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COMPARISON OF BUILDING ENERGY PERFORMANCE NORMS IN TURKEY AND UKRAINE

The paper presents the current state of building energy performance norms in Turkey and Ukraine with regards to EPBD and green building certification systems. The two most important things to be considered are building energy modelling techniques and creation of local norms for implementation of nearly zero energy building (nZEB) concept. In this case building energy modelling (BEM) using dynamic approach can be a powerful instrument for creating the reference buildings of each use type in order to obtain quantitative and economically justified performance indicators for both countries.

Key words: building energy performance, building performance certificate, nZEB, energy modelling, green buildings

Introduction. Energy consumption, energy conservation and energy efficiency in buildings have been important research areas for countries due to increasing energy demand, lack of the natural sources caused by use of fossil fuel and environmental issues. The contribution of building to environmental problems is increasing significantly. A considerable amount of energy is being used for the heating and cooling of a building to maintain its resident's thermal comfort. Turkey and Ukraine have a large energy potential for CO_2 emissions reduction in commercial, public and residential buildings with the use of sustainable building design and renewable energy systems. Both countries are on their way to the implementation of Energy Performance Building Directive (EPBD) and respective European standards and norms.

Purpose and objectives of the research. One of the objectives of the paper is to analyze the current state of building energy performance norms in Turkey and Ukraine. The other one is to see how building energy modelling using dynamic approach and sophisticated software products can help in implementation of advanced building energy performance approaches such as nZEB for both countries and green building certification systems.

Research materials and results.

Regulations regarding energy conservation and saving issues are not sufficient or detailed in Turkey [1]. Due to Turkey's application for EU membership, in recent years the country has reviewed and followed EU regulations and directives for member countries. Many legislative actions and energy directives are going to be/are harmonized and adapted from EU rules about energy efficiency in buildings.

Regulations regarding building energy performance in Ukraine have been reviewed and are continuously being improved during the last years to follow the EU regulations and directives. A lot of European Norms of Energy Performance of Building series are adapted as local standards and norms.

In Turkey and Ukraine there is a set of standards and laws that regulate the building energy performance, the short information on some of them is presented in the Figures 1 and 2 below [2-7]. As we can see Standards on building thermal insulation have some similar features, as building envelope regulations, but Ukrainian norms takes into account also cooling and DHW in addition to heating. The idea behind the EPC is similar in both countries.

