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Exploring the integration of energy sufficiency in climate and energy strategies of "catching-up" economies: examples from the building sector in Hungary and Lithuania

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IEEE R2P2 ARMIR

Presenter's Short Biography

- PhD in Technological Sciences, Power and Thermal Engineering
- Experience in studies related to analysis of energy demand forecasting, energy sector planning, analysis of energy efficiency indicators, analysis of energy policy, environmental issues of energy sector, GHG emissions inventory and projections for energy sector.
- Participation in FP7, Intelligent Energy Europe Programme, H2020, National Research Programme (Lithuania) projects, etc.

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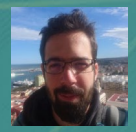

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REKK FOUNDATION

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Lithuania

Supported by:

Federal Ministry for Economic Affairs and Climate Action

European Climate Initiative EUKI

on the basis of a decision by the German Bundestag

CACTUS

STRENGTHENING CENTRAL AND EASTERN EUROPEAN CLIMATE TARGETS THROUGH ENERGY SUFFICIENCY

CACTUS: Consolidating Ambitious Climate Targets with end-Use Sufficiency

CACTUS paves the way for **more ambitious mitigation strategies** by providing explanatory quantitative and qualitative analysis on **sufficiency** mitigation potential and also support the development of sufficiency policies by raising the awareness of policy-decision makers on the **sufficiency concept**.

→ ***Target countries: Lithuania and Hungary***
Focus on transport and buildings

- Relatively higher energy poverty, lower level of energy services, but **economies and lifestyles are catching-up fast**
- Need to develop **sufficiency measures tailored to the local context**

ASSOCIATION négaWatt

Fraunhofer ISI

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Context

- Introduction of energy sufficiency
- Basic information about the countries in focus
- Relevant strategies and policies
- Process of indicators selection and setting sufficiency targets
- General trend of energy use
- Overview of the selected sufficiency indicators
- Integration of sufficiency assumptions into the models
- Policy options

Energy sufficiency

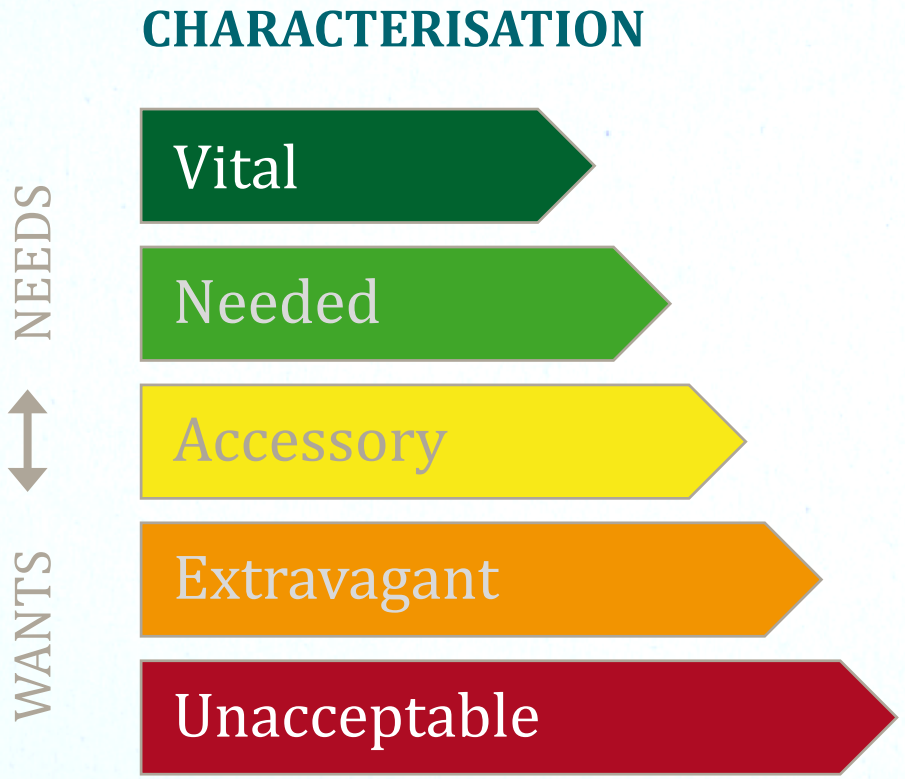
Energy sufficiency aims at fulfilling everyone's need for energy services while adjusting their nature and amount in order to keep energy demand at a level which does not endanger the carrying capacity of the earth.

