

Analyzing the Feasibility of Turkey's MTP (2026–2028) Policies for Buildings: A Path to Near-Zero Energy Buildings (nZEB)

Türkiye'nin OVP (2026–2028) Binalara Yönelik Politikalarının Uygulanabilirliğinin Analizi: Neredeyse Sıfır Enerjili Binalara (nZEB) Giden Yol

ABSTRACT

This study examines the policies and practices planned under the Medium-Term Program (MTP) for 2026–2028 regarding energy efficiency in buildings in Türkiye. The program aims to promote the widespread adoption of nearly zero-energy building (nZEB) standards for new construction, thereby minimizing energy demand and meeting the remaining energy needs through renewable energy sources. Enhancing renewable energy integration, particularly the expansion of systems such as solar power, is a strategic measure to improve energy supply security. Diversifying financial incentive mechanisms is crucial for accelerating investment in this sector. Finally, the development of digital monitoring and control systems is intended to enable the real-time tracking and management of energy consumption. This study analyzes the feasibility of these policy instruments, identifies potential implementation barriers, and provides recommendations to support Türkiye's progress toward its energy efficiency target.

Keywords: Buildings, Energy efficiency, Medium-term program, Policy

ÖZET

Bu çalışma, 2026-2028 dönemini kapsayan Orta Vadeli Program (OVP) kapsamında binalarda enerji verimliliğine yönelik planlanan politika ve uygulamaları incelemektedir. Program, yeni binalarda "neredeyse sıfır enerjili bina" (nZEB) standartlarının yaygınlaştırılmasını, böylece enerji talebinin minimize edilmesini ve kalan enerji ihtiyacının yenilenebilir enerji kaynaklarından karşılanmasını hedeflemektedir. Özellikle güneş enerjisi gibi sistemlerin genişletilmesiyle yenilenebilir enerji entegrasyonunun artırılması, enerji arz güvenliğini iyileştirmek için stratejik bir önlem olarak vurgulanmaktadır. Finansal teşvik mekanizmalarının çeşitlendirilmesi, bu sektördeki yatırımların hızlandırılması için kritik görülmektedir. Son olarak, dijital izleme ve kontrol sistemlerinin geliştirilmesi, enerji tüketiminin gerçek zamanlı takibini ve yönetimini sağlamayı amaçlamaktadır. Bu çalışma, söz konusu politika araçlarının uygulanabilirliğini analiz etmekte, potansiyel uygulama engellerini belirlemekte ve Türkiye'nin enerji verimliliği hedeflerine ulaşma sürecini desteklemek için öneriler sunmaktadır.

Anahtar Kelimeler: Binalar, Enerji verimliliği, Orta vadeli program, Politika

INTRODUCTION

Energy efficiency is not merely a technical concept but also a critical determinant of economic development, environmental sustainability, and social welfare. The rising global energy demand and finite nature of fossil fuels have positioned energy efficiency as one of the most important policy instruments for combating climate change (IEA, 2022). Among the United Nations Sustainable Development Goals (SDGs), Goal 7: Affordable and Clean Energy directly emphasizes the need to enhance energy efficiency.

Energy efficiency contributes not only to reducing energy consumption but also to strengthening economic competitiveness, decreasing external dependency and mitigating carbon emissions (Sultan Qurraie and Kılıç Bakırhan, 2023). The IPCC (2023) report highlights energy efficiency as one of the most cost-effective strategies for achieving global carbon-reduction targets. In this context, buildings, which represent one of the largest sources of energy demand and greenhouse gas emissions, have become central to international climate policies.

Globally, buildings account for approximately 30–40% of the total energy consumption (IPCC, 2023). This share is rising in developing countries owing to economic growth, rapid urbanization, and increasing living standards. Kochanski et al. (2024) demonstrate that circular economy practices in European buildings significantly reduce both energy consumption and carbon emissions. Their findings indicate that innovative approaches, such as circular business models and the use of sustainable materials, are as crucial as technical solutions in advancing building energy efficiency.

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Similarly, Reis-Machado and Nunes (2024) underscore the pivotal role of building-based efficiency policies in achieving CO₂ reduction and sustainability goals. According to their study, improving energy efficiency in buildings not only reduces emissions, but also strengthens energy security and contributes to long-term economic stability. Shahidi Hamedani et al. (2025) further argue that circular business models and smart systems in the construction sector serve as essential policy tools for enhancing energy efficiency. Smart meters, building automation systems, and digital building passports enable more transparent monitoring and management of energy use (Körner et al., 2024; Kılıç Bakırhan, 2025).

