

Energy efficient renovation approach in Turkey: targets, barriers and practice



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Building stock in Turkey is estimated around 8.8 million buildings and this stock represents a great energy saving potential.

Considering this saving potential and the requirements of European Union (EU) directives, future targets were established in Turkey with regard to energy efficiency in buildings [1]. However, in practice, there are barriers that prevent to achieve these targets. Therefore, there is an effort on researches aimed to remove the barriers and to develop convenient strategies for energy efficient renovations in Turkey. This article summarizes the strategical targets, the barriers and practices with regard to building energy renovation.

Targets on Energy Efficient Renovations

The main related legislative tools in Turkey are Energy Efficiency Law and Building Energy Performance Regulation [2, 3]. These are enacted respectively in 2007 and 2008 in compliance with the Energy Performance of Buildings Directive (EPBD) of EU

[1]. In order to guide new legislation, the recent Energy Efficiency Strategy Paper prepared by “Higher Planning Council of Turkey” was published in the Official Gazette on February 2012 [4]. This Strategy Paper involves situation analyses and strategical targets up to year 2023. It is planned to be revised in the future according to the political decisions, EU policy and encountered problems in practice. The key targets specified in Strategy Paper about energy performance requirements for buildings are summarized below.

- “SP-02: To decrease energy demand and carbon emissions of the buildings and to promote sustainable, environment friendly buildings using renewable energy sources”

This strategic purpose involves, limiting the maximum energy demand and maximum CO₂ emission in buildings by revising the legislation in line with EU applications, regarding different building types and different climatic regions. By the year 2017, it is planned to apply administrative sanction for the buildings which exceed the limits of carbon dioxide emissions. Afterwards, by year 2023, the aim is to provide at least one fourth of the building stock in 2010 consists of sustainable buildings.

Another action of this target is to encourage the use of renewable energy sources, cogeneration and micro generation, district and regional heating and cooling systems and heat pump systems in public housing projects.

- “SP-06: To use energy effectively and efficiently in the public sector”

Under this strategic purpose, decreasing annual energy consumption at the rate of 10% by 2015 and 20% by 2023 is targeted for public buildings. Renovation budget of the public buildings are decided to be primarily used for the energy efficiency projects that are developed according to energy audits.

In addition, the existing legislation is planned to be revised in order to prevent public rental of the buildings that exceed the maximum allowed energy consumption level.

Another important target under this title is, to carry out energy efficient renovations by performance guaranteed Energy Performance Agreements and to give priority to the allowance proposals for this purpose.

- “SP-07: To strengthen institutional structures, capacities and collaboration; to increase use of state of the art technology and awareness activities and to develop financial mechanisms except public”

In order to increase the capacities, the target is to train the related staff in both public and private sectors about the correct applications of Building Energy Performance Regulation. This strategic purpose also includes the increase in the total number of:

- energy managers
- energy efficiency consultancy companies
- unique designs/products on energy efficiency and renewable energy systems based on R&D.

Collaborating public sector, private sector and NGOs within the frame of an organized communication plan is another important action that is planned under this title in order to provide dissemination.

Setting these targets is a positive progress since a holistic approach is adopted by including limits for energy consumption, requirements for efficiency in public buildings as promotive samples and activities for raising awareness and dissemination in Turkey. However, in order to achieve these targets, new legisla-

tion arrangements and revisions for the existing legislation are required. In addition, remarkable concrete steps are needed to be taken in overcoming the barriers against the energy efficient renovations.

Barriers and Practices

In Turkey, there are several barriers against energy efficient renovation of the building stock such as; technological barriers, barriers based on insufficient funding, barriers related to climatic conditions, socio-logical barriers and legislative barriers. Samples of the important barriers in Turkey are explained below.

One of the important barriers is directly related to the existing policy and climate. The mandatory heat insulation standard, TS825, involves four different heating degree day regions as shown in **Figure 1** and defines the maximum limits of overall heat transfer coefficients according to these regions [5]. However, as a consequence of being a Mediterranean country, in Turkey there are five climatic regions as shown in **Figure 2**: tempered humid, tempered dry, hot-humid, hot-dry and cold climatic regions. Differently from the cold regions, buildings in hot climatic regions need specific measures mainly for

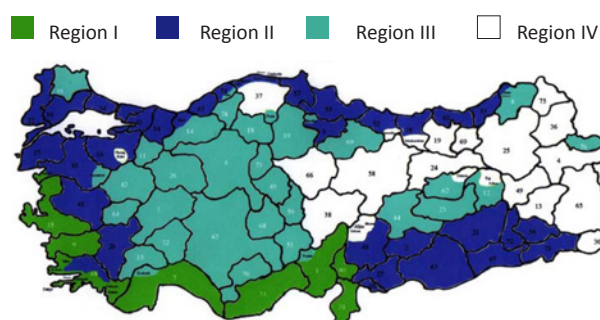


Figure 1. Heating degree day regions of Turkey.



