as a cost element, but also as a constituent of the sustainability value chain of the housing.

4.3.3 Return on Investment Period (Amortization)

According to the results of the analysis, the amortization period for the Metropol İstanbul Project is approximately 17.2 years. On the other hand, the amortization period in Trendist Residence is calculated as 16.0 years. This finding contradicts earlier research, suggesting that non-certified housing can offer a more efficient return on investment.

This situation can be interpreted in a number of ways. It shows that the green certified housing is priced higher in the sales market. However, this price difference is not offset by the rental income at the same rate. In other words, Metropol İstanbul is more expensive per unit square meter, but the rental income does not fully compensate for this difference. This indicates that sustainable housing may not invariably provide a short-term financial benefit in terms of investment, yet it may be favored by subsequent benefits such as long-term value enhancement, prestige, user' loyalty and reduced operating expenses (MacAskill et al., 2021).

In addition, the higher dues or equipment differences in green building projects may limit rental demand for potential tenants, which may extend the amortization period. Nevertheless, in projects such as Metropol İstanbul, factors such as environmental quality, which appeal to a more discerning user base and branding value, can compensate for the difference in the payback period in the long term.

In conclusion, this comparison reveals that green building investments should be evaluated with a long-term value accumulation and sustainability-based investment logic rather than short-term rental income.

4.3.4 Price Variation and Stability

Median values, standard deviations and coefficients of variation for Metropol İstanbul and Trendist Residence Projects were analyzed (Table 4.6). In the context of the sales market, the standard deviation for Metropol İstanbul project is calculated as 13,698.29 TL and the CV value is 0.092. The values obtained from this analysis indicate that prices are more tightly distributed around the mean and that the market has a relatively more homogenous structure. In contrast, Trendist Residence has a standard deviation of 24,018.36 and a coefficient of variation of 0.193. This high level of variability indicates that sales prices are distributed over a wider range and that there is greater uncertainty within the market.

Table 4.6 Price Distribution of Metropol İstanbul and Trendist Residence

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Metropol (Certified)	14,625,000.00	59,000.00	13,698.29	110.91	0.092	0.162
Trendist (Non-certified)	16,000,000.00	60,000.00	24,018.36	141.48	0.193	0.217

A similar pattern is observed in the rental market. While the standard deviation of rental prices in Metropol İstanbul is 110.91, this value is 141.48 in Trendist Residence. The coefficient of variation is calculated as 0.162 and 0.217, respectively. This discrepancy reveals that the green certified project exhibit a more stable price structure within the rental housing market.

The lower standard deviation and CV values observed in certified projects indicate that prices are shaped at more predictable levels as a result of environmental quality standards. In particular, the qualitative standards provided by green certification have been shown to both narrow the price range and reduce market fluctuations by rendering the project appealing to a specific user segment. Consequently, when evaluated in terms of both sales and rental markets, green certified projects exhibit lower price volatility and offer a more balanced and predictable market environment for investors and users.

4.4 İstanbul – Oyak Dragos & Nuvo Dragos

In this section, Oyak Dragos Houses, which have LEED certification, and Nuvo Dragos Houses, which do not have an environmental certification but have similar physical characteristics, located in Cevizli Neighborhood of Maltepe District of İstanbul, are examined.

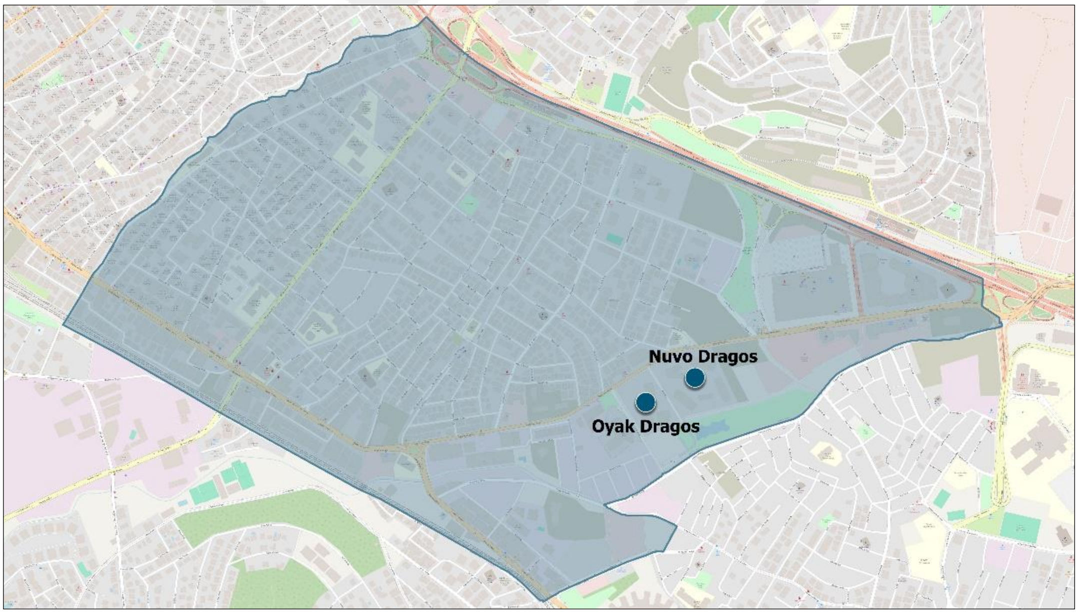

Figure 4.4 Locations of Oyak Dragos and Nova Dragos (Produced by the Author)

4.4.1 Sale and Rental Values

When the relevant data are examined, the average sales price of Oyak Dragos is 17,837,777.78 TL, while that of Nuvo Dragos is 9,839,090.91 TL (Table 4.7). The average unit sales price of the certified project is 96,710.84 TL/m², whereas the average unit sales price of the non-certified project is 89,594.37 TL/m². This finding indicates that green building certification exerts a positive influence on the unit price level.

Table 4.7 Sale and Rental Values of Oyak Dragos and Nuvo Dragos

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Oyak Dragos (Certified)	163.85	110.38	17,837,777.78	52,250.00	96,710.84	444.68
Nuvo Dragos (Non-certified)	119.52	83.71	9,839,090.91	55,100.00	89,594.37	423.20
Neighborhood Average	106.00	-	6,981,796.00	37,649.00	65,866.00	392.00

A notable phenomenon is evident in the realm of rental prices. The average rental price is calculated as 52,250.00 TL in the certified housing group and 55,100.00 TL in the non-certified housing group. However, when the rental prices on a square meter basis are analyzed, it is 444.68 TL/m² in Oyak Dragos and 423.20 TL/m² in Nuvo Dragos. In other words, despite the smaller non-certified housing with higher absolute rental value, the buildings with environmental certificates are still in a more advantageous position at the unit square meter level.

The findings reveal that the environmental quality of the housing creates value in the perception of the user and is one of the factors shaping the sales and rental decisions. Furthermore, both projects are priced well above the neighborhood average (65,866.00 TL/m² for sale and 392.00 TL/m² for rent).

4.4.2 Amount of Dues

An analysis of the dues data indicates that the certified housing has an average dues cost of 4,503.88 TL, whereas the non-certified project has an average dues cost of 6,210.06 TL. It is intriguing to note that Oyak Dragos Project, which has obtained environmental certification, exhibits a reduced cost structure for its members.

This finding contradicts the prevailing notion that green building projects invariably lead to increased utilization costs. In fact, the analysis indicates that energy and water efficient infrastructures have the potential to reduce long-term costs. This finding indicates that the operational advantages that come along with environmental performance should also be taken into consideration for the user.

4.4.3 Return on Investment Period (Amortization)

The calculations reveal that the average payback period is 18.3 years for the Oyak Dragos Project with green building certification and 17.9 years for the Nuvo Dragos Project without certification. This result shows that, contrary to previous examples, environmentally certified housing requires a slightly longer time period to amortize, rather than a shorter one, in terms of investment. The rationale behind this discrepancy can be attributed to the disparity in financial metrics between Oyak Dragos and Nuvo Dragos. While the former exhibits a higher sales price, the latter demonstrates a superior rental income. This indicates that, in certain green building projects, rental returns are comparatively constrained relative to the substantial sales value and the short-term financial benefit for the investor, which is not assured.

However, when indirect returns such as environmental quality, prestige factor, long-term value increase, user loyalty and lower operating costs are also taken into account in such projects, it is understood that the investment value of green housing should not be limited to the a period (MacAskill et al., 2021; Kim & Irakoze, 2023).

4.4.4 Price Variation and Stability

When both projects are evaluated in terms of houses for sale, the median sales price of the green certified Oyak Dragos project is 18,000,000.00 TL, the standard deviation is 10,441.62 and the coefficient of variation is 0.108 (Table 4.8). In the non-certified Nuvo Dragos project, the average sales price is 9,190,000.00 TL, the standard deviation is 8,190.17 and the CV is 0.091. These values reveal that prices in the non-certified project show a relatively narrower distribution and there is a more homogeneous structure in sales prices.

Table 4.8 Price Distribution of Oyak Dragos and Nuvo Dragos

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Oyak Dragos (Certified)	18,000,000.00	37,000.00	10,441.62	44.49	0.108	0.100
Nuvo Dragos (Non-certified)	9,190,000.00	48,000.00	8,190.17	47.53	0.091	0.112

When the data for rental housing is examined, the situation is reversed. The standard deviation of rental prices in the certified housing is 44.49 and the CV value is 0.100. On the other hand, the standard deviation of the non-certified project is 47.53 and the CV value is 0.112. This difference indicates that the green certified project has a more stable price structure within the rental housing market, thereby facilitating more predictable rental values.

The findings reveal that price stability in sales and rental markets may be subject to variation across different projects. Furthermore, environmental certification has been observed to exert a constraining influence on price fluctuations, particularly within the context of rental market. The lower coefficient of variation observed in rental housing suggests that green building projects appeal to a specific user profile and that rental prices are more stable in line with this homogenous user group.

In conclusion, it is observed that green building certification contributes positively not only to the price level, but also to price stability in the housing market. Thus, it is demonstrated that such certification creates a more stable market structure, especially in the rental housing segment.

4.5 İstanbul – TEKFEN HEP İstanbul & Babacan Premium

The present analysis of TEKFEN HEP housing located in Zafer neighborhood, in Esenyurt district of İstanbul, aims to evaluate the position of green certified housing in the housing market compared to non-certified projects with similar physical characteristics. Babacan Premium Project, which is located in the same neighborhood as the certified building but does not have a green certificate, is considered as a comparison group.

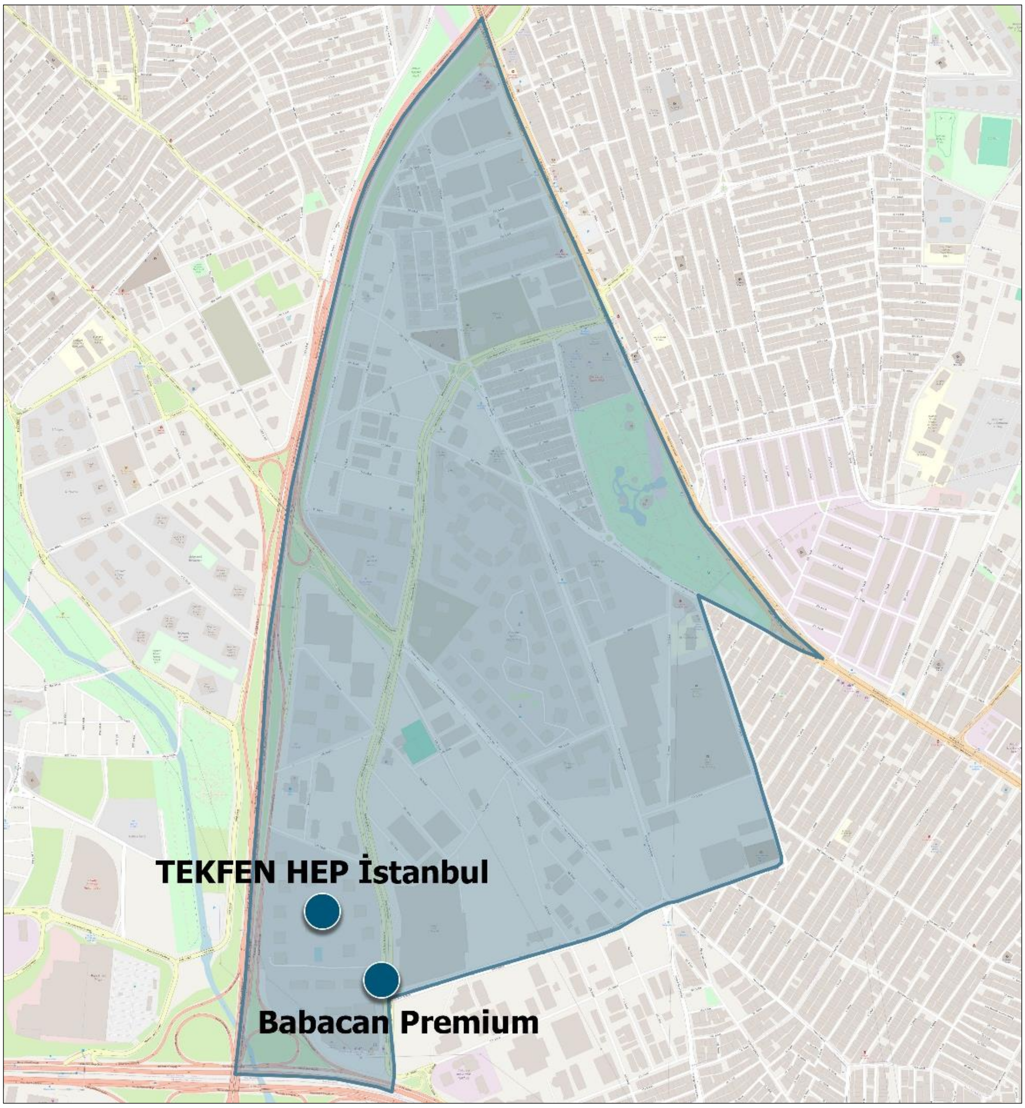

Figure 4.5 Locations of TEKFEN HEP İstanbul and Babacan Premium (Produced by the Author)

4.5.1 Sale and Rental Values

Upon analysis of Table 4.9, the average sales price of TEKFEN HEP is calculated as TL 4,759,574.47 and the sales price per square meter is calculated as TL 37,433.07. In contrast, the values for Babacan Premium are 4,161,093.75 TL and 38,866.02 TL, respectively. This situation reveals that residential properties with green certificates possess a higher market value per square meter.

Table 4.9 Sale and Rental Values of TEKFEN HEP and Babacan Premium

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
TEKFEN (Certified)	127.75	101.65	4,759,574.47	30,100.00	37,433.07	230.47
Babacan (Non-certified)	109.68	88.38	4,161,093.75	24,437.50	38,866.02	203.43
Neighborhood Average	104.00	-	3,418,584.00	18,846.00	32,871.00	209.00

In terms of rental prices, the average rental value of certified houses is TL 30,100.00, while it is TL 24,437.50 for non-certified houses. This absolute difference is also sustained when evaluated on a net square meter basis, as the average square meter rental value of certified residences is 230.47 TL/m², while it is 203.43 TL/m² for non-certified residences. TEKFEN HEP Project is located above the neighborhood average of 209.00 TL/m².

4.5.2 Amount of Dues

The average cost of dues is observed to be 4,500.00 TL in certified houses and 2,157.27 TL in non-certified houses. This difference may be attributable to a range of factors, including the maintenance costs associated with high-tech systems employed in green building projects, the extent of social facilities available and the quality of services provided. In addition, this finding is consistent with the observations of Antoniades (2011), who reported that higher fees in green housing projects are frequently balanced by superior service quality and reduced energy consumption.