At the national level, Türkiye introduced its first framework through the National Energy Efficiency Action Plan (2017–2023), prioritizing insulation, energy performance certificates, and the adoption of high efficiency appliances (Çin and Onaygil, 2023). This plan particularly emphasizes insulation investments in residential and public buildings, the mandatory use of performance certificates, and the widespread adoption of efficient technologies.

The Medium-Term Program (MTP, 2026–2028), published in 2025, builds on these efforts by integrating them into broader macroeconomic objectives. Within this framework, energy efficiency is positioned not only as a technical issue but also as an essential component of the green transition, energy supply security, and reduction of external dependency. The OVP identifies four key policy areas for improving energy efficiency in buildings:

- ✓ Stricter standards for new buildings
- ✓ Integration of renewable energy
- ✓ Financing mechanisms
- ✓ Digitalization and smart systems (MTP Report, 2025)

This approach is largely aligned with the European Union Energy Performance of Buildings Directive (2010/31/EU). However, while the EU has committed to more ambitious long-term goals, such as a 55% reduction in emissions by 2030 and climate neutrality by 2050, Türkiye's MTP remains focused primarily on shorter-term implementation measures.

The effectiveness of energy efficiency policies must be assessed not only in terms of technical solutions but also in broader social and political contexts. Putra (2024), who analyzed energy efficiency policies in Southeast Asia, highlighted the importance of political factors and institutional coherence in shaping climate policy outcomes. This insight is highly relevant for Türkiye, where effective institutional coordination is critical to the MTP's success.

Accordingly, this study aims to examine the energy efficiency policies of the Medium-Term Program (MTP, 2026–2028) for the building sector and evaluate the effectiveness of its proposed policy instruments. The primary objective is to analyze how the renovation of existing buildings, enforcement of stricter standards in new constructions, integration of renewable energy, expansion of financing and incentive mechanisms, and promotion of digitalization and smart systems can contribute to reducing Türkiye's energy consumption, lowering external dependency, and advancing carbon neutrality goals. In this regard, the policy tools of the MTP are discussed in light of national and international literature, practical challenges are identified, and recommendations are presented—such as strengthening enforcement mechanisms, increasing public awareness campaigns, ensuring active participation of local governments, and fostering academia–industry collaborations for technological adaptation and innovation.

The certification and incentive mechanisms highlighted in the Medium-Term Program (MTP 2026-2028) transcend the minimum energy performance criteria prescribed by the current Regulation on Energy Performance in Buildings (BEP Regulation). They aim to complete the legal and financial infrastructure necessary to mandate the 'Nearly Zero-Energy Buildings' (nZEB) standard. However, the existing technical and bureaucratic challenges in implementing the BEP Regulation necessitate that OVP targets go beyond merely issuing certificates. Instead, they require the support of robust incentive structures tiered according to actual energy savings performance to achieve the program objectives.

METHODOLOGY

This study employs a qualitative research design based on document analysis to evaluate energy efficiency policies in buildings within the scope of Türkiye's Medium-Term Program (MTP 2026-2028). The methodology was structured around two main components: data sources and analysis techniques.

Data Sources

Data for this study were collected through a systematic review of official policy documents and legal regulations. The primary data sources included:

Medium-Term Program (2026–2028): The main policy framework outlining the targets for energy efficiency and renewable energy integration in buildings.

National Energy Efficiency Action Plan (NEEAP): To understand the sectoral targets and timelines.

Regulation on Energy Performance in Buildings (BEP Regulation) and Related Legislation: To analyze the current technical standards and legal obligations.

Analysis Technique

The collected data were analyzed using content and thematic analyses. The analysis process was conducted in three stages.

1. Data Reduction: The relevant sections regarding building energy efficiency were extracted from the policy documents.

2. Thematic Coding: The extracted data were coded and classified into three main thematic categories:

- ✓ Targets: Explicit goals set by the MTP (e.g., nZEB transition and renewable energy share).
- ✓ Instruments: Mechanisms designed to achieve these targets (e.g., financial incentives, certification systems, and digital monitoring).
- ✓ Barriers: Potential technical, financial, or bureaucratic obstacles identified within the texts or inferred from the implementation context of the BEP Regulation.

3. Synthesis: The themes were synthesized to assess the feasibility of the policy instruments and develop recommendations.