Credit: wfeiden

Energy services – individual and collective choices

Energy services can be characterised and discussed

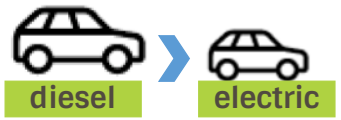
… policies and measures could regulate their level



Sufficiency leverages

1 **Servicial** — Intensity and duration of use of equipments

2 **Dimensional** — Size, nominal capacity of equipments



3 **Organisational** — Collective planning and sharing

Information

Raising awareness

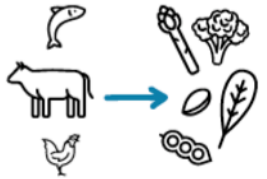
Incentives

Regulation

Land-use and urban planning

Building of infrastructures

\+ **Sufficiency on other goods and food**



\+ Consistency and comprehensiveness

Sufficiency at the start of a systemic approach

Choice and preparation of the primary resource

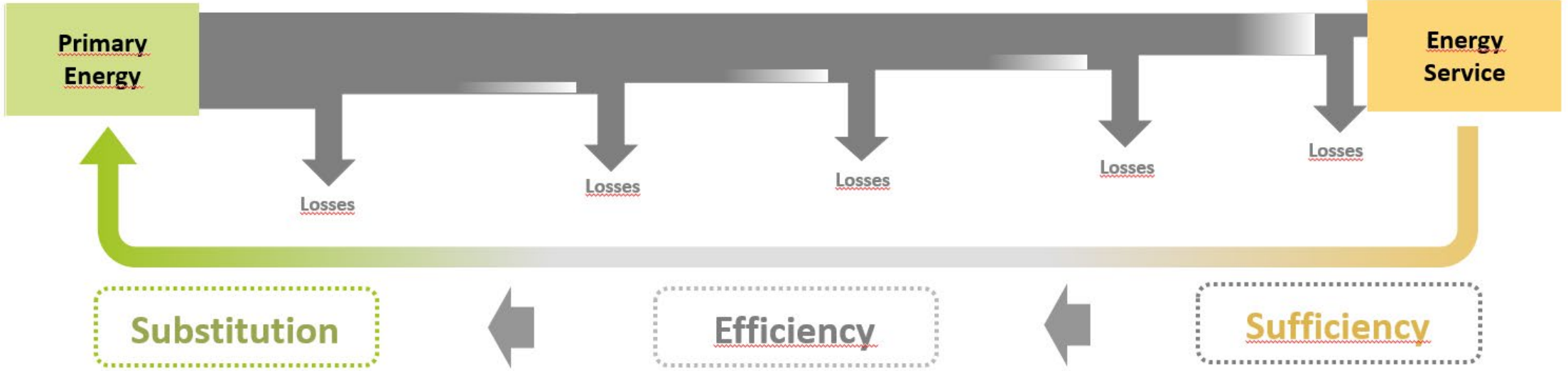
Transformation into the suitable carrier

Delivery of final energy to the end-user

Conversion into useful energy

Design and dimensioning

Conditions of use

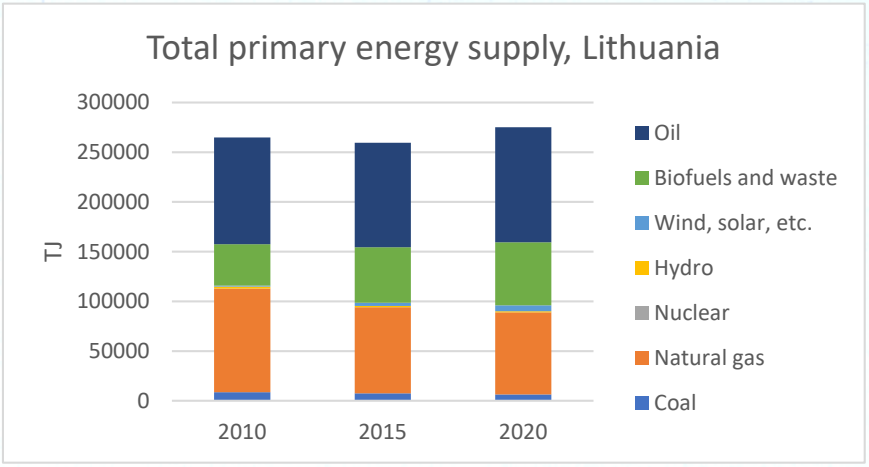


The questions investigated

- Are there **sufficiency potentials** related to energy services in Hungary and Lithuania which could contribute to net-zero climate targets?
- How could this sufficiency potential be applied in **existing energy scenario models** supporting national strategy formulation and policy-making?

