

# Analysis of Energy Efficiency Development and Its Drivers in Residential Buildings: Case of Lithuania

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# INTRODUCTION

Energy efficiency is one of the most powerful and cost-effective ways of meeting the targets of sustainable development.

- **Binding energy efficiency target for the EU for 2030** is of **32.5%**, with an upwards revision clause by 2023 (EC - Statement/18/3997);
- **Energy efficiency target for Lithuania** to increase in energy efficiency by **1.5%** a year and to save **740 ktoe** of final energy by **2020** (Parliament of Lithuania (2012). National Energy Independence Strategy);
- **Energy efficiency target for Lithuanian building sector** is **20% (at least 1000 GWh of heat energy a year) in 2020** (Minister of Energy (2017). Energy Efficiency Action Plan for 2017-2019).

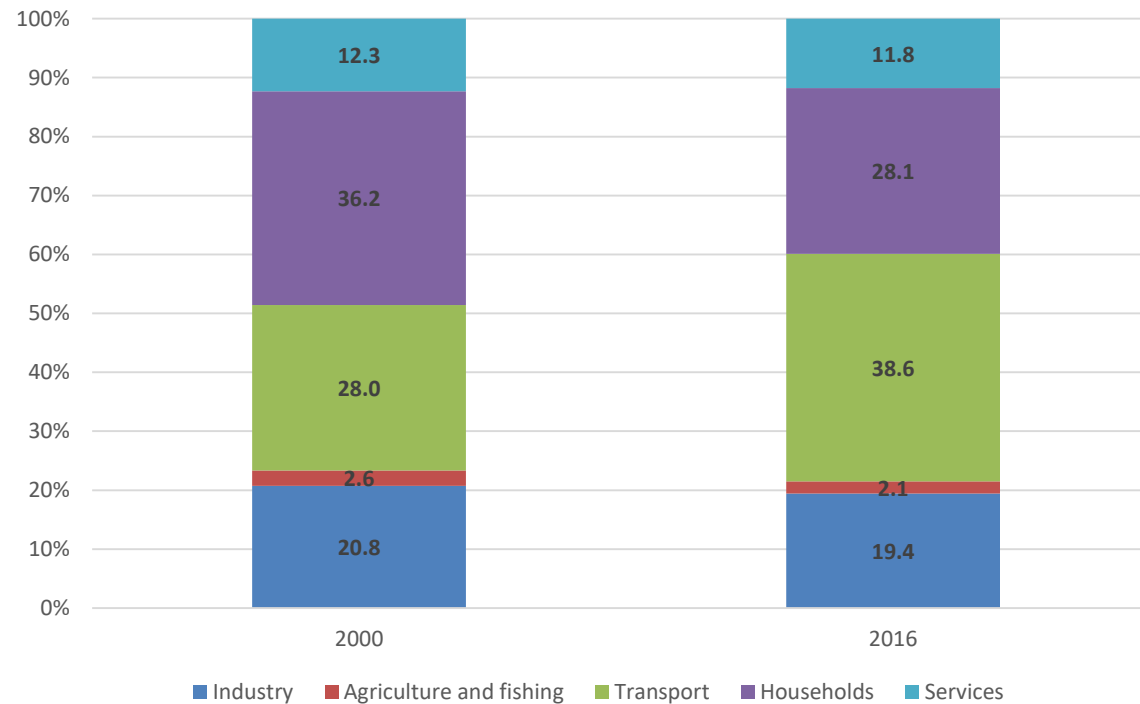


# AIM OF RESEARCH

- ✓ to analyze the **historical developments in energy efficiency** in Lithuanian residential buildings and **the key drivers of these changes** during 2000-2016.



# Structure of final energy consumption in Lithuania



Household consumes about one-third of final energy and about half of heat energy.



# METHODS

## Decomposition method (1)

- ✓ The **decomposition** of energy consumption variation aims at identifying **the role of different factors**.
- ✓ The methodology used **focuses on energy savings** as one of the main driver and is consistent with the calculation of **technical energy savings**.