RESULTS AND DISCUSSION

This section analyzes the policy measures planned within the scope of the Medium-Term Program (MTP) (2026–2028), classifying them into thematic areas, including standards, renewable integration, digitalization, and financial instruments, to assess their implementation feasibility.

Analysis of nZEB Transformation Targets

The Medium-Term Program (MTP, 2026–2028) places strategic emphasis on energy efficiency in new buildings as part of Türkiye's broader energy policy agenda. This prioritization stems from the fact that, compared to the long-term, costly, and technically complex process of retrofitting the existing building stock, integrating high energy performance from the outset in newly constructed buildings offers greater benefits at a lower cost. Within this framework, the promotion and widespread adoption of Nearly Zero Energy Building (nZEB) standards is one of the most critical objectives of the program. The nZEB concept envisions buildings that meet a significant portion of their energy demand through onsite production or renewable energy sources. The European Union's Energy Performance of Buildings Directive (EPBD) 2010/31/EU and its 2024/1275/EU amendment make compliance with nZEB standards mandatory, aiming to improve energy performance across member states. Türkiye's alignment with these standards under the MTP demonstrates a policy approach that is synchronized with international trends.

Recent reports have revealed that nZEB standards contribute not only to energy savings but also play a key role in reducing carbon emissions. For example, the European Commission (2020) emphasizes that nZEB implementations in the building sector are essential for achieving the EU's 2030 climate targets. Similarly, IEA (2022) underscore that nZEBs offer a viable roadmap for sustainable living, particularly in developing countries, by improving energy security and providing economic benefits.

In Turkey, the Energy Performance Certificate (EPC) system is a critical mechanism for assessing and certifying the energy performance of new buildings. However, owing to insufficient enforcement, the system's effectiveness remains limited (Yılmaz & Cesur, 2023). The MTP aims to strengthen the EPC's role, particularly by making it more binding in property sale and rental transactions, thereby increasing the market demand for energy-efficient buildings (Şişman et al., 2025). This approach is expected to elevate nZEB standards from being merely a technical requirement to a strategic policy tool that shapes market dynamics. The mandatory use of high-performance insulation materials in new buildings is another notable aspect of the MTP. Windows and façade systems with low thermal transmittance values help reduce heat loss and decrease the energy demand. Salah and Tuna-Kayılı (2021)

pointed out that passive building design and insulation investments are among the most effective strategies for achieving nZEB targets, especially in developing countries. In addition, heat pumps, solar energy systems, and other renewable solutions are being integrated into the energy infrastructure of new buildings. Iavorschi et al. (2025) identify renewable energy integration as a decisive factor in the success of nZEB policies, while Kim and Lim (2024) demonstrate the economic feasibility of solar-based nZEB solutions in the United States. This highlights the importance of the financial and regulatory incentive mechanisms developed under Türkiye's MTP.

In conclusion, the stringent standards proposed in the MTP for new buildings are expected to significantly reduce the energy consumption and carbon footprint of Türkiye's building stock in the long term. This policy framework will contribute not only to reducing dependence on energy imports but also to fulfilling Türkiye's international climate commitment. International literature supports the notion that nZEB practices generate not only environmental benefits but also have strong positive impacts on economic, social, and energy security dimensions (Anyanwu et al., 2024; Ibrahim et al., 2025). The framework of these policy targets, transition mechanisms, and expected outcomes is illustrated in Figure 1.