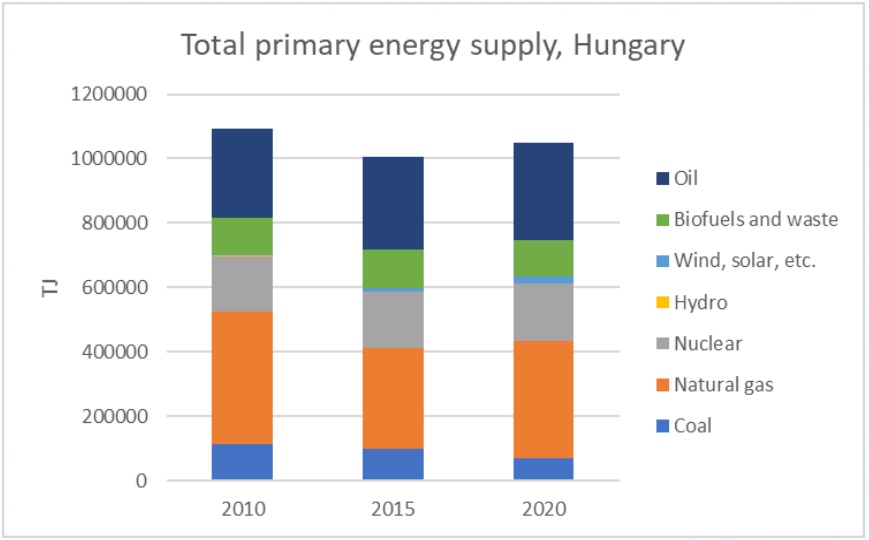
The countries in focus

Basic data on Lithuania, 2020	
Area	65,300 km2
Average population	2.79 million
GDP per capita	17,710 EUR*



Basic data on Hungary, 2020	
Area	93,000 km2
Average population	9.75 million
GDP per capita	14,010 EUR*

*Source of data: Eurostat, *at current prices*



Relevant strategies and policies

- The long-term climate and energy targets of Lithuania and Hungary, set out in their National Energy and Climate Plans (NECP) and Long-Term Strategies (LTS), are **similar**.
- Both countries aim for **energy independence and wish to achieve net-zero emissions** by relying mostly on renewables.
- In addition to the large-scale electrification of the economy, which would be based in Lithuania exclusively on **renewables** and in Hungary partly on **renewables and partly on nuclear energy, energy efficiency improvements** would also play a significant role.
- **Sufficiency**, as a policy objective and as a means to question the overall level of service demand, has not yet appeared on the Lithuanian and Hungarian agendas. Accordingly, sufficiency has not been integrated into climate and energy models used to elaborate the national decarbonisation strategies of both countries.
- Highlighting **the role of sufficiency as a key driver** next to efficiency and renewable energies may be essential to estimate its potential in the local context and to explore its consideration into climate and energy scenarios.

Sufficiency assumptions building in the CACTUS project

RESEARCH AND TECHNICAL DIALOGUE

1. Selection and priorisation of key indicators

2. Theoretical 2050 sufficiency potential in literature

3. Assumptions drivers, justifications and key policy measures

4. Local economic and socio-cultural context and trends

5. **2050 sufficiency potential target levels tailored to the national context – *to be integrated into scenario models***

Main sources:

- négaWatt, France, 2016 and 2021
- UmweltBundesAmt, Rescue 2019 and flächendsparend wohnen, 2021
- Millward-Hopkins et al. 2020 "Providing decent living with minimum energy: A global scenario",
- Grubler et al 2018 "A Low Energy Demand scenario for meeting the 1.5°C target“
- Kuhnhenn et al 2020 "A Societal Transformation Scenario for Staying Below 1.5°C"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Global Environmental Change

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ELSEVIER

Providing decent living with minimum energy: A global scenario

Joel Millward-Hopkins [a], Julia K. Steinberger [b], Narasimha D. Rao [c, d], Yannick Oswald [a]