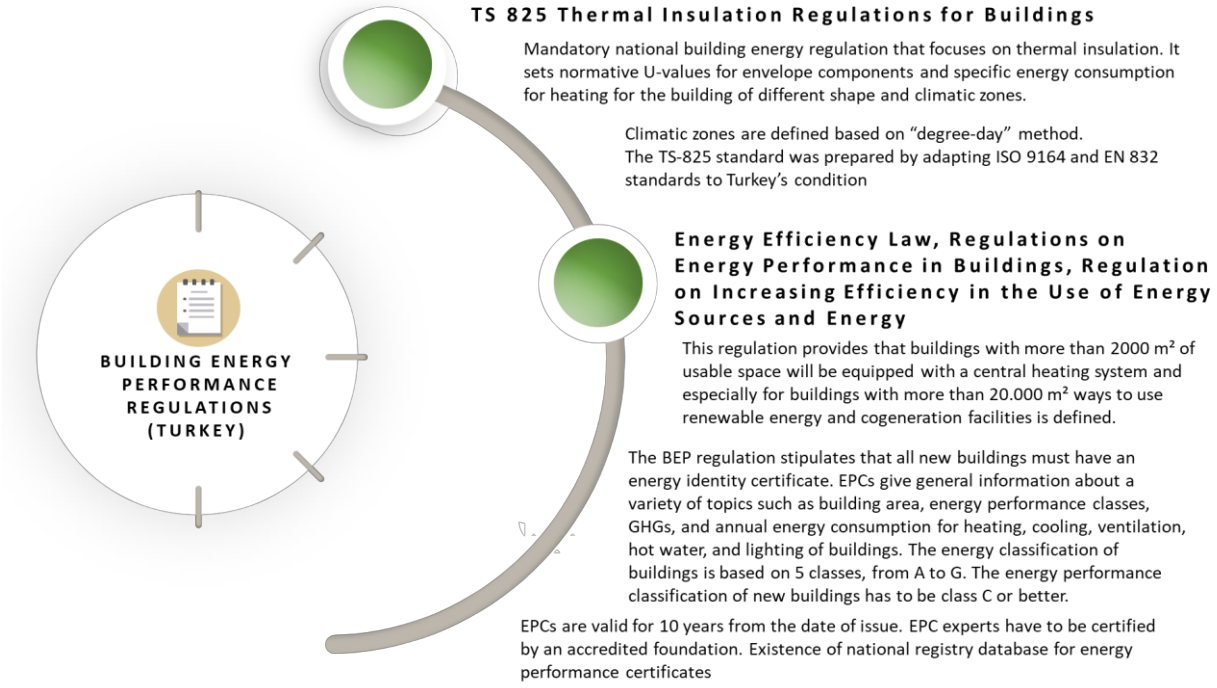

Figure 1 – Relevant building energy performance regulations in Turkey

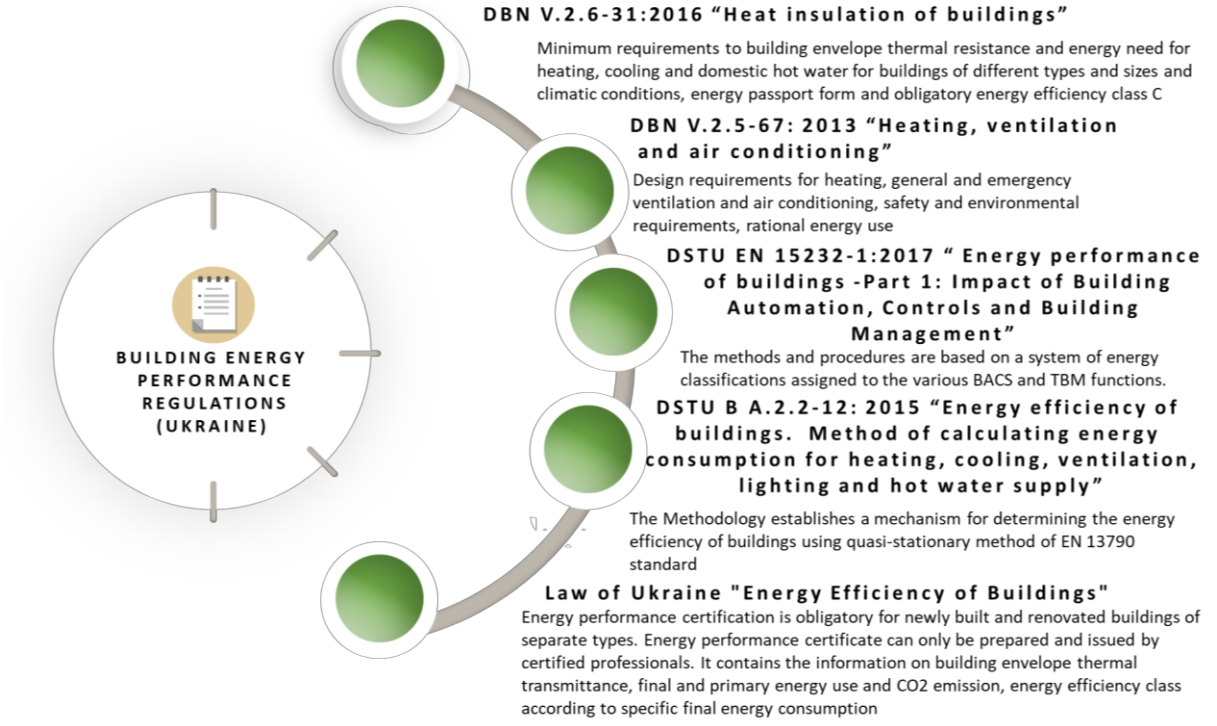

Figure 2 – Relevant building energy performance regulations in Ukraine

The EPBD requires all new buildings in Member States from 2021 (public buildings from 2019) to be nearly zero-energy buildings (nZEB) [8]. According to Article 2 "nearly zero-energy building" means a building that has a very high energy performance. The nearly zero or very low amount of energy required should be covered to a very significant extent from renewable sources, including sources produced on-site or nearby.