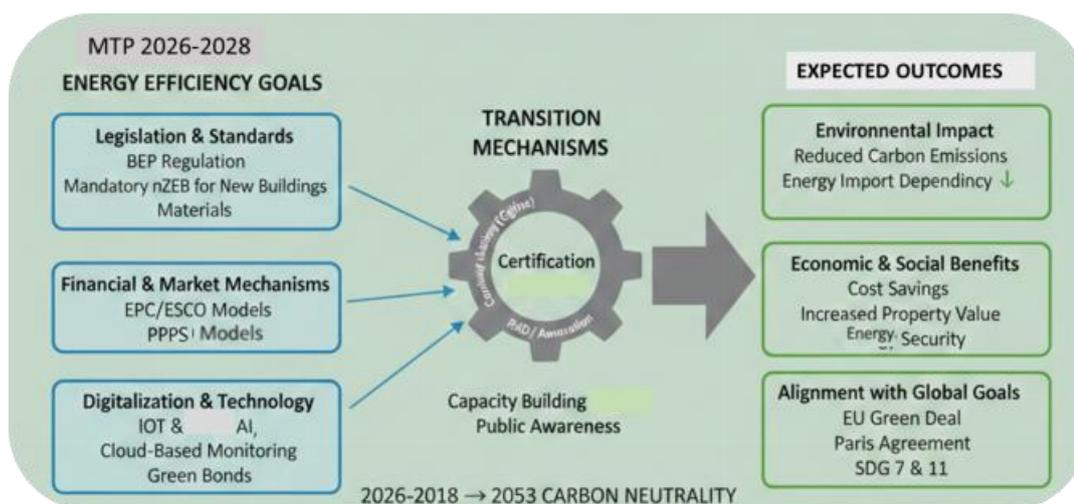


Figure 1: Conceptual Framework of Energy Efficiency Policies in Buildings under the MTP (2026–2028).

Renewable Energy Integration Strategies

Building on foundational standards, the MTP outlines strategic measures to integrate renewable energy sources directly into the built environment. One of the key complementary components of energy efficiency policies is the integration of renewable energy sources into a building. The Medium-Term Program (MTP, 2026–2028) places particular emphasis on the deployment of solar, wind, and geothermal energy solutions at the building level. Türkiye's high solar potential, with over 2,700 h of average annual sunshine, presents significant opportunities (Çakmak, 2024; Gyam et al., 2023).

Building-Integrated Photovoltaic (BIPV) systems, which are installed on rooftops and façades, allow buildings to autonomously meet a substantial portion of their electricity demand. Reddy et al. (2024) emphasize that BIPV systems not only generate clean energy but also provide passive benefits, such as shading and improved building aesthetics. Similarly, Tu et al., 2025 demonstrated that when PV systems are integrated with energy storage technologies, buildings can achieve carbon neutrality targets more rapidly. Pilot implementations of BIPV systems in public buildings play a pioneering role in facilitating the widespread adoption of this technology. Qahtani, 2024 highlighted that BIPV solutions have high potential for meeting energy demand in Saudi Arabia's residential sector, suggesting that a similar model could be effectively adapted for Türkiye.

Wind energy represents another viable source (Júnior et al., 2022), particularly in coastal regions, where small-scale wind turbines can be applied at the building level (Casini, 2015). Geothermal energy serves as a critical complementary source, particularly for space heating and cooling (Assad et al., 2022; Soltani et al., 2018). Ismaeil and Sobaih (2023) indicated that geothermal heat pumps, when integrated with PV systems, can deliver up to 30% energy savings in buildings.

The role of public institutions as early adopters of renewable energy technologies is widely recognized in the literature as a critical strategy. (Ghiasi et al., 2024) illustrate that hybrid PV–geothermal systems deployed in public buildings offer scalable solutions for sustainable energy supply. In Türkiye, integrating such systems into schools, hospitals, and municipal buildings would yield both environmental and economic benefits to the society. Integrating renewable energy into the built environment diversifies the energy supply and contributes significantly

to carbon neutrality goals. According to the IPCC (2023) report, increasing the use of renewable energy in the building sector could help reduce global greenhouse gas emissions by up to 15% by 2030. Additionally, (Chen et al., 2023) underscored that BIPV and geothermal solutions are pivotal in achieving climate neutrality in green building practices. In conclusion, the renewable energy integration strategies outlined in the MTP are expected to make buildings self-sufficient, enhance energy security, reduce carbon footprints, and accelerate Türkiye's green transition. The current literature supports the feasibility, both technical and economic, of hybrid systems that combine BIPV, geothermal heat pumps, and micro-wind turbines, offering innovative and scalable pathways toward sustainable urban energy solutions.

