CACTUS

STRENGTHENING CENTRAL AND EASTERN EUROPEAN CLIMATE TARGETS THROUGH ENERGY SUFFICIENCY

Understanding the gaps and addressing the potentials of energy sufficiency in “catching-up” European economies

eceee - Friday, June 10th

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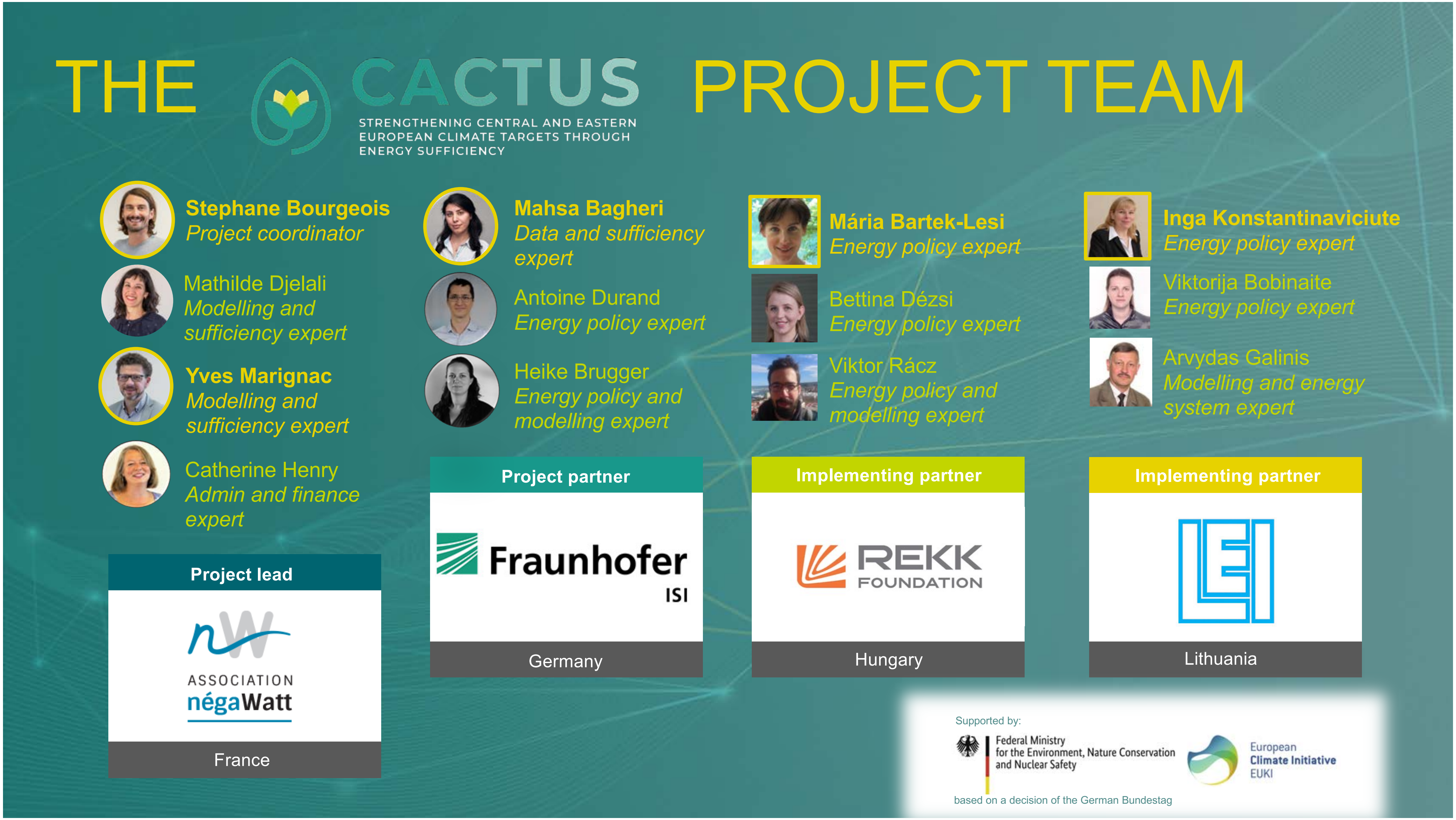
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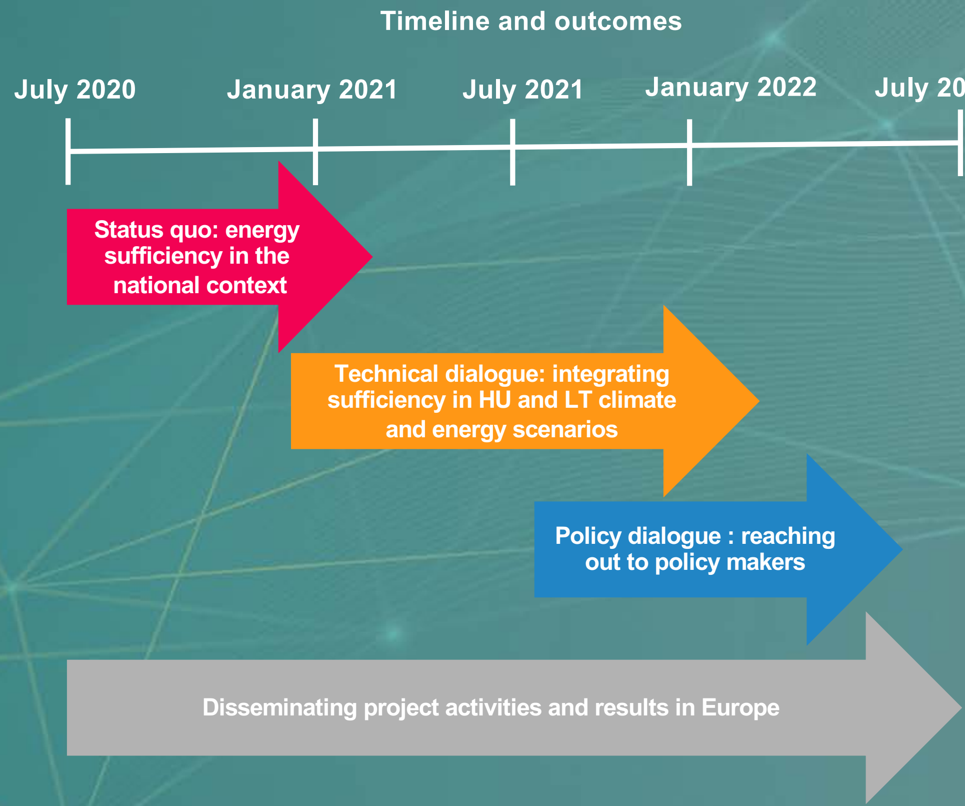
STRENGTHENING CENTRAL AND EASTERN EUROPEAN CLIMATE TARGETS THROUGH ENERGY SUFFICIENCY