4.5.3 Return on Investment Period (Amortization)

The calculations made within the scope of this analysis reveal that the average amortization period of certified houses is 13.1 years, while that of non-certified houses is 15.9 years. This finding indicates that green certified projects offer a more advantageous alternative for investors not only environmentally but also economically. The shorter amortization period indicates that the rental income of certified houses is stronger than the sales value and that these buildings are considered as options with high rental potential that are in demand in the market. This outcome aligns with the findings reported in the literature, as highlighted in MacAskill et al. (2021), which asserts that “green housing offers an advantage in return on investment”.

4.5.4 Price Variation and Stability

In terms of houses for sale, the standard deviation of the green certified TEKFEN HEP Project is 8,771.72 and the coefficient of variation (CV) is 0.234 (Table X). These values indicate that prices in the certified housing group are spread over a wider range around the average and have more fluctuations within the market. In the non-certified Babacan Premium Project, the standard deviation is 4,836.61 and the CV value is 0.124. This indicates that the non-certified project has higher price stability and a more homogenous market structure.

Table 4.10 Price Distribution of TEKFEN HEP and Babacan Premium

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
TEKFEN (Certified)	4,250,000.00	30,000.00	8,771.72	42.49	0.234	0.184
Babacan (Non-certified)	4,265,000.00	24,500.00	4,836.61	25.94	0.124	0.128

The data on rental housing also reveal a similar differentiation. In the certified housing group, the standard deviation of rental prices is 42.49 and the coefficient of variation is 0.184. Conversely, in the non-certified project, these values are 25.94 and 0.128, accordingly. This difference indicates that there is a greater degree of variability in rental prices in green certified projects, revealing a relatively more heterogeneous market structure.

4.6 İstanbul – Narlife & TOKİ

The Narlife Project, located in the Başıbüyük neighborhood of the Maltepe district, has been evaluated as a LEED-certified residential complex. Within the scope of the comparative analysis, the TOKİ Project, which is located in the same neighborhood and does not have a green certificate, has been included in the sample. Both building groups are similar in terms of location, architectural design and physical characteristics.

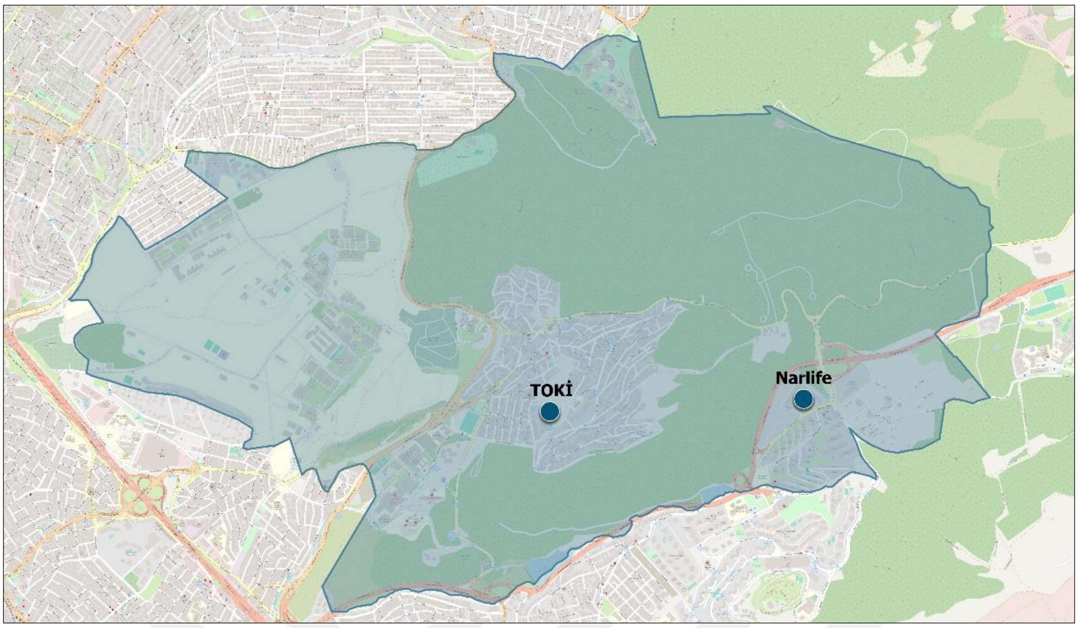

Figure 4.6 Locations of Narlife and TOKİ (Produced by the Author)

The unique aspect of this match is that TOKİ is the primary actor in the production of publicly subsidized housing for low-income groups in Türkiye. In this context, the inclusion of TOKİ in the analysis provides a significant opportunity not only to reveal the economic divide between market segments but also to highlight the socio-economic affordability limits of environmental certification systems.

The relatively low prices of TOKİ projects are a natural consequence of their being carried out under a public-sector production model. Since there are no other private-sector projects with similar characteristics in the same neighborhood that do not have green certification, TOKİ has been selected as the most appropriate comparison group. This situation also shows that the price differences in the analysis are not only due to certification but also to the nature of the producers.

In comparison to the green building analyses that are typically conducted within the private sector, as evidenced in the extant literature, this comparison presents an alternative evaluation area concerning the relationship between environmental sustainability and social housing policies. Thus, it proposes a new discussion ground on the place and potential effects of environmental performance criteria in public housing production.

4.6.1 Sale and Rental Values

The LEED-certified Narlife and TOKİ Projects demonstrate clear differences in terms of market segments (Table 4.11). In terms of average sales price, this value is approximately 14,886,842.11 TL for the Narlife Project, while it is only 4,517,777.78 TL for TOKİ housing. Similarly, average rental prices also support this difference; the average rental price in Narlife is 48,916.67 TL, whereas in TOKİ it is 22,100.00 TL.

Table 4.11 Sale and Rental Values of Narlife and TOKİ

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Narlife (Certified)	117.72	96.96	14,886,842.11	48,916.67	115,732.41	588.18
TOKİ (Non-certified)	93.00	81.82	4,517,777.78	22,100.00	48,232.50	245.56
Neighborhood Average	100.00	-	6,523,300.00	33,952.00	65,233.00	346.00

Calculations based on square meters, which were made to isolate the effects of these differences due to housing size, provide a clearer picture of the disparity. In the Narlife Project, the average unit sales price is 115,732.41 TL/m², while the rental price is 588.18 TL/m²; in TOKİ housing, these values are 48,232.50 TL/m² and 245.56 TL/m², respectively. In summary, residential properties that have been certified under the green building standard are priced at approximately double the premium in both the sales and rental markets.

4.6.2 Amount of Dues

There is a noticeable difference between the Narlife and TOKİ projects with respect to maintenance fees. While the average monthly maintenance fee for the Narlife project is 5,733.30 TL, this figure is only 896 TL for TOKİ housing. This discrepancy is closely related to the technical infrastructure, social amenities, management model and target user profile of the projects.

The LEED-certified Narlife Project features energy-efficient systems, wastewater recycling infrastructure, high-quality common area services, and various social facilities as part of its sustainable building management. The presence of environmental and quality-of-life features has been demonstrated to have a direct impact on maintenance fees. Nevertheless, the financial implications of this cost escalation are counterbalanced by the long-term economic benefits that arise from reduced energy and water consumption (Antoniades, 2011).

Within the context of the TOKİ project, the relatively modest maintenance fees can be attributed to three key factors. Firstly, the limited nature of the common areas available to residents. Secondly, the management approach, which is focused on providing basic services only. And thirdly, the utilization of a publicly supported operating model. In the context of these social housing projects, the capacity of users to contribute maintenance fees is a salient consideration. The management structure is predicated on accessibility as a primary concern, superseding the pursuit of sustainability objectives.

The discrepancy in maintenance fees between these two projects is indicative of a cost comparison, as well as the structural distinction between sustainable housing production and social housing policies. While high maintenance fees in green building projects may not always imply an economic burden, from the perspective of social housing users, such a cost increase could become an accessibility barrier. This necessitates careful consideration of this distinction at the policy level.

4.6.3 Return on Investment Period (Amortization)

According to amortization period calculations, this period has been determined as approximately 16.5 years for Narlife and 16.4 years for TOKİ. This disparity between the two is extremely limited, indicating that the green building certification does not provide a significant advantage in terms of return on investment in this example.

This situation suggests that Narlife's high sales price may have increased more rapidly compared to rental income. Conversely, TOKİ's low prices and rental levels, have kept the payback period relatively balanced. Ultimately, this finding indicates that green building projects may not always offer shorter amortization periods.

4.6.4 Price Variation and Stability

When examining the price distributions of Narlife and TOKİ Projects, the coefficient of variation (CV) for sales prices is 0.200 for Narlife and 0.167 for TOKİ (Table 4.12). This indicates that prices for Narlife, which are certified as green buildings, vary over a wider range, meaning that they exhibit greater volatility in the market. In contrast, the observation that prices for TOKİ remain within a narrower range is consistent with the standardized pricing structure of social housing policy, which aims to ensure affordability.

Table 4.12 Price Distribution of Narlife and TOKİ

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Narlife (Certified)	15,500,000.00	43,750.00	23,093.64	31.24	0.200	0.053
TOKİ (Non-certified)	4,225,000.00	22,100.00	8,044.19	29.86	0.167	0.122

Conversely, an examination of rental properties reveals a contrasting trend. While Narlife's CV value in the rental market is only 0.053, this ratio rises to 0.122 in TOKİ. In other words, rental prices in the social housing group show greater fluctuation, indicating a more heterogeneous user profile in terms of income level and housing type. In contrast, the more homogeneous distribution of rental values in certified projects reflects a market structure that targets a specific user segment and is more standardized. This difference highlights the structural distinction between social housing policies, which are focused on providing housing for low-income groups, and the market-based value proposition of environmentally certified projects.

4.7 İstanbul – Nivo İstanbul & Küçükçekmece Avrupa Konutları

The analysis of Nivo İstanbul Project, located in the İnönü neighborhood of Küçükçekmece District, aims to evaluate the position of green certified buildings in the housing market compared to non-certified projects with similar physical characteristics. Küçükçekmece Avrupa Konutları Project, which is located in the same neighborhood but does not have a green building certificate, is considered as a comparison group.

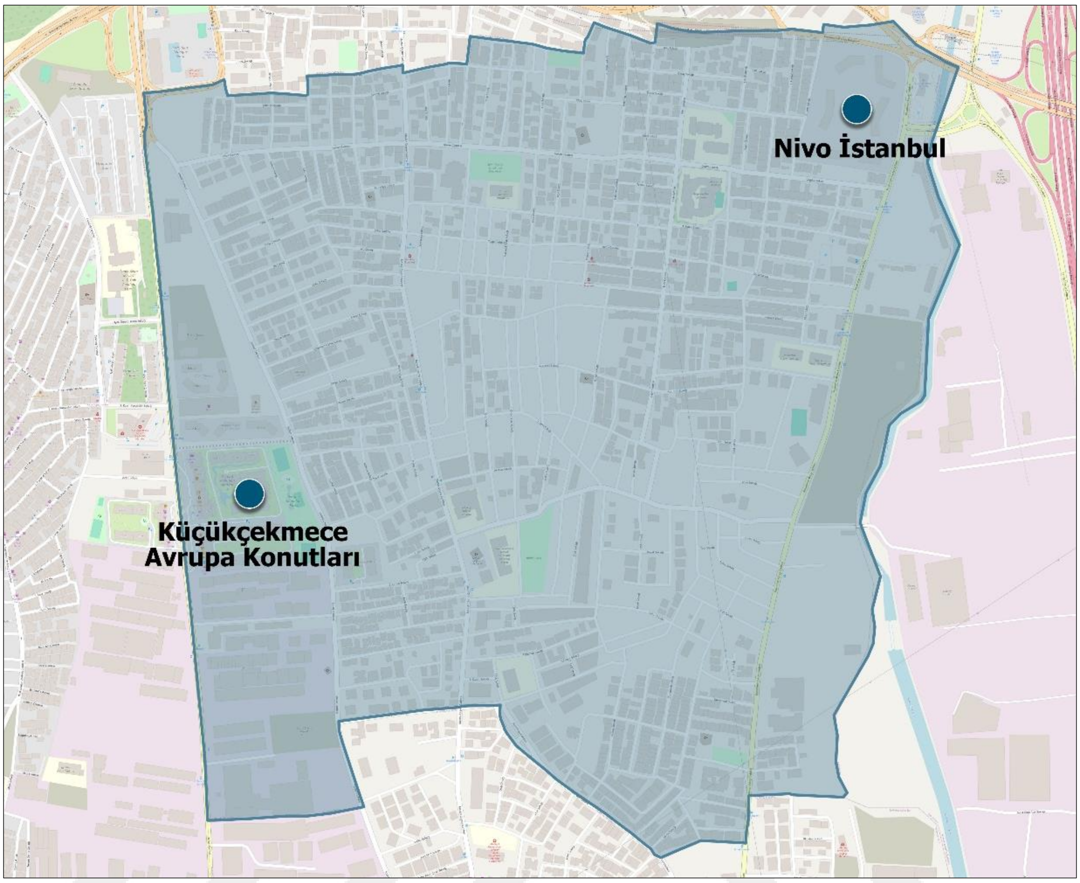

Figure 4.7 Locations of Nivo İstanbul and Küçükçekmece Avrupa Konutları (Produced by the Author)

4.7.1 Sale and Rental Values

In Table 4.13, a comparative analysis is conducted of the sale and rental values of the Nivo İstanbul and Küçükçekmece Avrupa Konutları Projects.

Table 4.13 Sale and Rental Values of Nivo İstanbul and Küçükçekmece Avrupa Konutları

Project Name	Average Gross m²	Average Net m²	Average Sale Price	Average Rental Price	Average Price Per m² for Sale	Average Price Per m² for Rent
Nivo (Certified)	82.28	59.76	4,837,926.83	27,888.89	57,146.36	354.52
Avrupa Konutları (Non-certified)	120.15	92.64	10,510,869.57	47,190.79	79,496.88	418.20
Neighborhood Average	99.00	-	3,597,759.00	23.29	36.34	262.00

The findings of this certified project demonstrate that green building certification does not always have a direct and positive impact on property values. A typical example of this is the fact that both sales and rental prices in a certified project such as Nivo İstanbul are lower than those of non-certified Avrupa Konutları.

A primary factor contributing to this disparity is the limited recognition of green building certifications among users. As MacAskill et al. (2021) observe, green building labels are often perceived as an "invisible value" in emerging markets and that users find it challenging to establish a direct correlation with environmental performance. This lack of awareness may limit potential demand and thus prevent price premiums from forming in certified projects.

Moreover, the limited prevalence of green housing production in Türkiye, coupled with the exclusive availability of environmental certification to a select number of projects targeting higher income demographics, hinders the establishment of a robust demand base for such structures within the broader housing market (Uğur & Leblebici, 2015). In this context, the fact that green-certified housing sometimes has lower square meter values is not only related to environmental quality, but also to limited awareness, lack of perception, and an unestablished market structure.

4.7.2 Amount of Dues

When comparing the Nivo İstanbul and Küçükçekmece Avrupa Konutları Projects, an unusual picture emerges in terms of maintenance fees. In the LEED-certified Nivo İstanbul, the average maintenance fee is 4,503.88 TL, while in the non-certified housing project, this figure rises to 6,210.06 TL. This discrepancy calls into question the prevailing assumption that maintenance costs are always higher in green building projects.

As indicated by the extant literature, the initial financial outlay and maintenance costs of green building applications can be substantial. However, it is asserted that these costs can be offset in the long term by a number of factors, including energy efficiency, water savings, and lower operating expenses (Antoniades, 2011). In this context, the low maintenance fee level at Nivo İstanbul demonstrates that the efficiency provided by green infrastructure can positively impact user costs.

4.7.3 Return on Investment Period (Amortization)

With regard to amortization period, the certified housing group (14.0 years) has a shorter payback period than the non-certified project (15.7 years). This difference shows that environmentally certified housing is more advantageous in terms of rental income.

The adoption of green building practices has been demonstrated to yield a dual benefit, encompassing both a symbolic enhancement in perceived prestige and a tangible economic advantage in terms of investment. The enhanced financial returns and the reduced time required for the investment to be profitable make certified residential properties a compelling option for long-term investment decisions.

