YEŞİL BİNA KAVRAMI: DÜNYA'DAN VE TÜRKİYE'DEN ÖRNEKLER

THE CONCEPT OF GREEN BUILDING: EXAMPLES FROM AROUND THE WORLD AND FROM TÜRKİYE

Doç. Dr. Arzu ÇAĞLAR
Kırşehir Ahi Evran Üniversitesi, Mühendislik Mimarlık Fakültesi, Mimarlık Bölümü, Merkez, Kırşehir
Dr. Öğretim Üyesi Hakan ÇAĞLAR
Kırşehir Ahi Evran Üniversitesi, Mühendislik Mimarlık Fakültesi, İnşaat Mühendisliği Bölümü, Merkez, Kırşehir
Volkan GÖNEN
GÖNEN Harita ve Mühendislik A.Ş., Merkez, Kırşehir
Beyza GÖNEN
GÖNEN Harita ve Mühendislik A.Ş., Merkez, Kırşehir

ÖZET

Dünya nüfusunun artması ve hızlı kentleşme, enerji tüketimini ve doğal kaynak kullanımını önemli ölçüde artırmıştır. Yapı sektörü, küresel enerji tüketiminin yaklaşık üçte birinden sorumludur. Bu nedenle bina tasarımında sürdürülebilirlik ilkelerinin benimsenmesi zorunlu hâle gelmiştir. Yeşil bina yaklaşımı, yapıların yaşam döngüsü boyunca çevreye olan etkilerini azaltmayı hedeflemektedir. Bu nedenle, yeşil bina, çevreye duyarlı, doğal kaynakları verimli kullanan ve yaşam döngüsü boyunca çevresel etkileri azaltılmış bina türü olarak karşımıza çıkmaktadır. Tasarım, inşaat, kullanım ve hatta yıkım süreçlerinde sürdürülebilirlik ilkelerini esas almaktadır. Bu bağlamdan yola çıkarak, bu çalışmada, yeşil bina kavramı, yeşil bina tasarım ilkeleri, yeşil bina sertifikasyon sistemleri, yeşil binaların ekonomik ve çevresel faydaları üzerinde durulmuştur. Her bir kavram başlıklar halinde açıklanmıştır. Bunun yanı sıra, Dünya'da ve Türkiye'de inşa edilen yeşil binalar detaylı bir şekilde incelenmiştir. Çalışma sonucunda, yeşil binaların, çevresel sürdürülebilirliği desteklediği ve enerji ve maliyet verimliliği sağladığı görülmüştür. Yeşil bina uygulamasının yaşam kalitesini artıran modern yapı yaklaşımı olduğu anlaşılmıştır. Bunun yanı sıra enerji ve su verimliliği, malzeme seçimi, iç mekân kalitesi gibi kriterleri optimize ederek çevresel etkileri azalttığı tespit edilmiştir. Hem küresel ölçekte hem de Türkiye'de inşa edilen yeşil binaların dönüşümünün, önemli ekolojik ve ekonomik kazanımlar sağlandığı ve gelecekteki kentleşme modellerini şekillendireceği görülmüştür. Çalışma, Türkiye'de yeşil bina dönüşümünün arttırılmasının yabancı enerji kaynaklarına olan bağımlılığı azaltabileceği sonucuna varılmıştır.

Anahtar Kelimeler: Yeşil bina, sürdürülebilirlik, enerji, Dünya'da yeşil bina, Türkiye'de yeşil bina