Analysis of Digitalization and Smart Systems

The success of these physical improvements is inextricably linked to the deployment of smart technology. The success of energy efficiency policies depends not only on physical improvements but also on the effective deployment of digitalization and smart technologies. Digital tools have introduced transformative innovations in the construction sector by enabling the real-time monitoring, analysis, and optimization of energy consumption. Accordingly, Türkiye's Medium-Term Program (MTP, 2026–2028) places digitalization at the core of its energy efficiency strategies. A key priority is the widespread adoption of smart meters and energy-monitoring systems. Smart meters allow consumers to visualize their energy use in real time, encouraging more conscious consumption patterns while assisting distribution companies with demand-side management. Tunde et al. (2024) demonstrate that AI-powered smart meters in urban areas can significantly reduce carbon footprints by optimizing energy use. Smart city applications play a vital role in enhancing energy efficiency. Through centralized management systems, energy usage patterns can be analyzed at the neighborhood or city level, enabling more efficient resource allocation. Artificial intelligence (AI)-driven energy management systems represent the most advanced level of digitalization. Ojadi et al., 2024 showed that smart grid systems powered by AI not only improve efficiency but also significantly lower carbon emissions by optimizing real-time energy use in buildings. Similarly, Amangeldy et al. (2025) emphasized that integrating deep learning algorithms into building automation can result in an additional 10–15% energy savings. Moreover, Internet of Things (IoT) applications enhance the functionality of smart systems. Simionescu & Strielkowski, 2024 find that IoT-based energy management solutions support sustainable urban energy use in the post-pandemic era and foster greater demand-side flexibility in the long term. Another dimension of digitalization is big data analytics and cloud-based energy management. Yao et al., 2024 highlighted that data from smart meters, when analyzed using cloud computing platforms, can lead to the development of personalized energy-saving strategies based on user behavior. In conclusion, digitalization and smart systems are not merely technological innovations; they are strategic enablers that enhance the sustainability, cost-effectiveness, and user engagement dimensions of energy efficiency policies. The MTP's focus in this area is well aligned with Türkiye's green development agenda and reflects the global trends.

Financial and Regulatory Incentives

To overcome the economic barriers associated with these technical solutions, the MTP proposes several financial instruments, including: One of the most significant barriers to investing in energy efficiency is the high upfront cost (Chlechowicz et al., 2022). Although technologies such as insulation, renewable energy integration, and smart systems offer substantial long-term savings, they require considerable initial capital, which can be prohibitive for many building owners to afford (Esfandi et al., 2024; Ibekwe et al., 2024). Therefore, developing appropriate financing and incentive mechanisms is critical for the successful implementation of energy efficiency policies.

The Medium-Term Program (MTP, 2026–2028) aims to facilitate investment access for building owners by offering low-interest loans and grant support. Similarly, the European Union employed dedicated energy efficiency funds and subsidy mechanisms. Masutti and Danielis (2025) highlight that innovative financing tools in Italy have played a significant role in accelerating the energy transition among low-income households. Energy Performance Contracting (EPC) is a model in which Energy Service Companies (ESCOs) cover the investment costs upfront, and building owners repay them through a share of energy savings. By removing the initial cost barriers, this model encourages retrofitting and modernization. Jiang (2024) emphasizes that the success of EPCs depends on clearly defined ESCO selection criteria and performance metrics. Moreover, Zheng et al. (2025) developed a game theory-based model to explain the dynamics between governments, ESCOs, and clients in promoting EPC adoption in public buildings. The MTP also promotes public-Private Partnership (PPP) models for large-scale public projects. Zerilli and Djeddi (2025) show that PPP-based energy efficiency investments in European social housing projects deliver successful outcomes, effectively leveraging the technical capacity of the private sector for public benefit. Similarly, Siriah (2025) asserts that PPPs and private financing schemes play a critical role in supporting energy efficiency investments in SMEs on a global scale. Today, beyond traditional grants and loans, instruments such as green bonds, blockchain-based energy contracts and carbon incentives are gaining prominence. Nour El-Din et al.

(2024) demonstrate that blockchain-secured digital twins can enhance transparency in energy performance contracts and increase trust in ESCOs. Similarly, Long and Tram (2024) found that blockchain-enabled financing mechanisms combined with national tax incentives increased investor interest in energy transition projects. Karakosta et al. (2025), analyzing ESCO development in countries such as Bulgaria and Greece, show that the effectiveness of incentive schemes is closely linked to the maturity of energy service markets. Furthermore, Zhang and Li (2025) report that integrating carbon incentives into EPC frameworks in industrial decarbonization projects helps ensure a more equitable distribution of benefits, particularly in the context of carbon neutrality targets. In conclusion, the financing and incentive mechanisms outlined in the MTP, such as low-interest loans, grant schemes, EPC/ESCO models, and PPP projects, are designed to improve access to capital for building owners while increasing private sector engagement. The literature affirms that multidimensional financial solutions not only support energy efficiency goals but also promote social equity, market dynamism, and progress toward climate neutrality.

Analysis of Policy Barriers and Implementation Feasibility

Based on the thematic analysis of the targets and instruments proposed in the MTP (2026–2028), this section examines the potential barriers to implementation and outlines the corresponding strategic solutions derived from the literature and international experience. The potential barriers and proposed solutions are presented in Table 1. The feasibility of the policy framework hinges on addressing several critical constraints.