4.7.4 Price Variation and Stability

With respect to price distribution, the Nivo İstanbul Project reveals a substantially higher degree of variability in the sales market (Table X). While the coefficient of variation (CV) for the sales prices of certified residences is quite high at 0.439, this ratio is 0.164 for non-certified projects. This finding indicates that prices in Nivo İstanbul are distributed over a wider range and present a more uncertain structure in the market.

Table 4.14 Price Distribution of Nivo İstanbul and Küçükçekmece Avrupa Konutları

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Nivo (Certified)	3,925,000.00	21,500.00	25,065.17	66.59	0.439	0.188
Avrupa Konutları (Non-certified)	8,676,000.00	41,250.00	13,065.54	58.71	0.164	0.140

In the context of the rental market, the difference is more limited. The CV value for certified housing rentals is 0.188, while for non-certified housing it is 0.140. Despite the fact that the rental market is less volatile than the sales market for both groups, price fluctuations are still greater for certified housing.

This table indicates that green certified residential properties may exhibit a more heterogeneous price structure, attributable to factors such as user base, equipment level, or project segmentation. Conversely, the standardization of residential production and the homogeneity of demand structure in non-certified projects may have resulted in prices forming within a more limited range.

4.8 İstanbul – Ağaoğlu Maslak 1453 & Mashattan

In this sub-section, the Ağaoğlu Maslak 1453 Project located in Maslak Neighborhood of Sarıyer District and Mashattan Project located in the same neighborhood, which do not have a green building certificate, are analyzed comparatively. Although both projects display comparable physical size and location characteristics, only Ağaoğlu Maslak 1453 has LEED certification.

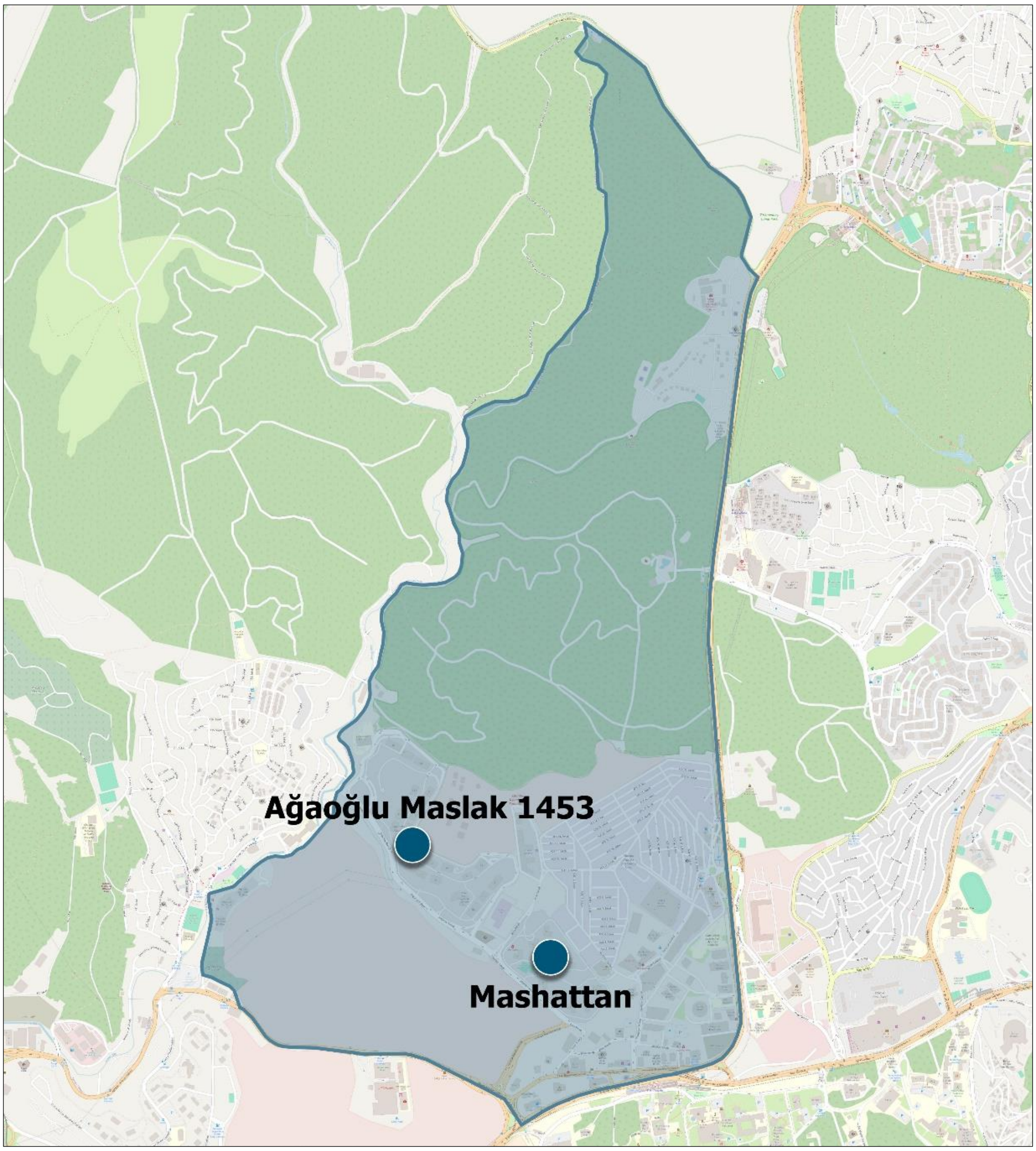

Figure 4.8 Locations of Ağaoğlu Maslak 1453 and Mashattan (Produced by the Author)

4.8.1 Sale and Rental Values

In terms of total sales price, the non-certified Mashattan Project (19,784,493.98 TL) has a higher value than the green certified Ağaoğlu Maslak 1453 (18,442,793.89 TL) (Table 4.15). The sales price per square meter is 111,789.68 TL for the certified project and 128,219.96 TL for the non-certified project. Similarly, the rent per square meter is also higher in Mashattan (547.43 TL) than in Maslak 1453 (475.38 TL).

Table 4.15 Sale and Rental Values of Ağaoğlu Maslak 1453 and Mashattan

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Ağaoğlu (Certified)	164.27	117.76	18,442,793.89	75,719.23	111,779.68	475.38
Mashattan (Non-certified)	153.12	116.96	19,784,493.98	78,954.55	128,219.96	547.43
Neighborhood Average	144.00	-	17,177,472.00	87,615.00	119,288.00	565.00

These findings demonstrate that green certified projects do not invariably attain a higher market valuation. This difference may be attributable to the fact that environmental certifications have yet to become a determining factor in user preferences, variations in branding levels, or the perceived value of on-site social amenities (Leskinen et al., 2020).

Furthermore, both projects are priced below or around the neighborhood average (119,288 TL/m² for sales and 565 TL/m² for rent). This indicates that there may be considerable price variations and fluctuating user expectations across different projects in the Maslak Region.

4.8.2 Amount of Dues

A comparison of Ağaoğlu Maslak 1453 and Mashattan Projects reveals that the maintenance fee (6,356.50 TL) is lower in the green certified project, while in the non-certified project this value rises to 8,447.75 TL.

This finding contradicts the general perception that environmentally certified buildings invariably incur higher operating costs. On the contrary, it is acknowledged that energy- and water-saving systems can serve to offset maintenance costs by reducing operating expenses.

As has been documented, green building systems can incur high costs during the initial investment phase; however, these costs can be offset over time by lower operating burdens (Antoniades, 2011). This example demonstrates that environmental performance can provide not only sustainability but also economic benefits for users.

4.8.3 Return on Investment Period (Amortization)

According to amortization period calculations, the return on investment period for the Ağaoğlu Maslak 1453 Project is 18.6 years, while for the Mashattan Project it is 18.7 years. This situation may indicate that certified housing offers a more advantageous structure for investors in the long term, with lower maintenance fees and stable rental income. Given the similarity in market segments targeted by both projects, it can be posited that environmental performance may influence investment decisions to a certain extent, despite only slight differences in economic returns (MacAskill et al., 2021).

4.8.4 Price Variation and Stability

As demonstrated in Table 4.16, a marked difference is evident in the statistics on the distribution of sales and rental prices between the Ağaoğlu Maslak 1453 and Mashattan Projects. The coefficient of variation (CV) for sales prices was calculated as 0.146 for the certified Maslak 1453 and 0.113 for the non-certified Mashattan. This finding suggests that sales prices exhibited greater volatility in Maslak 1453, indicating a comparatively lower degree of market price stability.

Table 4.16 Price Distribution of Nivo İstanbul and Küçükçekmece Avrupa Konutları

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Ağaoğlu (Certified)	17,950,000.00	70,000.00	16,319.17	99.20	0.146	0.209
Mashattan (Non-certified)	19,600,000.00	65,000.00	14,538.66	55.31	0.113	0.101

This difference is particularly apparent in the rental housing market. While the CV value of rental prices in Maslak 1453 is quite high at 0.209, this ratio is only 0.101 in Mashattan. This finding shows that rental prices in certified projects have a wider distribution and that there is diversity in pricing according to user profile or apartment characteristics.

Generally, higher price ranges observed in green building projects can be attributed to a number of factors. These include user preferences, variations in amenities offered, and the market not yet being fully mature. Conversely, the more limited price range observed in Mashattan suggests a market structure that is more uniform and a user profile that is more consistent.

4.9 İzmir – Soyak Mavişehir Optimus & Soyak Mavişehir A-B Site

In this section, Soyak Mavişehir Optimus Project, which have LEED certification, and Soyak Mavişehir A-B Site, which do not have an environmental certification but have similar physical characteristics, located in Yalı Neighborhood of Karşıyaka District of İzmir, are examined.

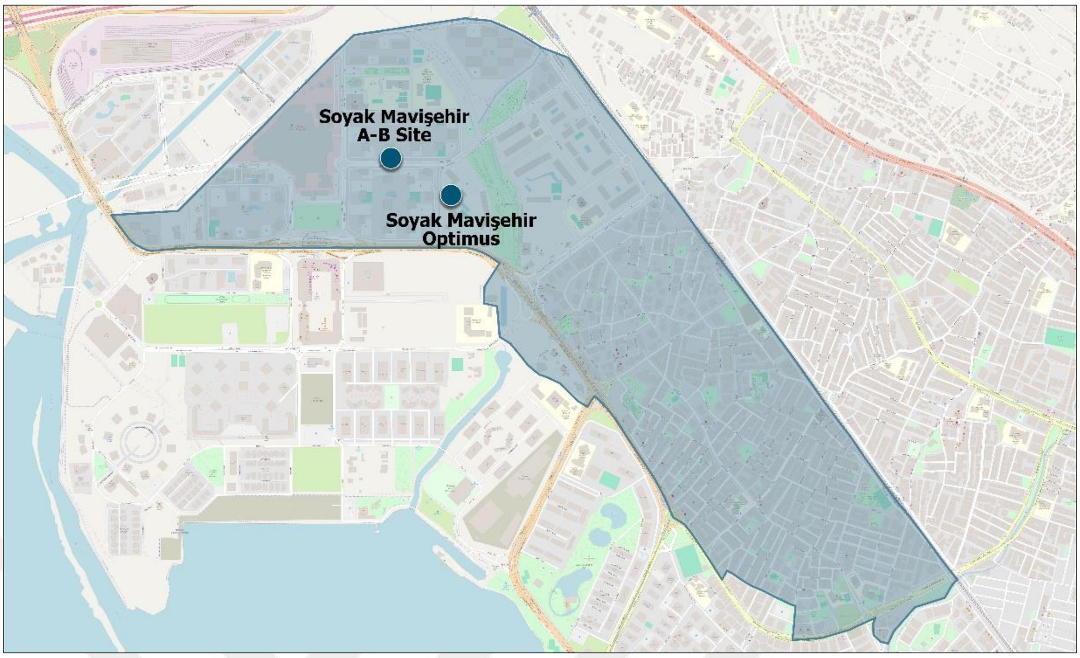

Figure 4.9 Locations of Soyak Mavişehir Optimus and Soyak Mavişehir A-B Site (Produced by the Author)

4.9.1 Sale and Rental Values

A comparison of the total sales prices of these two projects reveals that the non-certified project has a higher value than the Optimus Project (10,264,444.44 TL) with an average of 11,922,222.22 TL (Table 4.17). This difference is largely due to the size of the residences. In fact, while the average gross area of the A-B Site is 109.5 m², this value is reduced to 96.7 m² in the Optimus Project.

Table 4.17 Sale and Rental Values of Soyak Mavişehir Optimus and Soyak Mavişehir A-B Site

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Optimus (Certified)	96.69	76.62	10,264,444.44	42,619.05	97,293.31	478.10
A-B Site (Non-certified)	109.50	92.92	11,922,222.22	37,000.00	101,035.78	440.48
Neighborhood Average	119.00	-	5,714,975.00	30,112.00	48,025.00	274.00

However, when considering unit prices are taken into consideration, the discrepancy is considerably diminished. The average sales price per square meter for non-certified projects is 101,035.78 TL, while for certified projects it is 97,293.31 TL. A similar picture emerges in terms of rental prices per square meter: 478.10 TL/m² for the Optimus Project and 440.48 TL/m² for the A-B Site. This situation demonstrates that green certified residences are positioned with a slight premium in the rental market; however, this effect is limited on the sales side.

Both projects are significantly above the neighborhood average. However, the impact of environmental certification on market value remains marginal in this example, suggesting that conventional factors such as square footage, location and brand remain the key drivers of user decisions.

4.9.2 Amount of Dues

When comparing the Soyak Mavişehir Optimus and A-B Site projects, the average maintenance fee for the certified Optimus project is 3,264.25 TL, while for the non-certified A-B Site it is 3,628.00 TL. As in the Oyak Dragos, Nivo İstanbul, and Ağaoğlu Maslak 1453 projects, the maintenance fee ratio in the Optimus Project is lower than that of the non-certified structure being compared. This result challenges the common perception that green building projects always result in higher operating costs. Infrastructures prioritizing energy and resource efficiency may have a cost-reducing effect on operating expenses, particularly in the long term. In this example, the ability to manage a building with high environmental performance at a lower maintenance fee supports the positive impact of efficient systems on user costs.

4.9.3 Return on Investment Period (Amortization)

It is evident from the amortization period calculations that the return on investment period for the LEED-certified Soyak Mavişehir Optimus project is 17.1 years, whereas for the no-certified A-B Site, this period is extended to 18.9 years.

This difference underscores the notion that green building projects have the potential to offer investors benefits that extend beyond mere environmental considerations, delving into the realm of economic advantages as well. The shorter amortization period can be attributed to higher rental income and lower regular expenses, such as maintenance fees.

In this context, it can be said that sustainable housing should be evaluated not only as a means of contributing to the environment but also as a tool that adds value to investments.

4.9.4 Price Variation and Stability

When examining the price distributions of the Soyak Mavişehir Optimus and A-B Site Projects, stable trends in different directions are observed in the sales and rental markets (Table 4.18). The coefficient of variation in sales prices is higher in the Optimus Project at 0.141, while it is quite low at 0.065 in the A-B Site. This indicates that sales prices in the certified project have a wider distribution range. Different apartment types, view advantages, or internal building location differences may contribute to this variability.

Table 4.18 Price Distribution of Soyak Mavişehir Optimus and Soyak Mavişehir A-B Site

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Optimus (Certified)	10,450,000.00	40,000.00	13,732.10	45.87	0.141	0.096
A-B Site (Non-certified)	11,000,000.00	32,000.00	6,560.17	60.07	0.065	0.136

On the other hand, the scenario is reversed in the context of rental prices. While the coefficient of variation for rental prices in certified projects is 0.096, this ratio rises to 0.136 in non-certified project. In summary, while the Optimus Project provides a more balanced price structure in the rental market, rents in the A-B Site show greater variability. This difference can be explained by the homogeneous profile of green building users or the preference for more institutional practices in rental agreements.

The findings indicate that projects with environmental certification differentiate themselves in the market not only in terms of average prices but also in terms of price stability. The predictability of prices can be a significant criterion for decision-making, especially for investors.

