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# THE HUNGARIAN UTILITY COST REDUCTION PROGRAMME

## *AN IMPACT ASSESSMENT*

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# The Hungarian utility cost reduction programme

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# The Hungarian utility cost reduction programme

*An impact assessment*[*]

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**Highlights**

– Rationale for and consequences of Hungary's post-2012 utility rate cuts are assessed.
– The logarithmic mean Divisia index is used to decompose residential energy-use change.
– We find energy use to have increased in the first years and stabilised at a higher level.
– There are negative effects on energy conservation/efficiency and energy investment.
– Positive impacts are identified for most households, but contradictions prevail.

**Abstract**

In Hungary, regulated energy prices have been crucial in supplying electricity, district heating and natural gas to households, and as a result of a utility cost reduction programme, implemented in several stages starting from 2013, a sharp decline has been seen in these prices. However, this state intervention was performed without a strong policy background and the energy policy documents were just later adjusted to the prevailing situation. This paper focuses on the direct and indirect effects of this programme. The logarithmic mean Divisia index (LMDI) method is applied to decompose the absolute change in residential energy consumption between 2010 and 2017. We calculate price, intensive structure, extensive structure, expenditure and population effects. The results are in line with our expectations that decreasing energy prices for households had a positive impact on their energy use in the first few years. Overall, it induced an additional energy use of as much as 18.9 PJ between 2013 and 2017, while residential energy consumption stood at 263 PJ in 2017. We find that the state intervention created a new situation where the ratio of residential expenditure on energy services to total expenditure significantly decreased, the inflation rate declined and the economic and income situation of the majority, especially that of the middle class, considerably improved. However, the efficiency of the applied measures is still doubtful and several negative effects have also been detected. The utility cost reduction programme discourages energy conservation and energy efficiency; erodes the competitiveness of renewables; reduces gross capital formation in the energy sector; deteriorates security of supply; and increases energy prices for non-household customers. Despite these drawbacks, the utility cost reduction programme is expected to continue with some adjustments at most.

*JEL:* P22, P28, Q41, Q48

*Keywords:* utility cost reduction, decomposition, energy consumption, residential sector, energy prices, energy efficiency, energy poverty, energy policy, energy investment

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## 1. Introduction

With fewer than 10 million people, Hungary is a relatively small Central and East European EU member state with the ambition to escape from the middle income trap. However, this is not an easy task. After experiencing a contraction in 2009, Hungary's GDP per capita, expressed in purchasing power standard (PPS), stood at around only 65-66% of the EU average in the early 2010s (*Eurostat*, 2019m). Between 2010 and 2018, the economy delivered an average GDP growth rate of 2.5%, including both a 1.5% decrease in 2012 and a 5.1% increase in 2018 (*Eurostat*, 2019r), which has helped reach a GDP per capita figure equivalent to 71% of the EU average, though only 11 percentage points higher than in 2007.[1] While improvements have been reflected in wage increases, poverty reduction or the growth in actual individual consumption per capita (a measure of material welfare of households), such indicators place Hungary in a poor position in an EU or even a Visegrád comparison, with the latter including Czechia, Hungary, Poland and Slovakia.[2] By the early 2010s, for large segments of society, the payment of utility bills had become an everyday challenge. Utility prices belonged to the top issues on people's minds. At that time, the unemployment rate was high and many households were burdened by foreign-currency mortgage loans, which had been very popular before the global economic crisis, but whose payments had become difficult to meet after the exchange rates depreciated markedly.

In Hungary, the residential sector has the largest final energy demand (with a share of 35% in 2017), followed by the transport (25.2%) and industrial sectors (24.2%) (*Eurostat*, 2019i). Since the fall of the communist regime, Hungary's final energy consumption has fluctuated rather strongly, and this is also true for residential demand. Nevertheless, between 2014 and 2017, total final energy consumption was growing at a rate well above the EU average (*Eurostat*, 2019f), which may suggest that the increase in consumption was accompanied by a large proportion of waste (*MEHI*, 2019a). However, in 2018, the growth stopped and residential consumption declined (the latter is mainly because of the mild winter weather, though). The greatest potential for energy savings

[1] Moreover, since the aim should be to catch up with the developed Western countries, it may be worth comparing Hungarian development with the developed Western countries and not with the EU average.
[2] These sources are cited where they occur in the text.

lies in the household segment and there is an urgent need to make both energy efficiency and energy conservation a very high priority.[3] Gas is the dominant energy source in the residential final energy consumption (*Eurostat*, 2019f, 2019j), and households are the largest gas consumers in Hungary (*MEKH*, 2019d).