ABSTRACT

The increase of the world's population and rapid urbanization have significantly increased energy consumption and the use of natural resources. The construction sector is responsible for approximately one-third of global energy consumption. Therefore, adopting sustainability principles in building design has become essential. The green building approach aims to reduce the environmental impact of buildings throughout their lifecycle. Therefore, a green building is defined as a type of building that is environmentally friendly, uses natural resources efficiently, and has reduced environmental impact throughout its lifecycle. It is based on sustainability principles in the design, construction, use, and even demolition processes. Based on this

context, this study focuses on the concept of green buildings, green building design principles, green building certification systems, and the economic and environmental benefits of green buildings. Each concept is explained under separate headings. In addition, green buildings constructed both in the world and in Turkey have been examined in detail. The study concluded that green buildings support environmental sustainability and provide energy and cost efficiency. Green building practices have been recognized as a modern construction approach that improves quality of life. In addition, it has been found to reduce environmental impact by optimizing criteria such as energy and water efficiency, material selection, and indoor air quality. The transformation of green buildings constructed both globally and in Turkey has been shown to yield significant ecological and economic gains, and will shape future urbanization models. The study concluded that increasing the green building transformation in Turkey could reduce dependence on foreign energy sources.
Keywords: Green building, sustainability, energy, Green buildings in the world, Green buildings in Turkey

INTRODUCTION

Global warming, rapidly increasing production, water scarcity, rising carbon dioxide emissions, environmental pollution, and the rapid depletion of natural resources have brought the construction of environmentally friendly, ecological buildings to the agenda of the building sector. As interest in environmentally friendly building construction has increased, structures referred to as green buildings have emerged. Certified according to specific standards, green buildings have created a new trend and sector in the construction industry as buildings that are more valuable, capable of using natural resources efficiently, respectful of nature, aiming to integrate people with nature and protect their health, ecological, comfortable, and energy-efficient (Şimşek, 2012). Green buildings are part of the global response that recognizes the growing role of human activities in causing global climate change. They are advanced technological real estate assets that take into account the impacts of buildings on the environment and human health. Green buildings prioritize renewable energy sources, enable the recovery and reuse of wastewater, make maximum use of daylight, provide effective thermal insulation, and are capable of producing the energy they require. These goals can be achieved through improved site planning (building orientation), design, material selection, construction, operation, maintenance, transportation, and, where possible, reuse (Yudelson, 2008).

As the positive effects of green buildings on human health, employee performance, and the environment become better understood, the adoption of green building and green retrofitting practices has been increasing (Polat, 2025). It is the practice of creating responsible and resource-efficient buildings and using processes throughout a building's life cycle, including site selection, design, construction, operation, maintenance, and renovation (Dania et al., 2013; Circo, 2007; Olubunmi et al., 2016).

It is estimated that both in Turkey and worldwide, approximately 30% of total energy consumption is used for heating, cooling, ventilation, lighting, and hot water in buildings. On the other hand, if the energy consumed in the production of materials used in buildings—such as concrete, glass, wood, electrical components, and plumbing equipment—as well as the energy used for construction machinery, is taken into account, the total energy consumption exceeds 40%. Considering these factors, sustainability in buildings can be defined as minimizing the quantity and cost of inputs based on fossil fuels (energy, water, building materials, etc.) across all stages—from the materials that make up the building to the evaluation of parts that can be reused at the end of the building's life cycle. In this context, green buildings

are those in which inputs are used efficiently and at a minimum level while ensuring high indoor environmental quality (comfort) (Erdede & Bektaş, 2014).
In green buildings, recycled materials, water-saving, energy-efficient, and resource-efficient techniques are used during the design and construction phases. They adopt water-sensitive design and minimize vulnerability to flood risk. They reduce pollutant emissions released into water, air, and soil, and minimize noise and light pollution (Hussin, 2013; Li et al., 2014). Green Buildings (GB) have attracted increasing attention in recent years, and numerous studies have been conducted on the implementation of green building projects.
Enache-Pommer and Horman (2009) identified the three most important characteristics in the delivery of green hospitals as: "owner commitment," "expertise in sustainable delivery," and "early timing of sustainability goals." In the research conducted by Molenaar et al. (2009), the effects of major delivery methods—including design-bid-build (DBB), construction manager at-risk (CMR), and design-build (DB)—on the realization of green hospital projects were also examined. Critical project management factors in the execution of green building projects in Singapore were analyzed by Li, Chen, Chew, Teo, and Ding (2011). Recently, the essential project management knowledge and skills that project managers must possess for implementing green construction have also been investigated (Hwang & Ng, 2013).