4.10 İzmir – Soyak Siesta Oxygen-Blue and Soyak Siesta Energy-1/2. Lap

In this sub-section, Soyak Siesta Oxygen and Blue Projects located in İnönü Neighborhood of Karşıyaka District in İzmir and Soyak Sitesta Energy and 1-2. Lap Projects located in the same neighborhood, which do not have a green building certificate, are analyzed comparatively. Although both projects display comparable physical size and location characteristics, only Soyak Siesta Oxygen and Blue Projects have LEED certification.

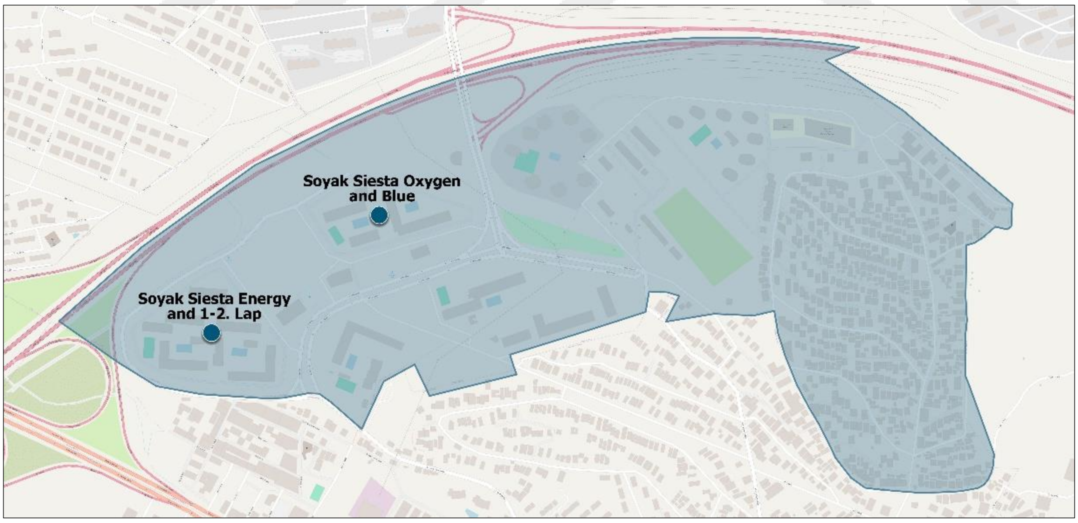

Figure 4.10 Locations of Soyak Siesta Oxygen-Blue and Soyak Siesta Energy-1/2. Lap (Produced by the Author)

4.10.1 Sale and Rental Values

A thorough examination of the aggregate sales prices of two projects presented in Table 4.19 reveals that the average price of residential properties within certified projects is 7,556,250.00 TL, while in non-certified projects, this value is calculated as 6,250,000.00 TL. However, this difference is largely due to differences in square meter size. The average gross area of certified residential units is approximately 89.19 m², while this value decreases to 83.00 m² in the non-certified group.

Table 4.19 Sale and Rental Values of Soyak Siesta Oxygen-Blue and Soyak Siesta Energy-1/2. Lap

Project Name	Average Gross m^2	Average Net m^2	Average Sale Price	Average Rental Price	Average Price Per m^2 for Sale	Average Price Per m^2 for Rent
Oxygen-Blue (Certified)	89.19	75.50	7,556,250.00	28,843.75	71,369.54	397.84
Energy-1/2. Lap (Non-certified)	81.78	68.89	6,250,000.00	28,222.22	67,446.04	398.12
Neighborhood Average	83.00	-	6,079,086.00	22,856.00	73,242.00	401.00

Therefore, an assessment based on square meter prices is more meaningful. The unit sales price for certified housing is 71,369.54 TL/m², while for non-certified housing it is 67,446.04 TL/m². Similarly, rental unit prices are almost equal: 397.84 TL/m² and 398.12 TL/m², respectively. This similarity suggests that environmental certification may not be a significant factor in the rental market and that other factors, such as social amenities, user profile and apartment type, may be more influential.

While both project groups are above the neighborhood average, certified projects do not create a difference in the rental market; however, they do provide a limited increase in value in the sales market. This situation indicates that the visible benefits of green building certification to users are more readily recognized by investors.

4.10.2 Amount of Dues

When examining maintenance fees in Soyak Siesta Projects, the average maintenance fee for LEED-certified residences is 3,757.20 TL, while for non-certified projects, this figure is calculated as 3,513.73 TL. Although the difference is limited, maintenance fees are slightly higher in certified projects.

This scenario demonstrates that, despite the long-term benefits offered by green buildings, such as energy and water efficiency, there is a possibility of a short-term increase in operating costs. This discrepancy can be attributed to a number of factors, including the implementation of more sophisticated management systems, the emergence of additional maintenance requirements or the provision of services that meet sustainability criteria subsequent to certification.

However, when evaluated alongside other economic indicators, such as the investment payback period, this discrepancy may reveal that the user is not only incurring costs but also gaining value.

4.10.3 Return on Investment Period (Amortization)

When evaluated in terms of amortization period, the return on investment period for certified Soyak Siesta Oxygen–Blue projects is calculated as 14.7 years, while for non-certified Energy–1/2. Lap projects, this period is reduced to 13.7 years.

This difference indicates that the equilibrium between rental income and sales price is more beneficial in non-certified projects. In other words, non-certified residential properties, which offer similar rental income at a lower investment cost, provide a faster return on investment in this example.

This finding indicates that green building projects may not invariably be economically profitable. While certified projects offer long-term environmental and health benefits, from an investor's perspective, the amortization period can be a disadvantage in some cases. Consequently, environmental performance should be evaluated in conjunction with financial returns, quality of life and user preferences.

4.10.4 Price Variability and Stability

The price stability analysis conducted specifically for Soyak Siesta Projects demonstrates a clear difference in stability between green certified and non-certified residences (Table 4.20). In the sales market, the coefficient of variation (CV) for certified residences is lower at 0.091, while for non-certified residences it is 0.108. This difference indicates that prices in certified projects exhibit greater stability and predictability within a narrower range.

Table 4.20 Price Distribution of Soyak Siesta Oxygen-Blue and Soyak Siesta Energy-1/2. Lap

Project Name	Median		Standard Deviation (SD)		Coefficient of Variation (CV)	
	For Sale	For Rent	For Sale	For Rent	For Sale	For Rent
Oxygen-Blue (Certified)	6,300,000.00	28,000.00	6,487.49	14.64	0.091	0.037
Energy-1/2. Lap (Non-certified)	5,950,000.00	28,000.00	7,285.35	57.59	0.108	0.145

The discrepancy is even more pronounced in the rental market. The rental CV value of certified housing was measured at a very low level of only 0.037, while in non-certified projects this ratio reached 0.145. This situation shows that certified housing offers a notably more stable structure in terms of rental prices, while the non-certified group experienced considerable fluctuations.

This situation illustrates that green building projects can offer benefits not only in terms of average prices but also in terms of the consistency of price behavior. Price stability is a substantial criterion for corporate tenants or long-term investors and environmentally certified projects have the potential to offer greater certainty in this regard.

4.11 Summary of the Findings and Discussion

The present thesis examined the position of green certified buildings in the housing market in Türkiye in comparison with similar projects without certification. The investigation was based on economic indicators such as sales prices, rental fees, maintenance fees, amortization periods and price stability. A total of ten green building projects located in Ankara, İstanbul and İzmir were analyzed by matching them with residential groups that share similar physical characteristics but lack green certification. The analyses conducted on each project pair reveal both general trends regarding the market position of green residential buildings and differences that emerge at the project level (Table 4.21).

Table 4.21 Comparative Evaluation of Projects Selected for Thesis in Terms of Market Indicators

Projects Name	Sale and Rental Values	Due Comparison	Amortization Period (Year)	Price Variation and Stability	Key Findings
Park Mozaik & Primera	Certified housing is more expensive both for sale and rent.	The due for certified building is higher.	The amortization period for certified building is shorter.	Certified building has lower variation in sales.	In the sales market, certified properties are more stable and homogeneous; in the rental market, certified properties are spread across a wider price range.
AND Pastel & Esentepe Avrupa Konutları	Non-certified housing is more expensive both for sale and rent.	The due for certified building is higher.	The amortization period for certified building is shorter.	Certified building has more variability in sales and rental prices.	The higher degree of price volatility in certified rental properties indicates that this segment is not yet fully developed.
Metropol & Trendist	Certified building is more expensive in terms of unit price and rent.	The due for certified building is higher.	The amortization period for certified building is shorter.	Certified building has lower variation in sales and rent.	Certified building has a more stable price structure in the sale and rental market.
Oyak Dragos & Nuvo Dragos	Certified building is more expensive in terms of unit price and rent.	The due for non-certified building is higher.	The amortization period for certified building is longer.	Certified building has a more heterogeneous structure in terms of sales prices, but lower variation in rental prices.	In the rental market, certified building is more stable and homogeneous; in the sales market, certified building is distributed across a wider price range.

Table 4.21 (cont'd)

TEKFEN HEP & Babacan	Certified housing is more expensive both for sale and rent.	The due for certified building is higher.	The amortization period for certified building is shorter.	Certified building has more variability in sales and rental prices.	The higher degree of price volatility in certified rental properties indicates that this segment is not yet fully developed.
Narlife & TOKİ	Certified housing is more expensive both for sale and rent.	The due for certified building is higher.	The amortization period for certified building is longer.	Certified sales prices have a more heterogeneous structure, while rental prices have lower variation.	In the rental market, certified building is more stable and homogeneous; in the sales market, certified building is distributed across a wider price range.
Nivo & Küçükçekmece Avrupa Konutları	Non-certified housing is more expensive both for sale and rent.	The due for non-certified building is higher.	The amortization period for certified building is shorter.	Certified building has more variability in sales and rental prices.	The higher degree of price volatility in certified rental properties indicates that this segment is not yet fully developed.
Ağaoğlu Maslak & Mashattan	Non-certified housing is more expensive both for sale and rent.	The due for non-certified building is higher.	The amortization period for certified building is relatively shorter.	Certified building has more variability in sales and rental prices.	The higher degree of price volatility in certified rental properties indicates that this segment is not yet fully developed.

Table 4.21 (cont’d)

Soyak Mavişehir Optimus & Soyak Mavişehir A-B Site	Non-certified housing is more expensive both for sale and rent, while certified housing has a higher unit rent.	The due for non-certified building is higher.	The amortization period for certified building is shorter.	Certified sales prices have a more heterogeneous structure, while rental prices have lower variation.	In the rental market, certified building is more stable and homogeneous; in the sales market, certified building is distributed across a wider price range.
Soyak Siesta Oxygen-Blue & Soyak Siesta Energy-1/2. Lap	Non-certified housing is more expensive both for sale and rent, while certified housing has a higher unit rent.	The due for certified building is higher.	The amortization period for certified building is longer.	Certified building has lower variation in sale and rent.	Certified building has a more stable price structure in the sale and rental market.

In comparisons based on the findings, it was taken into account that the projects were not under identical conditions. For example, factors such as a residential project being closer to main transport routes or social amenities, architectural design differences, or project reputation may be among other factors that could increase market value. Therefore, the analyses took into account not only the impact of green certification but also the potential positive effects of such spatial or qualitative differences on value. However, despite this limitation, the careful selection of similar residential groups ensured that the results obtained were meaningful and comparable.

According to general findings, the majority of projects which have obtained green certification have higher sales and rental values than comparable properties which have not obtained such certification. This finding indicates that green properties are held in higher regard within the market. However, in some cases – such as AND Pastel & Esentepe, Nivo & Küçükçekmece Avrupa Konutları, and Ağaoğlu Maslak & Mashattan – it has been observed that non-certified residential properties have higher prices. This underscores the notion that factors such as the services offered by the project, brand value or the variety of amenities can also influence market valuation beyond the certification itself.

A comparison of maintenance fees reveals that certified residences generally have higher maintenance fees. This outcome may be attributable to the supplementary services provided by green building initiatives, sustainable infrastructure systems and the maintenance requirements of common areas. However, there are exceptions to this rule, as evidenced by the higher maintenance fees applied to non-certified properties, as exemplified by Oyak Dragos, Nivo and Ağaoğlu.

When evaluated in terms of amortization period, it has been observed that in many cases, green-certified housing has a shorter investment return period. This finding indicates that green buildings have the potential to achieve financial self-sufficiency over a shorter timeframe through rental income, despite their initial higher costs. However, in certain instances, such as the Oyak Dragos, Narlife and Soyak Siesta projects, the amortization period exceeded that of non-certified residential properties. This phenomenon may be associated with maintenance fees or unit rental levels that did not meet expectations.

When price stability and variation levels are examined, it has been determined that green-certified housing typically exhibit a reduced variation coefficient within the sales market. This suggests that prices are distributed more uniformly. This situation demonstrates that green housing can form a more distinct market segment. However, within the context of rental housing market, it has been observed that in some projects—particularly AND Pastel, TEKFEN HEP, Nivo and Ağaoğlu projects—certified housing has wider price ranges, indicating that a stable price structure has to be established in this segment. Such fluctuations are indicative of the fact that the certified rental housing market is still in its developmental phase and that standard rental values have not yet been established.

The findings also reveal that the level of stability of green-certified housing in the market can vary depending on the type of housing (for sale or rent), the urban location of the projects and the marketing strategies of the developers. For example, in large-scale, central projects such as Metropol İstanbul, green-certified housing is positioned with lower variation, i.e., more stability, in both the sales and rental markets; however, in projects in developing regions, this stability is relatively weaker.

CHAPTER 5

CONCLUSION

The final chapter of this thesis presents a synthesis of the key findings and offers a broader reflection on the implications of green certified housing within the Turkish housing market. By integrating empirical results with theoretical insights, this chapter aims to assess the extent to which green housing contributes to the goals of environmental, economic, and social sustainability. The following sub-sections respectively evaluate the accessibility and inclusivity of certified housing, explore the role of financial incentives as a catalyst for market transformation, and provide recommendations for future research that could expand the current understanding of green housing from interdisciplinary perspectives. Through this comprehensive discussion, the study seeks to highlight not only the progress made in the green housing sector but also the existing structural limitations and opportunities for policy intervention.

5.1 Overall Assessment of Access to Green Housing

The construction of green certified buildings represents an advancement in the field of environmental sustainability, in addition to the establishment of a novel valuation paradigm within the housing market and the generation of various socio-economic effects. While the findings of this study reveal that green buildings frequently possess higher market values and are regarded as appealing from an investment perspective, they also highlight the fact that these projects are not equally accessible to diverse income groups within society.

The initial observation is that certified housing is predominantly situated in areas that primarily serve upper and upper-middle income demographics. Furthermore, it is noted that the sales and rental values of these projects typically exceed market averages. This situation demonstrates that access to green housing is largely related to economic power. Indeed, the similarly high maintenance fees confirm that these homes are not only targeted at those with a certain income level during the initial acquisition phase but also during the usage phase.

Moreover, the observation that demand for green housing is more concentrated in certain projects and more scattered in others indicates that user perception is not yet fully mature and that this type of housing is not yet standardized within the market. In particular, high price variations in the rental market indicate that there is still uncertainty about how users evaluate these homes. This situation reveals that green buildings cannot be achieved solely through supply-side interventions; it is also necessary to increase the level of information, trust and perceived benefits on the demand side.

As a result, the availability of green certified housing in Türkiye remains limited in terms of its appeal and inclusivity across the social spectrum. In order for green housing to be evaluated not only in terms of environmental sustainability but also in the context of social sustainability, public policies must be supported by incentive mechanisms, accessible models must be developed for low- and middle-income households, and these criteria must be integrated into social housing projects. The development of comprehensive approaches within this framework is expected to contribute to the achievement of environmental objectives and the establishment of socio-spatial justice within the housing market.

