ANALYSIS OF ENERGY EFFICIENCY DEVELOPMENT AND ITS DRIVERS IN RESIDENTIAL BUILDINGS: CASE OF LITHUANIA

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Overview

Energy efficiency is one of the most powerful and cost-effective ways of meeting the targets of sustainable development and lower fossil fuel dependency. Improvements of the energy efficiency represent the main tools of energy policy to improve the competitiveness of the economy, security of supply and climate change mitigation. On 14 June 2018 the Commission, the Parliament and the Council reached a political agreement which includes a binding energy efficiency target for the EU for 2030 of 32.5%, with an upwards revision clause by 2023 [1]. Lithuania made a commitment to increase energy efficiency by 1.5% a year and to save 740 ktoe of final energy by 2020 [2]. The target for residential building sector is 20% (at least 1000 GWh of heat energy a year) in 2020 [3]. Responding to commitments taken by the country, this research aims at analyzing the historical developments in energy efficiency in Lithuanian residential buildings and the key drivers of these changes. Therefore, the research focuses on identification and analysis of the key drivers of energy efficiency, including energy efficiency policy measures and factors of their successfulness, energy efficiency trends and gains of energy efficiency.

Method

Energy efficiency indicators are used to analyze trends of energy efficiency and assess the progress made. The decomposition method is used to determine the main drivers of energy efficiency and their contribution [4]. The multicriteria assessment method [5] is applied to identify the most successful energy efficiency measures and their factors.

Results

The residential buildings is one of the largest sectors in Lithuania in terms of energy consumption. Historically, it consumes about one-third of final energy and about half of heat energy. The sector has the largest potential for energy efficiency too. Fig. 1 and Fig. 2 presents tendencies of energy efficiency and its gains in residential buildings.

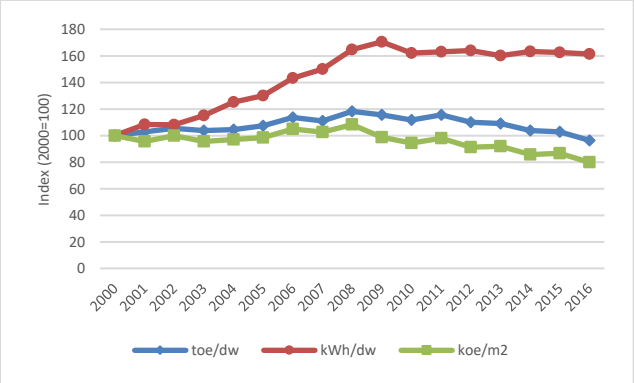


Fig. 1. The main energy efficiency indicators in residential buildings

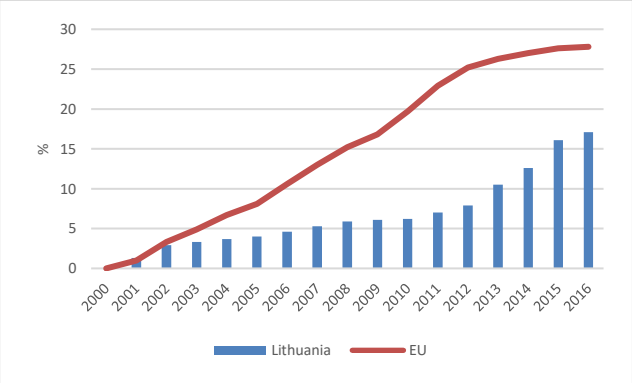


Fig 2. Energy efficiency gains in residential buildings

As it is seen from Fig. 1, electricity consumption in a dwelling (kWh/dw) increased by 60%. The growing number of appliances used by households is the main reason of the increase. The energy consumption per m^2 (koe/m^2) for space heating decreased by 20% and the energy consumption per dwelling (toe/dw) – by 3.6%. The penetration of new energy efficient buildings, the renovation of existing old dwellings and the use of more efficient heating appliances are the most important drivers of the descrease. Although in 2016, energy consumption per m^2 for space heating amounted to 11.3 koe/m^2, however, it was by 19% higher in comparison to the EU average. As it is seen from Fig. 2, the total energy efficiency gain was 17.1%, whereas it was on average 27.8% in the EU countries during 2000–2016. Energy efficiency gains were only 1.1% per annum in Lithuania.
Final energy consumption in residential buildings decreased moderately (by 0.01 Mtoe) during 2000-2016. Climatic effect, change in number of occupied dwellings, evalution of lifestyles (average floor area of dwelling, more appliances), energy savings and heating behaviours were relevant drivers of insignificant development of final energy consumption. It was estimated that the residents choice to have larger homes and increased number of dwellings were the drivers increasing energy consumption in residential buildings, i.e. by 0.22 Mtoe and 0.04 Mtoe. These increases were compensated by energy savings (by 0.29 Mtoe) achieved in residential buildings.

