

CRITICAL DISCUSSION ON BUILDING ENERGY RETROFIT POLICIES

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ABSTRACT

Building energy retrofit has become crucial in reducing the energy consumption of buildings since buildings have a significant energy consumption rate. Therefore, energy retrofit can reduce energy consumption while improving energy performance, and the building's overall image can also be changed. However, as it is for new buildings, governmental organisations should control and audit the building energy retrofit process to provide the requirements and keep the standard. Recently, energy retrofit gained popularity worldwide with the increasing interest in 'sustainable development' and 'energy efficiency' issues due to the existing building's role in energy consumption. In this case, different countries have developed policies based on their situations. For instance, since Europe has numerous old buildings, regulatory processes, incentives, and public awareness drive the retrofitting process. On the other hand, in the USA, companies offer energy-efficient retrofit solutions to building owners or operators due to the characteristics of the market-based driven energy retrofit process. However, Turkey has general laws on energy efficiency in buildings, such as the Energy Efficiency Law and the National Energy Efficiency Plan, as the building energy retrofit process is a brand-new topic. Thus, there is a need to develop detailed directives and incentives to manage the process efficiently. This paper discusses regulatory approaches and policies used for the building energy retrofit process in the European Union and the USA to develop proposals for the Turkish construction industry. First, it provides a comparative analysis of the policy-based process of building energy retrofit. For this purpose, the official building energy retrofit regulations are examined, pros and cons are discussed. Finally, a regulatory approach is proposed for the Turkish construction industry for building energy retrofit by investigating the challenges and opportunities.

Keywords: building energy, building energy retrofit, building energy retrofit policy, building energy regulation, building energy directive.

1 INTRODUCTION

According to the International Energy Agency (IEA), the building sector consumes one-third of the worldwide energy. In developed countries, building energy codes are developed with a broader scope, including renewable energy sources. However, existing buildings need more attention regarding energy improvements [1]. Concerning this, the European Commission started a program called 'Renovation Wave' [2]. The program has three main aims: tackling energy poverty and worst-performing buildings, energy renovation of public buildings and social infrastructure, and decarbonising heating and cooling. Besides that, the USA's Department of Energy develops strategies for benchmarking the buildings to follow and incentivise the improvements. To do so, the US Department of Energy publishes a document on building energy benchmarking policies and performance standards [3]. Moreover, to reach United Nations (UN) Sustainable Development Goal 7: Affordable and Clean Energy, some sub-targets are set forth. According to these targets, it is expected to double energy improvements by 2030, promote investments in energy infrastructures, and help developing countries develop their energy infrastructures [4]. Unlike European Union and the US, Turkey does not share a strategy for building renovation. Rather than that, it puts some rules in the Energy Efficiency Law [5] and Building Energy Regulation [6] following the Turkish Standards for thermal insulation requirements for buildings (TS 825) [7]. However, on behalf of generalised national regulations or laws, it is necessary to have building energy retrofit



strategies directed by local authorities since energy efficiency is directly related to environmental and climatic conditions. This paper aims to discover the upper-scale building energy retrofit strategies that lead local governments in the European Union and the US and make inferences about what to follow during the strategy development process for Turkey. The reason behind selecting the European Union and the US is that having multiple climatic zones and different building cultures reflect the local characteristics of the building codes and regulations.

2 BUILDING ENERGY RETROFIT POLICIES

Energy consumption and the energy demands of different territories may differ according to the political situations, building stocks, and climatic conditions. According to that, energy policies vary. For instance, 85% of the building stock of Europe was built before 2001. Moreover, 85%–95% of today's buildings will still be standing in 2050 [2]. Therefore, the European Union created more direct, specific, and detailed directives for the energy renovation of buildings. On the other hand, the US, rather than directives, created some encouragement programs such as building benchmarking and the Building Performance Standards program (BPS) for local governments.