THE CONCEPT OF GREEN BUİLDİNG

Green buildings are advanced technology properties that consider and minimize the impacts of buildings on the environment and human health (Erdede et al., 2014). A green building reduces the structural damage to the environment and promotes sustainable development by adhering to certain standards to keep harm at a minimum. It is an efficient structure that encompasses many functions, ranging from land use to generating its own energy. The primary goal of these structures is to reduce energy and water consumption while improving user health and productivity within the spaces (Sur, 2012).
Green buildings are constructed to enable people to integrate with nature in the most efficient way, protect the health of the occupants, increase employee productivity, use water, energy, and other resources more efficiently, and minimize potential environmental negative impacts (Kıncay, 2014).
Green buildings define sustainability not only through energy efficiency during the usage phase but also by considering multiple dimensions together, such as material selection, indoor air quality, water management, waste reduction, and ecosystem compatibility (Çimen, 2025).
The main advantages of green buildings can be listed as follows:

- ✓ Reducing carbon dioxide emissions from buildings,
- ✓ Minimizing environmental damage during the construction phase,
- ✓ Lowering operational costs,
- ✓ Promoting the use and development of renewable energy,
- ✓ Utilizing waste materials generated from excavation,
- ✓ Collecting and using rainwater through green roof applications,
- ✓ Benefiting from natural daylight,
- ✓ Providing energy savings,
- ✓ Reducing heating and cooling costs through insulation systems,
- ✓ Increasing the value of the building,
- ✓ Offering a healthier and more productive environment for users,
- ✓ Adding value to urban living spaces.

The environmental and human benefits of green buildings make them the best examples of sustainable construction techniques; in terms of resource consumption, they cause less harm to the environment compared to other buildings. Additionally, since resource recycling is possible, they are more cost-effective than standard buildings. Another benefit for people is the positive impact of high indoor air quality on occupants (Doğru, 2015).

In general, the environmental and human benefits of green buildings can be briefly listed as follows (Orhan & Kaya, 2016):

- ✓ From the design phase onwards, land is used in the most optimal way,
- ✓ Site placement is done without harming the environment and habitat,
- ✓ Construction waste management is ensured by using recyclable materials,
- ✓ Energy is produced as much as possible from renewable sources, and energy consumption is reduced,
- ✓ Users can lead a healthy life due to improved indoor air quality and natural daylight utilization,
- ✓ Savings are achieved in cooling, heating, and lighting,
- ✓ Rainwater and other water resources are recycled,
- ✓ Insulation in the roof and interior spaces is at a high level, preventing energy loss.

The concept of green (or sustainable) buildings emerged as a response to environmental and health issues caused by buildings and as a new approach to reducing the construction industry's impact on both the natural environment and human health. Therefore, it is important to have a clear understanding of the concept of green buildings. Although there is no universally agreed-upon definition of green buildings, the definitions are not entirely unique (Dwaikat & Ali, 2018). Indeed, there are significant commonalities among the various definitions presented in the literature. Green buildings are considered environmentally friendly and sustainable structures that, from site selection to climate considerations and spatial conditions, minimize energy consumption, utilize renewable energy sources, use natural and non-waste-generating materials, and are designed to be eco-friendly (Cassidy, 2003).

For a building to achieve green building status, it must obtain a green building certificate. Globally, green building certification systems include the LEED Certification (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and the WELL certification system. In Turkey, the “YeS-TR Certificate (Domestic National Green Certification System)” is used for green building certification.

EXAMPLE FROM THE WORLD AND TÜRKİYE

Examples From The World

- ❖ **Pixel Building (Melbourne, Austria)**

Pixel Building is an innovative eco-friendly office building considered one of the leading examples of sustainable architecture (Figure 1). It is located in the Melbourne area of Australia. The office was completed in 2010. Pixel Building was designed by Studio505 (now Decibel Architecture) and developed by Grocon.