5.2 The Role of Financial Incentives

One of the main obstacles limiting the proliferation of green certified housing within the housing market is the substantial initial expense associated with these structures. Both the additional costs encountered during the construction process from the perspective of development companies and the high sales and rental prices from the perspective of users make access to green housing difficult. Findings from the research indicate that the certification process, use of sustainable materials, integration of energy-efficient systems and management costs require more financial resources compared to traditional housing. This situation has the effect of limiting access to this type of housing, particularly for low- and middle-income groups, and may also act as a deterrent for investors seeking to pursue such projects, due to concerns about the cost-benefit balance.

In this context, it is essential to address both supply- and demand-side financial incentives must be addressed in a comprehensive manner in order to promote green housing. From a supply-side perspective, the implementation of tax exemptions for developers, the streamlining of building permit procedures, the subsidization of certification costs and the provision of special credit facilities for environmentally sustainable projects is expected to enhance the financial viability of such initiatives. From a demand-side perspective, the provision of instruments such as low-interest housing loans, mortgage subsidies and incentives for green housing will enhance the affordability of opportunities for users.

It is imperative for local governments and central public institutions to collaborate in order to formulate zoning incentives and financial support programs that encourage investments in green buildings, especially in major metropolitan cities. The implementation of such policies has the potential to stimulate not only the initiation of new projects but also the green transformation of existing building stock. In this regard, it is essential that green housing strategies do not remain limited to newly built projects. Instead, existing residential buildings – particularly those in densely populated urban areas – should be integrated into the sustainability agenda through retrofitting programs, certification pathways and energy-efficient renovations.

Furthermore, it is crucial that new green housing projects are planned in such a way that they are accessible not only to high-income groups but also to middle- and low-income households. For example, conversion loans, repayable grants and technical consultancy support can be provided to make existing properties energy efficient or integrate them into certification systems such as LEED/BREEAM/YeS-TR.

In conclusion, the affordability of green housing for a wide range of people, as well as the establishment of a sustainable presence within the market, can be achieved not only through environmental awareness but also through the implementation of a robust, sustainable and inclusive incentive policy. In this context, strategically designed financial instruments will both increase developers' willingness to invest and facilitate users' access to such housing. In the case of Türkiye, the development of such multi-layered incentive systems will increase both the prevalence of green housing and the likelihood of achieving urban sustainability goals.

5.3 Research Recommendations for Future Studies

This thesis undertakes a quantitative analysis of the position of green certified residences in the Turkish housing market. This analysis is based on listing data and provides comparative evaluations of residences based on price, rent, maintenance fees and amortization indicators. However, due to the nature of the study, some parameters were excluded from the scope. In particular, environmental and functional indicators such as energy consumption levels, user satisfaction, building maintenance and operating costs, life cycle analyses and building performance metrics could not be directly evaluated within the scope of the research. Therefore, future studies that address these missing dimensions in detail will reveal the true potential of green housing in a more comprehensive manner.

Several suggestions are worthy of consideration for future research. Firstly, qualitative studies focusing on user experiences and satisfaction levels will provide an opportunity to analyze the effects of certified housing on daily life in greater depth. The evaluation of green housing can be approached through a variety of methodologies, including focus group discussions, building user surveys and interview-based analyses. This multifaceted approach enables an assessment that encompasses not only the physical aspects of green housing, but also its perceptual and sociological dimensions. Secondly, technical evaluations based on energy performance analyses will provide the opportunity to test the claimed benefits of these structures in terms of energy savings and environmental impact with concrete data. Thirdly, spatial access analyses and mapping techniques can be used to evaluate the distribution of green housing within the city, its proximity to transportation options, access to social infrastructure and the level of spatial justice.

In order to implement these recommendations, there is a necessity for more comprehensive and integrated data sets are needed, rather than simply relying on advertisement data. A comprehensive array of project-level data that can be obtained from developer companies, local governments, energy distribution companies and certification providers. Furthermore, the provision of statistical databases pertaining to income levels, demographic structure and home ownership status to researchers will serve to enhance the depth and reliability of analyses conducted in this field.

Finally, studies revealing how green certified housing is perceived in real estate valuation processes are significant for understanding how market actors (appraisers, real estate consultants, investors) view these structures. There is a continuing need for qualitative and interdisciplinary research in this area in Türkiye.

The housing sector is of pivotal significance in Türkiye’s endeavors to achieve its sustainable development goals. In this context, green building practices must be addressed holistically, not only in terms of their environmental benefits, but also in terms of their economic feasibility, social acceptance and social inclusiveness. The present study aims to contribute to the literature on the accessibility, market position and social impacts of green housing and to guide future comprehensive studies.

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APPENDICES

A. BREEAM Certificate System

BREEAM is a rating method developed by Building Research Establishment (BRE) in the UK in 1990, which is considered as the pioneer of sustainable building certification systems (Çelik, 2009). The system was first introduced worldwide with the aim of contributing to sustainable development by evaluating the environmental performance of buildings and to encouraging more conscious design approaches in terms of ecological balance and energy efficiency (Öztürk, 2015, pp. 74-75; Baştanoğlu, 2017, p. 18).

Historical Development

The BREEAM certification system has undergone a series of updates and modifications to align with evolving regulatory frameworks since its inception (Figure 5.1). According to Howard (2019), the first version of BREEAM was developed in the 1990s in response to investor and tenant demands for a system that could evaluate building performance (as cited in Ade & Rehm, 2019). However, due to the time constraints inherent in its development, the initial version (version 1 for offices) of the system encountered technical challenges related to energy performance assessment. To address these shortcomings, BREEAM introduced updated certification schemes for new superstores and new homes in 1991 (Howard, 2019, as cited in Ade & Rehm, 2019). In subsequent years, the system was adapted for residential projects in 1993 and expanded to include industrial buildings with version 3 in 1998. In 2004, the scope of the system was expanded by developing BREEAM Retail for the retail sector (Doan et al., 2017; Mendonca, 2018; as cited in Ade & Rehm, 2019).

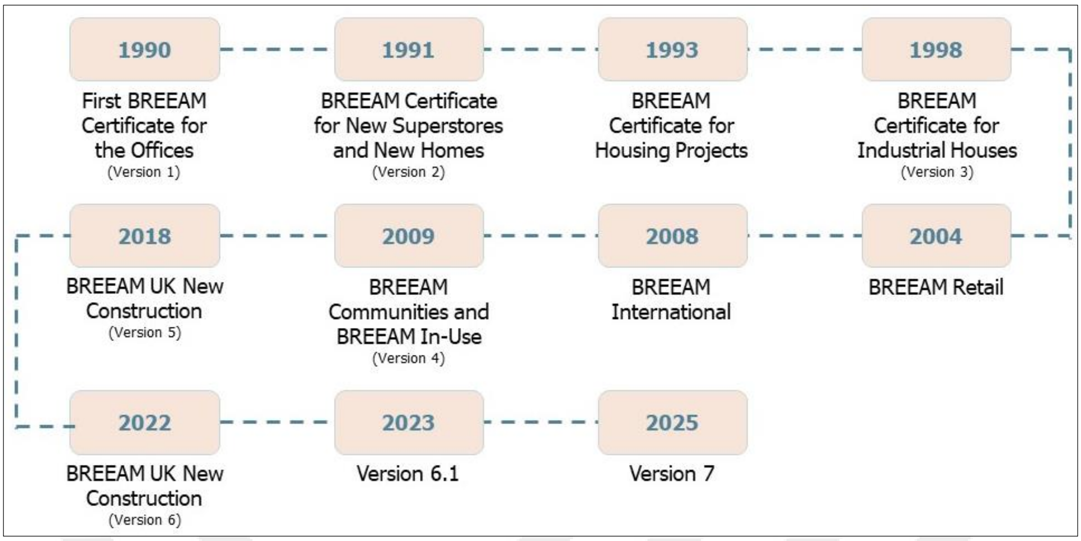

Figure 5.1 The Development of BREEAM (Source: Ade & Rehm, 2019; BREEAM, n.d.)

In 2008, BREEAM was implemented on a wide scale across Europe in order to adapt it to international projects and local standards. BREEAM asserted that the modifications introduced in this version were a response to the growing recognition of sustainability in the construction sector (BREEAM, n.d.). Subsequent to this development, in 2009, novel rating tools such as “BREEAM Communities” and “BREEAM in Use” were developed with the objective of enhancing the applicability of the system to a range of building types (Ade & Rehm, 2019).

This continuously evolving assessment system offered a more detailed structure in terms of sustainability by adding more comprehensive environmental criteria with the “BREEAM UK New Construction” update in 2018 (BREEAM, n.d.). In 2022, BREEAM UK New Construction v6 version was harmonized and published in line with the updates made to the building regulations in England. In 2023, the v6.1 version was announced, which includes changes in energy performance building regulations in Scotland, Wales and Northern Ireland.

The most recent version of BREEAM, “BREEAM New Construction v7”, is scheduled for full release in 2025 (BREEAM, n.d.). This new version aims to harmonize the building assessment, benchmarking and certification processes with the latest scientific data and provide a holistic life-cycle assessment focused on net zero carbon targets (BREEAM, n.d.).

In this process, BREEAM has developed a comprehensive methodology to provide solutions to the environmental, social and economic problems encountered in the built environment or that may arise in the future. The aforementioned methodology is predicated on the following fundamental principles for sustainable building design and operation (BREEAM, n.d.)[5]:

- *Net Zero Carbon:* BREEAM supports global sustainability strategies aiming to achieve net zero carbon emissions by 2050. It encourages the optimization of building energy use, the reduction of fossil fuels dependency, and the promotion of renewable energy sources to minimize both operational and embodied carbon emissions.
- *Whole Life Performance:* BREEAM provides frameworks and mechanisms to assess the environmental, social, and economic impacts of buildings throughout their entire life-cycle. By evaluating performance of buildings during design, construction, operation, and end-of-life stages, it helps to minimize resource consumption and supports long-term sustainability goals.
- *Health and Social Impacts:* BREEAM incorporates criteria that promote human health and well-being, such as improved indoor air quality, thermal and visual comfort, and enhanced natural ventilation. Its overarching objective is to ensure that buildings contribute to social sustainability by positively affecting the physical and mental health of users.
- *Circularity and Resilience:* Through the adoption of circular economy principles, BREEAM promotes resource efficiency and sustainable use of materials, water and energy in the built environment. In this framework, it

[5] https://breeam.com/about

encourages the establishment of sustainable supply chains, the reduction of waste and the recyclability of building components.

- *Biodiversity and Nature:* BREEAM encourages environmentally sensitive design strategies that protect biodiversity within buildings and urban areas. Key objectives include increasing green spaces, preserving ecological balance and sustainably managing natural habitats.
- *Disclosures and Reporting:* BREEAM advocates for transparent reporting of buildings' environmental impacts. This transparency facilitates performance monitoring and enables stakeholders to make informed decisions, helping building owners, investors, and users align management practices with sustainable development goals.

Program Types and Categories of BREEAM Certificate

The BREEAM program utilizes a consistent assessment mechanism that requires buildings to meet certain criteria for sustainability in the certification process. These criteria are subject to an independent verification process (BREEAM, n.d.). The program is comprised of six technical standards, which have been developed for the various stages of the life-cycle of a building or project. These standards ensure that projects progress in accordance with sustainability goals in the design, construction and operation processes. The following list details the relevant standards (BREEAM, n.d.)[6]:

- *BREEAM In-Use:* It provides a means to assess, compare and improve the sustainability performance of existing buildings at an international scale. It promotes sustainable improvements by enabling the securing and verification of operational asset data for property investors, owners, managers and tenants.

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[6] https://breeam.com/standards/

- *BREEAM Refurbishment and Fit-Out:* This standard has been established with the objective of ensuring that buildings are renovated sustainably and achieve high-performance. It aims to optimize the environmental, social and economic impact of the process by evaluating elements, including external envelope, structure, basic and local services and interior design.
- *BREEAM Communities:* The overarching objective of the framework is to facilitate collaboration among planners, local authorities, developers and investors, in order to support the creation of sustainable communities. It aims to ensure the integration of sustainable design in new settlements and urban regeneration projects.
- *BREEAM New Construction:* It gives a framework to ensure that newly constructed buildings are sustainable and high performance. The system aims to create consistency and comparability internationally, while delivering positive social, environmental and economic impacts.
- Home Quality Mark: The objective of this technical standard is to mitigate risk for new residential properties in the UK by providing independent verification that a property meets the expected level of performance in terms of sustainability and quality. For investors and developers, it aims to offer an advantage in a competitive market; and for buyers, the objective is to promote wellbeing and environmental responsibility.

The BREEAM certification system has been developed for the purpose of evaluating the sustainability performance of buildings. In comparison to certain categories within the technical standards mentioned above, the BREEAM has been shown to be more effective in this regard. The system employs ten fundamental categories in the calculation of the certificate score, namely management, health and comfort, energy, transport, water, materials, waste, land use and ecology, pollution and innovation. However, the weight allocated to these categories in the assessment process are subject to variation depending on the local building regulations of the country in which the certificate is applied, the version of BREEAM being used and the building type (BREEAM, 2019, as cited in Deligöz et al., 2020, pp. 230-231). In the BREEAM certificate, each category is assigned a weight score, with the maximum score designated as 100. For a project to be awarded a BREEAM certificate, it is necessary that at least 30% of these categories are fulfilled in terms of weight (Baştanoğlu, 2017, p. 20). The relevant categories and sub-categories are provided in Table 5.1.

Table 5.1 Categories, Credit Points and Intentions of BREEAM (Source: Öztürk, 2015; Gökbayrak, 2016)

Categories and Credits (Percentage of Scoring)	Intentions
1. Management (12%) 1.1. Sustainable Procurement 1.2. Responsible Construction Practices 1.3. Construction Site Impacts 1.4. Stakeholder Participation 1.5. Life-Cycle Cost and Service Life Planning	To encourage the adoption of sustainable management principles throughout the entire life-cycle of the building.
2. Health and Wellbeing (15%) 2.1. Visual Comfort 2.2. Indoor Air Quality 2.3. Thermal Comfort 2.4. Water Quality 2.5. Acoustic Performance 2.6. Safety and Security	To promote the protection of the health of living beings and to increase the comfort and safety of building users.
3. Energy (19%) 3.1. Reduction of CO_2 Emissions 3.2. Energy Monitoring 3.3. External Lighting 3.4. Low and Zero Carbon Technologies 3.5. Energy Efficient Cold Storage 3.6. Energy Efficient Transportation Systems 3.7. Energy Efficient Laboratory Systems 3.8. Energy Efficient Equipment 3.9. Drying Space	To minimize energy consumption in the building, measure the operational energy of the building and adopt efforts to improve it.
4. Transport (8%) 4.1. Public Transport Accessibility 4.2. Proximity to Amenities 4.3. Cyclist Facilities 4.4. Maximum Car Parking Capacity 4.5. Travel Plan	To ensure less car use in order to reduce carbon emissions. Encourage the use of bicycles, walking paths and public transport.
5. Water (6%) 5.1. Water Consumption 5.2. Water Monitoring 5.3. Leak Detection 5.4. Water Efficient Equipment	To reduce water consumption during the construction and operation of buildings and to achieve sustainable use of water.

Table 5.1 (cont'd)

6. Materials (12.5%) 6.1. Life-Cycle Impacts 6.2. Hard Landscaping and Boundary Protection 6.3. Responsible Sourcing of Materials 6.4. Insulation 6.5. Designing for Robustness	To foster recyclable, sustainable, durable materials used throughout the entire life-cycle of the building.
7. Waste (7.5%) 7.1. Construction Waste Management 7.2. Recycled Aggregates 7.3. Operational Waste 7.4. Speculative Floor and Ceiling Finishes	To identify waste management strategies and minimize waste generation during the construction and operation of the building.
8. Land Use and Ecology (10%) 8.1. Site Selection 8.2. Ecological Value of Site and Protection of Ecological Features 8.3. Mitigating Ecological Impacts 8.4. Enhancing Site Ecology 8.5. Long Term Impact on Biodiversity	To promote sustainable land use and landscape practices to protect the ecology and biodiversity of the site.
9. Pollution (10%) 9.1. Impact of Refrigerants 9.2. NOx Emissions 9.3. Surface Water Run Off 9.4. Reduction of Night Time Light Pollution 9.5. Noise Attenuation	To encourage the development of strategies to prevent pollution such as light, noise, sound, soil and water, which have an impact on climate change.
10. Innovation (Bonus Points – 10%)	To provide builders with the opportunity to perform beyond the standards and offer innovative solutions.