Challenges in Mandating nZEB Standards

Barrier: Although the MTP aims to make Nearly Zero-Energy Building (nZEB) standards mandatory for new buildings (Metehan, 2025), significant technical barriers exist. These include a shortage of qualified technical staff, high initial costs of high-performance materials, and a lack of specialized knowledge among Small and Medium-sized Enterprises (SMEs) in the construction sector.

Solution: To ensure feasibility, the government should prioritize developing comprehensive training programs and certification schemes for architects, engineers, and construction workers. Furthermore, technical support programs specifically tailored for SMEs are required to facilitate the transition to nZEB-compliant designs.

Barriers to Renewable Energy Integration

Barrier: Although Turkey boasts high solar potential, integrating renewable energy solutions at the building scale (e.g., building-integrated photovoltaics (BIPV)) faces technical limitations within the grid infrastructure to handle localized generation. Moreover, high upfront investment costs remain a major deterrent for building owners.

Solution: The feasibility of this target depends on the implementation of feed-in tariffs to make localized generation economically viable, along with subsidized financing mechanisms for rooftop solar PV projects to alleviate high initial costs.

Constraints of Financial Incentive Mechanisms

Barrier: The MTP relies on financial incentives, but the effectiveness of these measures may be limited by the treasury's budgetary constraints and the inherent bureaucratic complexity associated with accessing such funds.

Solution: To enhance feasibility, performance-based tax reductions that reward actual energy savings should be introduced. Additionally, leveraging Public-Private Partnership (PPP) models can effectively share investment risks between the public and private sectors.

Limitations of Digital Monitoring Systems:

Barrier: Although the deployment of smart meters and digital monitoring tools is crucial for optimization (Attah et al., 2024; Verma et al., 2020), the high cost of smart sensors (Ezhilarasi et al., 2023; Laflamme et al., 2023) and significant cybersecurity concerns regarding data privacy pose substantial risks (Attah et al., 2024; Malesvich, 2016).

Solution: Successful implementation requires the establishment of standardized data-sharing protocols to ensure security and trust. Furthermore, government-subsidized Internet of Things (IoT) adoption programs can help offset the high initial cost of monitoring infrastructure.

Table 1: Policy Barriers and Proposed Solutions for nZEB Implementation in Türkiye

Policy Target (OVP 2026-2028)	Potential Barrier (Implementation Context)	Proposed Solution/Recommendation
Mandatory nZEB Standard	There is a shortage of technical staff, high initial costs of materials, and a lack of specialized knowledge in SMEs.	Development of comprehensive training programs and certification schemes for architects and engineers.
Renewable Energy Integration	Technical limitations in the grid infrastructure to handle localized generation and high upfront investment costs are also challenges.	Implementation of feed-in tariffs and subsidized financing for rooftop solar PV projects.
Financial Incentive Mechanisms	Budgetary constraints of the treasury and bureaucratic complexity in accessing funds.	Performance-based tax reductions and public-private partnership (PPP) models to share investment risks.
Digital Monitoring Systems	The high cost of smart sensors and cybersecurity concerns regarding data privacy.	Standardized data-sharing protocols and government-subsidized IoT adoption programs.

CONCLUSION AND EVALUATION

The analysis of the Medium-Term Program (MTP, 2026–2028) reveals that Türkiye has established a comprehensive policy framework aligned with international trends to transition to energy-efficient and low-carbon buildings. The strategic prioritization of Nearly Zero-Energy Building (nZEB) standards for new construction, combined with enhanced renewable energy integration and digitalization, constitutes a robust roadmap for reducing energy dependence and fulfilling international climate commitments.

However, the successful implementation of these policies depends on overcoming the significant challenges identified through thematic analysis. Technical staff shortages, high upfront investment costs, and infrastructural limitations pose major barriers to the widespread adoption of nZEB standards and Building-Integrated Photovoltaics (BIPV). Therefore, the MTP's success hinges not only on the legal enforcement of standards but also on the effective deployment of the proposed financial and regulatory incentive mechanisms.

Future research should focus on the economic modeling of specific incentive structures, such as performance-based tax reductions, and the development of localized technical guidelines for nZEB applications in the Turkish context. Ultimately, the MTP has the potential to catalyze a significant shift in the construction sector, provided that policy design is complemented by proactive capacity building and targeted financial support.

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