# METHODS

## Decomposition method (2)

The **variation of the final energy consumption of households** can be explained by:

- ✓ **Climatic difference** between year  $t$  and  $t_0$  (“climatic effect”);
- ✓ **Change in number of occupied dwellings** (“more dwellings”);
- ✓ **More appliances per dwelling** (electrical appliances, district heating);
- ✓ **Change in floor area** of dwelling for space heating (“larger dwellings”);
- ✓ **Technical energy savings** (calculated from ODEX);
- ✓ **Other effects** (heating behaviors).

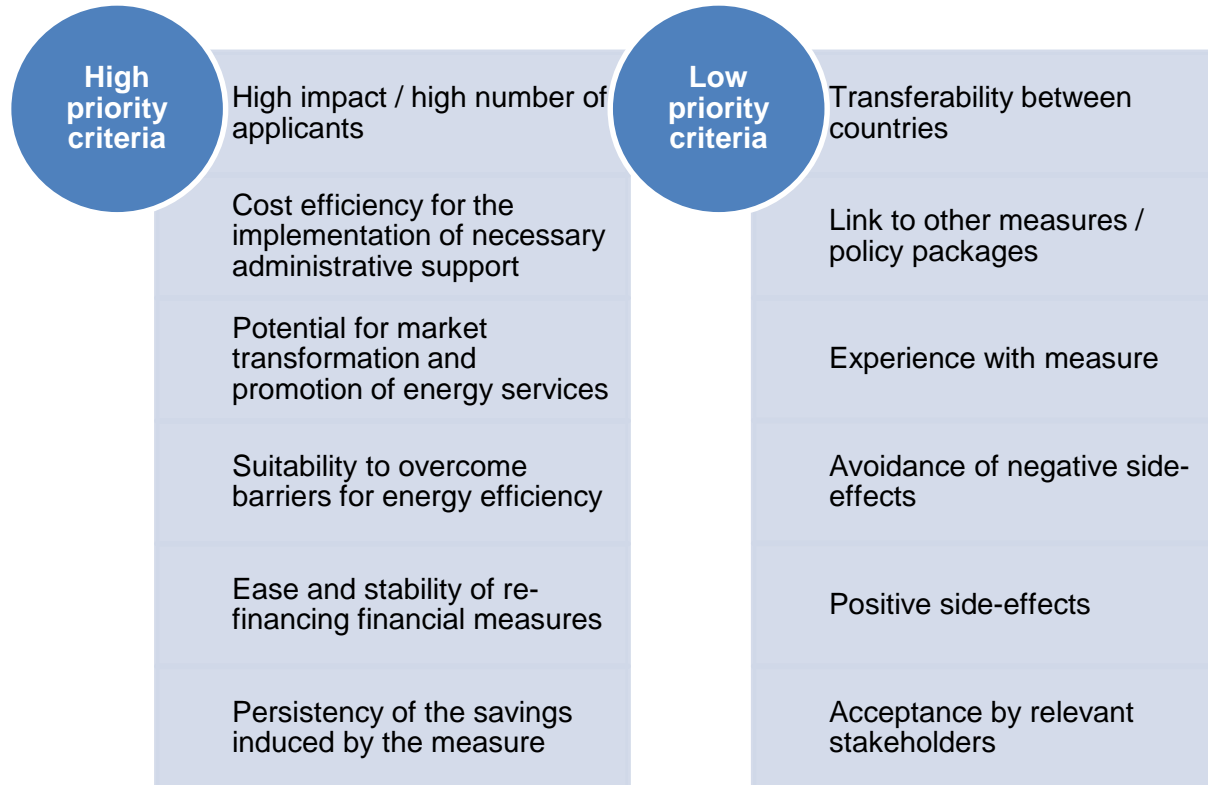