In accordance with the specified criteria, a building is considered unsuitable for BREEAM certification if it scores below 30 points. The scoring system provides a comprehensive and integrated method for assessing the sustainability performance of buildings (Schweber, 2013). The scores obtained by a building correspond to different BREEAM certification, based on predefined thresholds, as outlined below.

- Pass: 30-44 points
- Good: 45-54 points
- Very Good: 55-69 points
- Excellent: 70-84 points
- Outstanding: 85 points and above

The main features that distinguish the BREEAM certificate from other certificates are that it adapts to regional conditions, offers a comprehensive and detailed assessment and the process is constantly monitored by auditors assigned by BREEAM (Baştanoğlu, 2017). Nevertheless, the negative aspect of the water certification system is that the documentation process is difficult and challenging for project teams due to the detailed assessment requirements.

B. LEED Certificate System

The LEED certification system is a globally recognized green building rating system developed by the US Green Building Council (USGBC). First introduced in 1998 as LEED Version 1, the system was established to promote environmental sustainability in the construction industry and to evaluate the environmental performance of buildings using objective criteria (Doan et al., 2017). The overarching objective of the system is to minimize environmental impacts by ensuring that the choice of materials and construction techniques used in the building sector are consistent with the principles of sustainability (Gökbayrak, 2016).

A primary benefit of LEED certification is its provision of a holistic approach, which facilitates the comprehensive and harmonious functioning of all building components, as opposed to the evaluation of single elements such as energy efficiency or water consumption (USGBC, n.d.)[7]. This approach enhances the effectiveness and sustainability of green building practices by encompassing the environmental performance of buildings within a more extensive framework. Another reason why LEED is widely preferred globally is that its calculation and evaluation processes are simpler and more understandable compared to other systems (Doan et al., 2017). For example, since the process of the BREEAM system

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[7] https://www.usgbc.org/leed

includes more complex, stringent and detailed criteria, which reduces the transparency of the processes and makes it difficult to use in international markets.

However, both LEED and BREEAM systems are highly dependent on local regulations, construction standards and sustainability policies. BREEAM, on the other hand, gives more importance to regional differences and offers customized criteria sets according to the climatic conditions and local requirements of the countries. This is particularly evident in the BREEAM Gulf example, which was developed for the Persian Gulf Region. The assessment weights in this certification system are focused on water management rather than energy efficiency, due to the critical level of water resources in the region (Rezallah et al., 2012).

The primary distinctions between LEED and BREEAM are predominantly attributable to the policy frameworks and bureaucratic procedures of the nations in which these systems were pioneered (Rezaallah et al., 2012). In this context, LEED occupies a more favorable position in global platforms with its simple and flexible structure. Similar to BREEAM, LEED focuses mainly on environmental considerations; encompassing sustainable land use, water efficiency, energy and atmosphere management, material and resource utilization and indoor environmental quality. In addition, it includes assessment guidelines across various domains of use and scale including Building Design and Construction (BD+C), Interior Design and Construction (ID+C), Building Operation and Maintenance (O+M), Neighborhood Development (ND), Cities and Communities (cities and communities) and Residential, thereby comprehensively addressing the entire life-cycle of buildings (Doan et al., 2017).

It is evident that the LEED system’s modular and comprehensive structure facilitates its adaptation to a wide range of building and urban areas, encompassing diverse scales and functions. This attribute is a significant contributing factor to the system’s widespread adoption on a global scale.

Historical Development

LEED certification is subject to constant updates aimed at advancing sustainability objectives, with the system continually exceeding environmental standards and industry practices (Baştanoğlu, 2017). Since its inception as a pilot program, the system has undergone numerous updates to align with environmental and sectoral requirements. Each subsequent version has been developed to incorporate more comprehensive criteria and stricter environmental standards (Figure 5.2). This dynamic characteristic enables LEED to rapidly adapt to evolving environmental conditions, technological innovations and industry demands.

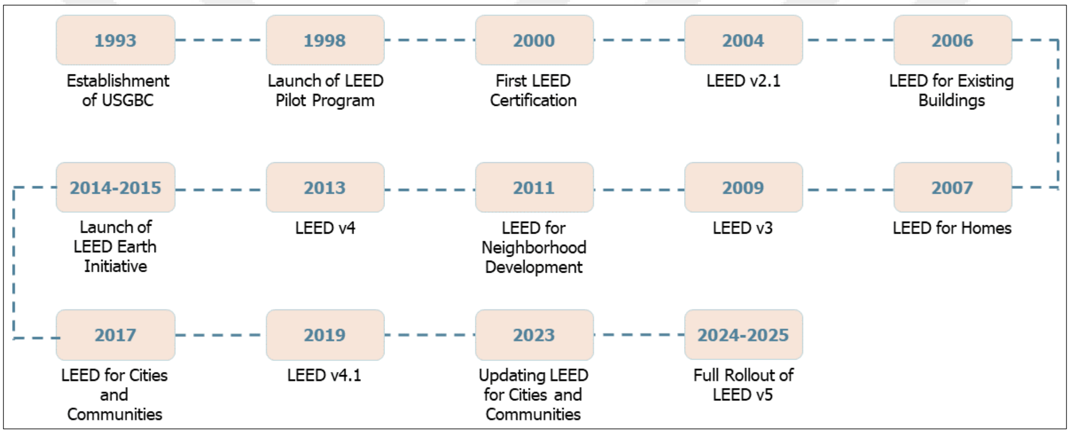

Figure 5.2 The Development of LEED (Source: Produced by the author with the information in USGBC Impact Report)

The LEED system, which emerged as a substantial reference point for green building projects, issued version 2.1 with the Building Design and Construction (BD+C) guide in 2004, addressing water and energy efficiency issues with greater specificity. Subsequently, in 2006, the Existing Buildings Operation and Maintenance (O+M) system was developed to enhance the environmental performance of existing buildings (USGBC, 2024). In the following year, the LEED for Homes guide was published with the aim of encouraging the design and construction of high-performance green homes (USGBC, 2024).

In order to further emphasize regional differences, the USGBC developed version 3 in 2009. In this version, significant updates were made to better reflect local conditions and support regional sustainability priorities. Two key innovations stood out in LEED 2009: Alternative Compliance Paths (ACPs) and Regional Priority Points (RP). ACPs aimed to provide flexibility to achieve sustainability goals in different regions. In this context, three ACPs specific to East Asia, Europe and South America were created for the LEED 2009 Building Design and Construction (BD+C) category (Wu et al., 2017). The second innovation, the RP mechanism, enabled projects with specific sustainability priorities to be rewarded with additional points. Within the scope of these updates, the score weights of criteria such as “Development Density and Community Connectivity” and “Alternative Transportation - Public Transportation Access” were increased and approaches that encourage sustainable development in dense urban fabrics with access to public transport were strengthened (USGBC, 2016).

LEED has been expanded to a scale that targets the sustainable development of cities and neighborhoods, not just individual buildings. This expansion is evidenced by the introduction of the Neighborhood Development (ND) certificate in 2011, which facilitated the transfer of sustainable urban development principles from the building scale to the neighborhood and city scale (USGBC, 2024).

LEED v4, published in 2013, placed more emphasis on monitoring building performance in the certification system and added new categories that enable the evaluation of material resources through life-cycle analysis (USGBC, 2013). This version aimed to address environmental impacts from a holistic perspective, with a greater focus on areas such as materials and resource management, indoor air quality, water and energy efficiency. However, LEED v4 has been criticized for not offering adaptable credit weights according to regional priorities and not providing flexibility on a project basis (Süzer, 2015).

This observation highlights the absence of incentive mechanisms that would ensure a stronger consideration of local environmental conditions and priorities in sustainable building design. Correct prioritization of environmental concerns contributes to more realistic results in performance assessment and facilitates the evaluation of projects not only at the building scale but also with regard to their impact on the surrounding environment. In this context, the commitment of certification bodies to incorporating local priorities and conditions into their certification systems is recognized as a social responsibility that motivates project teams to be sensitive to their region’s the sustainability requirements (Süzer, 2015).

Conversely, the global dissemination of LEED certification gained momentum with the LEED Earth Initiative launched between 2014 and 2015 (USGBC, 2024). The primary objective of this initiative was to expand the reach of LEED certification to emerging markets. Since 2017, the Cities and Communities system of the LEED certificate, which is a pivotal component in the realms of urban planning and sustainability, has been employed. This certification system has started to evaluate the sustainability performance of cities according to criteria including carbon emissions, water consumption and socio-economic indicators (USGBC, 2017).

LEED v4.1, published in 2019, offered a more applicable framework for both new construction projects and existing buildings with performance-based assessment methods focusing on carbon reduction. Finally, LEED v5, which is planned to be released in 2025, is set to further advance sustainability criteria and aims to improve green building standards (USGBC, 2024). However, in future versions of LEED, a flexible system that more strongly takes into account global environmental issues and regional differences should be adopted. Creating a customizable model on a project basis, instead of the uniform evaluation structure of the current system, will provide a more flexible and applicable framework in certification processes. As some projects may not fully comply with predetermined standard criteria and may require different arrangements according to local conditions (Süzer, 2015).

In this regard, it is imperative that category and credit weights can be adapted in accordance with the project location during the evaluation process. Moreover, the development of a flexible elimination mechanism is crucial to ensure that criteria not applicable to certain projects do not adversely impact the building score. In order to make the evaluation process fairer and more effective, score distributions and category weights for the credit system should be based on comprehensive analyses that include global sustainability priorities and regional environmental differences (Süzer, 2015).

Program Types and Categories of LEED Certificate

LEED certification has undergone continuous updates in order to advance sustainability objectives, with the development of six distinct programs in this direction. Each program is designed to minimize environmental impacts and facilitate the creation of healthy living spaces (USGBC, 2024). The following list comprises the aforementioned programs (USGBC, 2024; Gökbayrak, 2016):

- *LEED for Building Design and Construction (LEED BD+C):* The USGBC (2024) defines the certification program for newly constructed buildings or extensive renovation projects. The system is applied to projects where the design and construction of all electrical, mechanical, water and fire protection systems of the building are planned and supervised by the project developer. The building type is used for apartment buildings, schools, shopping centers, hospitals, data centers, accommodation areas, warehouses and distribution centers.
- *LEED for Interior Design and Construction (LEED ID+C):* The objective of its creation was to enhance the environmental and human-centric quality of existing building interiors. The implementation of this system has been successful in a variety of settings, including shopping centers, office spaces, cafe-restaurants, banks and accommodation areas.
- *LEED for Building Operations and Maintenance (LEED O+M):* This system was created to improve the operational processes of existing buildings that have been in operation for a minimum of one year. Its application can be used for the development of more effective energy, water and waste management issues for projects that do not require construction or involve minimal renovation works. It is used for accommodation, warehouses, distribution centers and apartment buildings.

- *LEED for Neighborhood Development (LEED ND):* It aims to promote the establishment more sustainable, integrated and well-connected neighborhoods. This program is applicable to projects in the planning and design phase or up to 75% complete, as well as to neighborhood-scale projects that have been completed or have been completed within the last three years.
- *LEED for Cities and Communities:* This program provides a comprehensive framework for local governments, developers and stakeholders, promoting sustainable development at the city and community scale. In essence, the system supports sustainable development at different levels, ranging from municipalities to corporate campuses.
- *LEED Residential:* Dwellings certified under this scheme are designed to be durable structures that improve indoor air quality, reduce water and energy consumption and provide low operating costs and long-term financial advantages. The certification can be applied as multifamily, multifamily core and shell and single-family homes.

The LEED program has been developed to promote environmental sustainability at both building and city scale. According to the USGBC (2024), LEED-certified buildings consume 25% less energy, reduce carbon emissions by 34% and save 11% in water use when compared to traditional buildings. In this context, each certification program is evaluated within the framework of specific evaluation criteria and a scoring system. In order to be granted a LEED certificate, projects must meet prerequisites in terms of sustainability and credit categories where they can earn points. The total points obtained by a project from these categories determine the level of the LEED certificate. The maximum total score in the LEED system is 110 and the certification level is calculated on this score (USGBC, n.d.). The relevant categories and credit scoring are outlined below (Table 5.2).

Table 5.2 Categories, Credit Points and Intentions of the LEED (Source: USGBC, n.d.[8]; Uğurlu, 2020)

Categories and Credits (Points)	Intentions
1. Integrative Process (1) 1.1. Integrative Process (1)	To support high-performance, cost-effective, equitable project outcomes through an early analysis of the interrelationships among systems.
2. Location and Transportation (Up to 16) 2.1. Sensitive Land Protection (1) 2.2. High Priority Site and Equitable Development (Up to 2) 2.3. Surrounding Density and Diverse Uses (Up to 5) 2.4. Access to Quality Transit (Up to 5) 2.5. Bicycle Facilities (1) 2.6. Reduced Parking Footprint (1) 2.7. Electric Vehicles (1)	To avoid development on inappropriate sites. To reduce vehicle distance traveled. To enhance livability and improve human health by encouraging daily physical activity.
3. Sustainable Sites (Up to 10) 3.1. Construction Activity Pollution Prevention (Prerequisite) 3.2. Site Assessment (1) 3.3. Protect or Restore Habitat (Up to 2) 3.4. Open Space (1) 3.5. Rainwater Management (Up to 3) 3.6. Heat Island Reduction (Up to 2) 3.7. Light Pollution Reduction (1)	To protect natural ecosystems and prevent construction-related pollution. To reduce the heat island effect. To ensure rainwater management. To increase open and green spaces. To promote the reduction of light pollution.
4. Water Efficiency (Up to 11) 4.1. Outdoor Water Use Reduction (Prerequisite) 4.2. Indoor Water Use Reduction (Prerequisite) 4.3. Building-Level Water Metering (Prerequisite) 4.4. Outdoor Water Use Reduction (Up to 2) 4.5. Indoor Water Use Reduction (Up to 6) 4.6. Optimize Process Water Use (Up to 2) 4.7. Water Metering (1)	To monitor the efficient use of water indoors and outdoors with water monitoring systems. To optimize the use of water in operational processes.
5. Energy and Atmosphere (Up to 33) 5.1. Fundamental Commissioning and Verification (Prerequisite) 5.2. Minimum Energy Performance (Prerequisite) 5.3. Building-Level Energy Metering (Prerequisite) 5.4. Fundamental Refrigerant Management (Prerequisite) 5.5. Optimize Energy Performance (Up to 18) 5.6. Enhanced Commissioning (Up to 6) 5.7. Advanced Energy Metering (1)	To reduce total consumption by increasing energy efficiency. To promote the integration of renewable energy sources. Using advanced measurement and management systems to

[8] https://www.usgbc.org/credits

5.8. Renewable Energy (Up to 5) 5.9. Enhanced Refrigerant Management (1) 5.10. Grid Harmonization (Up to 2)	monitor and optimize energy consumption.
6. Material and Resources (Up to 13) 6.1. Storage and Collection of Recyclables (Prerequisite) 6.2. Building Life-Cycle Impact Reduction (Up to 5) 6.3. Environmental Product Declarations (Up to 2) 6.4. Sourcing of Raw Materials (Up to 2) 6.5. Material Ingredients (Up to 2) 6.6. Construction and Demolition Waste Management (Up to 2)	To reduce life-cycle impacts by optimizing the use of materials. To collect recyclable materials and promote sustainable sourcing.
7. Indoor Environmental Quality (Up to 16) 7.1. Minimum Indoor Air Quality Performance (Prerequisite) 7.2. Environmental Tobacco Smoke Control (Prerequisite) 7.3. Enhanced Indoor Air Quality Strategies (Up to 2) 7.4. Low-Emitting Materials (Up to 3) 7.5. Construction Indoor Air Quality Management Plan (1) 7.6. Indoor Air Quality Assessment (Up to 2) 7.7. Thermal Comfort (1) 7.8. Interior Lighting (Up to 2) 7.9. Daylight (Up to 3) 7.10. Quality Views (1) 7.11. Acoustic Performance (1)	To improve the health and comfort of building users by improving indoor air quality. To use low emission materials. To increase daylight access and thermal comfort.
8. Innovation (Bonus Points – Up to 6) 8.1. Innovation (Up to 5) 8.2. LEED Accredited Professional (1)	To promote innovative sustainability strategies. To improve environmental performance with accredited professionals in the project team.
9. Regional Priority (Bonus Points – Up to 4) 9.1. Regional Priority (Up to 4)	To reward solutions tailored to local climate, ecosystem and infrastructure conditions and to increase sensitivity to region-specific environmental challenges.

