CACTUS

STRENGTHENING CENTRAL AND EASTERN EUROPEAN CLIMATE TARGETS THROUGH ENERGY SUFFICIENCY

Analytical Brief on Energy Sufficiency in the National Context: Hungary

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

European Climate Initiative EUKI

based on a decision of the German Bundestag

Hungary analytical brief: Energy Sufficiency in the National Context

prepared as part of the EUKI project "Consolidating Ambitious Climate Targets with End-Use Sufficiency" (CACTUS)

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CACTUS is a project on energy sufficiency and its integration into climate and energy strategies in the Central and Eastern European context funded by the European Climate Initiative EUKI.

It sensitises key scenario builders, policy makers and wider EU and climate and energy stakeholders on energy sufficiency and explores its integration in Hungarian and Lithuanian scenario models.

Since the Summer 2020, the négaWatt association has been coordinating the implementation of the Cactus project with its partners REKK, LEI and the Fraunhofer ISI, and with the financial support of the EUKI fund of the German Ministry of the Environment BMU.

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Introduction

For the EU to achieve climate neutrality in 2050 and, in line with this, reduce greenhouse gas (GHG) emissions 55% by 2030, national policies have to stretch across all activities of the economy. The National Energy and Climate Plans (NECPs) and Long-Term Strategies of most member states were established with a view to the previous, less ambitious 40% GHG reduction target of the 2030 climate and energy framework. The upward revision this year will require more stringent actions to deliver long-lasting emission reductions, especially in sectors where mitigation is slow, or emissions continue rising.

Besides energy efficiency improvements (consuming less energy for the same services) and increased renewable energy use (resulting in lower GHG emissions), curbing the demand for services without negatively affecting the well-being of consumers can contribute significantly to reaching sustainability goals. The term 'sufficient' means 'as much as you need'[1] or 'the quality of being good enough'[2]**.** In the context of energy consumption, **'sufficiency'** has varying definitions used in different disciplines, but mostly it is related to **consumption levels which do not endanger the carrying capacity of the Earth, requiring change in consumer behaviour** (Samadi et al. 2016, Förster et al. 2019, Spangenberg and Lorek, 2019).

Relatively low living standards might be associated with positive patterns of consumer behaviour in some energy consumption areas (e.g. higher reliance on public transportation, extended time of appliance use). Sustaining those practices at higher levels of consumer satisfaction could help avoid unfavourable developments (e.g. moving towards individual transport modes). The achievement of decarbonisation goals could be easier and faster and perhaps less costly if policies aiming to maintain and to widen sufficiency-oriented lifestyles could be applied effectively.

In Hungary, the energy consumption of households, although gradually increasing, is still below the EU average. On the other hand, there is also evidence for consumer habits leading to excessive energy use. Bearing the sustainability goals in mind, policies could be formulated to reverse the trend of these unsustainable practices.

The CACTUS project aims to support the integration of energy sufficiency in national scenarios and policies for two Central Eastern European (CEE) countries based on mitigation potential assessed by bottom-up modelling in the sectors of buildings and transportation. **This analytical brief explores the national context of energy sufficiency in these two sectors to identify sufficiency potential, review regulatory and socio-cultural barriers and enablers, and offer policy recommendations to reach more ambitious goals.** The analysis was supported by the elaboration of a dashboard, incorporating the present and projected 2030 values of some key indicators related to energy consumption, energy production and GHG emissions.

The first section provides some basic country-level data with a short overview of the energy sector. The second section addresses the status and developments of energy use in household and service building sectors, the related strategic goals of the government, and the regulatory and socio-cultural factors influencing the exploitation of sufficiency potentials. The third section assesses the energy use patterns in the passenger and freight transport segments in Hungary, highlighting policies that could encourage sufficiency, and examining the regulatory and social and cultural factors driving or hindering development. The last section draws conclusions.

[1] Oxford Advanced Learner's Dictionary, oxfordlearnersdictionaries.com/definition/english/sufficient?q=sufficient

[2] Cambridge Dictionary, dictionary.cambridge.org/dictionary/english/sufficiency

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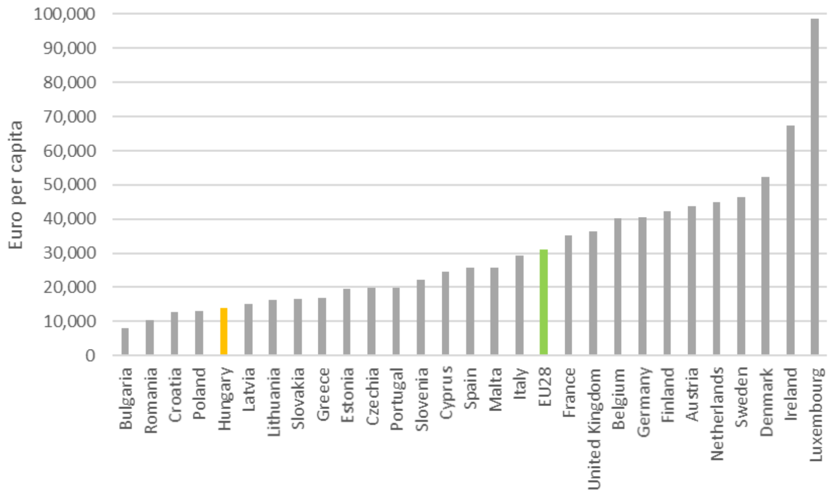
1. General information and overview of the energy sector

This section provides some general information on the Hungarian economy and a brief summary of the energy sector including strategic goals outlined in the National Energy and Climate Plan.

1.1. General information on Hungary

Hungary is a Central European country, situated in the Carpathian Basin sharing borders with Slovakia, Ukraine, Romania, Serbia, Croatia, Slovenia and Austria. Its territory is 93030 km^2. The population has fallen slightly from 10 million in 2005 to 9.8 million in 2019. The NECP projects a further decrease in population, falling to 9.17 million by 2030 (see the Annex). As Figure 1 shows, **Hungary has the fifth lowest per capita GDP in the EU (EUR 13,910), less than half of the EU average (EUR 31,030) expressed in current prices.**

Figure 1: GDP per capita in the EU countries, 2018, at current prices

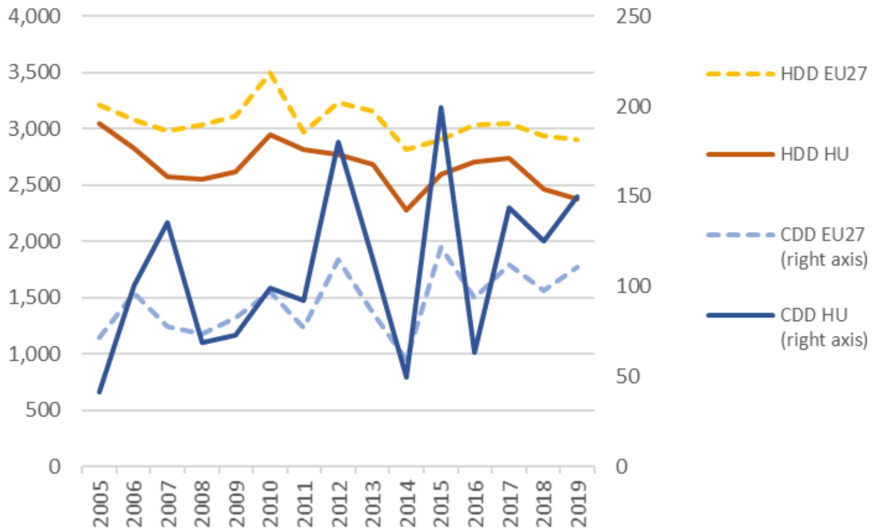


Source of data: Eurostat

The level of average annual net earnings expressed in PPS is the 6th lowest in the EU, reaching around 57% of the EU average.

Hungary has a temperate continental climate. As shown in Figure 2, since 2005 the heating degree days (HDD) varied between 3,042 (2005) and 2,278 (2014) , while the cooling degree days (CDD) had the lowest value of 41.63 in 2005, peaking at 199.47 in 2015.[3] **Although the heating and cooling demand is slightly lower than the EU average,** they have higher variability than the smoother EU27 average values, which in general show **higher (and slowly decreasing) heating and growing cooling demand.**

Figure 2: Heating degree days (HDD) and cooling degree days (CDD) in Hungary and in the EU, 2005-2019



Source of data: Eurostat

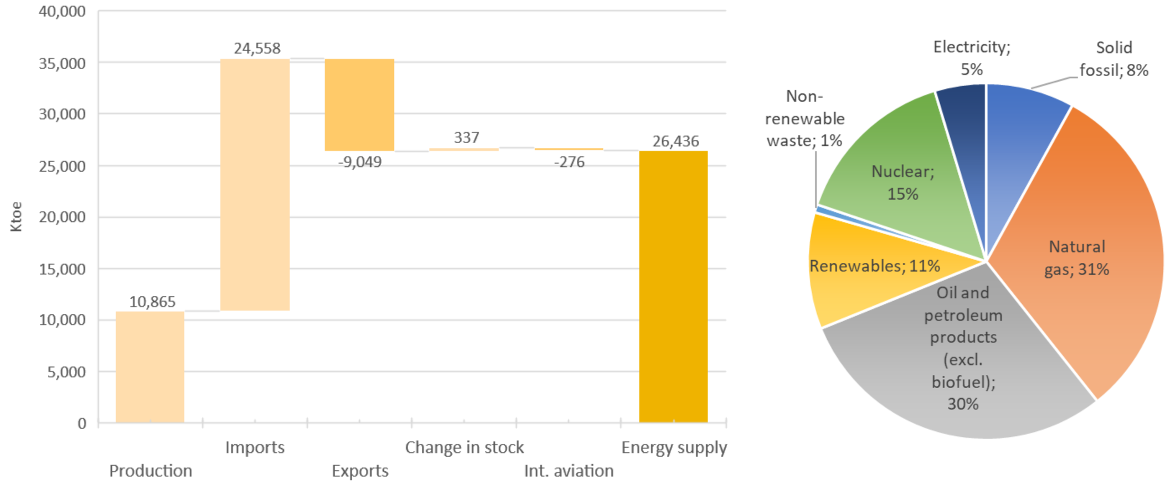
1.2. Overview of the energy sector in Hungary

The primary energy production of Hungary amounted to 10.9 Mtoe in 2018, 37% of which was nuclear energy, followed by renewables (28%) and natural gas (14%). Lignite accounted for 11%, while oil and petroleum products made up 10%.

As Figure 3 shows, energy imports were more than double of exports, a large share of which was reexported oil and natural gas. Imports account **for nearly 60% of domestic demand.** Net imports are composed mainly of oil and petroleum products (45%) and natural gas (42%).