Figure 2. Climatic regions of Turkey.

decreasing high cooling energy demand in order to provide reduction in total annual energy demand. Therefore, the national heat insulation standard based on heating degree days is not able to accurately represent the specific requirements of these climatic regions.

The climatic diversity is a challenge that is faced in Mediterranean countries and requires different strategies for each climatic region. The national legislation has to consider and reflect these strategies as well. Therefore, developing energy efficiency strategies in Turkey is more complicated than northern countries and this procedure requires more consideration than application of the heat insulation standard. For example, **Figure 3** displays the energy simulation results of the same residential building assumed as constructed in different climatic regions of Turkey. In each case, it is assumed that, overall heat transfer coefficients of the building envelope components are equal to the maximum limits allowed by the heat insulation standard for the related city. All other parameters are same for three cases. As seen from the graph, in hot-humid climate (Antalya) cooling energy consumption is the dominant while in cold climate heating energy consumption is extremely high.

Another important barrier in Turkey is the uniformity of the legal boundary climatic design conditions for the buildings with different functions. The different building types require different design strategies since their behaviors are significantly affected by the internal heat gains. In example, considering the mild climatic region of Turkey, energy needs for cooling and lighting are dominant in commercial buildings while heating energy needs are remarkable in residential buildings.

There are also some barriers related to financial issues. The recent EU Directive, EPBD Recast, is one of the main binding legislation forcing energy efficient renovations in buildings and this directive requires to set energy performance requirements for buildings “with a view to achieving cost-optimal levels”. In accordance with the cost optimal methodology framework provided by EPBD Recast and related EU Regulation, global costs of the energy efficiency measures/packages have to be calculated for long term periods [1, 6]. The measures which result with benefits in both energy performances and global costs represent the cost optimal level. However, the investment costs of these measures are not always affordable for the investors because of their expensiveness and long payback periods. In order to overcome this