# METHODS

## Multicriteria assessment method

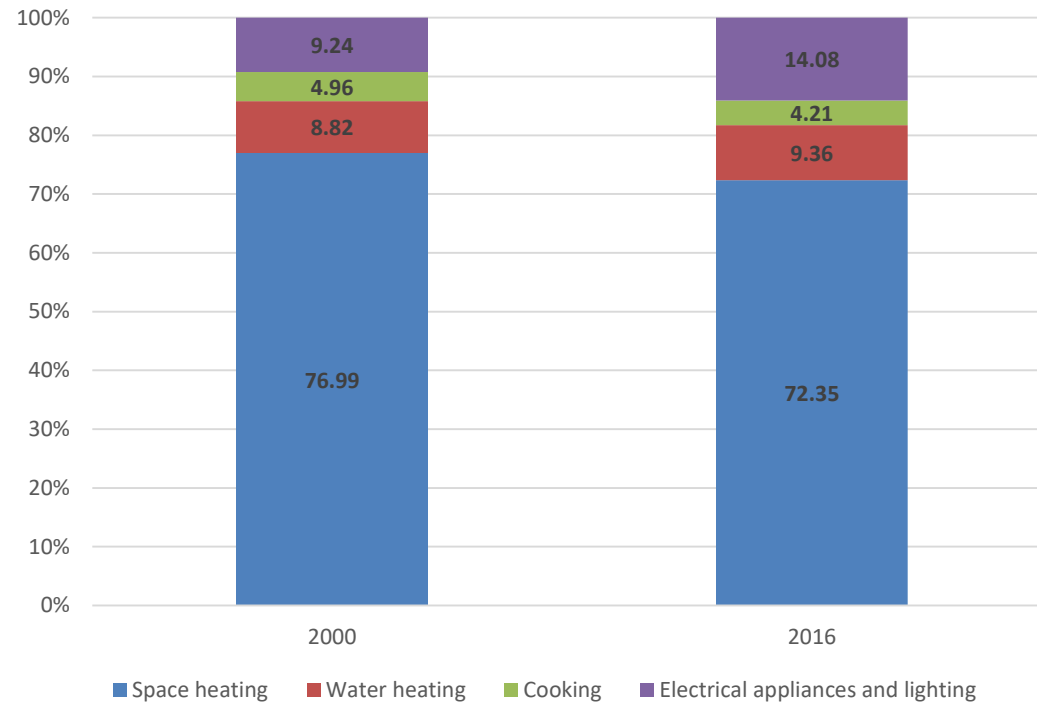
Evaluation of the chosen policy measures **enables to rank the policy measures** according to their success:

- ✓ **12 criteria** have been identified to define the success level of a measure;
- ✓ Distinction between **6 "high"** and **6 "low" priority criteria**;
- ✓ Quantitative evaluation of each policy with a **score between 1 (worst) and 5 (best)** for each of the 12 criteria.





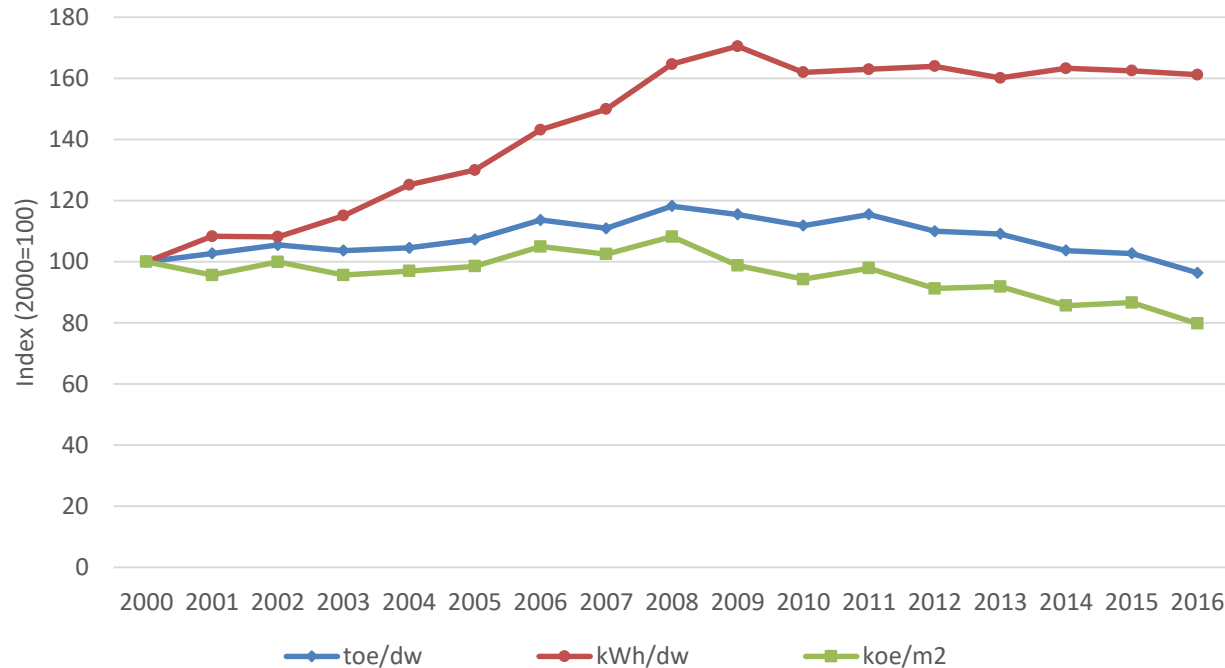
# Structure of energy consumption by end-use