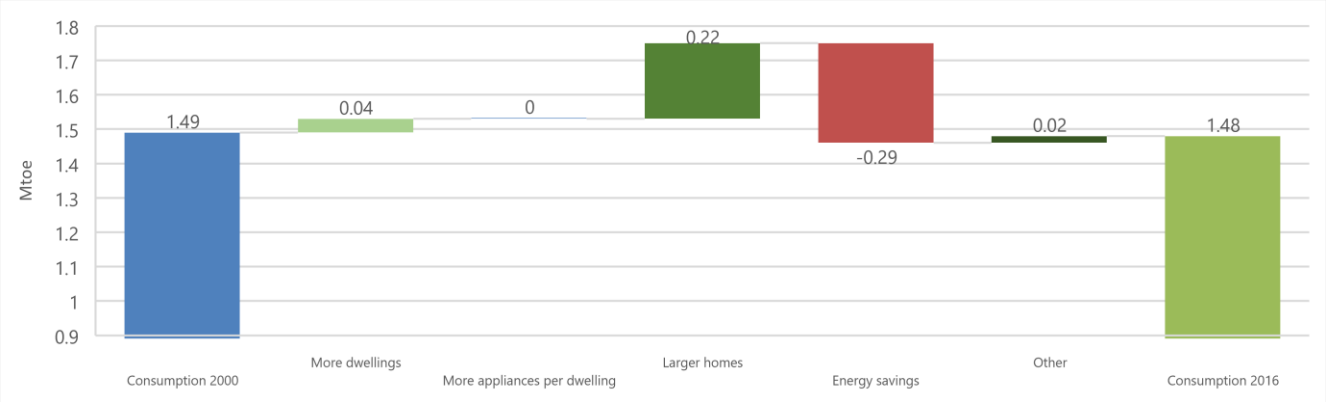
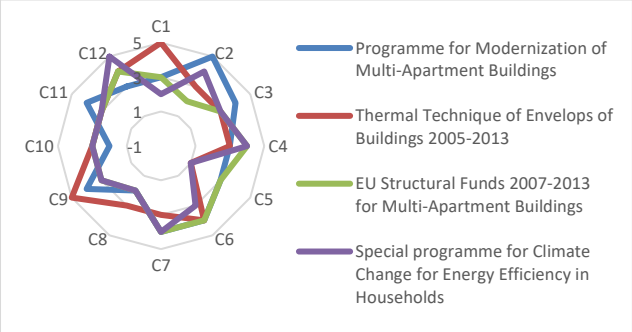


Fig. 3. Main drivers of the energy consumption variation in households (at normal climate)

Historically various energy effiency measures have been implemented in Lithuanian residential buildings for the purpose of achieving energy savings [4]. These are normative and financial measures. The normative measures are building standards, which set requirements for heat lossess in the buildings. The financial measures are subsidies and sof loans for insulation of envelops and roofs of the buildings, change of windows and doors, improvement of engineering infrastructure. The radar graph (Fig. 4) presents the most succesfull energy efficiency measures used in residential buildings.



Here: C1: High impact / high number of applicants; C2: Cost efficiency for the implementer; C3: Potential for market transformation and energy services; C4: Suitability to overcome barriers for energy efficiency; C5: Ease and stability of re-financing financial measures; C6: Persistency of the savings induced by the measure; C7: Transferability between countries; C8: Link to other measures / policy packages; C9: Level of experience with the measure; C10: Avoidance of negative side-effects; C11: Positive side-effects; C12: Ease of acceptance by relevant stakeholders; from 5 = very important to 1 = low importance.

Fig. 4. Assessment of the most successful energy efficiency measures in Lithuanian residential building

“Programme for Modernization of Multi-apartment Buildings” and the related measure of EU Structural funds for 2007-2013 “Promotion of Multi-apartment Houses” are the most succsesful energy effiency measures. Their average scores are 3.4 and 3.2, respectively. The advantages of the first measure is that it assures high cost efficiency for the implementer, has high potential for market transformation, the impact of measure is long-lasting, country has good experience in its implementation and the measure provides high positive side-effects. The EU Structural funds for 2007-2013 are assessed postively too because they are suitable to overcome barriers for energy efficiency, are highly accepted by the stakeholders and has long-lasting impact. The STR 2.05.01:2005 “Thermal Technique of Envelopes of the Buildings” (2005-2013) is the highest impact measure in terms of amounts of energy savings. Moreover, country has much experience with the measure implementation.

Conclusions

Lithuania approaches to energy efficiency goal set for the residential buildings at moderate rates. Country makes efforts to increase energy efficiency in its residential buildings through the implementation of energy eficiency measures. However, the implementation of ambitious energy efficiency target for residential sector will require additional technical, political and administrative measures based on best practice exemples. Therefore, existing energy efficiency measures should be improved in order to achieve energy saving targets.

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