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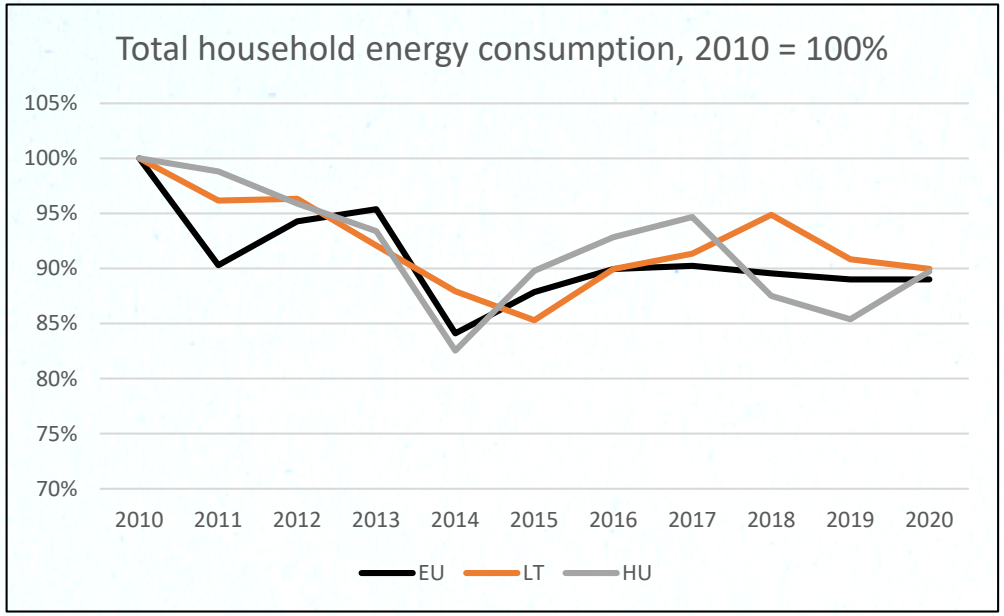
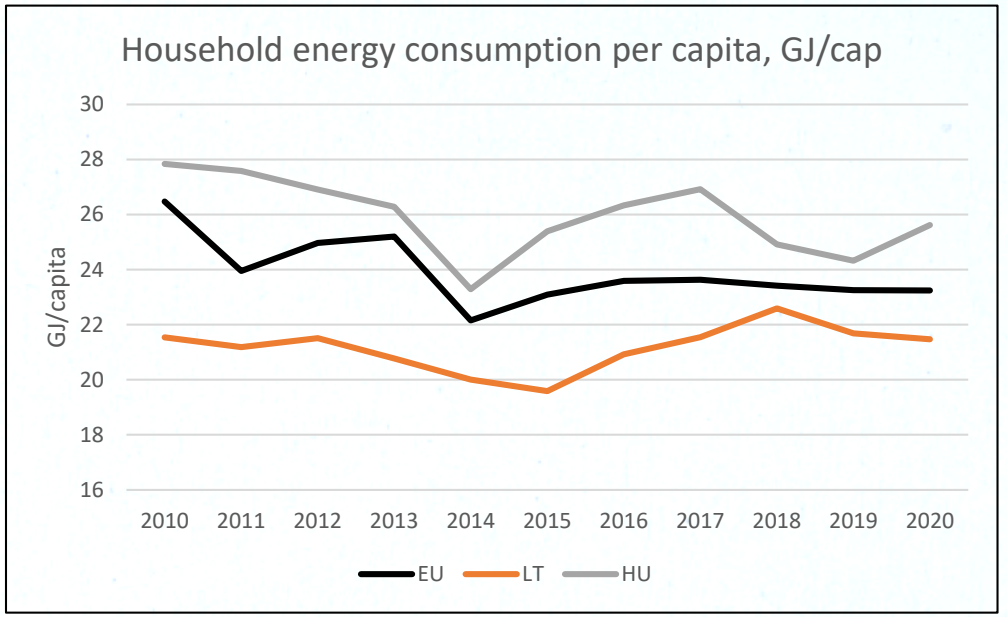
Residential energy consumption





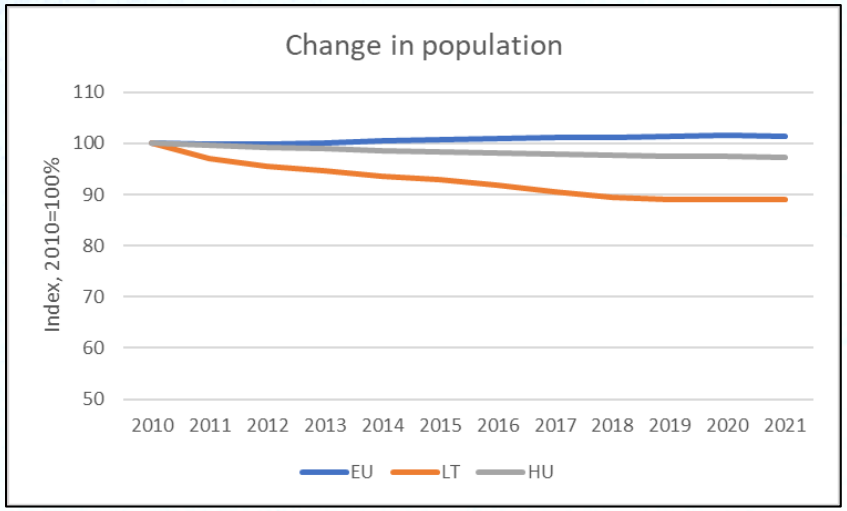
- Residential energy consumption is responsible for 34% of final energy use in LT and 27% in HU (28% in EU). Within this, heating is responsible for 70%.
- Total consumption decreased by about 10%, due to energy efficiency improvements.
- Energy counsumption per capita exceeds the EU average in Hungary and it is below the EU average in Lithuania, despite its geographical location.