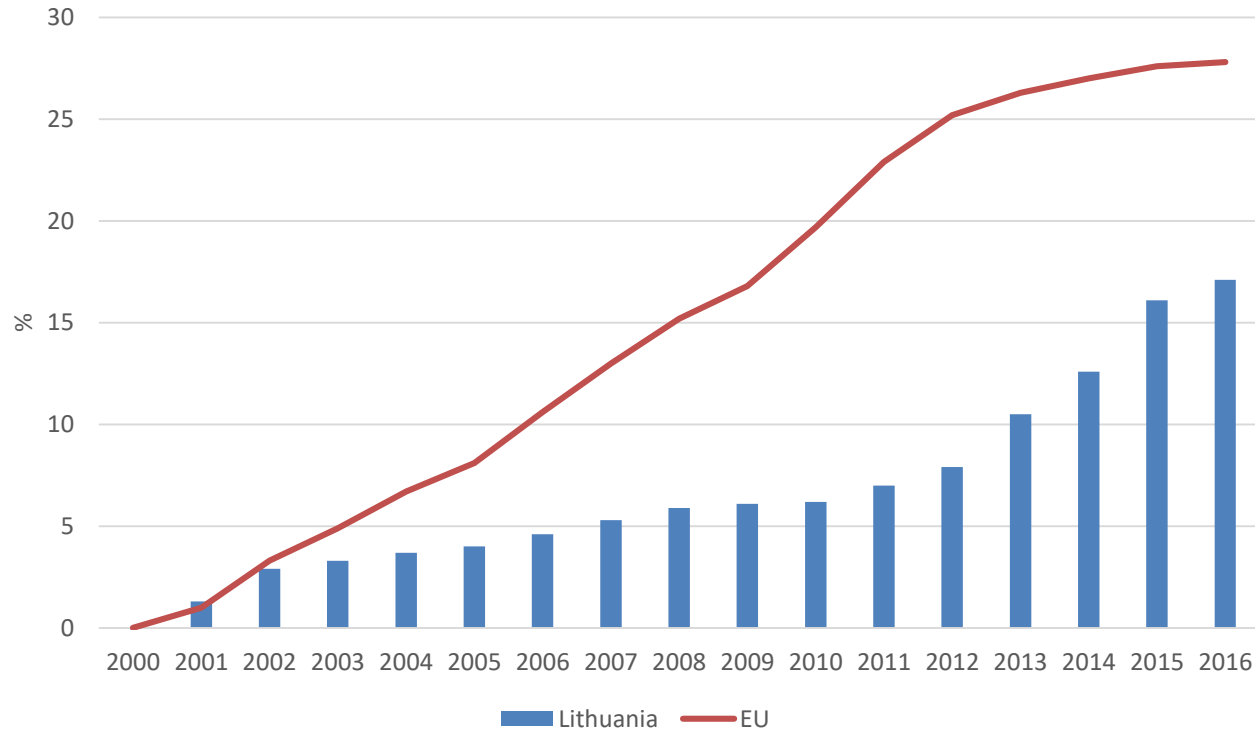
# The main energy efficiency indicators in residential buildings in Lithuania (1)



- ✓ **Electricity consumption in a dwelling (kWh/dw)** increased **by 60%**;
- ✓ **Energy consumption per m<sup>2</sup> for space heating (koe/m<sup>2</sup>)** decreased **by 20%**. Although energy consumption per m<sup>2</sup> amounted to 11,3 koe/m<sup>2</sup>, however it was by 19% higher in comparison to EU average;
- ✓ **Energy consumption per dwelling (toe/dw)** decreased by **4 %**.