As concrete numeric thresholds or ranges are not defined in the EPBD, these requirements leave

room for interpretation and thus allow Member States to define their nearly zero-energy buildings (NZEB) in a flexible way, taking into account their country-specific climate conditions, primary energy factors, ambition levels, calculation methodologies and building traditions. This is also the main reason why existing nearly zero-energy buildings (NZEB) definitions differ significantly from country to country. Among the most frequently used performance indicators are:

- Energy demand/final energy use
- Primary energy and CO_2 emissions
- Renewable energy share.

The other approach that can be used for building performance evaluation is green building certification systems. The most frequently used ones are LEED, BREEAM, DGBN, etc. [9, 10]. BREEAM (Building Research Establishment Environmental Assessment Method) is a voluntary certification system developed in the UK. LEED (Leadership in Energy and Environmental Design) was developed by USGBC in the USA. Both systems have assessment category that is related to building energy use and efficiency. The modelling is done using ASHRAE Standard 90.1-2013 for BREEAM International New Construction 2016 and ASHRAE Standard 90.1-2010 for LEED BD+C v4 certification schemes.

BREEAM takes into consideration the following building metrics:

- The building's heating and cooling energy demand
- The building's primary energy consumption
- The total resulting CO2 emissions

Three scenarios can be considered

- Notional building (NCM or Appendix G, ASHRAE Standard 90.1-2013)
- Actual or as-designed building
- BREEAM best practice building

LEED takes into consideration the following building metrics:

- Performance rating method / Energy cost reduction (%)
- Percentage of renewable energy

Three scenarios can be considered

- Baseline building (Appendix G, ASHRAE Standard 90.1-2010)
- Actual or as-designed building
- Renewable energy systems modelled within actual building model using the same simulation software

In order to perform the analysis for creation of nZEB concept or during the green building certification process dynamic building energy modelling (BEM) should be applied. The most developed and frequently used BEM software are DOE-2, eQuest, EnergyPlus, TRNSYS, etc. Those programs use the International Weather for Energy Calculations (IWEC) files that are available for three locations in Turkey (Ankara, Istanbul, Izmir) and two locations in Ukraine (Kyiv, Odesa) [11]. The meteorological data for other locations can be obtained from Meteonorm web-site on a paid basis [12]. BEM can be used for/during:

- Pre-design phase (before we put pencil to paper) to optimize energy use or to compare design options
- Green building certification process (BREEAM, LEED etc.)
- Advanced energy audit
- Renovation planning
- LCA and LCC
- Daylight modelling
- Thermal comfort modelling (PMV, PPD)

Conclusion. There is still a gap between Turkish and Ukrainian and European Norms or international approaches regarding the building energy performance. The two most important things

to be considered are building energy modelling techniques and creation of local norms for implementation of nZEB concept. In this case building energy modelling using dynamic approach can be a powerful instrument for creating the reference buildings of each use type in order to obtain quantitative and economically justified performance indicators that can be used for nZEB concept in both countries. The next steps will include the choose of the office and/or residential building projects to be used as reference ones and analysis of building energy modelling results with different envelope solutions, HVAC design options and renewable energy systems in different climates within Ukraine and Turkey.

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СЕКЦІЯ 3.
ІНЖИНІРИНГ ТА АВТОМАТИЗАЦІЯ ЕЛЕКТРОТЕХНІЧНИХ КОМПЛЕКСІВ