Selected energy sufficiency indicators for buildings sector and assumed levels for 2050

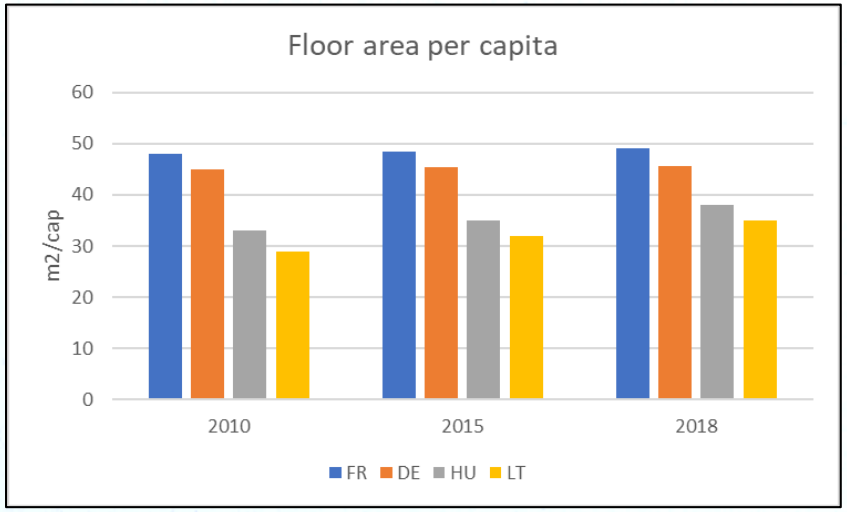
Indicator	Theoretical sufficient target level ranges for 2050 from litterature	Lithuania		Hungary	
		Base year data (2017)	Assumed level for 2050	Base year data (2017)	Assumed level for 2050
No of households (thousand)	-	1357	972	4134	4031
Average household size	2 - 4[a]	2.2	2.2	2.37	2.3
Number of dwellings (thousand)	-	1459	1345	4651	4632
Average floor area per capita (m2/capita)	30[b]-35[c]	35	32	37	35
Average size of new dwellings (m2)	N/A	113.2	100 (house) 54 (flat)	100.08	80.5
Average needs for hot water (kWh/person)	294-371[d]	1047	698	893	520
Average needs for cooking (kWh/person)	N/A	814	349	337	220

[a]Millward-Hopkins et al. 2020, [b]Grubler et al. (2018) [c]Bierwirth and Thomas et al. (2019), [d]négaWatt (2018)

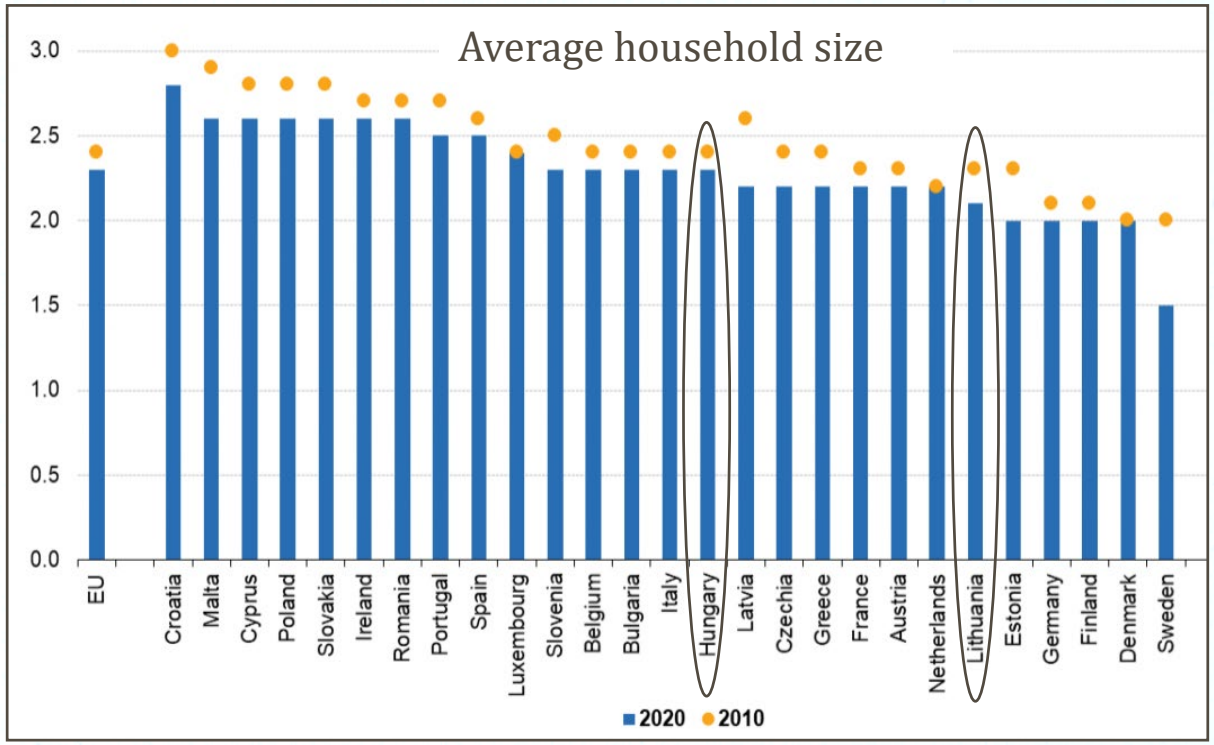
Trends - household size and floor area per capita