2.1 European policies

There are mandatory, incentive-based articles and recommendations for building energy renovation in the Directive on the Energy Performance of the Building proposal in 2023 [8]. The first version of the Energy Performance of the Buildings Directive (Directive 2002/91/EC) [9] draws a framework for renovating the buildings. In that sense, more than 25% of the surface area of the building shell is renovated, or if the renovation cost is more than 25% of the value of the building, it is considered a major renovation. According to the directive published in 2002, there are three main ideas: the renovation should be cost-effective, incentives should be provided, and the function of the building should not be changed during the renovation. The incentive system is left to the member states. As a recast to Directive 2002/91/EC, Directive 2010/31/EU is produced. Starting with Directive 2010/31/EU, building renovation started to be mentioned more often. The major renovation is defined for any building, unlike Directive 2002/91/EC, without considering its size. Moreover, in Directive 2010/31/EU, renovation plans started to be considered for the Member States [10]. The European Commission announced the Directive (EU) 2018/844 [11] as an amendment to Directive 2010/31/EU. This directive focused on the 2030 targets, which are aimed at reducing green gas emissions by 40% until 2030 compared to 1990. In this instance, there were more efforts on the building renovations related to the lifecycle of the buildings, long-term strategies, education, cost-effectiveness, financial mechanisms, services, etc. The Directive (EU) 2018/844 became a base for the latest directive proposal prepared on March 2023 [8]. Then, the European Commission published the Renovation Wave program for the member states [2]. In the Renovation Wave program, the European Commission defines some strategies as 'energy efficiency first', 'affordability', 'decarbonisation and integration of renewables', 'life cycle thinking and circularity', 'high health and environmental standards', 'the green and digital transitions', 'respect for aesthetics and architectural quality'. In the Renovation Wave program, as a result of public consultations and analysis, the large-scale renovation program's principles are shaped as follows:

- Strengthening information, legal certainty and incentives,
- Ensuring adequate and well-targeted funding,



- Increasing the capacity to prepare and implement projects,
- Promoting comprehensive and integrated renovation interventions,
- Making the construction ecosystem fit to deliver sustainable renovation,
- Using renovation as a lever to address energy poverty and access to healthy housing for all households,
- Promoting the decarbonisation of heating and cooling.

In order to realise the Renovation Wave, the European Bauhaus initiative is established as a funding organization. The initiative aims to create a bridge between the stakeholders in Europe to create a more sustainable building stock for the future with the values of sustainability, aesthetics, and inclusion [12]. As a blend of Directive (EU) 2018/844 and the Renovation Wave program, the new Energy Performance of the Buildings Directive (EPBD) [8] proposal emerged. The building energy renovation-related articles of the proposal of EPBD are given in Table 1.

2.2 USA policies

In the USA, there is no federal code for building energy retrofits. However, in terms of building energy regulations, as it is called in the USA ‘codes’, the decision is left to the states. Most states apply the International Energy Conservation Code (IECC) [13]. IECC does not give direct standards for building energy renovation. However, it provides the general standards on climate zones and their relationships with the building’s thermal envelope, requirements, etc. According to the code, additions, alterations, renovations, or repairs should be done according to the defined rules [13].

Recently, to monitor the situation on a federal scale, the US Department of Energy Office of Energy Efficiency and Renewable Energy established a Building Performance Standards (BPS) program [14]. Moreover, the US Energy Protection Agency published a toolkit for building energy benchmarking and transparency. That toolkit has four sections: (1) benchmarking and transparency, (2) Building Performance Standards, (3) state and local government coordination, and (4) data access. According to the toolkit [3], the stakeholders of the building benchmarking are building owners, the public, state and local governments, and residents. The main aim of the benchmarking for the states is to follow local governments to create a building energy upgrade policy process with the help of BPS. For the building owners, the main aim is the encouragement by cost savings and the potential for energy use reduction. For the public, the motivation aims to improve indoor and outdoor air quality, create new job opportunities, and improve public health. And finally, for the residents, it is desired to enhance comfort and resident satisfaction. The toolkit develops some strategies to integrate energy efficiency benchmarking to states and local governments, as in Table 2. As a supporting document to the benchmarking plan, Energy Star sets a manual for energy upgrades for the buildings [15]. At its essence, the Building Upgrade Manual is a recommendation book for businesses considering building energy upgrades. The Building Upgrade Manual aims to assist companies with benchmarking, investments, financing, retro-commissioning, lighting, supplemental loads, air distribution systems, heating and cooling, and facility-specific recommendations.