Figure 1. Pixel building view (Web message 1)

Pixel Building has gained worldwide attention for its sustainable architectural goals. The building was designed to be a carbon-neutral office by balancing operational and embodied carbon emissions. It achieved the highest level of environmental performance with a 105 Green Star rating awarded by the Green Building Council of Australia. Additionally, it demonstrated high sustainability performance by reaching the Platinum level in the LEED assessment system of the U.S. Green Building Council.

The building generates its own energy through solar panels on the roof and façade, supported by wind turbines (Figure 2). Solutions such as natural ventilation, high-performance glazing, and automated shading systems have reduced energy demand. Rainwater is collected, treated, and reused in various building systems. Additionally, greywater recycling is implemented. Vacuum toilets designed within the office significantly reduce water consumption.

Figure 2. Facade and roof panels (Pixel case study, 2025)

Pixel Building stands out not only for its environmental performance but also for its appearance. The colorful, pixel-like façade panels provide both aesthetic appeal and shading/climate control (Web communication, 2).

- **One Central Park (Sydney, Australia)**

One Central Park is an iconic mixed-use (residential + retail) project in Australia, recognized for its sustainable architecture (Figure 3). The building was realized through a collaboration between French architect Ateliers Jean Nouvel and Australian PTW Architects, and it has gained international attention, particularly for its vertical gardens and eco-friendly design features. Construction was completed in 2014. The complex consists of two high-rise residential blocks (approximately 623 apartments in total) with retail and service areas on the lower levels. The east block has 33 floors, while the west block has 16 floors (PTW Architect, 2025).

The most striking feature of the building is its vertical gardens covering the façade. Over an area exceeding 1,100 m², more than 35,000 plants and over 250 different species have been used. This green façade design was developed by French botanical artist Patrick Blanc. These plants enhance the building's aesthetics while also helping to improve urban air quality. Another technical innovation in the building is the heliostat system. Using a 42-meter cantilevered heliostat, motorized mirrors reflect sunlight into shaded areas. During the day, it brings natural light into interior spaces and the surrounding park, and at night, it transforms into a light display resembling an LED art installation (Web communication 3).

The building is one of the largest multi-storey residential structures to achieve a high score in the 5-star Green Star rating for green building standards. A low-carbon trigeneration energy plant provides combined heating and cooling for the building. Advanced water recycling systems are also in place. The plants help reduce energy use by providing shading and contribute to oxygen production by capturing CO_2 (PTW Architect, 2025).

Figure 3. One Central Park

- **Bahrain World Trade Center 1 and 2 (Bahrain)**

The Bahrain World Trade Center (BWTC) is located in Manama, the capital of Bahrain. It is an iconic skyscraper recognized worldwide for its architecture and innovative sustainability features. Completed in 2009, it has received numerous international awards for its high-tech and environmentally friendly design (Web source 4).

Designed by Atkins, the BWTC is used for office and commercial purposes. Each tower consists of 50 floors and features two sail-shaped skyscrapers (Figure 4). This design is inspired by the sails of traditional Arab trading vessels. The form of the towers is not only aesthetic but also functional. The gap between the towers and the sloped surfaces help direct wind flow, contributing to renewable energy generation (The BWTC Architecture, 2025).