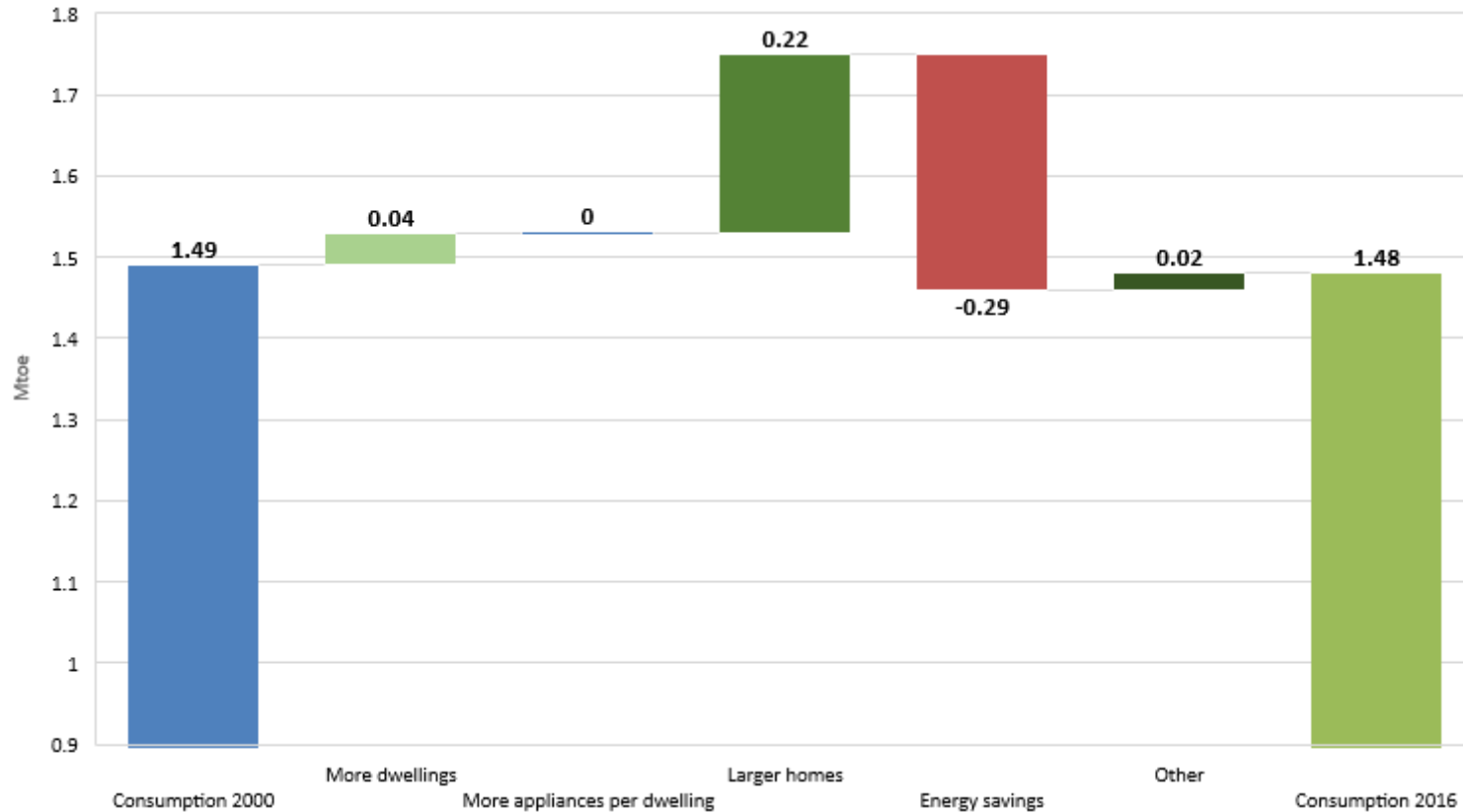
# The energy efficiency gains in residential buildings in Lithuania



- ✓ Total energy efficiency gain was **27.8% in the EU** countries, but **17.1% in Lithuania**.
- ✓ Energy efficiency gains were only **1.1% per annum in Lithuania**.