Table 1: Building energy renovation articles from proposal for Energy Performance of Buildings Directive (2023).

Category of the article	Article ID	Scope of the article	Summary of the article
Energy performance and efficiency	6a	Recommendation	Increasing the energy efficiency of the buildings by deep renovation should be the high priority in terms of energy efficiency.
	6b	Recommendation/ Incentive-based	A regulatory, financial, and advisory framework should be arranged focusing on worst-performing buildings.
	7	Mandatory	The whole life cycle of the buildings should be considered in terms of building renovations in the renovation plans.
	7a	Incentive-based	The promotion of the renovation or adaptive re-use should be promoted over demolition by the help of European Bauhaus initiative.
	11	Recommendation	During the building energy improvement, climatic conditions, climate change and local conditions with indoor environmental quality, circularity, and energy savings should be considered. The social housings should not be excluded.
Calculation and methodology	11a	Mandatory	Energy performance certificates of the buildings should reflect the climate performance of the buildings.
	12	Mandatory/ Recommendation	The energy performance of the buildings can be calculated in the national, regional or local level. Besides thermal characteristics of the materials, ventilation and cooling, passive heating and cooling elements, shading, indoor environmental quality, adequate natural light, etc. should be considered.
	18	Mandatory	The member states should define the minimum performance requirements for the renovated parts of the buildings. Member states also should select major renovation type if it is about value or surface area.
Deep renovation and minimum energy performance standards	22	Mandatory	There are some issues cannot be overcome by economic incentives such as split incentives or ownership issues, in that case, regulatory approaches should be considered for continuous improvement of the building stock.



Table 1: Continued.

Category of the article	Article ID	Scope of the article	Summary of the article
Deep renovation and minimum energy performance standards (continued from previous page)	23	Incentive-based	The priority should be in the energy improvement of the worst-performing buildings therefore, economic and social incentives should be applied.
	23a	Mandatory	The member states should report the efforts and investments to the Union.
	25	Mandatory/ Recommendation/ Incentive-based	The member states may give grants to renovations until reaching to the mandatory minimum energy standards of the buildings. After minimum energy standards become mandatory, state aids may continue.
	32	Recommendation	One-step deep renovation and staged deep renovation are both options. In that sense the type of the renovation should be decided by considering cost-effectiveness, resulting carbon budget, building use, renovation time, existing condition of the building, extent of renovations, etc.
	32a	Recommendation/ Incentive-based	Long term contracts should be established in the staged renovation and different incentives should be applied in the different stages of the renovation.
	33	Recommendation	The term of 'deep renovation' has not been defined in the European Union law yet. In that case, member states should define the term and the aim should be to reach net zero energy building stock.
	33a	Recommendation/ Mandatory	A deep renovation standard may cause higher reduction of emissions. In that case, local policymakers play a crucial role in terms of designing market by regulations and creating public-private partnerships. Renovations must be carried out to reach better performance and avoid performance gaps.
	46a	Incentive-based	The member states should provide guarantees for finances to the owners of the vulnerable housings. Moreover, European Union may provide a special instrument like 'EU Renovation Loan'.



Table 1: Continued.

Category of the article	Article ID	Scope of the article	Summary of the article
Deep renovation and minimum energy performance standards (continued from previous page)	46d	Recommendation	Member states should focus on fees and educations of renovation construction workers.
	47	Recommendation	Local advisory and collaborative environment should be established to achieve minimum energy standards by renovation.
	48	Incentive-based	Vulnerable housings such as social houses should be provided financial incentives to reach minimum energy performance.
National building renovation plans	29	Mandatory	Member states should establish renovation plans replacing long-term renovation strategies. The renovation plans should be stronger with skilled workers, and financial incentives considering EU funds.
Financing	44	Incentive-based	Member states can be supported by several 2021–2027 multiannual framework programmes for the building energy renovation.
	46a	Incentive-based	The member states should provide guarantees for finances to the owners of the vulnerable housings. Moreover, European Union may provide a special instrument like ‘EU Renovation Loan’.
Collaboration, reporting and consultation	55	Recommendation	Local authorities should be involved and in the building energy renovation process of legislations and programmes such as trainings. These acts will increase the public awareness and encourage architects and local planners to make more energy-efficient renovations.
	44	Incentive-based	Member states can be supported by several 2021–2027 multiannual framework programmes for the building energy renovation.
	23a	Mandatory	The European Commission should publish a summary report on the situation and progress of the union building stock at local, regional and national level, in particular regarding the worst-performing buildings.
	35a	Recommendation	District or neighbourhood scale renovations may create a better community ecosystem. Besides that, districts should be designed by consulting to the local authorities.