The certification process is based on a total of 110 points, 100 of which are derived from basic sustainability categories and the remaining 10 points are derived from regional priority performance criteria and innovative design approaches. The LEED certification system consists of four different certification levels within the framework of the specified evaluation criteria and scoring system:

- LEED Certified: 40-49 points
- LEED Silver: 50-59 points
- LEED Gold: 60-79 points

- LEED Platinum: 80 points and above

In the LEED certification process, experts can obtain either the LEED Green Associate or LEED Accredited Professional (AP) titles by completing the relevant training courses and successfully passing the required examinations (Baştanoğlu, 2017). However, in contrast to the BREEAM system, in which independent auditing professionals directly intervene in the process, the LEED certification process is managed through an online platform run by the USGBC. Initiation of the assessment process by project owners and teams occurs through the uploading of all documents necessary for certification and documents demonstrating compliance with sustainability criteria to this system. Examination of the uploaded documents by the USGBC is conducted for compliance with the scoring and criteria determined by LEED and a determination is made as to whether the project qualifies for the relevant certification level as a result of this evaluation (USGBC, n.d.).

C. YeS-TR Certificate in Türkiye

The YeS-TR certification system is a national certification system that assesses buildings and settlements in Türkiye based on environmental sustainability. This system was developed with consideration for Türkiye's unique dynamics such as climate conditions, energy use and resource management. The primary objective of the system is to evaluate the performance of buildings and settlements within the framework of ecological, economic and social sustainability principles. The certification system employs a holistic approach emphasizing the efficient management of energy and water use, the promotion of renewable energy sources, the monitoring of carbon emissions and the effective implementation of waste management processes throughout the life-cycle of buildings (Ministry of Environment, Urbanization and Climate Change, 2014).

Historical Development

The establishment of a national certification system for green building and sustainable settlement practices in Türkiye commenced with the publication of the "Regulation on the Certification of Sustainable Green Buildings and Sustainable Settlements" in the Official Gazette No. 29199 in 2014 (Kılıçarslan et al., 2019) (Figure 5.3). This regulation provided a framework for the identification, assessment and certification of green building standards specific to Türkiye. The initial version of the system was designed to establish a guideline for evaluating and certifying the social, environmental and economic performance of existing and new buildings and residential areas (Resmi Gazete, 2014).

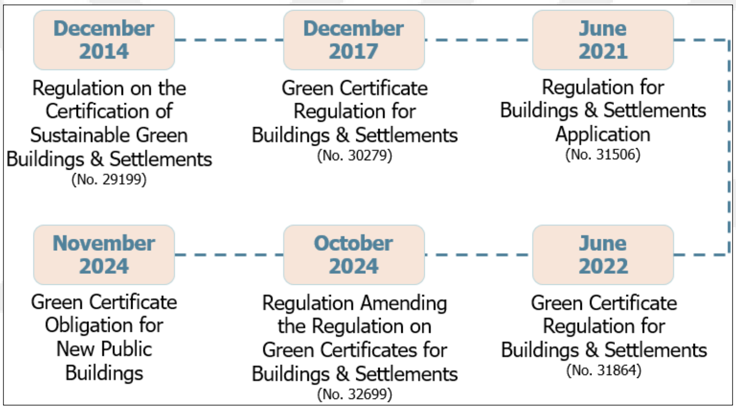

Figure 5.3 The Development of YeS-TR (Source: Resmi Gazete, 2014, 2017, 2021, 2022, 2024; Ministry of Environment, Urbanization and Climate Change, 2024)

However, in line with the needs arising in practice, it has become necessary to update the certification process and make it more comprehensive. In this context, the "Green Certificate Regulation for Buildings and Settlements" numbered 30279 was published in 2017 and the previous regulation was repealed (Kılınçarslan et al., 2019; Çillioğlu Karademir & Dağ, 2021; Özaydın & Baz, 2021; as cited in Koçak & Topay, 2022). The recently introduced regulation serves to provide a more precise delineation of the duties, qualifications and responsibilities of the individuals and organizations that will be involved in the assessment and certification process. With this amendment, it is aimed to establish a more systematic structure and an up-to-date framework for the certification process (Resmi Gazete, 2017).

The system underwent further development and was updated with the "Regulation for Buildings and Settlements Application" published in the Official Gazette No. 31506 in 2021 and detailed information on the principles of the certification process was shared (Koçak & Topay, 2022). This regulation detailed the principles of the certification process. It provided a clearer roadmap on evaluation criteria, scoring methods and certification processes in comparison to the regulation that was published in 2017 (Resmi Gazete, 2021).

Subsequent to the aforementioned developments, the "Green Certificate Regulation for Buildings and Settlements" was published in the Official Gazette No. 31864 in 2022. This regulation was developed more comprehensive procedures and principles regarding the qualifications of experts and training institutions involved in the green certification process specified in the previous regulation (Resmi Gazete, 2022). The annex to this regulation comprises documents such as "Green Certificate Building Assessment Guide", "Green Certificate Settlement Assessment Guide" and "Green Certificate National Green Building and Green Settlement Certification Training Considerations". These guides contain information on the evaluation criteria, crediting, rating and qualifications of green certification experts for green buildings and settlements, thus ensuring transparency of the certification process (Resmi Gazete, 2022).

The most recent amendments to the certification process were made with the "Regulation Amending the Green Certificate Regulation for Buildings and Settlements", published in the Official Gazette No. 32699 in 2024 (Resmi Gazete, 2024). The aforementioned regulation has given rise the two guidelines: Green Certificate Building Assessment Guide (v1) and Green Certificate Settlement Assessment Guide (v1). Consequently, the scope of the system has been expanded and the following significant innovations have been introduced (Resmi Gazete, 2024):

- For the first time, the scope of green certification encompasses "buildings where production activities are carried out in industrial areas". Consequently, buildings constructed in organized industrial zones (OIZ) will be subject to the same evaluation process, incorporating sustainability criteria. Concurrently, negotiations with the relevant ministries and banking institutions are underway to establish incentives and financing opportunities for sustainable building projects in industrial zones.

- The previous limitation on the number of projects that green certification experts could undertake has been removed. Previously, the regulations allowed experts to provide services for a maximum of three buildings or development at a time, but this limit has been removed in the new regulations.
- The certificate system, which was utilized at the national level prior to the implementation of this regulation, has facilitated its application in international projects following the introduction of the 2022 regulation. The objective of this amendment is to enhance the scope of applicability by eliminating more limited expressions.
- The definition of "existing building" has been revised in the current regulations and the prerequisite that buildings with a certificate of occupancy must have been constructed a minimum of two years prior to application for a green certificate has been eliminated. This amendment is intended to broaden the scope of the regulation, encompassing a more extensive building stock.

Program Types and Categories of YeS-TR Certificate

In the process of establishing the scope of the Green Building and Settlement Guide in the most recent regulation issued in 2024, the primary module approaches of six international and two national green building systems were examined and prepared, with consideration given to national and local conditions (Ministry of Environment, Urbanization and Climate Change, 2024). In this regard, the main modules and sub-criteria have been formulated to be open to comparison with international sustainability certificates.

In accordance with the assertions put forth by Koçak & Topay (2022), the system is subjected to a three-stage evaluation process as delineated within the framework of green certificate evaluation guidelines:

- *Planning and Design Phase (Preliminary Phase):* This stage encompasses the completion of all requisite permits and procedures prior to the initiation of construction activities. To be eligible for certification, all criteria determined at this stage must be fulfilled completely.
- *Implementation Phase:* Evidence of progress in new development areas or community projects must be submitted. This stage is considered to have been successfully completed if at least 50% to 70% of the project has been completed and the necessary conditions have been met.
- *Post Implementation:* It refers to the full completion of building or settlement projects. When all construction activities are completed and the necessary assessment processes are passed, the project is entitled to be certified.

The green certificate building assessment guide can be applied to both existing buildings and new buildings (Deniz & Kömürlü, 2024). In both modules, buildings are classified according to their typologies as residential, hotel, shopping, commercial, office, health and education buildings (Cenk et al., 2024). The categories of the YeS-TR certificate are as follows: integrated building design, construction and management, indoor environmental quality, building material and life-cycle, energy use and efficiency, water and waste management and innovation. The subsequent table comprises the categories, sub-categories of these categories and the objectives of these categories (Ministry of Environment, Urbanization and Climate Change, 2024) (Table 5.3).

Table 5.3 Categories, Credit Points and Intentions of the YeS-TR Building Guideline (Source: Ministry of Environment, Urbanization and Climate Change, 2024)

Categories and Credits (Points)	Intentions
1. Integrated Building Design, Construction and Management (15) 1.1. Project Planning 1.2. Integrated Design 1.3. Preparation of Construction Related Documents 1.4. Construction 1.5. Control, Commissioning and Acceptance 1.6. Operation, Maintenance, Measurement and Facility Management	To integrate the design, construction and management processes of buildings with the participation of all stakeholders.
2. Indoor Environmental Quality (20) 2.1. Visual Comfort 2.2. Auditory Comfort 2.3. Thermal Comfort 2.4. Air Quality	To improve the health and comfort of users by integrating passive and active systems into the design process to improve visual, auditory, thermal comfort and indoor air quality.
3. Building Material and Life-Cycle Assessment (16) 3.1. Building Material Life-Cycle and Environmental Product Declaration 3.2. Healthy Product Declaration 3.3. Dangerous Radiation Release 3.4. Responsible Use of Resources 3.5. Local Resource Utilization 3.6. Use of Reused, Reclaimed or Recyclable Materials 3.7. Durable Material Usage	To minimize the environmental impact of the materials to be used. To reduce the use of non-renewable resources. To minimize industrial waste. To aim that the materials used do not harm human health.
4. Energy Use and Efficiency (25) 4.1. Building Energy Performance 4.2. Renewable Energy Technologies	To reduce the need for energy and ensure its efficient use. To utilize renewable energy sources.
5. Water and Waste Management (24) 5.1. Water Management 5.2. Waste Management	To ensure sustainable water use in buildings. To utilize alternative water sources. To plan domestic solid waste management.
6. Innovation (Bonus Points – 10) 6.1. Engineering and Design Solutions that Improve Quality of Life 6.2. Improvement of Monitoring and Evaluation System	To improve environmental and vital quality. To encourage innovative and remedial practices to increase consumer awareness.

The green certificate settlement guide extends beyond the confines of individual building buildings, aiming facilitate the planning of sustainable settlement areas. This guideline addresses elements such as energy, water, transport, ecological balance and social and economic sustainability with a holistic approach by ensuring the implementation of sustainability principles at the urban scale, not only for individual buildings. In light of this understanding, the categories of regional and immediate environment profile, sustainable land use, ecology and disaster management, transport and mobility, urban design, social and economic sustainability have been developed. The categorization of these parameters is delineated in the accompanying table (Ministry of Environment, Urbanization and Climate Change, 2024) (Table 5.4).

Table 5.4 Categories, Credit Points and Intentions of the YeS-TR Settlement Guideline (Source: Ministry of Environment, Urbanization and Climate Change, 2024)

Categories and Credits (Points)	Intentions
1. Regional and Close Environment Profile (8) 1.1. Spatial, Local and Regional Data 1.2. Project Data	To define an area for the sustainable development of medium and small-sized cities. Ensuring legal requirements, financing and stakeholder engagement.
2. Sustainable Land Use, Ecology and Disaster Management (26) 2.1. Planning and Ecological Value Asset 2.2. Sustainable Site Selection and Energy Efficient Planning 2.3. Sustainable Urban Development and Land Use 2.4. Disaster Resilience 2.5. Environmental Management and Infrastructure Planning	To ensure integrity between scales in urban planning and design. To take the most appropriate location decisions by protecting ecological values. To use land and transport decisions effectively. To develop sustainable solutions for environment and disaster management.
3. Transport and Mobility (25) 3.1. Accessibility and Functional Connectivity 3.2. Sustainable and Alternative Systems 3.3. Transport Quality 3.4. Climate Change Adaptation Process	To encourage pedestrian-priority transport by ensuring social sustainability. To priorities traffic safety and urban livability by increasing transport quality and efficiency.
4. Urban Design (21) 4.1. Process and Project Design 4.2. Circularity System 4.3. Public and Open Spaces 4.4. Services and Facilities 4.5. Structures 4.6. Environment	To promote the creation of public spaces that are flexible, environmentally sensitive, preserve local identity and support healthy living in sustainable settlements.

Table 5.4 (cont'd)

5. Social and Economic Sustainability (20) 5.1. Social and Economic Development 5.2. Socio-Cultural Quality	To enhance social equity, economic welfare and quality of life by protecting the natural and cultural environment.
6. Innovation (Bonus Points – 10) 6.1. Engineering and Design Solutions that Improve Quality of Life 6.2. Improvement of Monitoring and Evaluation System	To improve environmental and vital quality. To encourage innovative and remedial practices to increase consumer awareness.

The evaluation of green building and settlement guidelines is made out of 100 points (Koçak & Akten, 2023). "Innovation" title is awarded as a bonus point (10 points). In general terms, the YeS-TR certification system is comprised of four distinct certification levels, categorized according to the evaluation criteria and scoring system:

- YeS-TR Pass: 32-39 points
- YeS-TR Good: 40-54 points
- YeS-TR Very Good: 55-74 points
- YeS-TR National Superiority: 75 points and above

The YeS-TR certification process includes a number of experts and institutions involved in the evaluation and approval process. The green certification expert is tasked with the guidance of project owners, ensuring that the process adheres to the stipulated requirements. The green assessment expert's role involves analyzing the compliance of the projects with the sustainability criteria and conducting technical examinations. The green certification commission is tasked with the evaluation of applications and the verification of compliance with the requisite criteria. The assessment organization, in its capacity as an independent authority, is responsible for the thoroughness and reliability of the certification process and the approval of the certification decision (Ministry of Environment, Urbanization and Climate Change, 2024).

D. BEST Certificate

BEST certificate is a national green building rating system that was developed by ÇEDBİK for Türkiye. The primary objective of this certification is to encourage the establishment of healthy communities, enhance environmental sustainability and promote economic growth. In addition to these objectives, it aims to raise building standards, to measure sustainability in the built environment and to achieve ideal conditions through the implementation of various solutions (ÇEDBİK, n.d.)[9].

The objective of all green building certification systems employed globally is to minimize the detrimental impacts of the built environment on both natural resources and on human beings, whilst encouraging sustainable building practices (Eren, 2021, as cited in Ozan et al., 2022). A distinctive feature of the BEST certificate is that it has been developed taking into account Türkiye's geographical characteristics, local climatic conditions and national legislation (Ozan et al., 2022). While green building assessment systems such as LEED and BREEAM, which are widely utilized internationally, are globally accepted, they are not as directly compatible with the regulations and legal arrangements in Türkiye as BEST (Kılavuz, 2015; Ünver et al., 2020, as cited in Ozan et al., 2022).

Moreover, since BEST is conceived as a completely local system, it facilitates a more accessible and economical assessment process in comparison to international certification programs. This is particularly evident in terms of certification costs, which are significantly lower for a local system. Consequently, project owners face a reduced financial burden and the dissemination of sustainable building practices in Türkiye is encouraged.