CACTUS : **energy sufficiency** and
its integration into climate and energy strategies
in the Central and Eastern European (CEE) context

- 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**

→ ***Exploratory work in Lithuania and Hungary***
Focus on transport and buildings



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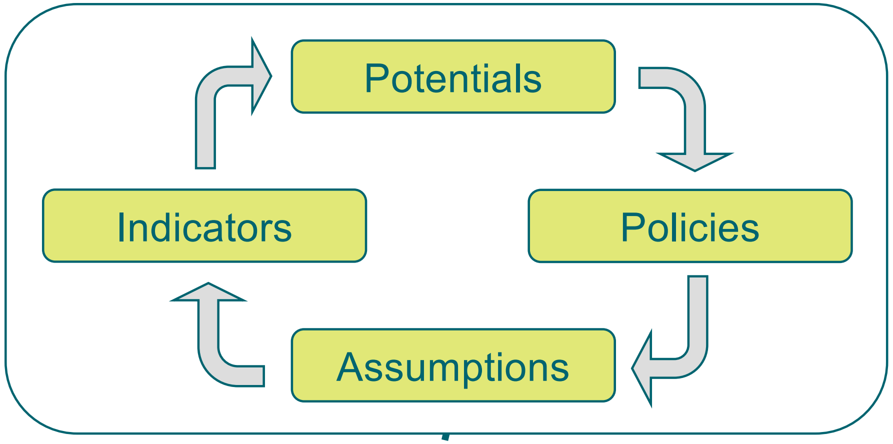
Energy sufficiency

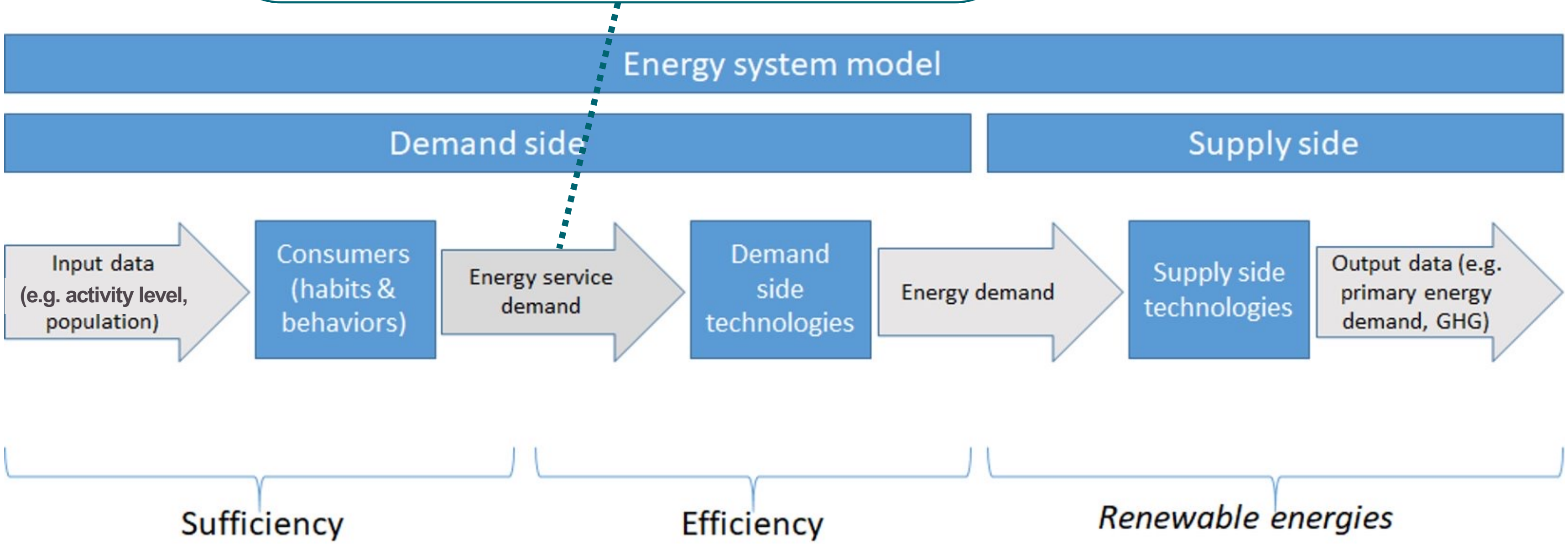
Energy sufficiency aims at fulfilling everyone's need for energy services while adjusting their nature and amount in order to keep energy demand at a level which does not endanger the carrying capacity of the earth.