Table 1: Continued.

Category of the article	Article ID	Scope of the article	Summary of the article
Collaboration, reporting and consultation (continued from previous page)	35b	Recommendation	Member states should create an industrial plan for locally adaptable prefabricated production considering aesthetics, insulation and energy generation and insulation and green infrastructures contributing to biodiversity, water management, accessibility and mobility.
Indoor air quality, health and safety	11	Recommendation	During the building energy improvement, climatic conditions, climate change and local conditions with indoor environmental quality, circularity, and energy savings. The social housings should not be excluded.
	35	Mandatory	Building energy renovation should contribute to the healthy indoor environmental quality and removal of harmful substances.

Table 2: Building energy upgrade strategies from the Toolkit for Building Energy Benchmarking and Transparency (2011).

Type of strategy	The strategy	Definition of the strategy
Stakeholder engagement strategy	Identification of the interested stakeholders	Local decision makers should make a list of stakeholders with the unifying approach. Stakeholders should be included in the early design phase and kept informed during the process.
	Creating a structure of engagement	Flexibility should be provided for the stakeholder engagement.
	Allowing for ongoing engagement	Creating a team that provide engagement with stakeholders in the rulemaking and implementation process.
Decision points for designing a benchmarking policy	Determination of department responsible for administration and funding support	The department selected can provide help to the building owners. Scope of this help can cover compliance process and financing help.
	Identification of the building types	Local governments should emphasize the building types that are in need for the compliance process considering occupancy rates, financial hardship, building size, etc.
	Determination of reporting schedule and process	The reporting schedule should be building specific.



Table 2: Continued.

Type of strategy	The strategy	Definition of the strategy
Decision points for designing a benchmarking policy (continued from previous page)	Identification of the approach to ensure data quality	The data should be ensured that high quality, for that Energy Star's Portfolio Manager can be used.
	Decision on an approach for data transparency	The energy benchmarking data should be accessible to the public by open access websites, online maps or spreadsheets, on building labelling, etc.
	Determination of how to use benchmarking data	State and local government can encourage building owners for energy upgrades by incentivizing, competitions, etc.
	Normalizing business activity	Metrics should be adopted by the operation of the building.
Applying building performance standards metrics	Recognition of the differences in property types while setting standards	Local decision-makers should differentiate energy performance levels by property type.
	Setting a timeframe for compliance	The local governments should set long-term standards for the buildings.
	Ensuring that performance is measured and standards are set with high quality data	In the BPS design, data asked should be defined well for monitoring easily.
	Changing standards based on local considerations	The standards may be changed according to the local building performances, technology developments, stakeholder needs, shifting priorities, etc.
Data access	Program integration	Operational information about the building such as the Energy Star score can be added to the EPA's Portfolio Manager to follow the effects of the energy upgrades of the buildings.
	Developing consistent building-level identifiers	By Unique Building Identifier (UBID) system, the buildings can be identified by their geospatial location.
	Normalizing business activity	Metrics should be adopted by the operation of the building.