[3] Heating Degree Days (HDD) and Cooling Degree Days (CDD) indices are used as a measure of the intensity of cold and heat in a given location, based on the difference between selected room temperatures and outside temperatures taking into account the days with higher or lower temperatures compared to selected base values (15°C in case of HDD and 24°C in case of CDD). Eurostat uses the following calculation method for statistical purposes: HDD - If $T_m \leq 15°C$ Then [HDD = $\sum_i(18°C - T^i_m)$] Else [HDD = 0] ; CDD - if Tm ≥ 24°C Then [CDD = ∑iTim - 21°C)] Else [CDD = 0]. (T^i_m denotes the daily mean temperature.) Source: https://ec.europa.eu/eurostat/cache/metadata/en/nrg_chdd_esms.htm

Figure 3: Energy supply and fuel composition, 2018



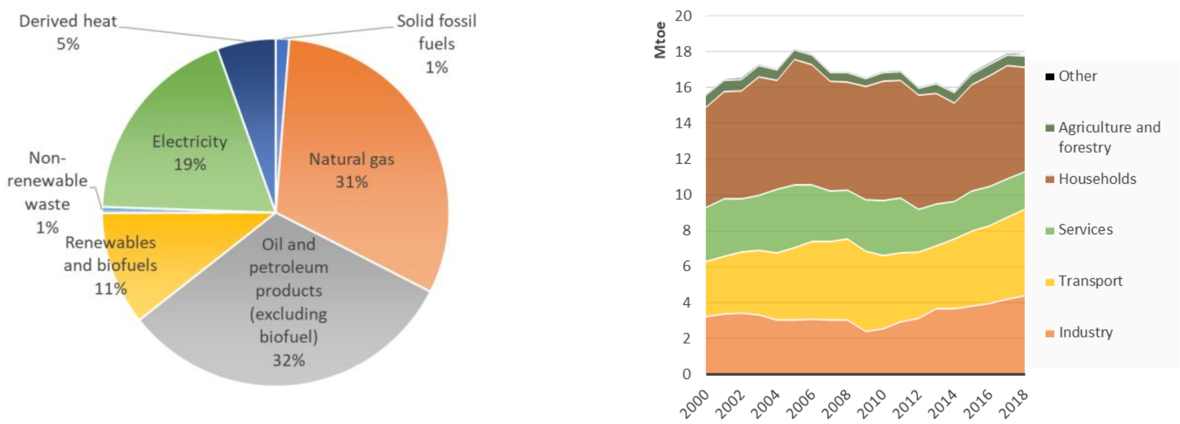
Source of data: Eurostat

The total energy supply was 26.4 Mtoe in 2018, 31% of which was natural gas and another 30% oil. Nuclear maintains a dominant role in electricity generation, making up 15% of primary supply, while renewable products account for 11%, over half of which is attributable to household biomass for heating (Eurostat, 2019). Coal supplies 8%.

Final energy consumption was 17.9 Mtoe in 2018 broken into energy sources in Figure 4. The share of natural gas and petroleum products is the highest **in households and the transport sector, respectively.** Industry used almost half of the electricity in 2018, followed by the household and services sectors. Renewables and biofuels make up 11% of total final consumption.

Nuclear energy accounts for about half of Hungary's electricity mix followed by natural gas (23%), coal (15%) and renewables (12%). In 2018, 69% of the demand was sourced domestically and 31% came from imports.

Figure 4: Composition of final energy use by fuel (2018) and by sector in Hungary (2000-2018)



urce of data: Eurostat

Two important trends are visible in final energy use. **The amount and corresponding share of the transport sector has been rising since 2000**, except for a drop in 2009 due to the economic crisis. Its share in total final consumption increased from 20% in 2000 to 27% in 2018. While energy consumption fell in the services sector, **households did not achieve considerable energy savings over the period. The energy use of the industry sector has also been rising since 2009, driven by the economic recovery.**

1.3. The main sector-relevant targets and measures focusing on energy demand

Hungary will most likely reach its 2020 renewable energy target of 13% with the share already at 12.61% by the end of 2019 (Shares database, 2019). Renewable electricity auctions and subsequent RES-E investments will contribute to meeting the 2030 RES-E targets. **Hungary will also comply with its greenhouse gas (GHG) mitigation target** for sectors outside of the Emission Trading Scheme, managing a 5.4% reduction while the Effort Sharing Decision[4] allowed a 10% increase (Eurostat)**). For the targeted 9% fall compared to 2005,** primary energy consumption was 7% lower than the projected 2020 level at the end of 2018, however**, the gap between the targeted and achieved final energy consumption reduction by 2018 compared to 2005 was considerable: 1% versus 23%.** [5] Although the actual 2020 numbers will be strongly shaped by the effects of the pandemic, more effort has to be made to ensure that the energy consumption levels are put on the right path to reach decarbonisation goals (Eurostat).

Based on the Energy Strategy and National Energy and Climate Plan (NECP), one of the most important energy policy goals of Hungary is to decarbonise energy production and strengthen energy sovereignty through the combined use of renewable and nuclear energy. Coal-based electricity production is to be phased out by 2030. **Another important goal emphasized in the NECP is to maintain the government policy of 'utility rate cut'**. This regulation is related to the end user energy prices for household consumers and small businesses supplied under universal service provision, keeping the utility rates at a near constant level after a phased 20% reduction compared to pre-2013 levels.

The main national objectives for 2030 presented in the NECP are the following:

- 40% reduction in greenhouse gas (GHG) emissions - corresponding to the EU target at the time of drafting the plan,
- minimum 7% reduction of non-ETS emissions - in line with the Effort Sharing Regulation,
- maximum 785 PJ (18.7 Mtoe) final energy consumption in 2030 (equal to the 2005 consumption level) – stating that industry and transport consumption should not be limited in case of economic growth,
- minimum 21% renewable energy share in gross final energy consumption.

Besides these goals, the Hungarian government also aims to reduce energy import dependency and reach the average final energy intensity level of the EU.

The energy efficiency goal allows a slight increase in final energy consumption by 2030 compared to the present values, also indicated by the comparative dashboard in the Annex.

[4] Effort Sharing Decision, No 406/2009/EC.

[5] These values correspond to the 20% national reduction targets set against the business-as-usual projected energy use for 2020. Source: NEEAP of Hungary, 2015, https://ec.europa.eu/energy/sites/ener/files/documents/hungaryActionPlan2014_en.pdf.

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2. The building sector – trends, potentials, and strategies

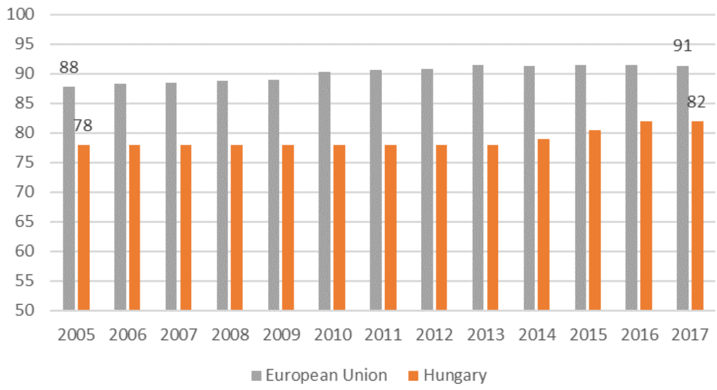
2.1. Households

Hungary's household sector is responsible for 32.6% of the final energy consumption and 12% of the GHG emissions[6].

2.1.1. Average floor area and the size of households

The average floor area of dwellings in Hungary is 82 m^2, approximately 10% lower than the Europe-wide average (91 m^2). Both are rising moderately as shown in Figure 5, but no significant convergence of the Hungarian value is yet visible.

Figure 5: Floor area of dwellings (m^2 average)



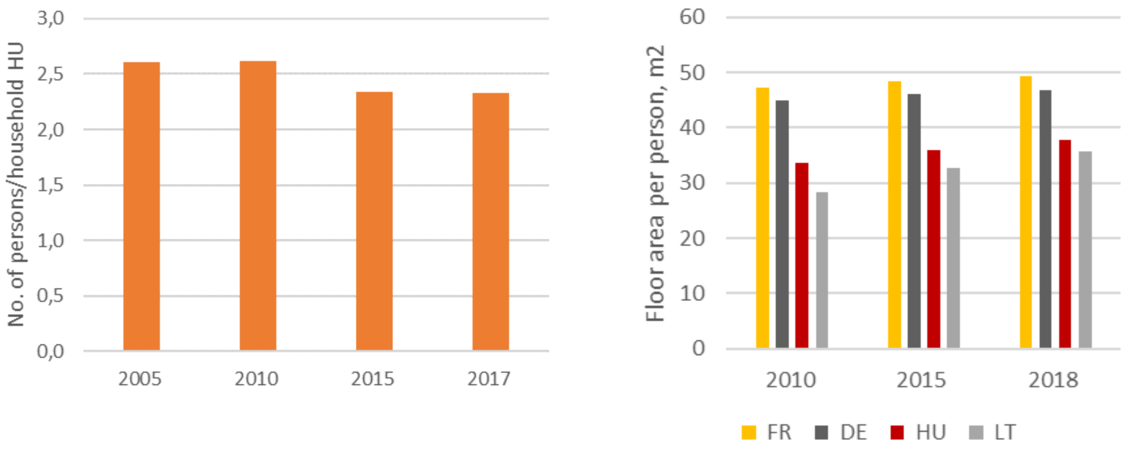
Source: Odyssee-Mure Database

A significant drop in the average household size is shown in Figure 6. **The NECP envisages a further decline in the size of households to 2.23 by 2030** (see the Annex). The trend is similar across the EU28 countries, falling from 2.40 to 2.31 between 2010-2017. **Floor area per capita is expanding continuously in Hungary,**

[6] Compared to total GHG emissions excluding LULUCF and including international aviation.

with a significant (15%) increase observable over the last 12 years. This could result in growing energy needs per person unless counterbalanced by energy efficiency measures. Compared to the other countries participating in the project, the per capita floor area in Lithuania and Hungary are below the values of France and Germany but are growing at a higher rate.[7]

Figure 6: Average household size and floor area per person

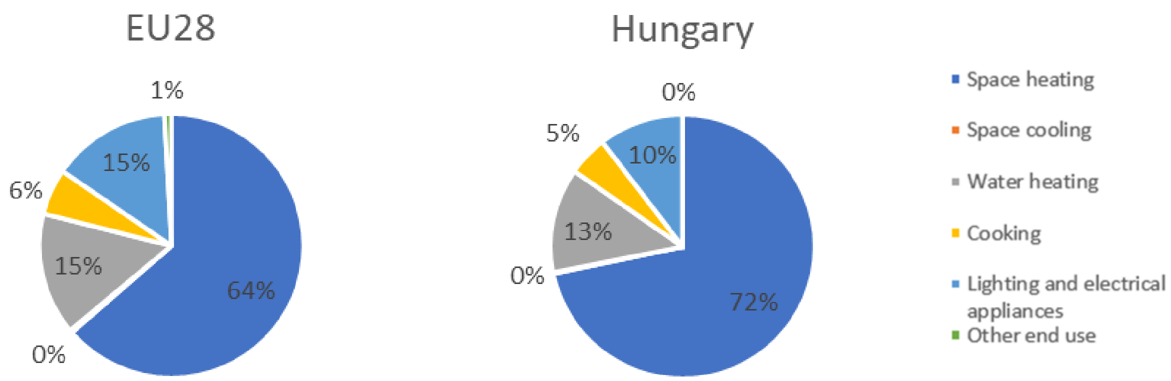


Source of data: Central Statistics Office Hungary, Odyssee-Mure Database

2.1.2. Final energy consumption by end use and by fuel

Hungary's household energy consumed for space heating is significantly higher (72%) compared to EU28 (64%) (Eurostat).