Source of data: Eurostat

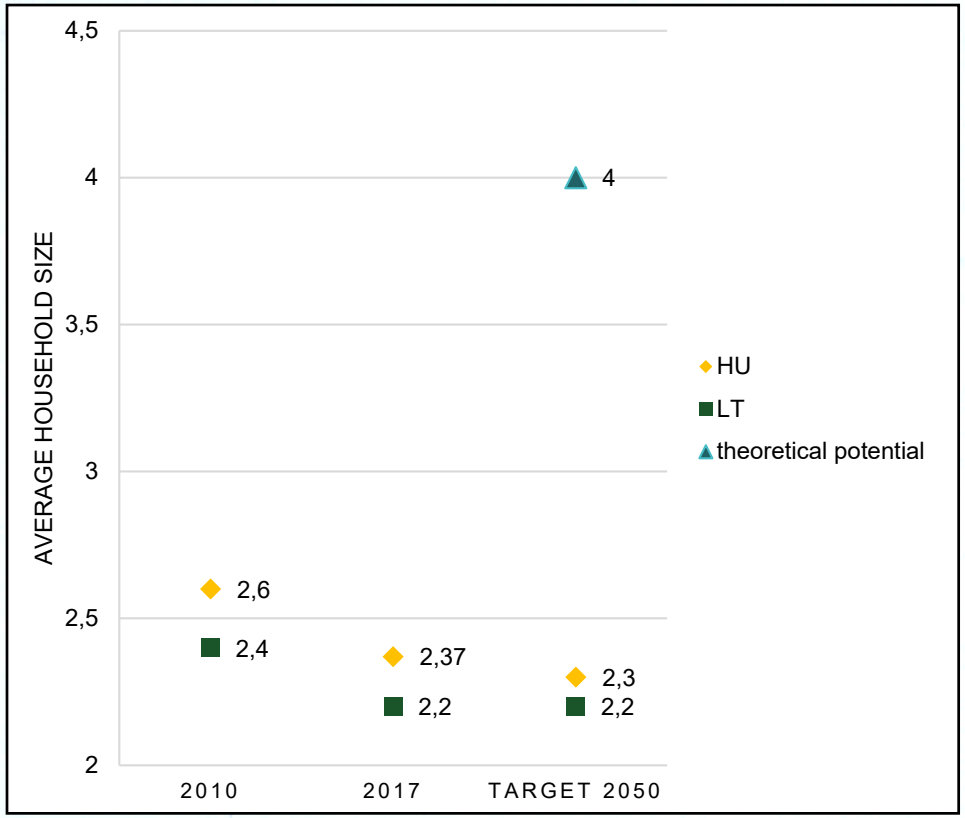


Source of data: Odyssee database



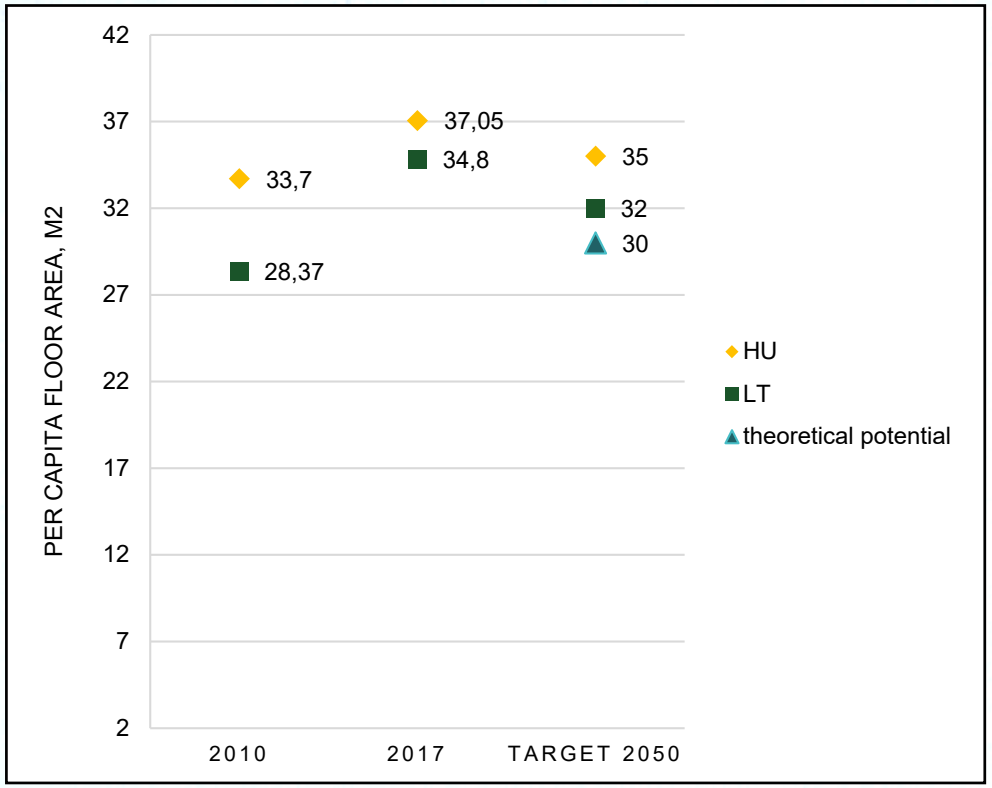
Source of graph: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=File:Average_number_of_persons_per_household_by_country,_in_2010_and_in_2020.png