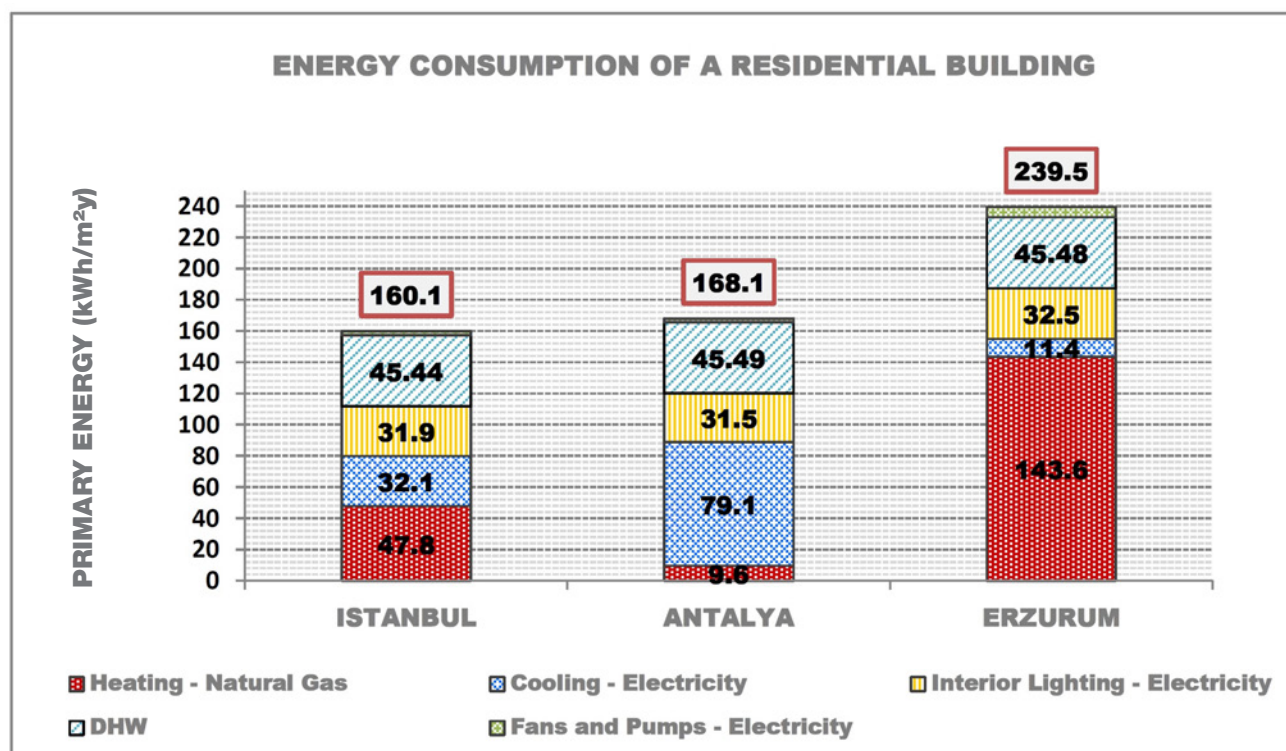


Figure 3. Sample calculation results for the same building in different climatic regions of Turkey.

barrier, subsidies and incentives are required for the cost optimal solutions.

In fact, there are some loan opportunities for the heat insulation, windows, efficient heating system, efficient appliances, efficient lighting and solar water heaters in residential buildings. These loans are provided by TuREEFF (Turkish Residential Energy Efficiency Financing Facility), with support of the EBRD (European Bank of Reconstruction and Development) and CTF (Clean Technology Fund) [7]. This loan program involves \$350 million for energy efficiency investments in residential buildings. It is expected to support also future strategical targets by this funding program in the following years. However, today still the common practice in residential building renovations is limited with heat insulation and individual window changes. In addition, the urban transformation projects in Turkey are mainly focused on demolishing and reconstructing instead of renovation.

In Turkey, a legal basis requiring energy efficient renovations is not yet brought in. However, there are researches focusing on national applications of cost optimal methodology framework of EPBD Recast, and on specific deep energy renovation strategies

and also on developing the ecological standards for the urban transformation [8, 9]. Although one of the researches on ecological standards for the urban transformation is conducted under the Ministry of Environment and Urbanization; mostly, these researches are conducted with individual efforts and not connected with each other or not coordinated by legal authorities in order to guide laws and regulations. But the outcomes of these researches are needed to be linked with legal arrangements to make the effort valuable.

Conclusion

In Turkey, there is an intension in energy efficient renovation of existing buildings. The actions are mostly individual attempts and are mainly limited with heat insulation applications on the facade. However, in order to manage the whole energy saving potential with a holistic approach, a new legal basis is required. While existing regulation and standards are being revised, barriers also have to be considered.

Academic studies are also focused on existing building renovations. But, a high level coordination is required between these studies in order to provide corporation and coherence and to benefit from their common results. ■

References

- [1] EPBD recast (2010), Directive 2010/31/EU of the European Parliament and of Council of 19 May 2010 on the energy performance of buildings (recast); Official Journal of the European Union.
- [2] Energy Efficiency Law, Law Number: 5627, 18.04.2007. Republic of Turkey Official Gazette, 26510, Ankara, 2007 [in Turkish].
- [3] Energy Performance of Buildings Regulation, Ministry of Public Works and Settlements, Republic of Turkey Official Gazette, 27075, Ankara, 2008 [in Turkish].
- [4] Energy Efficiency Strategy Paper, Higher Planning Council of Turkey, 25.02.2012. Republic of Turkey Official Gazette, 28215, Ankara, 2012 [in Turkish].
- [5] Turkish Standards Institution, TS 825: Thermal Insulation Requirements for Buildings, Ankara, 2008.
- [6] Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council, Official Journal of the European Union.
- [7] Turkish Residential Energy Efficiency Financing Facility, 2015, Available from <www.tureeff.org>.
- [8] National Research Project "Determination of Turkish Reference Buildings and National Method for Defining Cost Optimum Energy Efficiency Level of Buildings", funded by The Scientific and Technological Research Council of Turkey (TUBITAK), Project No: 113M596, (2013-2015).
- [9] "Development of Application Standards and Infrastructure for the Ecological Settlement Unit in Transformation of the Areas under Disaster Risk" Project, Republic of Turkey, Ministry of Environment and Urbanization, General Directorate of Infrastructure and Urban Transformation, (2015-2016).