Credit: wfeiden

Modelling approach



Building energy sufficiency
assumptions
works the same
as for other assumptions



The impact of sufficiency in the négaWatt scenario 2022 for France

2022-2050

Sufficiency

• accounts for

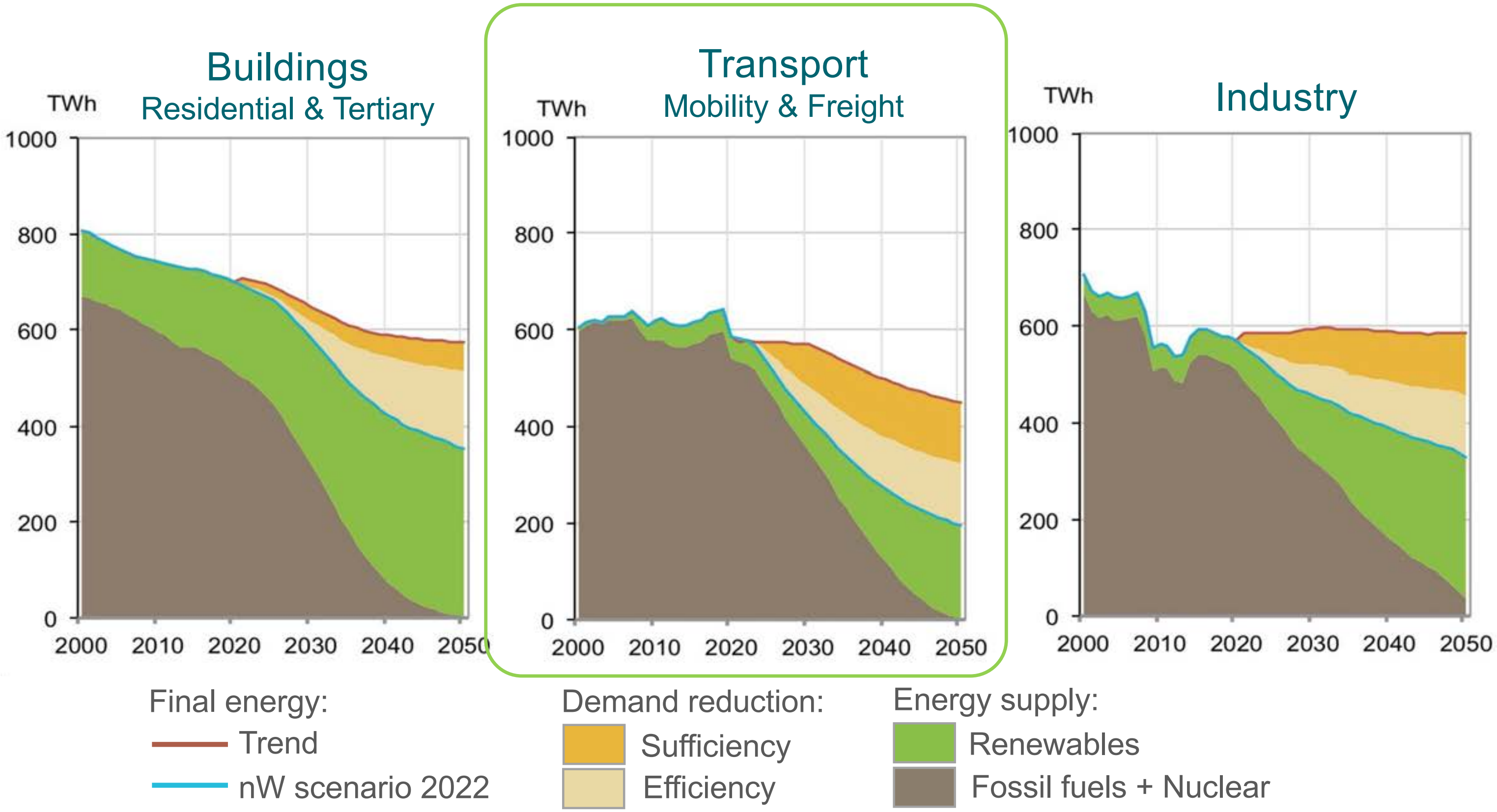
~ 20%

drop in **demand**
(final energy)