Figure 7: Final energy consumption by end use, 2018

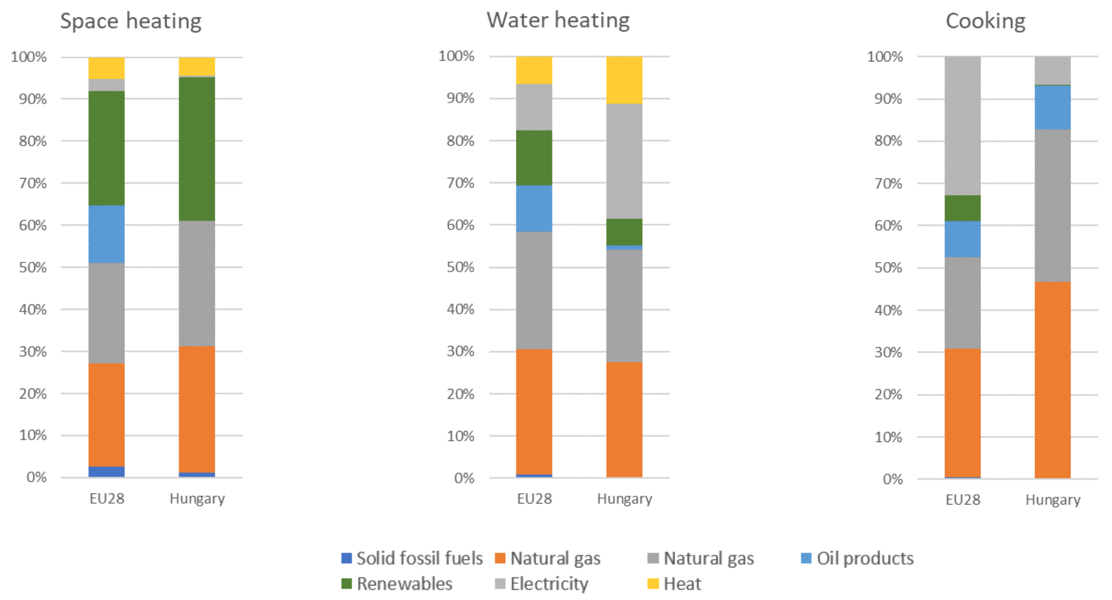


Source of data: Eurostat

[7] Values are computed using average dwelling size, number of dwellings and population data from the Odyssee database. Data on the number of dwellings was not available for the EU.

Based on the composition of household energy use by fuel[8], space heating in Hungary mostly relies on two sources - natural gas and renewables. The share of solid fossil fuels and oil products are negligible compared to the EU28 average (Figure 8).

Figure 8: Final energy consumption by end use and by fuel, 2018



Source of data: Eurostat

The large contribution of solid biomass to heating is attributable to biomass (wood) used in conventional stoves, especially in non-urban areas. This constitutes a significant proportion of renewable energy counted towards renewable energy targets, raising several concerns: **besides its harmful environmental and health effects, the large volume of total biomass use in the economy leads to sustainability concerns (Bartek-Lesi et al., 2019)**

As regards water heating, the most important difference compared to the EU average is that Hungarian water boilers are highly electrified. On the other hand, the most widely used cooking appliances use natural gas.

2.1.3. Per capita energy consumption and household characteristics

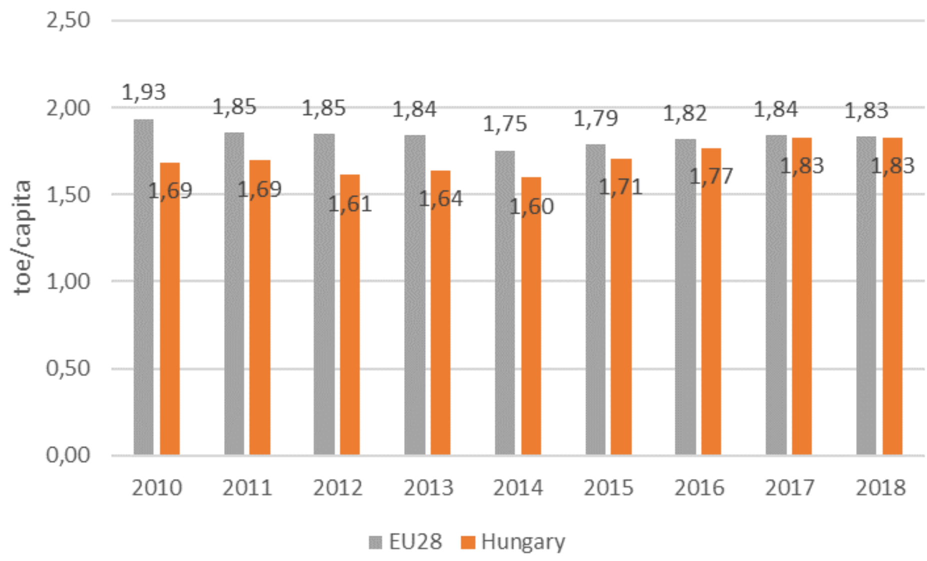
Like several EU countries, Hungary revised its solid biomass accounting system in the residential sector in 2017, switching from the earlier method of calculating biomass consumption based on supply side data (firewood sales) to a new methodology using demand side data gained from representative household surveys on fuels used for heating. Since the recalculation revised the statistics back to 2011, there is a sharp increase from 2010 to 2011, where the value jumped from 30.3 PJ to 76.2 PJ (Bartek-Lesi et al., 2019), rendering longer term evaluations impossible. However, interesting trends have emerged over the decade

[8] Lighting and electrical appliances are not presented as these end uses are fully based on electricity.

since. While **the per capita energy consumption in the EU28 has fallen slightly in 2018 compared to 2010, the opposite can be observed in Hungary** (Figure 9)[9].

Hungary's stagnant and falling energy consumption trend in the first half of the 2010's reversed to growth in the latter half. This might be explained by the introduction of the 'utility rate cut' policy of the government, which reduced prices by about 20% in three consecutive waves. This price regulation serves as a flagship policy of the government, considered to be the main tool for fighting energy poverty, though it benefits all consumers. Szép and Weiner (2020) examined the effect of this policy, finding it indeed led to higher consumption from 2013.

Figure 9: Energy consumption per capita

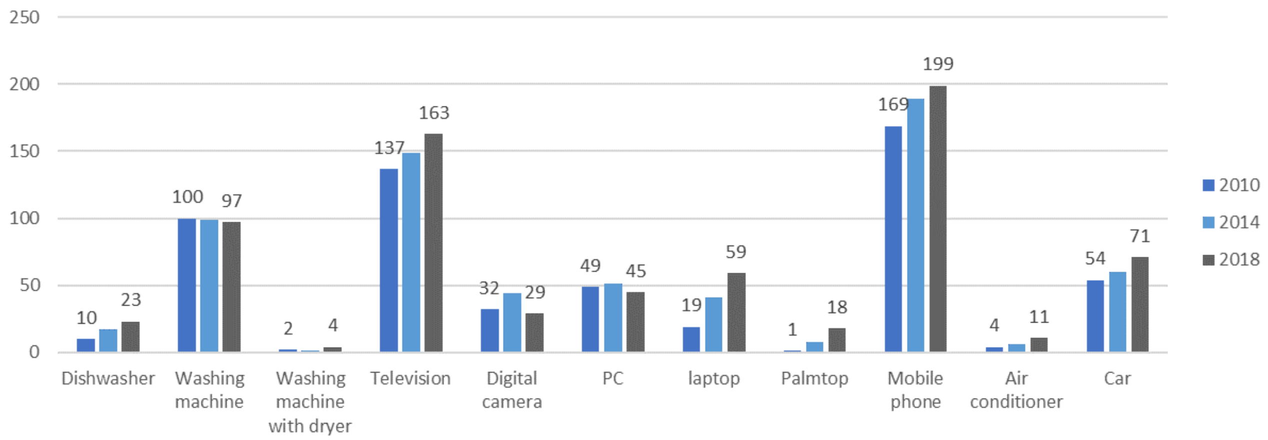


Source of data: Eurostat

Electricity for lighting and appliances is a small but growing part of energy consumption in Hungary, showing 8% growth between 2015 and 2018 though more detailed data is unavailable (Eurostat). Figure 10 shows the change in the number of electrical appliances since 2010. Among the trends, personal computers are replaced by laptops and tablets, growing at a faster rate than PCs are declining, meaning higher **levels of electronic device use. The number of air conditioners and dishwashers were minimal in 2010, but by 2018 can be found in every 4th or 5th household. Two televisions per household is becoming the norm.**

[9] The very low levels of per capita energy consumption for 2014 can be considered as outliers due to a record warm winter that year, see https://earthobservatory.nasa.gov/images/83371/some-perspective-on-winter-2014

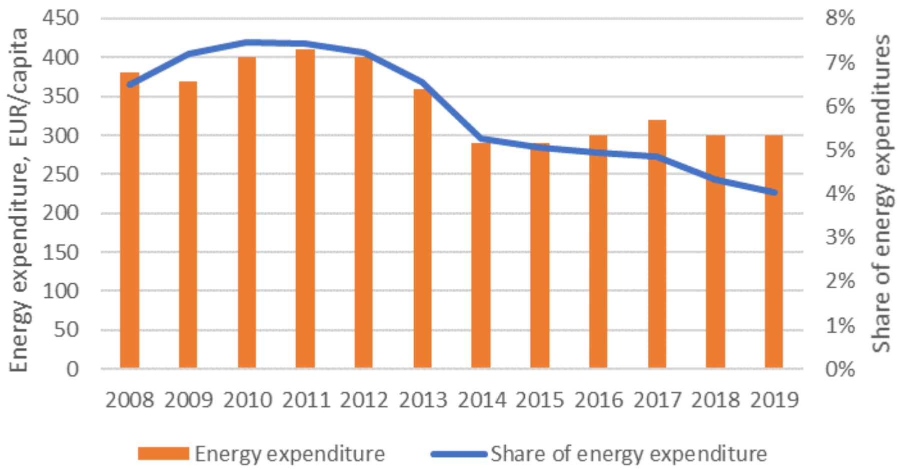
Figure 10. Number of appliances per 100 households



Source: Central Statistical Office of Hungary

Figure 11 presents the value of households' energy-related expenditures (including electricity, natural gas and other fuels) and its share of their overall spending. **The impact of the utility rate cut is clearly visible, here, as energy expenditures fell by 38% between 2012 and 2014.**