Energy consumption should also be viewed in light of Hungary's high energy import dependency rate, which was over 60% in 2017, while the EU as a whole imported 55% of the energy it consumed (*Eurostat*, 2019g). Hungary's energy mix is dominated by hydrocarbons, with their share in primary energy consumption reaching 68.1% in 2017 (*MEKH*, 2019c). Except for domestic lignite, mainly used in a single lignite-fired power plant responsible for about 15–20% of Hungary's electricity production but expected to be phased out by the end of the 2020s[4] (*Eurostat*, 2018b; *MEKH*, 2019b; *Weiner*, 2019b), the bulk of Hungary's primary energy is imported, and, in spite of all efforts, this will remain the case. Regarding natural gas, the production-to-consumption ratio has fallen below 20%. Hungarian gas production was declining rapidly until 2015. Since then, however, it has grown slightly (*Eurostat*, 2018a; *MEKH*, 2019d). The production of oil, principally a transportation fuel, is growing much more rapidly (*MEKH*, 2019e), but despite a large oil field discovery, recently announced, it will still be limited (*Kasnyik*, 2019). As for nuclear fuel supply, Hungary is 100% reliant on (Russian) imports. Currently, the share of net imports in total electricity consumption is around 30% (*Eurostat*, 2018b; *MEKH*, 2019b), but substantial cross-border electricity transmission capacity exists (*ITM*, 2018a: 12). Although hours with high share of electricity imports are largely due to price competitiveness of imports vis-à-vis domestic production, the problem is that the domestic installed generation capacity was unable to meet inland electricity consumption during 21.5% of hours between 2015 and 2018 (*Bartek-Lesi et al.*, 2019a: i, 94). All the above mean that domestic energy prices are to a large extent reliant on factors that are outside the Hungarian borders.

However, if the standard of living is relatively low, poverty rates are high and households spend a disproportionately large share of their income on utility costs, then

[3] Despite attempting to achieve the same outcome, energy efficiency and energy conservation are two different things. Energy efficiency refers to using technologies that require less energy to perform the same function (e.g., using LED light bulbs, replacing outdated boilers or improving home insulation). In contrast, energy conservation means changing behaviours in order to use less energy (e.g., turning the lights off when leaving the room) (*EIA*, 2018).

[4] To be precise, only its lignite-fired units will be gradually retired.

the government needs to respond in some way. In our previous works, we argue that when the government addresses such an issue, it should take into account the various dimensions of security of energy supply. According to the dimensional approach, security of supply has dimensions such as availability, affordability or sustainability. Thus, decisions on security of supply are regarded as the consequences of choices among security of supply dimensions, in other words, the prioritisation of different dimensions (*Weiner*, 2018, 2019b). In the early 2010s, a shift in domestic energy policy towards the affordability dimension began taking place, reflected in a utility cost reduction programme and campaign (*Weiner*, 2019b: 31). This started in 2013 and resulted in an average decline of 24% in residential electricity, district heating and natural gas prices in 2013 and 2014.

In parallel to the utility cost reduction programme, the Hungarian energy landscape went through a major renationalization campaign, expanding both state assets and 'special domestic private property', the latter having close and intensive coordination with the government. Various new taxes have also burdened the energy sector, while the energy regulator started to undertake a special role, characterised as having strong government control and unquestionable decisions (*András Deák*, personal communication, 16 December 2019). The latter is related to the centralised decision-making that can be observed at policy level. Therefore, both the energy sector and energy policy have dual characteristics in Hungary. The energy market is characterised by a mixed ownership structure, but with new dynamics. In the mid-2010s, multinational companies dominated energy retail and distribution, while state-owned companies the wholesale market. Recent new dynamics refer to exiting multinationals and entering state-owned and domestic private companies in gas and electricity distribution and retail, with a single state-owned player in the regulated prices segment of the gas retail market, as well as to decreasing share of state-owned activity in gas wholesale (*MEKH*, 2016, 2019h).[5] Regarding the legal framework, both free-market regulation (for industrial consumers) and a price cap (for households) are present at the same time (*Felsmann*, 2014).

The Hungarian energy sector is encumbered by everyday politics (*LaBelle and Georgiev*, 2016). Keeping utility prices low has become part of the so-called 'freedom fight

[5] Balázs Felsmann provided valuable comments on this part of the paper.

against Brussels' and also, at least on paper, associated with several energy-related decisions, including agreements on Russian gas imports, the 2014 decision on the construction of new units at the Paks Nuclear Power Plant (Paks II) and holding a veto in the European Council in June 2019 regarding the 2050 target to reduce emissions to net zero. However, contradictions have arisen around the reality of the utility rate cut, regarding gas prices, for example, since the market could justify further price cuts.