[9] https://www.cedbik.org/best

Historical Development

Until 2013, a green building certification system specific to Türkiye was non-existent (Ozan et al., 2022). However, with the increasing global prevalence of sustainability practices and the increase in greenhouse gas emissions in the housing sector, initiatives have been launched to address this deficiency. In this direction, a green building certification guide for residential buildings was prepared by ÇEDBİK in 2015 (Deligöz et al., 2020).

In the continuation of this process, Türkiye is set to implement its own national certification system. ÇEDBİK has developed BEST-Residential and BEST-Commercial certification systems in order to evaluate and promote sustainability criteria in new housing projects (ÇEDBİK, n.d.). The development of this system has involved contributions from academics, universities and sector stakeholders, with the objective of creating a framework that is compatible with Türkiye's local climate conditions, construction sector dynamics and existing legal regulations (Yıldız, 2019, as cited in Ozan et al., 2022). The overarching objective of the BEST certificate is twofold: firstly, to promote sustainable construction and secondly, raise environmental awareness in the building sector. To this end, the BEST certificate aims to address the concept of green building with Türkiye-specific criteria.

Program Types and Categories of BEST Certificate

Within the scope of the BEST certification, residential and commercial buildings are evaluated across nine key areas according to the guidelines published by the Ministry of Environment, Urbanization and Climate Change (2019, 2020): integrated green project management, land use, water use, energy use, health and comfort, material and resource use, residential living, operation and maintenance and innovation (Ministry of Environment, Urbanization and Climate Change, 2019, 2020) (Table 5.5).

Table 5.5 Categories, Credit Points and Intentions of the BEST-Residential and BEST-Commercial Certificate Guideline (Source: Ozan et al., 2022; Geçimli, 2021; Ministry of Environment, Urbanization and Climate Change, 2019, 2020)

Categories and Credits	Points in BEST-Residential	Points in BEST-Commercial	Intentions
1. Integrated Green Project Management	9	10	To promote the work of experts in their field to work together to achieve the best score from the beginning to the end of the project.
1.1. Integrated Design	Prerequisite	Prerequisite	
1.2. Integrated Design	Up to 2	Up to 2	
1.3. Environmental-Friendly Contractor	2	3	
1.4. Construction Waste Management	3	3	
1.5. Noise Control	2	2	
2. Land Usage	13	12	To consider all factors for the protection of the built environment in building design and construction processes.
2.1. Land Settlement	Up to 3	Up to 3	
2.2. Disaster Risk	3	3	
2.3. Relationship between Housing and Settlement Areas	2	2	
2.4. Reuse of Land	3	2	
2.5. Proximity to Urban Facilities	Up to 2	Up to 2	
3. Water Usage	12	12	To reduce water consumption, preventing water losses and evaluating water use in the building utilization process.
3.1. Reducing Water Use	Prerequisite	Prerequisite	
3.2. Reducing Water Use	Up to 6	Up to 6	
3.3. Preventing Water Losses	2	Up to 2	
3.4. Wastewater Treatment and Utilization	Up to 2	Up to 2	
3.5. Surface Water Runoff	2	2	
4. Energy Usage	26	26	To encourage the reduction of energy consumption in the building utilization process and to increase the use of renewable energy.
4.1. Control, Commissioning and Acceptance Process	Prerequisite	Prerequisite	
4.2. Energy Efficiency	Prerequisite	Prerequisite	
4.3. Energy Efficiency	Up to 15	Up to 15	
4.4. Renewable Energy Use	Up to 7	Up to 7	
4.5. Outdoor Lightning	1	2	
4.6. Energy Efficient Electrical Appliances	1	-	
4.7. Elevators	2	2	
5. Health and Comfort	14	14	To ensure thermal, visual and auditory comfort of building users.
5.1. Microbial Contamination Control	-	Prerequisite	
5.2. Indoor Air Quality Plan	-	Prerequisite	
5.3. Thermal Comfort	3	3	
5.4. Visual Comfort	Up to 3	Up to 3	
5.5. Fresh Air	3	3	

5.6. Pollutant Control	2	2	
5.7. Auditory Comfort	3	3	
6. Material and Resource Usage	14	12	To promote the use of sustainable, recyclable and environmentally friendly materials.
6.1. Responsible Resource Utilization	-	Up to 2	
6.2. EPD Certified Materials	-	Up to 2	
6.3. Environmentally Friendly Materials	3	-	
6.4. Utilization of Existing Building Elements	Up to 3	Up to 2	
6.5. Material Reuse	Up to 3	-	
6.6. Use of Local Materials	Up to 3	Up to 2	
6.7. Durable Materials	Up to 2	2	
6.8. Flexible Design	-	2	
7. Building Life	14	12	To create equal opportunities for building users to fulfil their requirements in the utilization process.
7.1. Universal and Inclusive Design	Up to 2	Up to 2	
7.2. Safety	Up to 2	Up to 2	
7.3. Sports and Recreation	2	2	
7.4. Art	1	1	
7.5. Transportation	3	3	
7.6. Car Parking Area	2	Up to 2	
7.7. Working from Home	2	-	
8. Operation and Maintenance	6	10	To ensure generation, separation and storage of waste.
8.1. On-site Waste Separation and User Access	2	3	
8.2. Waste Technologies	1	2	
8.3. Building Maintenance and User Guide	1	3	
8.4. Monitoring Consumption Values	2	2	
9. Innovativeness	2	2	To encourage up-to-date technologies and innovative approaches.
9.1. Innovation	1	1	
9.2. Approved Consultant	1	1	

In accordance with the BEST-Residential Certificate Guideline (2019) and BEST-Commercial Certificate Guideline (2020), certificates are assessed on the basis of 110 points. The BEST certificate system consists of four distinct certificate levels, in line with the specified criteria and scoring method:

- Approved: 46-64 points
- Good: 65-79 points
- Great: 80-99 points
- Perfect: 100 points and above

Evaluations on the green building certification systems utilized in Türkiye has exposed fundamental ambiguities and insufficiencies. While both YeS-TR and BEST certification systems boast their own online resources, expert networks and training materials, access to the information of certified buildings remains limited (Cenk et al., 2024). This situation creates a significant gap in terms of transparency and accessibility for both academic research and practitioners. Additionally, a notable disparity emerges between YeS-TR and BEST with respect to the criteria applied. For instance, BEST places significant emphasis on land use, transportation and functionality, while YeS-TR prioritizes domains such as material use, interior quality and innovation (Cenk et al., 2024).

A combined evaluation of the two systems reveals that both demonstrate a disregard for cost and biodiversity concerns. However, it is crucial to recognize the significance of these criteria in the context of climate change mitigation and the pursuit of sustainable development goals. The necessity for economically sustainable decisions throughout the entire life cycle of buildings is highlighted by the need for the cost parameter to be included in the evaluation criteria (Cenk et al., 2024). Furthermore, the absence of criteria such as transport, land use and functional integrity in the YeS-TR system is particularly noteworthy when considering the effects of Türkiye's mountainous and rugged topography on building design. Consequently, the development of novel criteria that encompass the prevailing physical characteristics is imperative to enhance the efficacy of national certification systems.

E. List of Certified Buildings

Province District Neighborhood	Project Name	LEED Version	Points Achieved	Certification Level	Certification Date
Ankara Çankaya Alacaatlı	Park Mozaik Evleri A Block	LEED-New Construction Version 3	62	LEED Gold	18.02.2019
Ankara Çankaya Alacaatlı	Park Mozaik Evleri B Block	LEED-New Construction Version 3	69	LEED Gold	14.04.2020
Ankara Çankaya Alacaatlı	Park Mozaik Evleri C Block	LEED-New Construction Version 3	64	LEED Gold	21.03.2018
Ankara Çankaya Alacaatlı	Park Mozaik Evleri D-E-F-G-H Blocks	LEED-New Construction Version 3	62	LEED Gold	12.09.2018
Ankara Çankaya Alacaatlı	Park Mozaik Evleri I Block	LEED-New Construction Version 3	67	LEED Gold	14.09.2020
Ankara Çankaya Alacaatlı	Park Mozaik Evleri J Block	LEED-New Construction Version 3	67	LEED Gold	12.10.2020
İstanbul Kartal Esentepe	AND Pastel Mavi Block	LEED-New Construction Version 3	63	LEED Gold	13.03.2020
İstanbul Kartal Esentepe	AND Pastel Turuncu-1 Block	LEED-New Construction Version 3	66	LEED Gold	25.12.2018
İstanbul Kartal Esentepe	AND Pastel Turuncu-2 Block	LEED-New Construction Version 3	65	LEED Gold	29.07.2019
İstanbul Kartal Esentepe	AND Pastel Turuncu-3 Block	LEED-New Construction Version 3	66	LEED Gold	11.12.2019
İstanbul Kartal Esentepe	AND Pastel Yeşil-1 Block	LEED-New Construction Version 3	65	LEED Gold	16.09.2020
İstanbul Kartal Esentepe	AND Pastel Yeşil-2 Block	LEED-New Construction Version 3	64	LEED Gold	11.06.2020
İstanbul Kartal Esentepe	AND Pastel Yeşil-3 Block	LEED-New Construction Version 3	64	LEED Gold	20.03.2020
İstanbul Ataşehir Atatürk	Metropol İstanbul A Block	LEED-New Construction Version 3	60	LEED Gold	26.09.2017
İstanbul Ataşehir Atatürk	Metropol İstanbul B Block	LEED-New Construction Version 3	62	LEED Gold	15.08.2017

İstanbul Ataşehir Atatürk	Metropol İstanbul C1 Block	LEED-New Construction Version 3	62	LEED Gold	15.08.2017
İstanbul Ataşehir Atatürk	Metropol İstanbul C2 Block	LEED-Core and Shell Version 3	64	LEED Gold	15.08.2017
İstanbul Ataşehir Atatürk	Metropol İstanbul D11 Block	LEED-Core and Shell Version 3	67	LEED Gold	15.08.2017
İstanbul Ataşehir Atatürk	Metropol İstanbul E Block	LEED-Core and Shell Version 3	65	LEED Gold	15.08.2017
İstanbul Ataşehir Atatürk	Metropol İstanbul G Block	LEED-Core and Shell Version 3	67	LEED Gold	15.08.2017
İstanbul Maltepe Cevizli	Oyak Dragos A Block	LEED-New Construction Version 4	62	LEED Gold	13.03.2024
İstanbul Maltepe Cevizli	Oyak Dragos B Block	LEED-New Construction Version 4	62	LEED Gold	24.06.2024
İstanbul Maltepe Cevizli	Oyak Dragos C Block	LEED-Core and Shell Version 4	68	LEED Gold	30.07.2024
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B2 Block	LEED-New Construction Version 3	54	LEED Silver	10.06.2018
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B3 Block	LEED-New Construction Version 3	55	LEED Silver	10.05.2018
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B4 Block	LEED-New Construction Version 3	56	LEED Silver	18.04.2018
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B5 Block	LEED-New Construction Version 3	55	LEED Silver	22.03.2018
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B8 Block	LEED-New Construction Version 3	55	LEED Silver	22.01.2018
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B10 Block	LEED-New Construction Version 3	54	LEED Silver	13.11.2017
İstanbul Esenyurt Zafer	TEKFEN HEP İstanbul B11 Block	LEED-New Construction Version 3	52	LEED Silver	10.11.2017
İstanbul Esenyurt Zafer	Narlife A Block	LEED-New Construction Version 3	60	LEED Gold	23.05.2016
İstanbul Esenyurt Zafer	Narlife B Block	LEED-New Construction Version 3	60	LEED Gold	28.01.2016

İstanbul Esenyurt Zafer	Narlife C Block	LEED-New Construction Version 3	61	LEED Gold	6.10.2015
İstanbul Küçükçekmece İnönü	Nivo İstanbul A Block	LEED-New Construction Version 3	52	LEED Silver	27.02.2021
İstanbul Küçükçekmece İnönü	Nivo İstanbul B Block	LEED-New Construction Version 3	64	LEED Gold	4.06.2020
İstanbul Sarıyer Maslak	Ağaoğlu Maslak 1453 A Block	LEED-New Construction Version 3	60	LEED Gold	15.09.2017
İstanbul Sarıyer Maslak	Ağaoğlu Maslak 1453 B Block	LEED-New Construction Version 3	63	LEED Gold	6.04.2018
İstanbul Sarıyer Maslak	Ağaoğlu Maslak 1453 C Block	LEED-New Construction Version 3	61	LEED Gold	17.11.2017
İzmir Karşıyaka Yalı	Soyak Mavişehir Optimus First	LEED-New Construction Version 3	64	LEED Gold	26.02.2015
İzmir Karşıyaka Yalı	Soyak Mavişehir Optimus Gold	LEED-New Construction Version 3	63	LEED Gold	30.03.2015
İzmir Karşıyaka İnönü	Soyak Siesta Blue	LEED-New Construction Version 3	53	LEED Silver	17.02.2016
İzmir Karşıyaka İnönü	Soyak Siesta Oxygen A11B6	LEED-New Construction Version 3	52	LEED Silver	25.08.2016
İzmir Karşıyaka İnönü	Soyak Siesta Oxygen A121314B7	LEED-New Construction Version 3	53	LEED Silver	25.08.2016
İzmir Karşıyaka İnönü	Soyak Siesta Oxygen C1	LEED-New Construction Version 3	52	LEED Silver	25.08.2016

F. Project Visuals

2

CERTIFIED - AND Pastel

Esentepe Avrupa Konutları **- NON-CERTIFIED**

AND Pastel	Esentepe Avrupa Konutları
Land Area: 45,000 m2	Land Area: 39,730 m2
Number of Dwellings: 1,250	Number of Dwellings: 865
Number of Blocks: 7	Number of Blocks: 14

3

CERTIFIED - Metropol İstanbul

Land Area: 800,000 m2
Number of Dwellings: 1,368
Number of Blocks: 5

Trendist Residence **- NON-CERTIFIED**

Land Area: 57,000 m2
Number of Dwellings: 820
Number of Blocks: 16

4

CERTIFIED - Oyak Dragos

Land Area: 30,852 m2
Number of Dwellings: 414
Number of Blocks: 2

Nuvo Dragos **- NON-CERTIFIED**

Land Area: 52,000 m2
Number of Dwellings: 999
Number of Blocks: 5

5

CERTIFIED - TEKFEN HEP İstanbul

Land Area: 56,000 m2
Number of Dwellings: 1,424
Number of Blocks: 11+14

Babacan Premium **- NON-CERTIFIED**

Land Area: 28,500 m2
Number of Dwellings: 1,400
Number of Blocks: 6

6

CERTIFIED - Narlife

Land Area: 29,500 m2
Number of Dwellings: 609
Number of Blocks: 3

TOKİ **- NON-CERTIFIED**

Land Area: 20,000 m2
Number of Dwellings: 305
Number of Blocks: 6

7

CERTIFIED - Nivo İstanbul

Land Area: 42,000 m2
Number of Dwellings: 1,418
Number of Blocks: 6

Küçükçekmece Avrupa Konutları **- NON-CERTIFIED**

Land Area: 30,000 m2
Number of Dwellings: 1,368
Number of Blocks: 5

8

CERTIFIED - Ağaoğlu Maslak 1453

Mashattan **- NON-CERTIFIED**

Land Area: 325,000 m2
Number of Dwellings: 4,203
Number of Blocks: 24

Land Area: 109,000 m2
Number of Dwellings: 1,818
Number of Blocks: 10

9

CERTIFIED - Soyak Mavişehir Optimus

Land Area: 86,358 m2
Number of Dwellings: 1,109
Number of Blocks: 2

Soyak Mavişehir A-B Sitesi **- NON-CERTIFIED**

Land Area: 109,000 m2
Number of Dwellings: 1,818
Number of Blocks: 10

10

CERTIFIED - Soyak Siesta Oxygen & Blue

Land Area: 40,000 m2
Number of Dwellings: 885
Number of Blocks: 7

Soyak Siesta Energy & 1-2. Lap **- NON-CERTIFIED**

Land Area: 80,000 m2
Number of Dwellings: 1,424
Number of Blocks: 15