Figure 11. Energy expenditure and its share in total consumption expenditure



Source of data: Eurostat

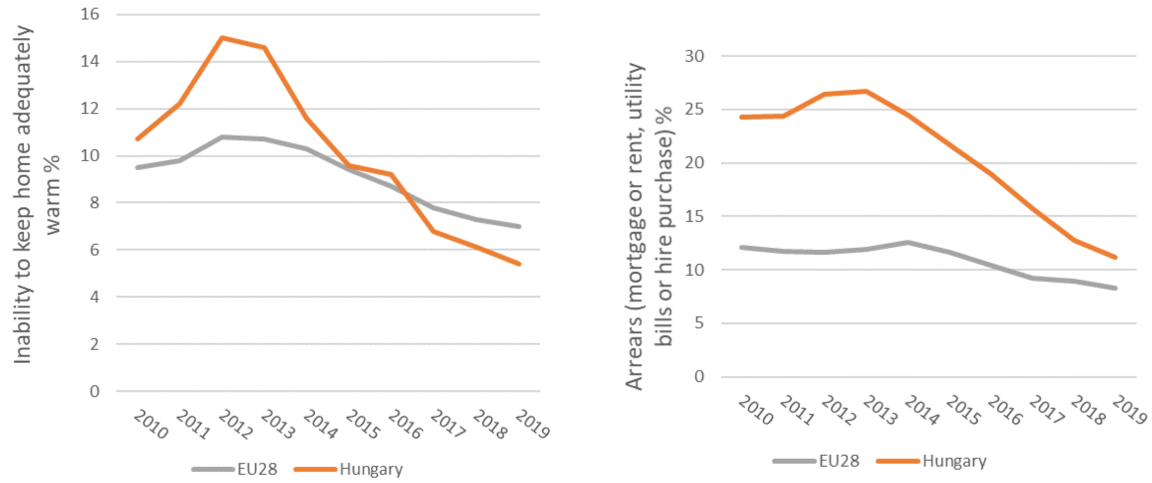
Energy related spending is also influenced by improvements in energy efficiency. However, according to the NECP, **building renovations carried out in Hungary are mostly partial renovations, while complex renovations are rarely executed.** According to the results of a survey referenced in the NECP, 41% of households participated in efficiency investments over the last 5 years: 6-7% towards replacing windows, 42% towards thermal insulation and 31 % to replace boilers.

2.1.4. Indicators of energy poverty

End user price regulation has downside effects for energy consumption practices and the motivation of households to invest in energy efficiency and engage in energy sufficiency. On the other hand, Hungary has made a significant progress in the improvement of some energy poverty indicators.

As shown in Figure 12, the share of households unable to keep their homes adequately warm and with arrears on utility bills has fallen in Hungary and the EU, though more dramatically in Hungary. Still, Hungary's NECP estimates that **35-42% of dwellings are underheated**. The calculation of heating deficiency ratio is based on the theoretical heating energy requirement and the actual consumed energy. This ratio would fall by 0.27 % with 1 % growth in GDP, according to the estimation.

Figure 12: Indicators of energy poverty



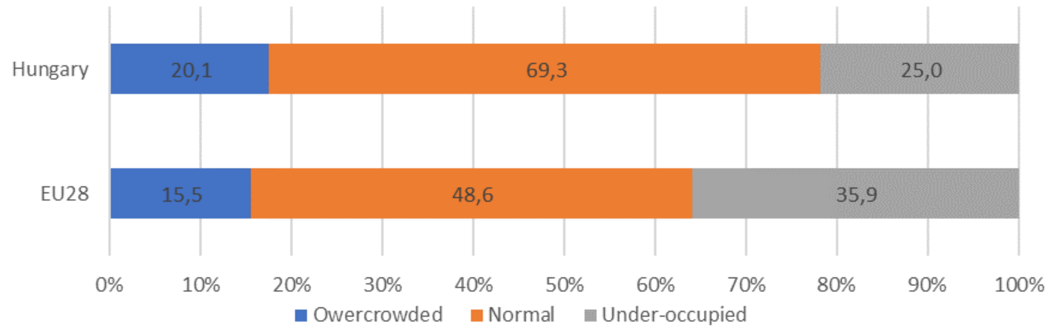
Source: EUROSTAT - EU-SILC survey

Underheating takes several forms, from setting a lower general temperature in the dwelling to heating only those rooms that are constantly in use. Although this practice can result in substantial energy savings, it might also cause depreciation (e.g. if moulding occurs due to humidity problems).

Figure 13 presents indicators related to housing occupancy. An overcrowded dwelling does not have enough rooms relative to the number of occupants, while under-occupied dwellings have excess rooms which more than meet the needs of the household. The first situation is associated with poverty and the second with unnecessary or wasteful energy consumption. Under-occupied dwellings can also be associated with the inability or unwillingness of older inhabitants to resettle to a smaller dwelling once their children grow up and move out.

As the charts show, **the share of overcrowded dwellings is higher and that of under-occupied dwellings is significantly lower than the average in the EU28**. This implies that the overall floor area of household buildings is better utilized in Hungary, albeit there is a need for tackling the problem of overcrowding stemming from poverty.

Figure 13. Share of overcrowded and under-occupied dwellings, 2018



Source: EUROSTAT - EU-SILC survey

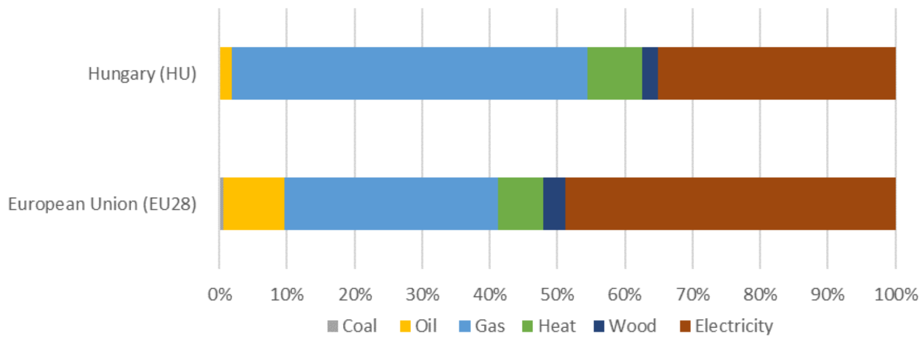
2.2. The tertiary sector

The tertiary sector contributes 11.8% to Hungary's final energy consumption and is responsible for 4.5% of greenhouse gas emissions (Eurostat).[10]

2.2.1. Final energy consumption by fuel

Figure 14 presents the composition of energy use in the tertiary sector by fuel, where only one third of total final energy consumption is covered by electricity, while in the EU it is nearly half. Natural gas accounts for more than half of the sector's energy consumption.

Figure 14. Energy consumption in the tertiary sector by fuel, Hungary and EU28, 2018



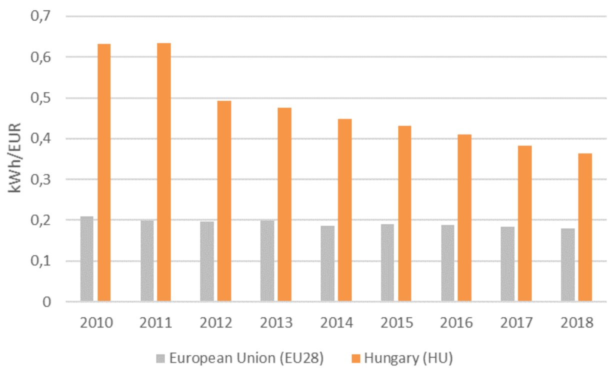
Source: Odyssee-Mure Database

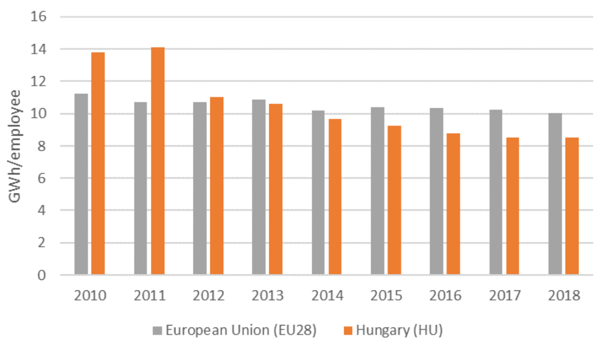
[10] The total value includes international aviation and excludes LULUCF.

2.2.2. Energy consumption per value added and per employee

Figure 15 compares the energy intensity (per value added energy consumption) of the tertiary sectors in Hungary and the EU. **One euro of value added requires significantly more energy in Hungary, and although the gap is narrowing,** in 2018, the Hungarian energy intensity was still almost twice as high as the EU average.

Figure 15. Final energy consumption per GVA and per employee in the services sector, Hungary and EU28, 2010-2018





Source: Odyssee-Mure Database

The per employee figures, however, show a different picture. This value has also declined in the period, leading to lower values for Hungary than the EU from 2013. However, this also suggests that the Hungarian services sector is more labour intensive. Of course, the value of both indicators depends largely on the types of services and activities constituting the tertiary sector.

2.3. Strategic energy and climate policy goals related to the building sector

This subchapter summarizes the priorities of national strategic documents related to the buildings sector. It includes the objectives and measures set out in the National Energy and Climate Plan (2020), National Energy Strategy (NES) (2020)[11] and the National Building Energy Strategy (2015). Firstly, it is important to note, that the goals stated in these strategies are not always linked to specific measures. Secondly, the strategies have several overlapping points that build upon each other. Finally, the most relevant document, the Buildings Energy Strategy, is outdated and the content does not necessarily reflect the latest strategic directions.

[11] Hungary updated its Energy Strategy 2030 from 2012 in 2020, in parallel with establishing its National Energy and Climate Plan to better align the development of the energy sector with climate ambitions. The NECP and NES are based on harmonized modelling (Hungarian Times model).

Article 2a of the Energy Performance of Buildings Directive (EPBD) prescribes that all EU countries must establish a **long-term renovation strategy** to support the renovation of national buildings into highly energy efficient and decarbonised building stock by 2050. The strategy must include an overview of the national building stock and outline national initiatives to promote the spread of smart solutions and energy-efficiency related education. It must also elaborate the policies and measures for facilitating the cost-effective deep renovation of buildings targeting least efficient buildings first. As **the strategy is currently under preparation**, it is not covered in this brief.

The National Energy and Climate Plan of Hungary (2020) envisages that municipal district heating systems (with supplied heat over 100 000 GJ per year) in the medium term, and district heating service in the long term will fall within the category of 'efficient district heating/district cooling', reducing the energy consumption of buildings and GHG emissions. **It identifies the largest potential for energy savings in the modernisation of residential buildings and heating systems, where** energy efficiency improvements and transition to alternative heating methods can replace 1/4 of natural gas imports. Modernisation projects in the retail sector are planned to be implemented by the introduction of ESCO financing schemes through energy efficiency obligations for energy distributors and/or retail energy trade undertakings to introduce programmes and implement measures resulting in documented energy savings for final customers.

The annual deep renovation rate of 3% floor area for central government buildings is also included within the strategic objectives outlined in the NECP in line with the provisions of the Energy Efficiency Directive. The **NECP envisages more stringent legal obligations to exploit the energy saving potential in the operation of public buildings** and the development of a personal incentive scheme for operators of public bodies. It highlights the need for the clarification of rules for implementing the proposals of energy auditors and consultants for public buildings.