out of 53% in total

• contributes to meeting
net-zero carbon footprint

• also contributes to strongly reducing
net primary materials footprint

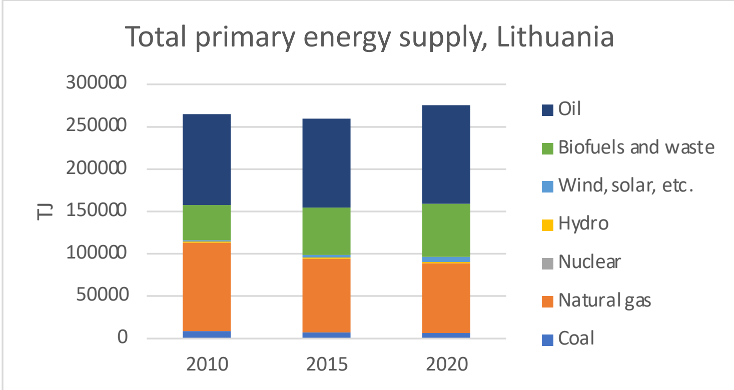


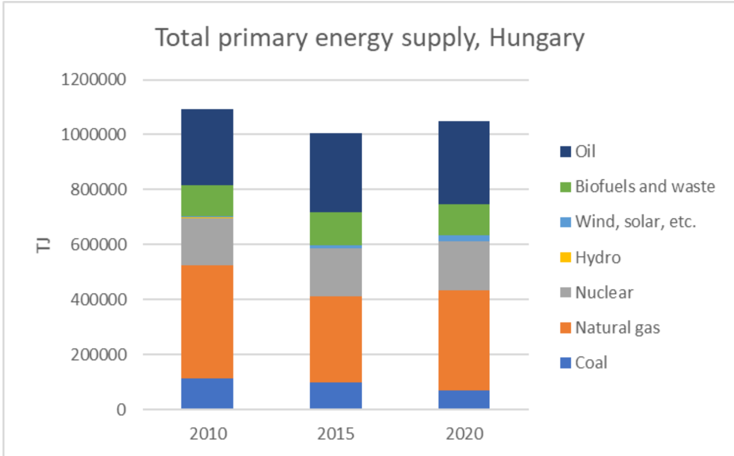
The countries in focus

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*





Source of data: IEA country profiles

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

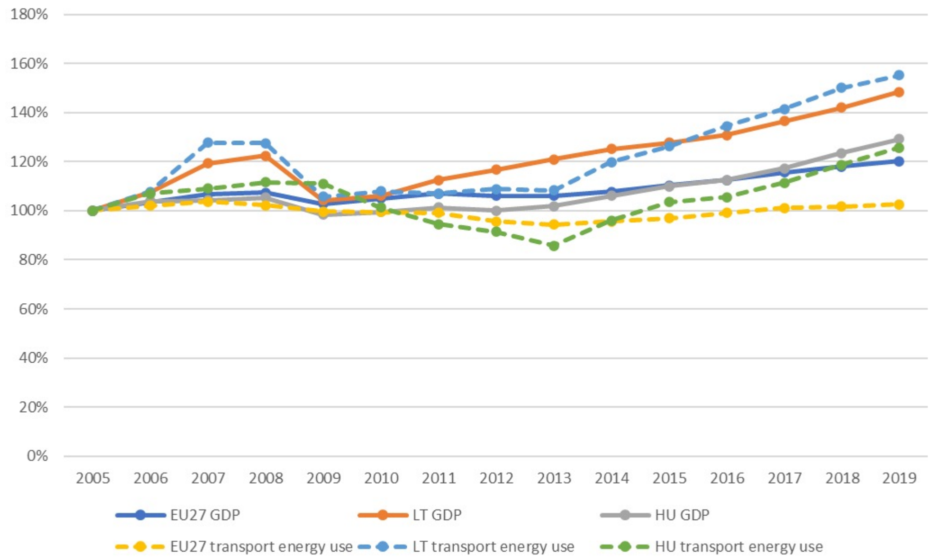
5. **2050 sufficiency potential target levels tailored to the national context – *to be integrated into scenario models***


Global Environmental Change
Volume 65, November 2020, 102168
Providing decent living with minimum energy: A global scenario

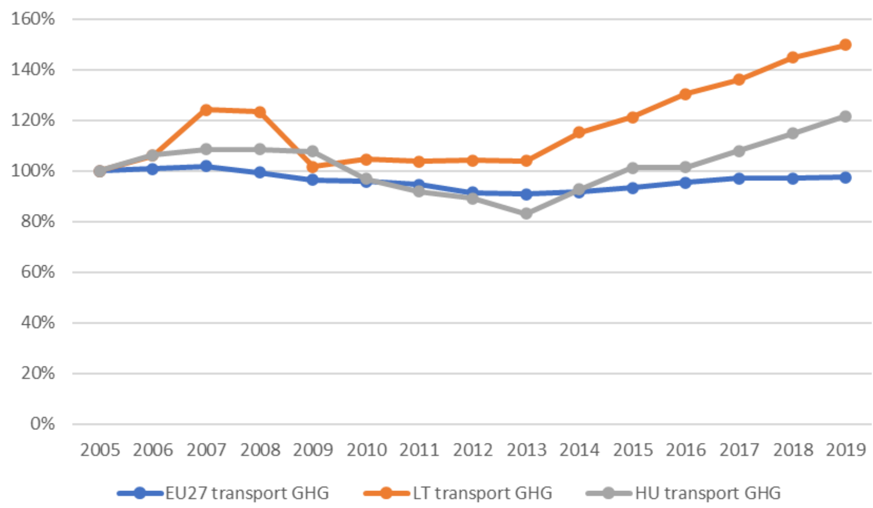
Main sources:

- 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"

Energy consumption, GDP and GHG trends in the transport sector



Source: EUROSTAT

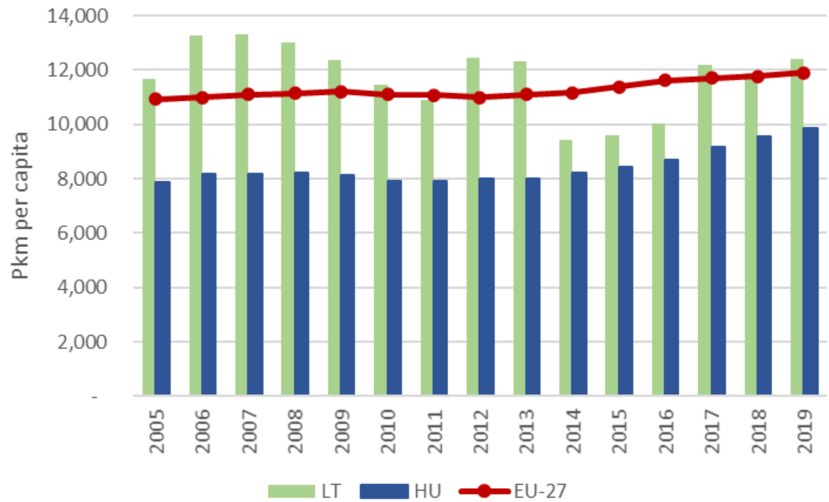


Source: UNFCCC

2005-2019	GDP	Energy consumption	GHG emissions
EU-27	20%	3%	-3%
HU	29%	26%	22%
LT	48%	55%	50%