What 2050 sufficient target levels for average household size?



- Average household size decreased in HU and LT similarly to other countries in the EU, and the number of households increased.
- The trend is assumed to continue, due to demographic and social changes.
- Policies might halt the decrease, stabilising its value at around the present EU average (2.3) despite lower official projections.
- The indicator has an effect on the number of dwellings in use and total heated floor area, which impacts overall residential energy use.

What 2050 sufficient target levels for floor area per capita ?



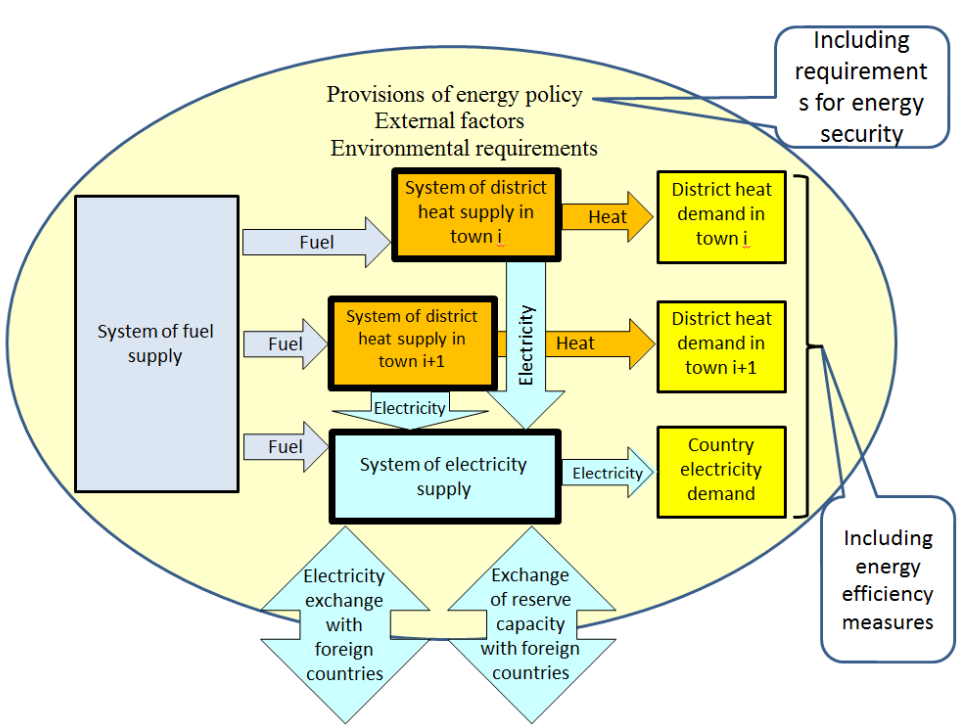
- The average size of new dwellings decreased in the last years in both countries
- However, demographic changes contribute to the larger per capita floor area
- Providing incentives to move from unnecessarily large to smaller dwellings can decrease the value.
- The impact of this indicator on total residential energy consumtion also depends on population size and the vacancy rate of buildings.

Status-quo of the energy models in Lithuania and Hungary

Country	Lithuania	Hungary
Name of the model	LT-ENERGY	HU-TIMES
Developing environment	MESSAGE	TIMES
Main owner/user of the model	LEI	REKK
Sectors covered	Household, Tertiary, Industry, Transport, Power system	Household, Tertiary, Industry, Transport, Power system
Model approach	Bottom-up optimization	Top-down/Bottom-up optimization
Geographical coverage	National	National

It is to be noted that none of the models cover the whole demand side. Mostly the energy demand service is modelled externally, and the result is used as the input for the modelling.

Integration of sufficiency assumptions into the LT-ENERGY model



The mathematical model used for this analysis does not model explicitly energy sufficiency measures. Therefore costs (if any) related to implementation of sufficiency measures are neglected;

Sufficiency measures in modeling are represented by exogenously given correspondingly reduced final energy demand;

Calculations are based on example of one scenario used for preparation of the current version of the National energy strategy;

No bounds on CO2 emissions are applied in order to better explore impact of sufficiency measures. However, CO2 price is growing from 52 Eur/t in 2020 until 104 Eur/t in 2030. Later it stays constant;

The results should be considered only as an as an indicative assessment of the scale of the possible impact.