The National Network of Energy Engineers is to be strengthened to provide support for the energy efficient operation of public bodies and households. In the future, it will be mandatory to list the contact information of the closest network consulting point in building performance certificates.

The NECP includes the following measures in the sector:

- Awareness raising programs to support energy efficiency measures.
- Energy Efficiency Innovation Programme for development and dissemination of building automation, building supervision and control systems.
- Building Energetics Tender Program with 1.1 million EUR/year budget targeting the promotion of RES fuels, energy efficiency actions, public awareness raising of climate policies, the green economy, energy literacy and the construction of low energy buildings.
- Supporting investments in the residential sector with funds from the Hungarian Development Bank through credits offered to private persons, apartment blocks and housing co-operatives, subject to a minimum 10% own contribution. The energy efficiency measures include insulation of heating systems, the replacement of doors/windows, and the installation of renewable sources of energy (PV panels, solar thermal collectors, heat pumps and modern wood gasification equipment).
- Hungary will encourage the use of heat pumps and the burning of biomass in efficient individual heating equipment to satisfy the heating and cooling needs of modern buildings.

The NECP strongly builds on the content of the **National Energy Strategy** (NES, 2020). The NES, however, articulates some additional goals not mentioned in the NECP:

- Approximately 2/3 of the Hungarian building stock needs to be modernized, 12% of which is in sub-scale condition, meaning the renovation is not economically viable.

- Various studies estimate the annual energy savings potential to be 110-130 PJ with about **60% of the savings identified for buildings.**
- Increasing the proportion of decarbonised, near-zero energy residential buildings to 33% by 2030 from 0% in 2017.
- Measures in the district heating sector: improvement of controllability; smart cost sharing, harmonization of seconder (renovation) and primer (system deployment) developments.
- Introduction of **low-temperature heating networks** in the efficient building stock, helping to utilize **geothermal energy in district heating,** reduce network losses and primary energy needs, while connecting new customers to the network.
- For individual residential heating/cooling: increasing the share of energy-efficient, renewable solutions.
- **Implement awareness-raising programs** to encourage sustainable energy using practices.

The National Building Energy Strategy (NBES) was prepared in 2015, therefore some of its goals are not relevant anymore. Nevertheless, it is the most specific strategic document, and thus, it names several objectives related to the energy efficiency objectives in the building sector, which support general national economic interests like job creation and reducing budgetary expenditures. The strategy targets the reduction of energy poverty through renovation and states that high energy savings can be obtained in new, highly efficient buildings, through renovation of old buildings supplemented by increasing efficiency in district heating, RES utilization, introduction of energy management systems, and programs to raise awareness and spread information.

2.4. Main drivers and bottlenecks to energy sufficiency

Among the main drivers and bottlenecks affecting possible energy sufficiency improvements, are regulatory measures and behavioural, social, and cultural factors.

2.4.1. Regulatory aspects

As the strategic documents show, Hungary targets efficiency improvements in the buildings sector to reduce energy consumption for current and expected energy needs. The other approach is the expansion of new district heating systems and renovation of existing networks. The NECP projects 0.4 Mtoe decrease in the residential final energy consumption by 2030 compared to 2017 (see the Annex).

However, **goals or measures targeting the reduction of the specific demand itself is absent**. What is more, **utility price regulation pushes in the opposite direction by de-incentivizing energy-conscious consumption**.

2.4.2. Behavioural, social, and cultural factors

Behavioural patterns and routines are shaped by cultural factors and social norms (Shove, 2010). Each country's residents have their own specific characteristics which influence their attitude towards energy consumption. These endowments must be taken into account when policies and measures are created and evaluated.

According to a household survey carried out in 2018 across five EU countries**, around 65% percent of Hungarian households heat their rooms to temperatures above 22 °C and 24% above 24 °C**, irrespective of whether it is possible to control temperature in their homes (Csutora et al., 2018). Although subjectively assessed by respondents, this is a high share compared to other countries and suggests that **overconsumption of heating energy is a common phenomenon in Hungary**.

According to the same survey, only 14% of Hungarian households would like to receive feedback on their consumption level compared to previous periods or other similar households compared to 40% in the other countries. Furthermore, 22% would like targeted advice on energy saving options compared to 44-78% in the other four countries.

Regulated prices only reaffirm these behavioural patterns: the perceived low price level and the strong communication support accompanying the policy make potential savings from lower energy consumption seem less beneficial than the discomfort it may take.

2.5. Possible improvements in the building sector

Historic data on energy consumption reveals that household energy efficiency measures have not resulted in notable energy savings in Hungary. As the summarized strategic documents show, measures outlined for energy efficiency improvements are in force, but energy sufficiency has not appeared on the policy agenda.

This analysis shows that the change in some sufficiency-related indicators may lead to increasing energy consumption:

- The average floor area of dwellings and the floor area per person are increasing. The demographic changes behind these trends, such as the falling average household size and rising number of households, are very difficult to influence with policies. Further expansion of per capita floor area is also expected with more wealth accumulation, partially resulting from improvements in the living conditions of deprived households living in overcrowded dwellings. However, increasing the floor area over sufficient levels can be avoided by well-targeted policies. The modelling performed within the CACTUS project evaluates the policy effects on overall energy consumption based on various assumptions for sufficient average floor area values.
- Space heating energy use makes up 72% of final residential energy consumption in Hungary, about a third of which comes from biomass burned in conventional stoves. This mode of heating is outdated, uncomfortable, and the fuel is often mixed with materials having very harmful environmental effects. Increasing household affluence can push transition to more sustainable heating modes, such as natural gas or heat pumps, which will increase accounted GHG emissions unless biomass accounting is revised at the EU level. Model calculations can explore the effects of switching to different heating fuels and provide insights for policy makers on which should be supported.
- The per capita energy consumption in Hungary reached parity with the EU average over the last three years. One explanation is the utility rate cut which reduces incentive for energy-savings. The effect of policies restoring this incentive and measures targeting sufficient levels of heating temperatures in homes can be evaluated through the modelling.
- A positive impact of the utility rate cut policy is the improvement of energy poverty indicators. The share of households unable to keep their homes adequately warm has dropped below the EU level while households with arrears on utility bills is also down, though still above the EU average. On the other hand, according to the Hungarian NECP, 35-42% of dwellings remain underheated. Replacing the blunt price regulation with targeted measures aiming to increase access sufficient energy services

could help restore more conscious energy consumption and provide stronger incentives to save energy and make energy efficiency investments. The question to be explored within the project is the extent to which sufficiency and efficiency improvements from restored energy awareness of the population can counterbalance the rebound effect of better conditions for energy poor households.

- Besides energy poverty, the high underheating ratio can also result from the low mobility rate of Hungarian households. Older people, especially in the countryside, are often living in large houses built for more generations, while younger people prefer having their own dwellings. The unfavourable distribution of dwellings can also be reinforced by the fact that Hungarians tend to own the dwellings they live in. Encouraging the mobility of households could result in a certain rearrangement of under and over-occupied buildings, the effect of which can be investigated under various assumptions.
- The modelling could also help assess the possible effects on overall energy use of maintaining a certain number of household appliances per households or per capita.

As opposed to the household sector, employees of companies in the tertiary sector have a less direct effect on overall energy consumption. Improvements are delivered at the organisational level due to energy cost saving considerations. However, economic growth, the development of individual businesses, and the objective of providing more comfort for employees and customers can result in larger service floor areas and more energy use. According to the projections of the WAM scenario in Hungarian NECP the final consumption of the tertiary sector will increase by 0.3 Mtoe between 2017 and 2030 (see the Annex).

The COVID19 pandemic brought about important changes in the sector but the effects can be contrasting. With employees forced to work from home, utilization of office buildings decreased substantially. As a result of restrictions, energy usage in the tertiary sector migrated to the housing sector. It is not possible to draw long term conclusions on how durable this current trend will be after the softening of restrictions but the effect on final energy consumption will depend on the energy efficiency of buildings across these sectors.

3

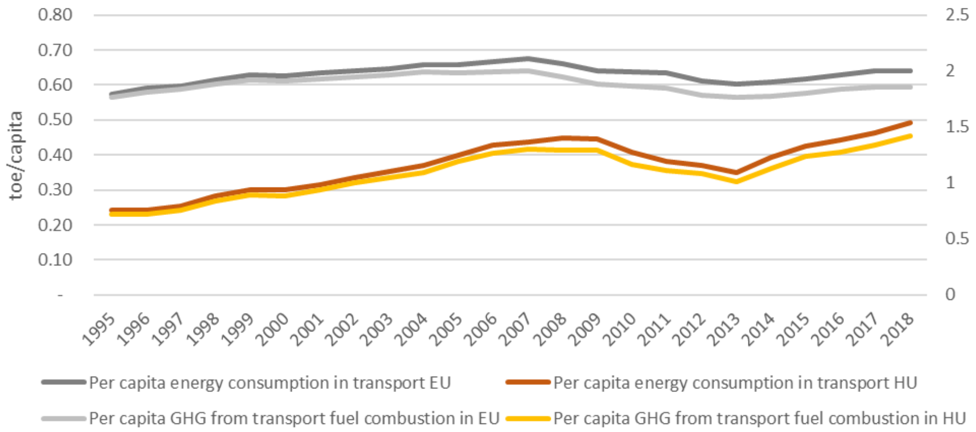
3. The transport sector – trends, potential and strategies

The fossil fuel consumption and GHG emissions of the EU transport sector have been on the rise, contributing some 25% of total emissions. Hungary's transport sector consumed 4.8 Mtoe (201.4 TJ), up 55% from 3.1 Mtoe in 2000, responsible for 27% of final energy consumption and 22% of GHG emissions[12], 98% of which comes from road transportation (Eurostat).

[12] GHG emissions exclude LULUCF and include international transport.