# Main drivers of the energy consumption variation



- ✓ **Final energy consumption** in residential buildings slightly decreased in 2016 in comparison to 2000;
- ✓ Residents choice to have **larger dwellings and growing number of dwellings** were the drivers increasing energy consumption in residential buildings by 0.22 Mtoe and 0.04 Mtoe, respectively;
- ✓ Residential buildings achieved **energy savings** (technical) of 0.29 Mtoe.



# Energy efficiency measures in Lithuanian residential buildings

## Normative measures:

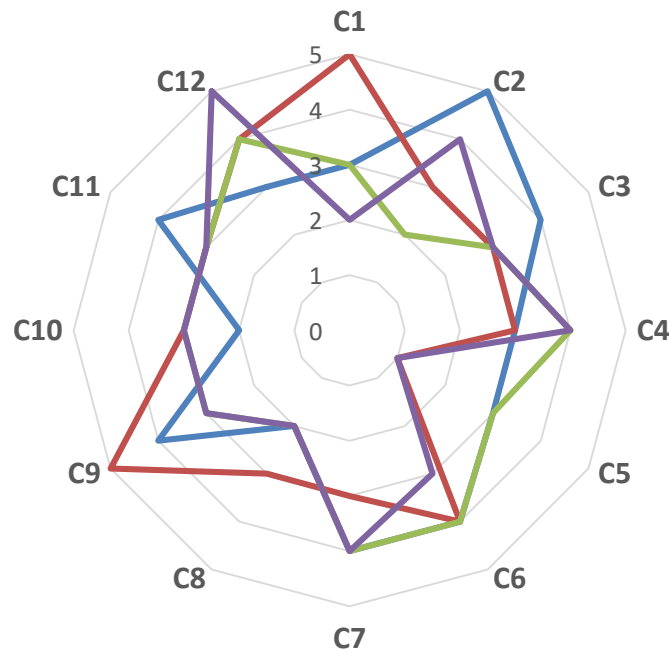
- ✓ Energy performance of buildings.  
**Certification of Energy Performance;**
- ✓ **Projection of Energy Performance in Buildings** from 2013 (STR 2.05.01:2013);
- ✓ EU-related: **Revised Directive for Labelling of Energy-related Products** (Directive 2010/30/EU) - **Labelling of energy consumption-related products;**
- ✓ Thermal Technique of Envelopes of the Buildings 2005-2013.

## Financial measures:

- ✓ European Union Structural Funds for 2014-2020 (**Modernization of Multi-apartment Buildings**);
- ✓ **Programme for Modernization of Multi-apartment Buildings;**
- ✓ **Special Programme for Climate Change** (Energy Efficiency Improvement in the Household Sector);
- ✓ Promotion of Modernization of Multi-apartment Buildings (EU Structural funds for 2007–2013);
- ✓ Programme for Development of Problematic Areas in Municipalities during 2011-2013.



# The most successful energy efficiency measures used in Lithuanian residential buildings (1)



- Programme for Modernization of Multi-Apartment Buildings
- Thermal Technique of Envelops of Buildings 2005-2013
- EU Structural Funds 2007-2013 for Multi-Apartment Buildings
- Special programme for Climate Change for Energy Efficiency in Households

- 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



## The most successful energy efficiency measures used in Lithuanian residential buildings (2)

**“Programme for Modernization of Multi-apartment Buildings”** and **EU Structural funds for 2007-2013 “Promotion of Multi-Apartment Buildings”** are the most successful energy efficiency measures.

Their average scores are 3.4 and 3.2.

**“Programme for Modernization of Multi-apartment Buildings”**: 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 positively because they are suitable to overcome barriers for energy efficiency, are highly accepted by the stakeholders and has long-lasting impact.

**“Thermal Technique of Envelopes of the Buildings”** (2005-2013) is the highest impact measure in terms of amounts of energy savings.



# CONCLUSIONS

- Lithuania approaches to energy efficiency goal set for the residential buildings **at moderate rates**.
- **More intensive efforts are necessary** to increase energy efficiency in the residential buildings through the implementation of energy efficiency measures.
- Implementation of ambitious energy efficiency target for residential sector **require additional technical, political and administrative measures** based on best practice examples.
- **Existing energy efficiency measures** needs for improvement in order to achieve energy saving targets.

**Thank you for the attention**

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