3 BUILDING RETROFIT POLICIES IN TURKEY

In Turkey, in terms of building energy efficiency control and monitoring, there is a law called the Energy Efficiency Law [5], a regulation called Regulation on Energy Performance of Buildings [6] and a standard called Turkish Standards for Thermal Insulation Requirements for Buildings (TS 825) [7]. The law [5] is created according to the Directive 2002/65/EC in the process of European Union compliance. However, the recasts were not followed in the process. The law aims to monitor the buildings' energy efficiency and make building energy retrofit applications mandatory. According to the law, an energy management board establishment is necessary for industrial and public buildings to monitor the process. Energy consumption reports, and projections must be audited by the General Directorate of Electrical Works Survey Administration for industrial businesses. There are also incentives in the law. The projects have to be completed in 2 years to use the incentives [5].

According to the Energy Performance Regulations in Buildings [6], every building must have an energy identification certificate (BEP-TR). Moreover, according to the regulation, the building energy performance must be upgraded if a retrofit occurs. All the retrofit applications must be made according to Turkish Standards for thermal insulation requirements for buildings (TS 825) [7]. In that sense, TS 825 gives general calculation methodologies for all types of buildings according to the climatic zones in Turkey. As a result, Turkey has yet to establish an official strategy for building energy retrofit; rather, there are some rules for building retrofit.

4 INFERENCES

The European Union and USA have different approaches to building energy retrofit strategies. According to European Environment Agency, Europe has four different climatic zones, with different countries and building cultures. Therefore, the European Union has particular and well-defined policies with recommendations, incentives, and rules to apply in the member states. On the other hand, USA building energy improvement regulations are left to the states and the local governments. In that case, recommendations and incentives are given to the states, and to monitor the situation, systems are created. In Turkey's case, the most problematic part is that there is no strategy or plan to follow. There are some rules for the application of building retrofits. However, no governmental plan exists like the European 'Renovation Wave'. In Turkey, too, there may be some strategies to spread the idea of building energy retrofit all over the country. Referring to the European Union and the USA policies, the proposed general headlines and the scopes of the strategy may be:

- Identification of the energy strategy
 - Mandatory requirements
 - The levels of the building energy retrofits should be defined (e.g. deep renovation, staged renovation).
 - The buildings that are required to be intervened primarily should be defined (e.g. worst-performing buildings).
 - The standards that will be used as part of building energy retrofit planning should be defined.
 - The digital systems, software, and tools that are going to be used and their functions should be defined.
 - The energy performance certificate program should be explained, and the necessary score after the energy retrofit should be identified.
 - Contract types for the building energy retrofit process should be defined.



- Local governments should establish local renovation strategies and plans to spread and promote renovation.
- The local governments should report the situation in the renovation plan, and the Ministry of Environment, Urbanism and Climate Change should publish the data.
- Recommendations
 - The local amendments can be done on the standards.
 - Methodology and minimum energy performance standards should be defined by local authorities.
 - Each local government should identify their amendments to the standards used for the building energy retrofit.
- Incentive-based requirements
 - Vulnerable housings should be identified and supported to reach minimum energy performance.
- Stakeholder engagement
 - Recommendations
 - Establishing non-governmental organizations to support the spreading retrofit process should be encouraged.
 - Local governments should educate the building energy retrofit workers.
 - A nationwide industrial plan should be established for the building energy retrofit.
 - Incentive-based requirements
 - The local stakeholders should be trained about the strategies, and businesses should be informed about the incentives.
- Financing and incentives
 - Recommendations
 - Local governments should establish long-term agreements with the stakeholders.
 - Incentive-based requirements
 - Incentives should be created, including mortgage opportunities, loans, and grants.

5 CONCLUSION

In conclusion, different approaches for Europe and the US affect energy policies caused by political situations, climate zones, building age and building stock quality. Since the European Union is aware that most buildings are old, develops policies and building energy retrofit strategies accordingly. Within this context, the European Commission publishes directives for the member states, including recommendations, mandatory applications, and incentives from the central government. On the other hand, the USA knows businesses are the heart of the building industry. Therefore, the strategies and policies are generally developed to encourage businesses for building energy retrofit. Thus, the policies are based on recommendations and incentives. What is typical for the USA and the European Union is that they do not put general regulations to apply in the States. The regulatory parts are left to the local governments to consider local conditions. As a result, what is necessary for Turkey's case is to have a building energy retrofit strategy at first to spread the general idea and leave the regulatory process to the local governments for them to cover local issues.



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