As shown in Figure 16, the per capita energy consumption and greenhouse gas emissions in the Hungarian transport sector are below the EU average but are growing at a faster rate, approaching the EU level. While the per capita energy consumption increased from 0.57 to 0.64 toe/capita in the EU, the **Hungarian per capita consumption more than doubled in the same period,** growing from 0.24 in 1995 to 0.49 toe/capita in 2018. GHG emissions follow a similar trend, though increasing at slower rate due to improved environmental performance of new vehicles replacing old fleets. EU **per capita GHG emissions were flat from 1995 (1.8 tons/capita) to 2018 (1.9 tons/capita), while doubling in Hungary over the same period (0.7 to 1.4 tons/capita).**

Figure 16: Per capita energy consumption and GHG emissions in the transport sector of Hungary and the EU, 1995 - 2018



Source of data: Eurostat

3.1. Passenger transport

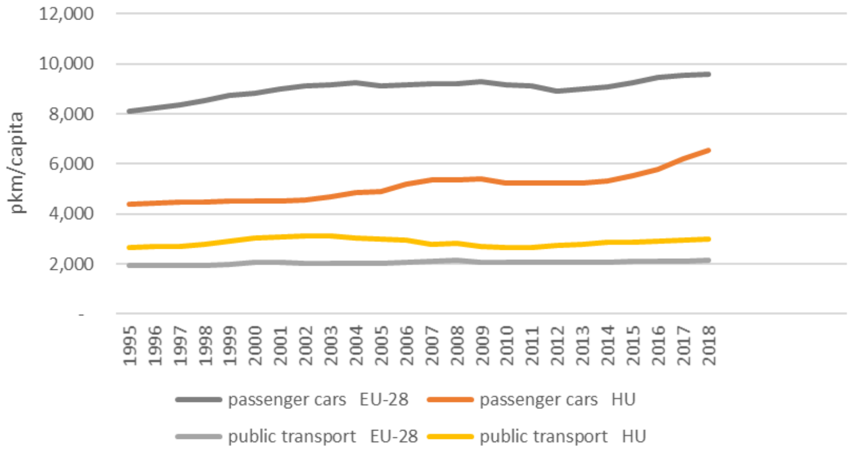
Sustainable transportation systems start with public transportation and non-motorized individual modes (depending on travel distances), while trains and ships require relatively smaller amounts of energy compared to road transport (assuming similar propulsion system and fuel type). This section examines the change in demand for passenger transport, the evolution of car ownership, modal split, and the age of vehicles in passenger transport.

3.1.1. Passenger km per capita

The per capita passenger km values are used to compare the evolution of demand for passenger travel in Hungary and in the EU. From 1995 to 2018, **the demand for total transport increased by 35% in Hungary and 17% in the EU28**, shown in Figure 17. **The majority of this growth stems from use of private cars: in this segment, the per capita passenger kilometres in Hungary were 49% higher than in 1995** compared to 19% in the EU. **Growth in public transport was far slower**, achieving 11% and 13% in the EU28 and Hungary, respectively.

The absolute value of per capita passenger travel was 9,541 pkm/capita in Hungary and 11,726 pkm/capita in the EU. The Hungarian NECP projects rising demand for passenger transport, expecting the per capita performance to reach 12,705 pkm.

Figure 17: Evolution of demand for passenger travel in Hungary and the EU, passenger kilometres per capita, 1995-2018

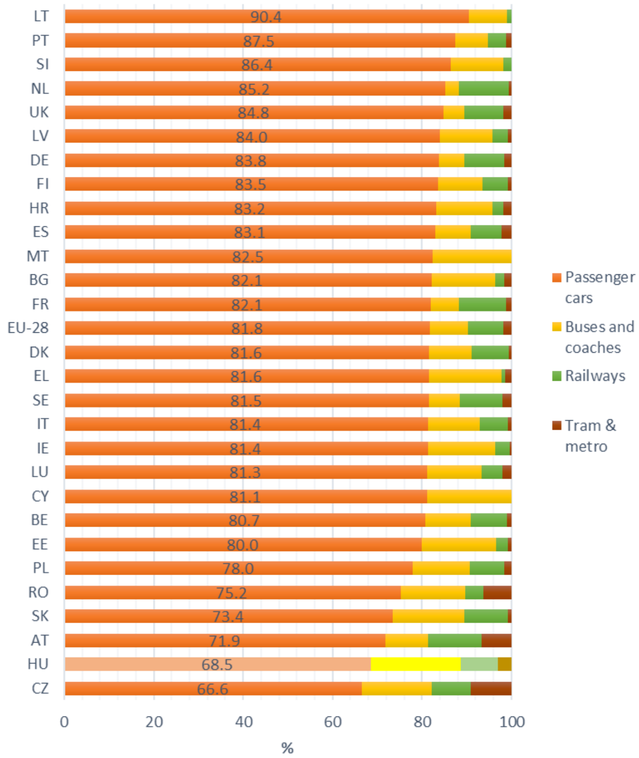


Source of data: EC, DG Move, 2020

3.1.2. Modal split in passenger transport

The modal split in passenger transport refers to the percentage share of transport modes in the total transport volume (expressed in pkm). Figure 18 presents the EU values.

Figure 18: Modal split in the EU countries, 2018



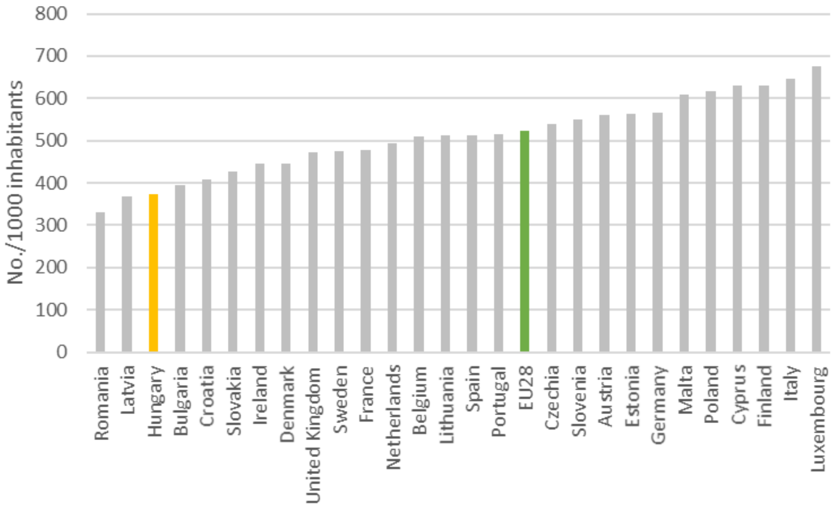
Source of data: EC, DG Move, 2020

Hungary has the second lowest share of individual car use in the EU. However, there is clear **shift towards less sustainable travel modes, with car travel gaining more importance** to the detriment of public transportation. The contribution of passenger cars to total pkm increased from 62% in 2005 to 71% in 2018, while the share of train, metro and trams fell from 13% to 8.6% over the same period.

3.1.3. Passenger cars

Hungary ranks favourably among countries in terms of passenger car ownership, third in the EU with the lowest rate of passenger cars per 1000 inhabitants, as shown in Figure 19. The number of cars per 1000 inhabitants in the EU is 524 compared to 373 in Hungary, but this is up from 232 in 2000.

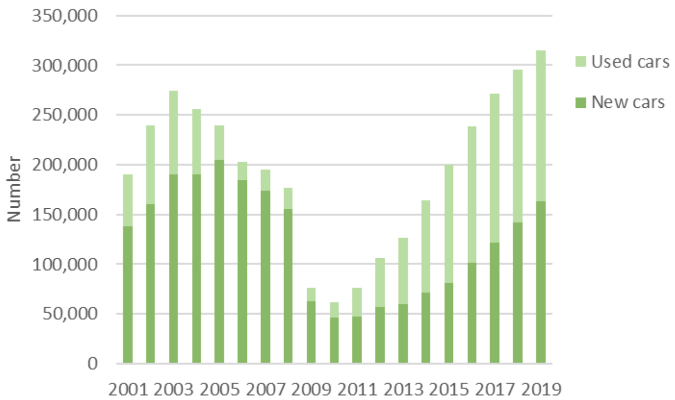
Figure 19: Number of passenger cars per 1000 inhabitants



Source of data: Eurostat

The number of newly registered cars has been steadily rising since 2010, following a period of falling sales after 2003. However, **since the economic crisis the share of used imported cars has been on the rise, making up about 50% of car sales**, as Figure 20 shows.

Figure 20: Share of new vehicles in registered cars in Hungary, 2001 - 2019



Source of data: Hungarian Statistical Office

Although the longer service life of cars could be positive from a sufficiency perspective, older vehicles have negative environmental effects depending on their age and engine type. **The composition of all vehicles by age shows a similar trend.** The proportion of cars over 10 years was declining until 2005, stabilized until 2008, and rose steadily thereafter. This happened despite the growing number of new car registrations, in line with the expansion of used vehicle imports. **The share of cars older than 10 years reached 72% by 2018** (Eurostat).

3.2. Freight transport

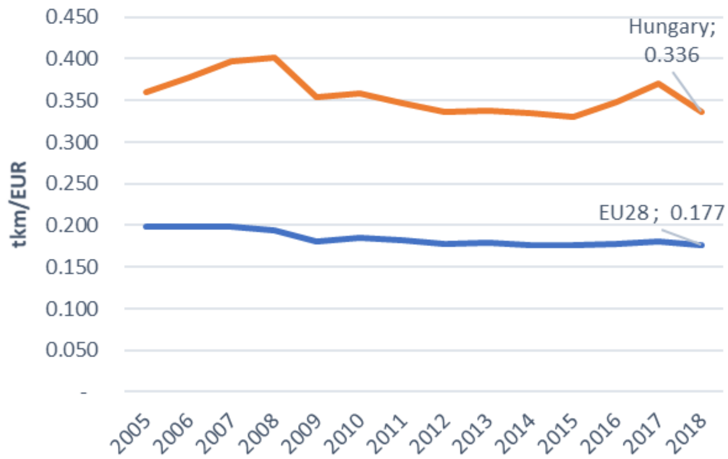
Since freight transport performance has been traditionally correlated with economic development, the decoupling of GDP growth and GHG emissions will have a critical role in transport decarbonisation (see for example Alises et al. 2014 and Sharmina et al. 2020). Measures will need to address the use of more efficient vehicles, renewable fuels, modal shift, and different possibilities of curbing demand. In this subsection we investigate the evolution of freight transport intensity, the modal split of freight transport in Hungary and the EU, and the use of vehicles according to age categories.

3.2.1. Tonne km per GDP

Freight transport intensity measures the tonne-kilometres (tkm) per unit of GDP. The trend shows how successful the economy is in decoupling economic growth from freight transport demand: decreasing values imply that less tonne-kilometres are associated with producing one euro of GDP. The next chart on Figure 21 presents the freight transport intensity of the Hungarian economy in the last 13 years compared to the EU average.

The figure reveals that the freight performance of one euro of GDP fluctuated around 0. 35 tkm, compared to the average EU value dropping below 0.2 tkm. The difference can be explained by several factors, the most important of which is the sectoral composition of the economy. Nevertheless, **while the European average shows signs of decoupling, this is not evident in Hungary**. Hungary's NECP projects a 18% uptick in freight transport intensity between 2017 and 2030 (see the Annex).

Figure 21: Tonne km in freight transport per GDP, Hungary and the EU, 1995 - 2018

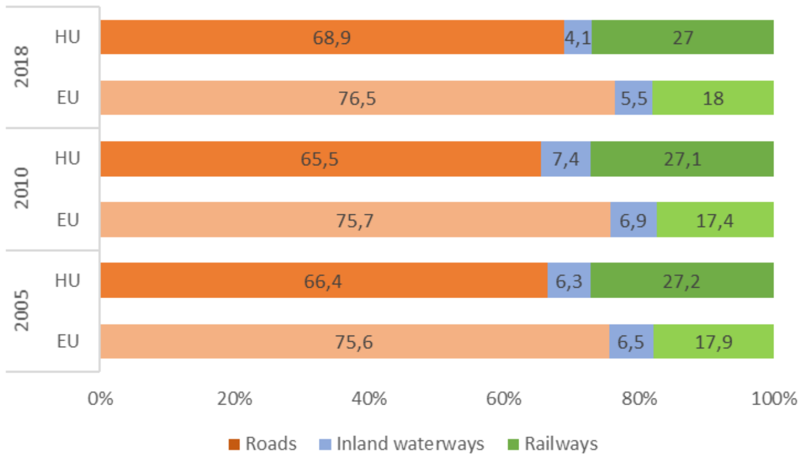


Source of data: Eurostat and EC DG Move, 2020. Note: The tkm values refer to road transport adjusted for territoriality, rail, inland waterways and pipeline transport. GDP is expressed in 2010 euros.