Sufficiency relevant passenger transport trends since 2005

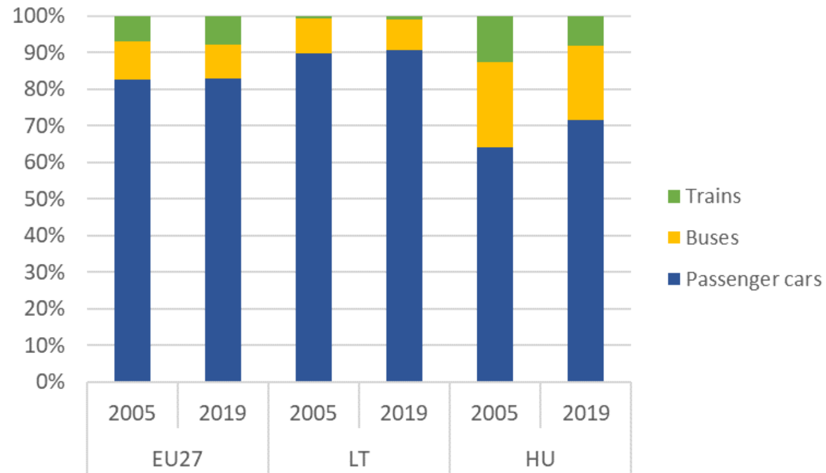
Total pkm per capita



The improving living standards is the main driver of the increased travelling in pkm per capita.

During 2014-2019 travelling distances started to **increase by 5% a year in LT, by 3% in HU and by 1% in EU-27.**

Modal split



The share of cars in total passenger transport was the highest in LT (91% in 2019), but it increased the most in HU (from 64% in 2005 to 72% in 2019).

In 2019, the relevant modal share of **buses** in LT (8%) was almost at the level of EU-27 (9%) and less than half of the share in HU (20%).

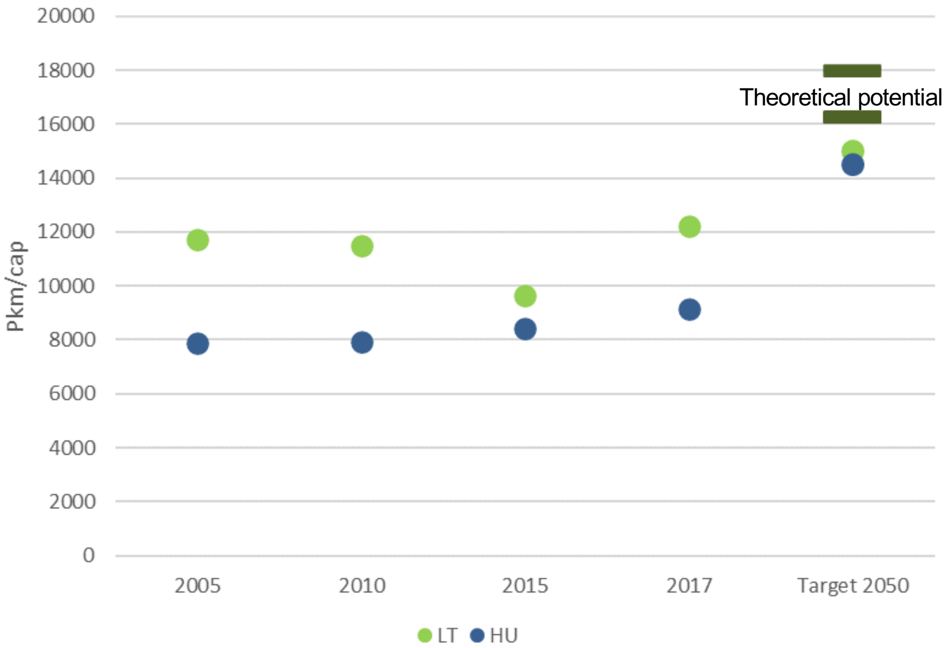
Selected energy sufficiency indicators for transport

Indicator	Sufficient target levels for 2050	Lithuania		Hungary	
		Base year (2017)	Assumed target level for 2050	Base year (2017)	Assumed target level for 2050
Number of persons/car	2 – 3 [a, b, d]	1.35	1.6	1.5	1.7
Number of cars/capita	0.34 [b]	0.48	0.5	0.22	0.3
Pkm/capita	LT: 16,218 [b], HU: 17,935 [a]	12,208	15,000	9,341	14,499
Pkm by car/capita	LT: 8,674 [b] HU: 1,077[5, b] – 7,526[5, c], 1,710[6, b] – 23,878[6, c]	11,088	11,500	1,415[1] 4,774[2]	988[1] 5,181[2]
Pkm by bus/capita	LT: 1,968 [b] HU: 2,154[5, a], 3,420[6, a]	602[1] 367[2]	1,500	477[1] 1,392[2]	706[1] 2,897[2]
Pkm by rail/capita	LT: 1,366 [b] HU: 2,154[5, a], 3,420[6, a]	150	700	311[3] 789[4]	951[3] 2,521[4]
Pkm by air/capita	581 [c] – 1,841 [b]	628	1,000	N.A.	1,000
Pkm/capita for soft mobility	N.A.	N.A.	200	N.A.	564

Note: 1 Local, 2 Long-distance, 3 Tram/Metro, 4 Rail, 5 Urban, 6 Rural

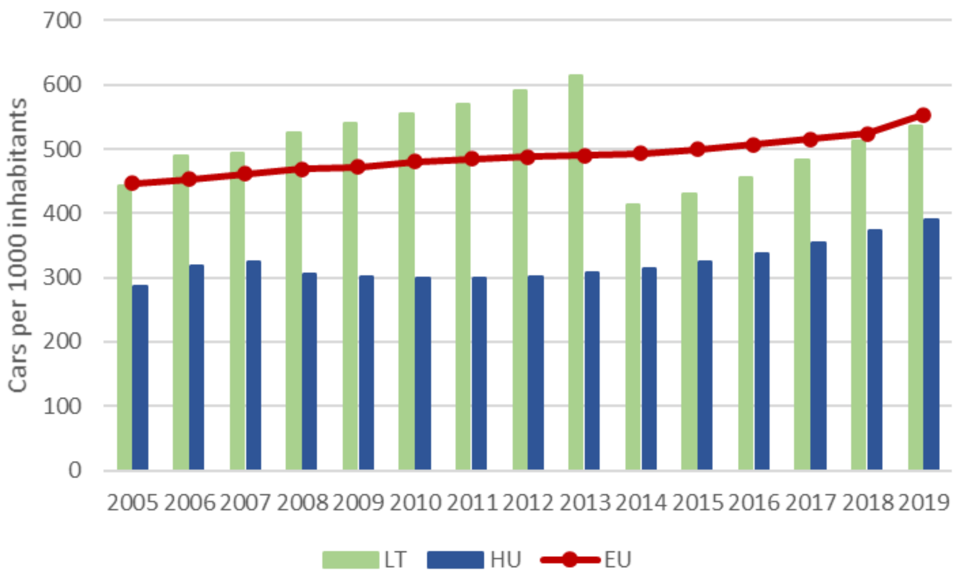
Sources: a) Millward-Hopkins et al. 2020, b) Grubler et al. 2018, c) Kuhnhenn et al. 2020, d) Association négaWatt 2017