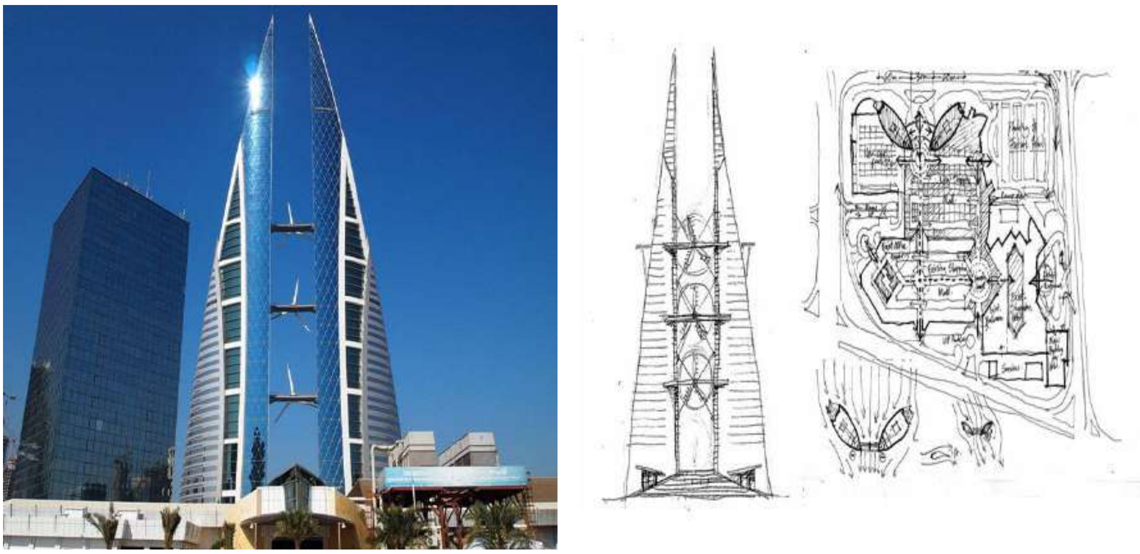

Figure 4. Bahrain Trade Center (Atabey, 2025)

The most distinctive feature of the Bahrain World Trade Center is the three large wind turbines integrated between the towers. Each turbine is approximately 29 m in diameter and is connected by a skybridge structure in the middle of the towers. These turbines are designed to convert wind from the Persian Gulf into energy. The turbines have the capacity to generate electricity to meet approximately 11–15% of the building's total energy needs (Web message 5).

The BWTC incorporates environmentally friendly architectural approaches such as energy efficiency systems, shading/heat control solutions, energy-efficient lighting, and insulation.

Thanks to these approaches, both energy consumption is reduced and the building's environmental impact is kept low (Bahrain WTC, 2025).

- **Parkroyal Collection Pickering (Singapore)**

Parkroyal Collection Pickering, Singapore, located right next to Chinatown in the city's central business district, is a sustainability pioneer hotel known for its "hotel in a garden" concept (Figure 5). The building, with its architecture that integrates nature, stands out both for guests and for those interested in eco-friendly design (TTG Asia, 2023).

Designed by Singapore-based WOHA Architects and completed in 2013, it is a 5-star sustainable hotel. The total greenery used in the hotel covers approximately 15,000 m², which is equivalent to 200% of the building's construction area. These green spaces, surrounded by high terraces, sky gardens, greenery on concrete surfaces, and waterfall/water features, truly transform the building into a garden. The plants provide shading on the building façade, reducing energy consumption. They also help clean the surrounding air and make outdoor spaces comfortable through natural cooling effects (Web communication, 6).

The hotel employs many advanced eco-friendly technologies. Solar panels on the roof—about 262 panels—generate approximately 65,000 kWh of renewable energy per year. The rainwater harvesting system collects around 6 million liters of water annually, which is used to irrigate the greenery. The building's carbon footprint has been reduced by minimizing the volume of concrete used. Natural ventilation and high-performance glass reduce the need for artificial cooling and lighting. Motion and light sensors optimize energy usage. The building design maximizes the entry of natural light (TTG Asia, 2023).

Figure 5. Parkroyal Collection Pickering (Singapore)

- **Robinson Tower (Singapore)**

Robinson Tower is a striking high-rise project located in Singapore's central business district, combining modern architecture, sustainability, and the concept of public green spaces (Figure 6). Robinson Tower was designed through a collaboration between the international architecture firm Kohn Pedersen Fox Associates (KPF) and local partner Architects 61. It was completed in 2019. The building was developed on a triangular/"V"-shaped plot. This unique form gives the architecture a dynamic character. The upper section consists of offices, while the lower section houses retail spaces. In between, landscaped areas such as green terraces and rooftop gardens are incorporated. The building's multi-faceted façade maximizes natural light and creates a "crystalline" effect when viewed from the outside (KPF, 2025).