3.2.2. Modal split in freight transport

As Figure 22 illustrates, more than three-quarters of EU freight transport in 2018 was on roads compared to 68.9% in Hungary. However, the evolution of the modal shift over time suggests that road transport is expanding while the role of inland waterways and rail transport are stagnant.

Figure 22: Performance of freight vehicles by age category (tkm %) in EU member states

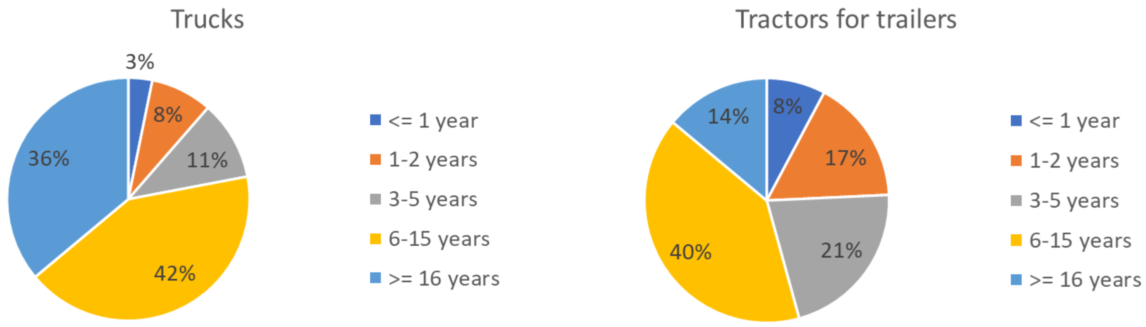


Source of data: Eurostat

3.2.3. Composition of vehicles by age

Energy use and pollution from freight transport are related to the efficiency and environmental performance of vehicles, a factor of the age composition of the vehicle fleet.

Figure 23: Composition of freight vehicles by age category (% of the number of registered vehicles) in Hungary, 2018



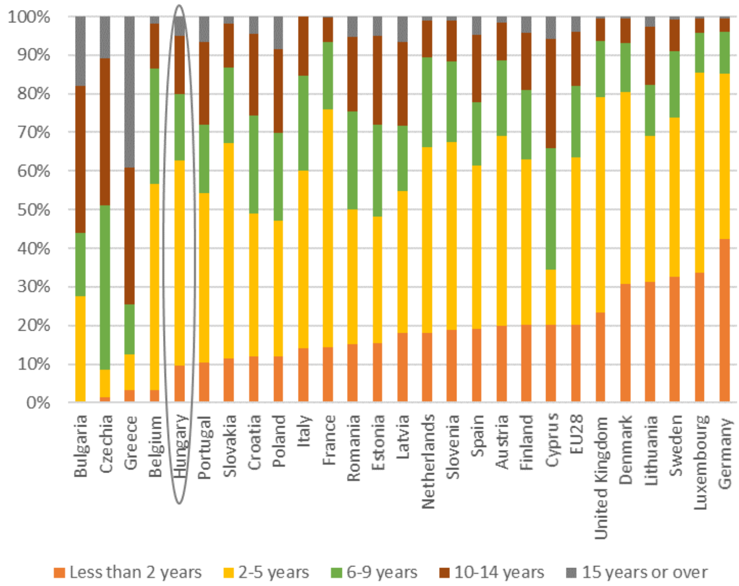
Source: Hungarian Statistical Office

Figure 23

As Figure 23 shows, the **share of vehicles younger than 6 years is low for trucks and somewhat better for tractors moving larger haulage**, partially due to the stricter environmental regulation[13] and the greater role of economic factors in operating heavy-duty vehicles.

Figure 24 highlights that most tonne-kilometres are performed by younger, more efficient vehicles in Hungary, despite the pre-eminence of old vehicles in the national fleet: more than 60% of the activities are carried out by vehicles less than 5 years old and around 80% by vehicles under 10 years.

Figure 24: Performance of freight vehicles by age category (tkm %) in EU member states



Source of data: Eurostat

3.3. Strategic energy and climate policy goals related to the transport sector

Hungary's NECP foresees greening of transport through renewable energy use and better energy efficiency. The plan partially builds on existing strategic documents, such as the National Transport Strategy and the Transport Energy Efficiency Improvement Action Plan.

The NECP does not set out goals for the absolute reduction of demand for transport, although it is widely acknowledged that curbing demand for transportation is one of the basic pillars for decarbonisation (see for example EASAC, 2019). It aims **to facilitate the decoupling of economic growth and energy consumption, but also states that rising energy use due to economic growth should not constrain the industry and transport sectors**.

The main targets set for the transport sector include a 14% the share of renewable transport energy use (RES-T) by 2030, 7% met by conventional biofuels, 3.5% by advanced biofuels, and the rest would be reached through electrification. Another key goal is to **limit the growth of petroleum products to 10 % by 2030**. The

[13] On the evolution of EU emission standards see: https://www.transportpolicy.net/standard/eu-heavy-duty-emissions/

development of advanced biofuels and expansion of electric vehicle charging infrastructure will be supported with dedicated funding.

More specific measures targeting sustainable transport development include:

- replacement of light commercial vehicle fleets used in public services (e.g. postal service)
- supporting electric vehicles through purchase subsidies and tax allowances
- supporting intermodal transport through tax advantages for combined freight transportation
- implementation of the Green Bus Programme through which 1300 environmentally friendly local buses will be put into operation by 2029

The document also mentions car sharing but does not specify any corresponding targets or measures.

The National Energy Strategy (2020) sets out objectives that contribute to reaching sufficiency goals, e.g. the promotion of alternative ways of mobility, such as car-sharing, car-pooling, bike-sharing, use of bicycles and more efficient transport planning. It acknowledges that the promotion of working in home-office can contribute to the reduction of transport energy use.

The Hungarian Transport Infrastructure Development Strategy (2014) defines more precise measures limiting private transport demand, such as the improvement of service quality in public transportation (increased convenience, shorter travel time, better connections, intelligent passenger information systems), increased availability of public transport in less densely populated areas, the establishment of new P+R and B+R parking facilities, and the promotion of active modes of mobility by ensuring new biking routes, new biking storage and parking places, and creating low-traffic zones.

Similar strategic goals, together with the requirement to implement the integrated development of rail transportation in Budapest and better connecting suburban areas and city centres are included in the Budapest Transport Development Strategy (Balázs Mór Plan 2014-2030), which emphasizes active and conscious awareness raising of travellers and the provision of comfortable and seamless public transport services supported by IT solutions.

Some goals from the 2014 strategy have already been realized, including new biking routes and P+R parking places. New infrastructure facilitating integrated rail transportation and the improvement of public transport availability have been initiated recently in Budapest.[14]

3.4. Main drivers and bottlenecks to energy sufficiency

The regulatory and behavioural factors that hinder or help coping with the ever-increasing demand for transport are summarised in the next subsections.

3.4.1. Regulatory aspects

The **Hungarian government is reluctant to establish energy reduction goals in the transport sector** due to economic growth expectations. The transport and freight energy intensity still need to be improved to enable the decoupling of transport GHG emissions and economic growth, as shown in previous chapters.

[14] http://abouthungary.hu/news-in-brief/budapest-transportation-development-plans-in-the-works/

Nevertheless, the NECP projects improvements through additional measures (targeting the development of public transportation, supporting the deployment of electric vehicles, and promoting the shift to low-emission transport modes in the freight transport segment), estimating a 3.1% drop in GHG emissions by 2030, in spite of increasing transport demand (see the Annex).

The NECP does not outline targets for non-motorized transport modes such as bicycle and pedestrian infrastructure or measures facilitating the use of shared vehicles as an alternative to own cars. The creation of integrated, harmonised transportation systems with the involvement of rail transportation receives attention in larger cities, but the opportunities offered by the existing infrastructure are not yet adequately utilized, despite the fact that it could entail substantially lower traveling time and contribute to less traffic congestion.

One positive improvement supporting sufficiency is the recent change in the support scheme for electric vehicles. Originally, purchase support was offered to individuals and companies for purchasing light duty electric vehicles, covering 21% of the purchase price, up to HUF 1.5 million (~ EUR 4100). The new support system made this dependent on the price of the vehicle, thus pushing customers towards cheaper and smaller electric cars: up to the purchase price of HUF 11 million, a maximum of HUF 2.5 million can be received, while in the price range of HUF 11 and 15 million the maximum support decreases to HUF 0.5 million.

Another improvement is an adjustment of the legal framework to facilitate teleworking through the amendment of the Labour Code, spurred by the COVID-19 pandemic.[15]

3.4.2. Behavioural, social, and cultural factors

One of the most important determinants of consumers' choices is their demand for comfort and convenience, which can have a decisive role on transport choices. (Shove, 2010). **Although walking and bicycling played an important role in smaller cities and settlements, passenger car use has become dominant, making it inconvenient and dangerous to cycle on the roads without proper infrastructure**.

Individual car ownership is very widespread with the easiest travel connections compared to public vehicles only convenient and comfortable in large cities. However, the younger generation seems to prefer access to vehicles over ownership, visible in cities like Budapest where **car-sharing businesses are successful** (See for example Carrone et al., 2020).

Budapest traffic data collected in March 2020 shows that the **COVID-19 pandemic caused a significant drop in demand for transportation**, while the fear from infection led to a substantial change in modal shares. The modal share of car use increased from 43% to 63%, while the share of public transport fell from 43% to 18%. However, the **share of cycling rose from 2% to 4%, partially as a result of the lower car traffic in the city centre** (Bucsky, 2020) also supported by temporary bike lanes[16]. This supports the assumption that less traffic and safer bike infrastructure might contribute to higher use of active modes.

[15] Act I of 2012 on Labour Code. https://www.property-forum.eu/news/hungary-to-create-flexible-home-office-regulations/6592

[16] https://koronavirus.budapest.hu/en/2020/04/06/temporary-bike-lanes-will-help-traffic-during-the-pandemic/

3.5. Possible improvements in the transport sector

Although the number and the use of passenger cars has been steadily increasing, the role of public transportation is still more pronounced in Hungary than in the EU. It is important **to avoid continued growth in the share of individual motorized travel modes and reverse the trend** through measures facilitating active modes and public transportation.