What 2050 sufficient target levels for total pkm per capita ?



- It is assumed that by 2050, **the total transport demand** could increase in both countries compared to 2017, reaching about 15000 pkm per capita.
- Assumed level for 2050 is based on the sum of estimations for **the different transport modes**: cars, buses, navigation, air, soft mobility (bicycles).
- Sufficiency in transport sector can be reached via inducing modal shift, mitigating traffic and reducing demand for transportation.

Catching up trends for passenger cars



- In 2019, 536 passenger cars per 1000 inhabitants were registered in LT, compared to 390 in HU.
- In 2014, old and not used passenger cars which owners could not provide evidence that cars were technically in order, had been automatically registered out; therefore, the official number of passenger cars significantly reduced in LT.
- Although both countries have their own characteristics, a common feature is that number of cars per inhabitant **in LT and HU is growing faster** than in the EU-27.

Focus on integrating sufficiency assumptions into energy and climate scenario models

1

Analysis of scenario models and comparison with sufficiency-focused models (e.g. négaWatt)

2

Technical dialogue on the capacity of the models to integrate sufficiency assumptions

3

Assessment of impact of selected indicators on potential model output

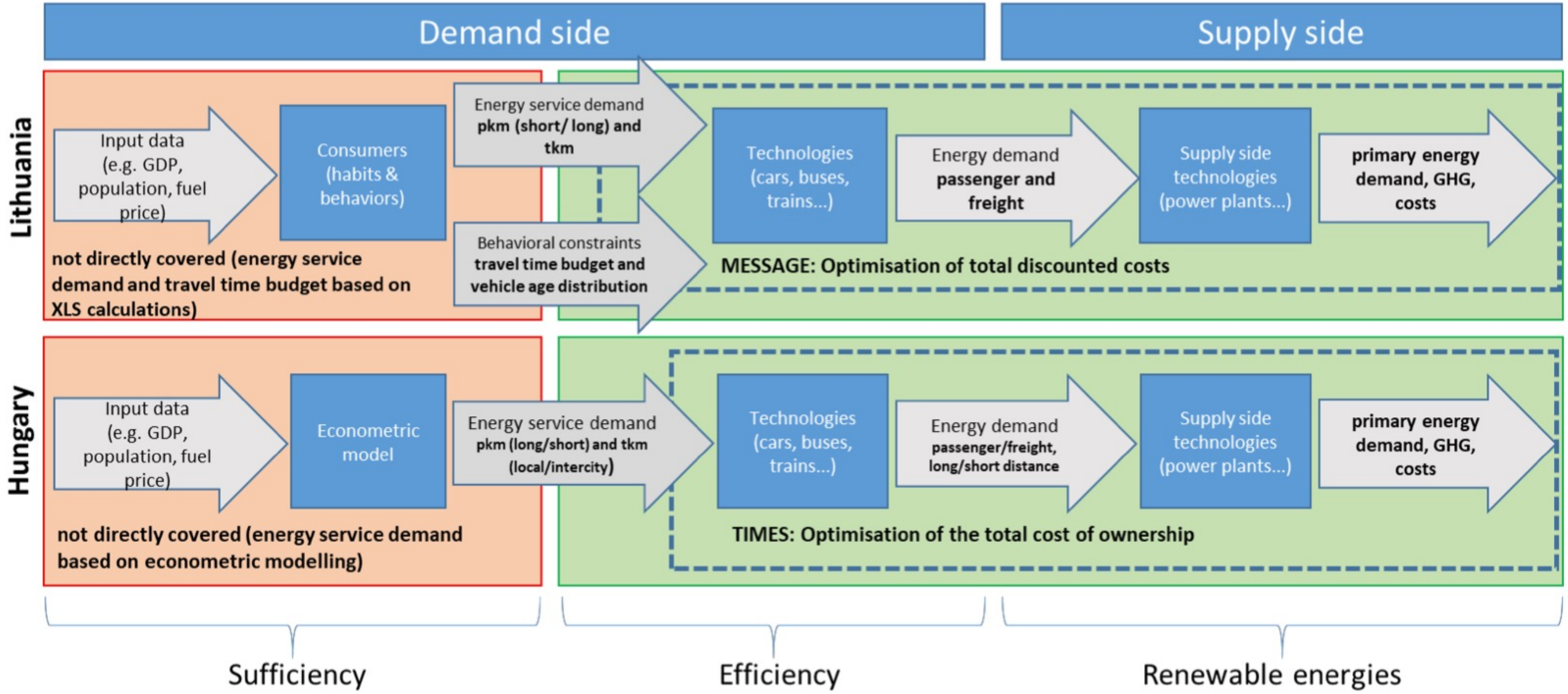
4

Technical dialogue on direct and indirect impacts of sufficiency measures

5

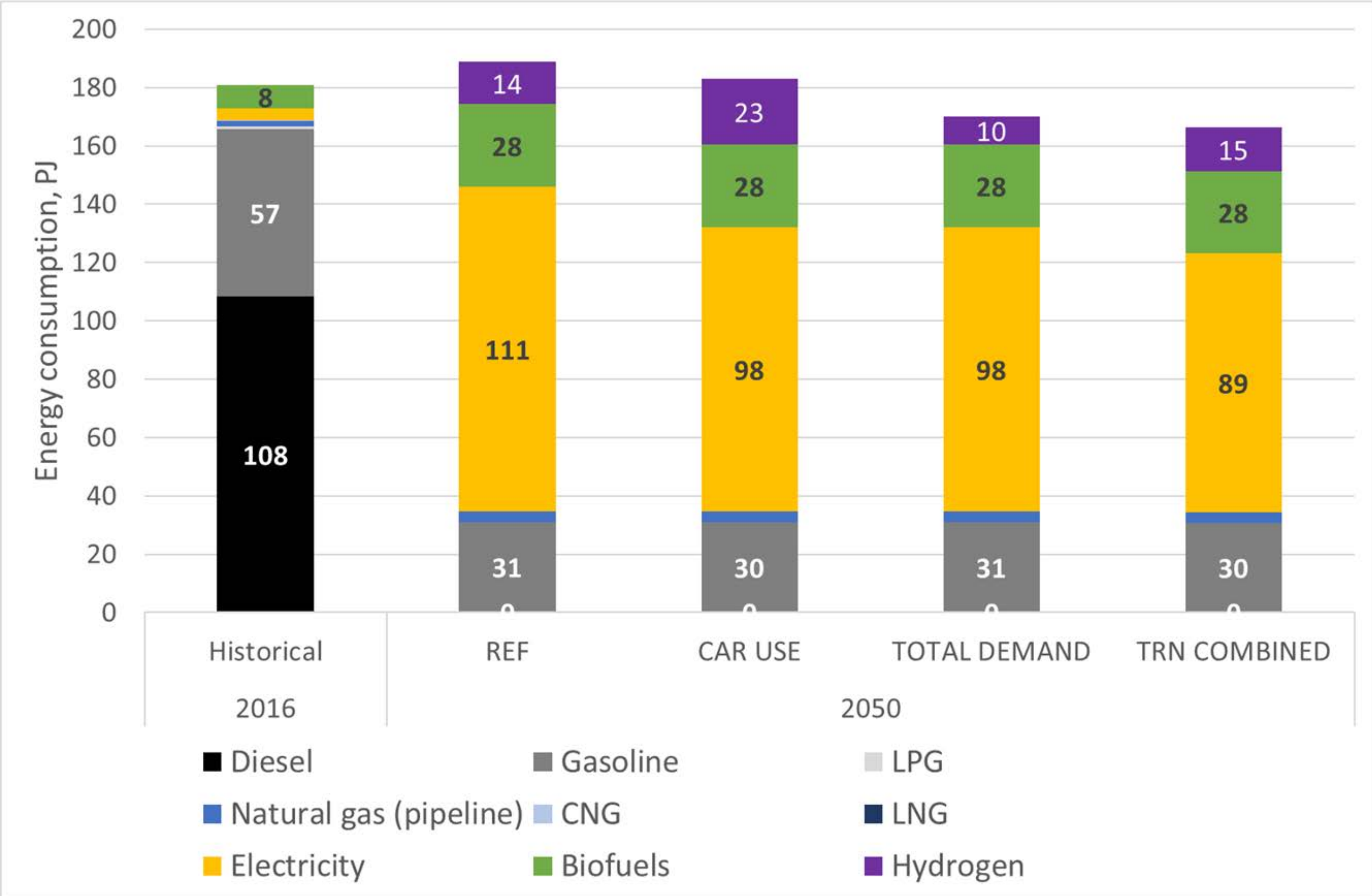
Discussions and recommendations on dealing with quantifiable and non-quantifiable sufficiency impacts

Approach in the transport models in Lithuania and Hungary



Hungary - Decrease in transport energy consumption resulting from sufficiency measures