According to Singapore's Landscape Replacement Policy, enacted in 2014, any green space lost during construction must be compensated for with publicly accessible green areas within and around the building. Therefore, rooftop gardens, terrace areas, and small parks are integral components of the building's design (Welch, 2019).

Figure 6. Robinson Tower (Web message, 7)

EXAMPLES FROM TÜRKİYE

❖ Business Istanbul A-B-C Blocks

Business Istanbul is a building constructed by SVR Gayrimenkul Yatırım ve Ticaret A.Ş. The building covers a total area of 242,000 m², with 117,000 m² for Phase 1 and 125,000 m² for Phase 2 (Figure 7). This project, implemented in Istanbul, has been designed with a focus on sustainability and energy efficiency. Business Istanbul has been awarded the BLEED Platinum Certificate (ERKE, 2025).

In Blocks A-B-C of Business Istanbul, design and systems focused on energy and water efficiency have been developed. Low-emission and environmentally friendly materials have been used. Solutions enhancing indoor air quality have been implemented. Architectural arrangements have been made to maximize natural light usage and improve environmental comfort (Web communication, 8).

Figure 7. Business Istanbul A-B-C blocks (Web message 9)

❖ Adana City Hospital

Adana City Hospital, developed by Rönesans Real Estate, is a significant healthcare facility spread over an area of 278,458 m² (Figure 8). The hospital, notable for its modern architecture, has received the LEED Gold Certification due to its environmentally friendly approach. In addition, studies such as energy modeling and daylight simulation have reduced the hospital's energy consumption while enhancing comfort for both patients and staff within the building (ERKE, 2025).

Figure 8. Adana City Hospital (Web message 10)

- **Gelal Sock Factory**

Gelal Sock Factory operates in the Şabanözü/Çankırı and Esenyurt/Istanbul Organized Industrial Zones (Figure 9). The main production facility in Çankırı demonstrates high environmental performance through sustainability-focused design and operations. The Gelal Sock Factory project has earned the distinction of being the first in Europe and Turkey to receive the LEED Platinum Certification under LEED v4.1. The facility has achieved 60% energy efficiency, 100% water efficiency in landscaping, 57% water efficiency within the building, and 82% success in selecting operationally sustainable materials (ERKE, 2025).

Figure 9. Gelal sock factory (Çankırı) (ERKE, 2025)

- **Taksim 360 Project**

Taksim 360, located in Beyoğlu, Istanbul, is a large-scale mixed-use project that includes residential, office, commercial, and hotel spaces (Figure 10). The Taksim 360 project is a residential development in Istanbul with a built-up area of 18,000 m², constructed by GAP İnşaat. This project has been certified at the LEED GOLD level, focusing on environmentally friendly practices. The building is designed to maximize the use of natural light and incorporates energy-saving systems. Solutions to increase water efficiency have been implemented. Environmentally friendly and low-emission products were preferred in material selection. It provides indoor environmental quality and comfort in accordance with healthyliving space standards.

Figure 10. Taksim 360 project (Web message, 11)

RESULTS

Designing buildings as green buildings or converting existing buildings into green buildings provides benefits in many areas such as environmental impact, economics, and sustainability. Significant energy savings are achieved through thermal insulation, efficient HVAC systems, and the use of renewable energy. Water consumption is reduced with low-flow fixtures, gray water, and rainwater systems. Greenhouse gas emissions decrease due to reduced fossil fuel use and energy demand. Raw material consumption is reduced through the use of recycled and local materials. Waste management improves during the construction and operational phases. Operating costs are lower. Long-term reductions are observed in energy and water bills. Green-certified buildings (LEED, BREEAM, etc.) are more valuable and desirable in the market. Durable and efficient systems lower long-term maintenance costs. Good air quality, natural lighting, and low-VOC materials positively impact health. User comfort and satisfaction increase. Thermal, visual, and acoustic comfort are improved. Employee/student performance can increase in office and educational buildings. Green buildings promote a culture of sustainable living. The urban heat island effect is reduced. Green roofs, light-colored surfaces, and landscaping improve the urban climate. The load on infrastructure decreases. Reducing the carbon footprint has a positive global impact.

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