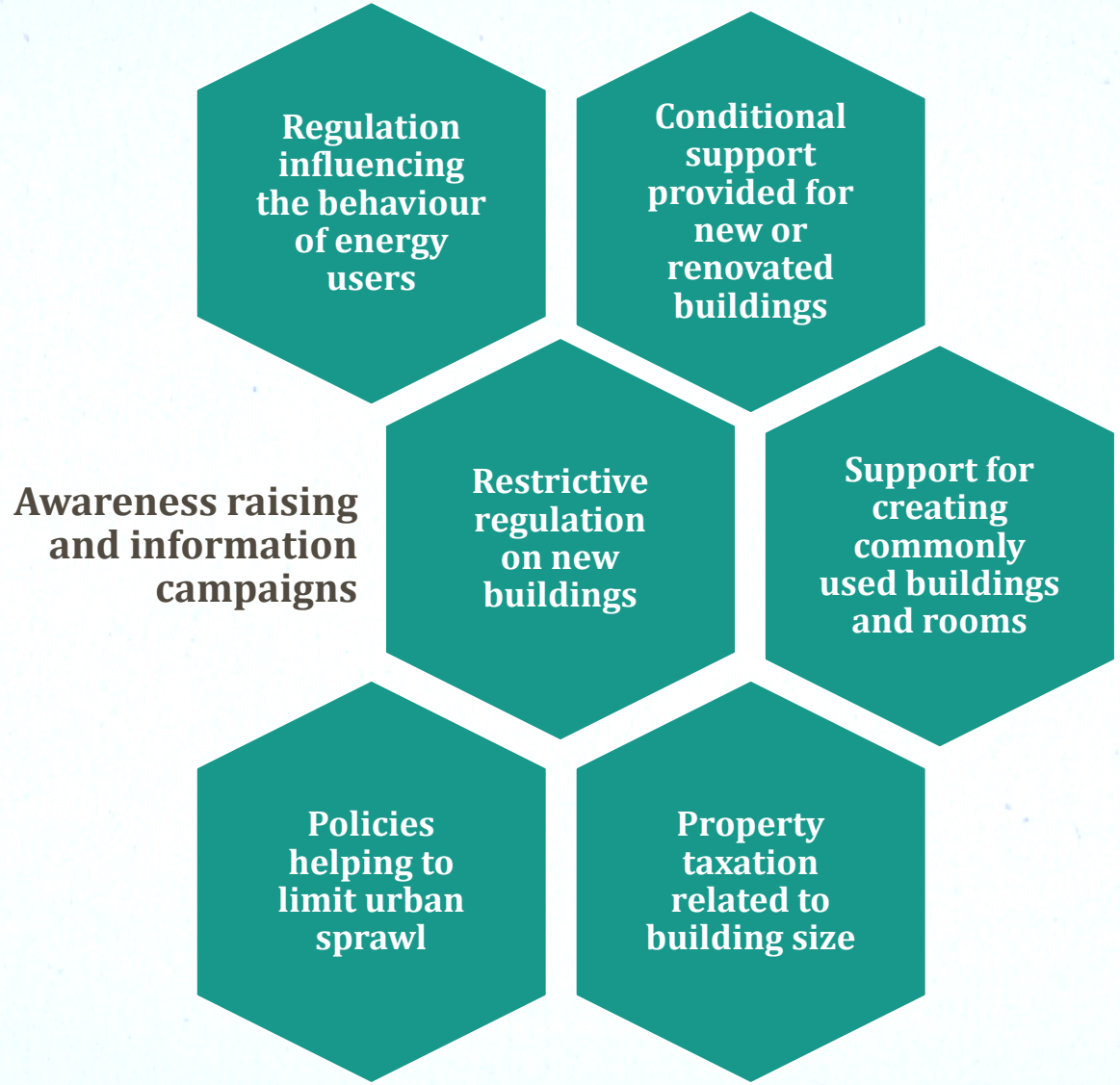
Preliminary results of the integration of sufficiency assumptions

- **If energy sufficiency** were implemented at the level **for the selected energy sufficiency indicators** for 2050, then the consumption of energy and fuel could decrease **in Lithuanian households by 18.3%,** in comparison to levels of one of the National Energy Independency Strategy scenario. This corresponds to expected reduction in total final energy consumption of 4% in 2050.

- A systematic integration of the energy sufficiency concept in all sectors of the economy can lead to significant reductions in energy demand, e.g., **the French NegaWatt scenario showed that energy sufficiency could enable a reduction of the FEC by 23% in 2050 compared to 2020,** which is significantly higher than the results of the modelling of few sufficiency indicators in the Lithuanian households.

- In order to unlock energy sufficiency potential, **relevant policies** should be implemented.

Energy sufficiency policy options for the building sector



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Thank you !

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