As the previous chapters highlighted, people were more inclined to ride bicycle during the lower traffic periods under the COVID-19 pandemic lockdown. This suggests that increasing the availability of safe and seamless bicycle lanes would contribute to the expansion of active transport modes, not only in the larger cities but also in smaller settlements, where car usage has substantially increased in recent years. A lower demand for travel can also be sustained with home office and teleworking sparked by the lockdown. Increasing the accessibility and convenience of public transport vehicles can also help reduce private motorized transport. Besides the Green Bus Programme outlined in the NECP, which will help replacing the older, polluting vehicles to **modern, clean buses, new investments in rail transportation infrastructure and more comfortable vehicles can also encourage travellers to switch from their cars to public transportation, especially if accompanied by the introduction of congestion charge (as planned in Budapest) and higher parking fees.** The newly built P+R facilities proved to be very popular, while there are more and more pedestrian zones completed and planned.[17] Companies offering vehicle-sharing services operate successfully. **Policies facilitating the use of shared cars instead of car ownership will also contribute to lower energy consumption**.

Modelling in the CACTUS project framework can estimate the potential effect of the following changes on transport energy use:

- higher share of bicycle use due to improved bicycle infrastructure
- higher modal share of public transportation assuming higher level of service and increased costs related to car use (e.g., increased parking fees, introduction of congestion fees, introduction of bans for cars running on specific fuel types, larger pedestrian, and low traffic areas)
- increased use of car sharing services, replacing car-ownership in densely populated areas
- and in parallel, decreased car ownership and/or lower private car use.

The Hungarian economy is freight transport intensive, mainly due to the current structure of economic activities, whereas the modal share of road transport is still lower than in the EU. **Besides maintaining and improving the current modal split, it is important to limit and reverse the growth in GHG emissions in the sector**. **To achieve more substantial emission reduction, it will be essential to contain the constantly increasing demand for transport**. Freight will have to rely on clean technologies to decarbonize, though **policies might induce deeper changes by shifting the focus from exclusively technology-driven options to instruments that can bring about structural transformation, through the creation of circular economy and the reorganization of value chains and logistic systems** (Sharmina et al., 2020). These fundamental changes are a difficult to measure but the effects of favourable shifts in the modal share can be evaluated by modelling.

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[17] See for example:

https://pestbuda.hu/en/cikk/20210108_cars_to_be_barred_from_city_park_heroes_square_to_become_pedestrian_zone

Conclusions and link with the CACTUS project

The Hungarian National Energy and Climate Plan is based on a GDP growth path of 21% by 2030 compared to 2017 with a decline in population of 6%. Primary energy consumption is expected to grow by 16% to 2030 compared to 2005, while final energy is slightly below its 2005 value. It assumes a 42% fall in residential energy use, 28% decline in the tertiary sector, and 28% growth in the transport sector. It also clearly states that energy use in the transport sector will not be limited during an economic upswing.

Compared to energy related trends in the EU, Hungarian households use lower but increasing energy per capita in the building and transport sectors, driven by changes in lifestyle and consumption practices and failed policies to shift behaviour. Future economic development might result in higher income and consumption levels, increasing the likeliness of wider adoption of unsustainable energy consuming practices.

The CACTUS project aims to contribute to the development of effective national decarbonisation policies by assessing the potential role of energy sufficiency through an examination of different scenarios and by performing model-based assessments. This analysis has shown that some energy related activities in the **building sector** reflect potential sufficiency improvements:

- The average floor area and household size are below the EU average, but the average floor area per person increased substantially in the last 12 years. Policies encouraging more sufficient use of space in new dwellings could reverse this trend. The modelling to be performed within the CACTUS project can evaluate the effects of such policies on overall energy consumption, based on average floor area value assumptions.
- The flagship policy of the current government, the 'utility rate cut', has visible consequences for energy consumption. It improved energy poverty but offered all class of households the same low rate. Abolishing regulated prices in favour of targeted policies to fight energy poverty could restore incentives to avoid wasting energy and incentivize energy efficiency upgrades in homes. The bottom-up analysis to be developed within the CACTUS project can evaluate the effects of policies restoring the incentives to reduce energy consumption with sufficient levels of heating energy use in homes.
- 35-42% of the dwellings are underheated due to estimations in the NECP. Model calculations can help estimate whether efficiency improvements from increased energy awareness can counterbalance the rebound effect in energy poor households. Besides energy poverty, the high underheating ratio estimated for Hungary can also result from the low mobility rate of Hungarian households. Encouraging the mobility of households could result in a rearrangement of under and over-occupied buildings, the effect of which can be investigated under various assumptions.
- To solve the air quality challenge associated with individual biomass heating the change of old stoves should be encouraged. This requires policies promoting more advanced heating modes (besides energy efficiency upgrades). Model calculations can investigate the effects of switching to different heating modes and provide insights for policy makers on the effectiveness of support options.
- The modelling could also assess effects of household appliances per households or per capita on energy use.

Transport energy consumption and GHG emissions are rising steadily in Hungary, although per capita values have not yet reached the average in the EU. The share of passenger car use, as well as the number of cars per person, remain well below the EU average but are increasing. Policies encouraging active and public transport modes, such as ensuring seamless and safe bicycle infrastructure, creating low-traffic zones, improving the accessibility and comfort of public transportation vehicles, pricing congestion, and promoting vehicle sharing and telecommuting can reverse this trend.

Modelling could be used within the CACTUS project to estimate the potential effect of the following changes on **transport energy use**:

- higher share of cycling due to improved bicycle infrastructure,
- higher modal share of public transportation assuming higher level of service and increased costs related to car use (e.g. increased parking fees, introduction of congestion fees, introduction of bans for cars running on specific fuel types, larger pedestrian and low traffic areas),
- increased use of car-sharing services, replacing car-ownership in densely populated areas,
- lower car ownership and/or lower private car use.

The freight transport intensity of the Hungarian economy is about twice the intensity of the EU and is projected to increase. Although the modal split is more advantageous and the performance of the vehicle fleet by age is comparable to that of the EU, promoting modal change can reduce current energy consumption levels. On the other hand, fundamental structural changes will be required in supply chains to and economic configurations decrease transport demand in the long run.

Within the CACTUS project, the sufficiency potential in the above-mentioned areas will be assessed and incorporated in modelled scenarios for energy use and GHG emissions. Based on the results, policy recommendations will be formulated, and the project will provide a forum for sharing the results and discussing mitigation options with national policymakers.

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ANNEX – Comparative Dashboard

The analysis of energy sufficiency potential was aided by a **comparative dashboard** listing key input indicators related to energy demand, and output indicators related to energy production and GHG emissions. The final version of the Hungarian Long-Term Strategy, including projections for 2050 have not yet been published at the time of preparing this analytical brief, therefore the dashboard relies on the 2030 WAM scenario of the Hungarian NECP. The expected changes in the indicators presented in the dashboard are discussed in the related chapters of the document.

	Indicator		Hungary					
			Unit	**Details/comments**	**Base year 2017**		**NECP 2030 (WAM scenario)**	
	Population		thousand persons		9,778	[1]	9,170	[1]
	GDP		million EUR	current prices	125,603	[1]	152,691	[1]
Energy consumption	Primary energy consumption		Mtoe		24.5	[1]	30.7	[1]
	Primary energy intensity of the economy		kgoe/EUR		0.195	[1]	0.201	[1]
	Final energy consumption		Mtoe		18.5	[1]	18.7	[1]
	Final energy intensity		kgoe/EUR		0.15	[1]	0.12	[1]
Buildings	Share of buildings in final energy consumption		%	household and services over total final consumption	46%	[3]	35%	[3]
	Consumption in buildings	*Heat*	ktoe	space heating, w/o hot water			4,761	[4]
		Specific electricity	ktoe	household and services sector, incl. all electricity, (Eurostat)	1,683	[4]		
Residential	Final energy consumption		Mtoe		6.3	[1]	5.9	[1]
	Energy consumption in households per capita		toe/person		0.64	[3]	0.65	[3]
	Average prices	*Heat*						
		Electricity	EURct/kWh	including energy fee, system tariffs and taxes	11.48	[1]	12.8	[1]
	Monthly energy expenditure of households as a share of total (%)		%	electricity, gas and other fuels (Eurostat)	4.8%	[2]		
	Number of dwellings		thousand	(Odyssee database)	4,428	[2]		
	Consumption per dwelling	*Heat*	MWh/dwelling	per dwelling, with climatic corrections (Odyssee database)	14.81	[4]		
		Electricity	kWh/dw	electrical appliances, lighting (Odyssee database)	1,784	[4]		
	Average household size		person/household		2.33	[1]	2.23	[1]
	Floor area per person		m2	(Odyssee and NECP)	35.40	[4]		
	Population living in overcrowded /undercrowded buildings		%	2018 data (due to methodological change - Eurostat)	20.1%	[2]		
Tertiary	Final energy consumption		Mtoe		2.2	[1]	2.5	[1]
	Employees in tertiary sector (G-S activities)		Mpersons	(Odyssee database)	3.0	[2]		
	Energy consumption per employee		toe/person		0.7	[3]		
	Electricity consumption per employee		kWh/person	(Odyssee database)	2,765	[2]		
Transport	Share of transport in final energy consumption		%	excluding air transport fuels	24.5%	[3]	27.7%	[3]
	Share of electricity in transport energy use		%	(Eurostat)	2.2%	[2]	7.4%	[4]
	Energy consumption	*Road transport*	ktoe	(Eurostat)	4,318	[2]	4,975	[4]
		Air transport	ktoe	Inernational aviation (Eurostat)	4,497	[2]		
	Share in road transport energy use	*Passenger transport*	%	(Eurostat)	59%	[4]		
		Freight transport	%	(Eurostat)	41%	[4]		
Passenger Mobility	No. of cars per person		No/1000 persons	DG MOVE Transport in figures, 2019	355	[2]		
	State of the car stock / replacement rate		%	Hungarian Statistical Office	10.0%	[2]		
	Passengers	*Cars*	Mp.km	(Eurostat)	60,645	[2]	74,318	[4]
		Buses	Mp.km	(Eurostat)	17,997	[2]	19,768	[4]
		Rail	Mp.km	(Eurostat)	11,629	[2]	12,365	[4]
		Coasts and rivers	Mp.km	(Eurostat)	10	[2]	0.5	[4]
Freight	Freight	*Road*	Mt.km	(Eurostat)	39,687	[2]	59,436	[4]
		Trains	Mt.km	(Eurostat)	11,345	[2]	15,081	[4]
		Rivers	Mt.km	(Eurostat)	1,992	[2]	2,429	[4]
Energy production	Domestic primary energy production		Mtoe		11,147	[1]		
	Share of RES in gross final energy consumption		%		13.3%	[1]	21.0%	[1]
	RES-E in gross electricity consumption		%		7.5%	[1]	21.3%	[1]
GHG emissions	GHG emissions -% relative to 1990		%		67.9%	[3]	66.9%	[3]
	Share in GHG emissions	*Buildings*	%		18.0%	[3]	21.6%	[3]
		Transport	%		20.2%	[3]	21.0%	[3]

[1] Official data contained in the NECP; [2] Data retreived from statistical databases; [3] Data calculated from NECP; [4] Based on background calculation for NECP