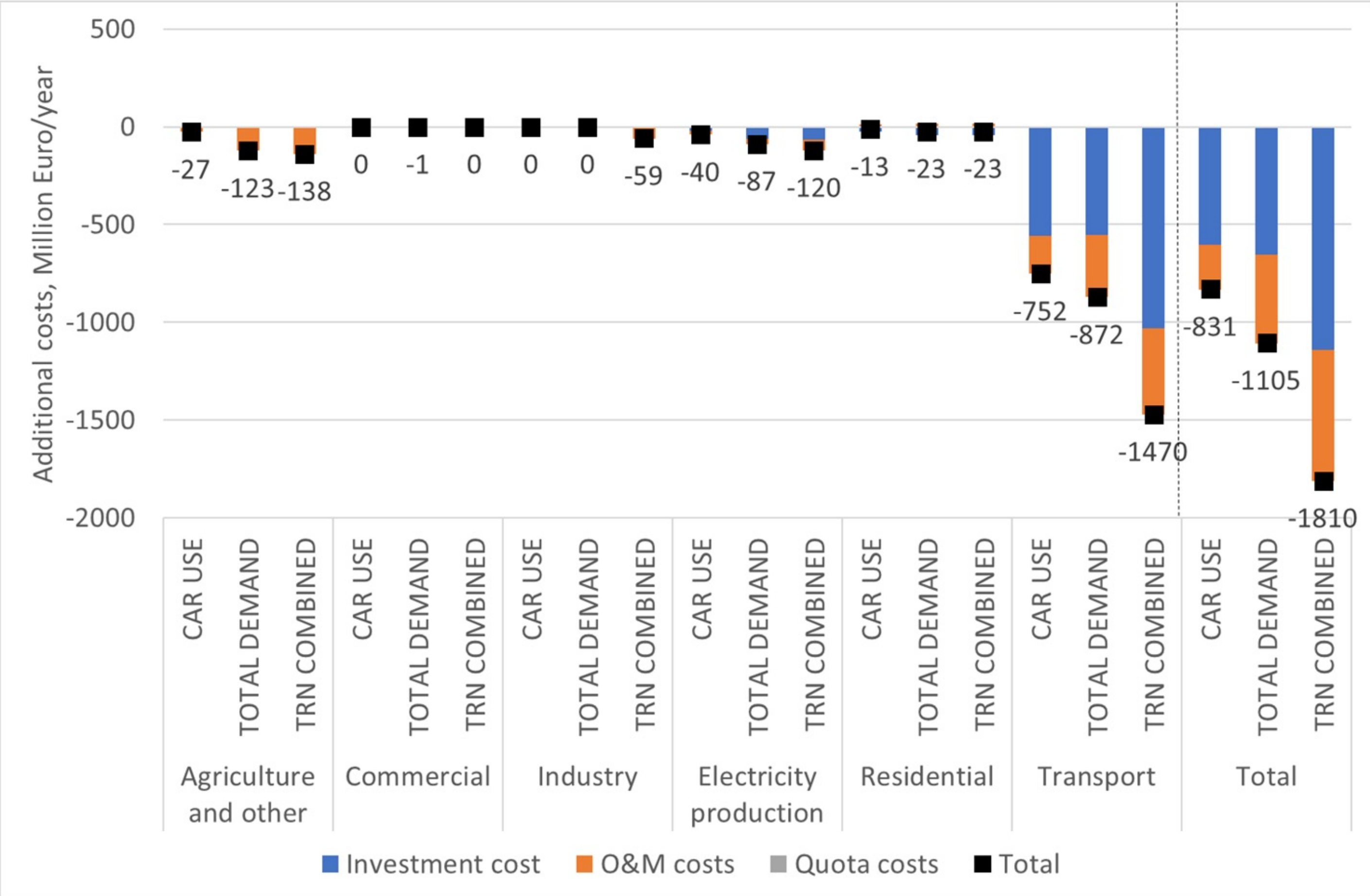
Energy consumption by demand segment in the transport sector by 2050



- Lower demand for car trasport under the CAR USE scenario results in 6 PJ lower energy use. Modal shift mainly happens between (electric) cars and (hydrogen fueled) buses and rails both in the short- and long-distance passenger transport segments.
- The fall in demand for total passenger transport (TOTAL DEMAND scenario) brings about 18.6 PJ savings in energy consumption. The use of both electric and hydrogen fueled vehicles is reduced.
- The combined effect (TRN COMBINED) of the above mentioned sufficiency measures is an overall 22.3 PJ drop in energy consumption. While electricity use decreases by 22.3 PJ, the increase in hydrogen use (0.8 PJ) offsets the lower consumption of gasoline and biofuels.

Net benefits are realized from transport sufficiency measures

Annual additional cost in the different scenarios compared to REF (Million Euro/year)



- The largest cost savings can be observed in the transport sector due to the decreasing investment and operation and maintenance costs.
- In case of the CAR USE scenario the decreasing overall additional cost might be counterintuitive, but it is based on the fact that renewable public transport is assumed to be more cost efficient, and the analyzed share of cars is lower than in case of REF.

Summarized results of introducing sufficiency assumptions in models

- **Hungarian transport sector.** The HU-TIMES „hybrid” energy system model does not capture the demand side in very detail yet. Thus, sufficiency-related indicators had to be considered exogenously – i.e. as given. Two indicators were investigated: the per capita demand for car transport, and the per capita demand for total passenger transport
  - ✓ The modelling showed these two sufficiency-related changes would **reduce by roughly 13% energy demand for the transport sector**, compared to a reference scenario. The possible cost savings due to lower production capacity requirements could reach 1800 million Euros.
  - ✓ The amount of greenhouse gas mitigation resulting from reaching the sufficient consumption levels was not assessed at this stage of the modelling, as only the results for 2050 were analysed, for which year the model assumes net-zero emissions.

- **Lithuanian transport sector.** Similarly, energy sufficiency measures could not be modelled explicitly in the MESSAGE-based models used in Lithuania. Energy sufficiency was represented by exogenously given correspondingly reduced final energy demand. Seven quantified indicators were estimated.
  - ✓ If energy sufficiency is implemented in transport at the level of the prioritised energy sufficiency target levels for 2050, energy and **fuel consumption would decrease by 22% in passenger transport**, in comparison to levels assessed in one of the NEIS scenario without any energy sufficiency measures.
  - ✓ This corresponds to expected changes in final energy consumption of 8% in 2050.

Main conclusions and the way forward

- Analysing the relevant sufficiency indicators in the transport sector, as a key consumption sector and a particularly relevant area from a sufficiency perspective, revealed that efforts to preserve some favourable consumer habits by introducing relevant policies and providing higher quality services can help avoiding the expansion of unsustainable behavioural patterns and might lower the costs of meeting decarbonisation goals.

- The possible effects of energy sufficiency policies can be analysed, to form a basis for further projection, only if relevant statistics are available. This would require the systematic collection and publication of data. Important factors such as the spatial distribution of access and use of mobility services and its possible change are important but complex.

- The deployment of energy sufficiency measures is largely determined by consumer behaviour, which is influenced by many different factors under which infrastructure plays a key role in the mobility sector. Often these factors and consumer choices defy the economic logic that underpins choices in classical energy sector modelling.

- This eventually allowed for introducing context-tailored sufficiency assumptions in the modelling of national trajectories, touching on methodological issues regarding the consistency of doing so in object-oriented, optimisation models historically mostly developed to describe the supply side. These models show some limitations in the type and range of sufficiency assumptions that could be included and the right representation of their impacts – which calls for deeper improvements of and reflection on the models

Questions/Discussion

Thank you for your attention!

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https://cactus-energy-sufficiency.eu/

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