In this paper, our main objective is to examine the effects of suddenly falling residential energy prices on household energy consumption. First of all, we find the answer to the question of how much the price effect itself increased the residential energy consumption between 2010 and 2017, and what other factors offset this effect. Further, since the utility cost reduction programme has affected not only energy use but has also had significant impact on other economic trends (energy mix, energy use, energy efficiency and energy conservation), we also focus on post-2013 changes in the following indicators: prices (those of electricity and gas, as well as the consumer price index), consumption expenditure data, social disparities with an outlook to energy poverty, and gross capital formation in the energy sector. In several cases, the tendencies are highlighted with a regional outlook, and the results are compared to the Visegrád countries.

This paper is partly a follow-up of our previous work (*Sebestyén Szép*, 2017). At least three factors create the foundation for this research. Firstly, by 2019 more data had become available, allowing for the overall evaluation of the first five years of the utility cost reduction programme. In the former analysis, the study period was shorter, limited to the period of 2010–2015. Secondly, Hungary submitted its National Energy and Climate Plan (NECP) to the European Commission in January 2020, and utility price cuts remain a priority in this document. Thirdly, improvements in the statistics also prompt us to reconsider previous results and conclusions.

The rest of the paper is organised as follows. *Section 2* gives a background by introducing the steps of state intervention (*Section 2.1*) and its rationale (*Section 2.2*), as well as by examining how the regulated energy prices appear in the different energy policy documents (*Section 2.3*). *Section 3* describes the methodology and data. It shows the logarithmic mean Divisia index (LMDI) method and considers international experiences related to the topic. *Section 4* presents the index decomposition results, by quantifying the price, intensive structure, extensive structure, expenditure and population effects of utility cost reduction programme on household energy use. *Section 5* provides a detailed discussion of the results with respect to the context and positive and negative (sometimes indirect) consequences of the utility rate cuts. Out of these, *Section 5.1* points to the social effects, encompassing poverty, energy poverty and social disparities. *Sections 5.2 and 5.3* deal with the role of gas and firewood in Hungary and their broader policy and political contexts. *Section 5.4* looks at Hungary's energy efficiency targets, tools, achievements and prospects. *Section 5* ends with a list of other negative effects of the utility cost reduction programme (*Section 5.5*). Finally, a summary, conclusions and policy implications are presented at the end of the paper (*Section 6*).

## 2. Background

### 2.1. Steps of the state intervention

More intense governmental control started in 2010, when Hungary's National Development Ministry became the price-setting authority after this task was taken away from the Hungarian Energy Office (*LaBelle and Georgiev*, 2016). Three years later, the scheme to lower residential utility costs began. Since 2013, prices of the main energy carriers (natural gas, electricity and district heating) have been reduced in the household sector in three consecutive steps:

– In the first phase, between 1 January 2013 and 31 October 2013, the price decline was 10% in the case of all the three energy sources.

– In the second phase, starting from 1 November 2013, a further 11.1% price cut was made for the three energy sources.

– As part of the third phase, residential consumer prices for natural gas decreased by 6.5% from 1 April 2014, for electricity by 5.7% from 1 September 2014 and for district heating by 3.3% from 1 October 2014.

Consequently, prices paid by households have fallen by a total of 25.2% for natural gas, 24.6% for electricity and 22.6% for district heating. This price reduction was unified; it was not differentiated according to the income levels of households.

Nevertheless, state intervention continued with other subsidies in 2018, called the winter utility cost reduction. Households heating with piped gas or using district heating received a price compensation payment, with HUF 12,000 (almost EUR 40) being credited into their accounts (*MEKH*, 2019f). And, finally, households heating with firewood, coal or using bulk or bottled liquefied petroleum gas (LPG) became also part of this programme. Municipalities with no piped gas, which is quite rare in Hungary, provided cash support to households up until September 2018. 284 municipalities with 29,000 households belong to this category. On the other hand, in municipalities where piped gas or district heating is available, the subsidy was to be received in-kind, with a deadline to supply the selected fuel type only by late 2019. In this case, a total of 800,000 households from 2,886 municipalities (out of Hungary's 3,200 municipalities) got the possibility to apply for support, but only 372,000 did so. In contrast, households using gas or district heating were automatically eligible for this. Among them, winter utility cuts were given to 3.2 million consumers of piped gas and 650,000 households with district heating (*Ministry of Interior*, 2018; *Tamásné Szabó*, 2018; *Önkormányzati Hírlevél*, 2019).

### 2.2. The market background

Since the collapse of the communist regime, prices of food and other commodities, including vehicle fuel, have generally moved with the inflation index, but prices of services, especially those of residential energy, increased at a rate higher than the inflation rate. This gap started to narrow after the state intervention took place in 2013–2014 (*Fig. A1 in the Appendix*). However, according to *Magyar* (2015), in real terms, the households spent only 5-6% more on energy in 2015 than in 1996.

This degree of change in energy prices has significantly influenced household expenditures. *Eurostat* (2019h) data suggest that in 2010 spending on electricity, gas and other fuels was a much higher share of total spending in the Visegrád countries than in Western Europe or compared to the EU average (*Fig. 1*). By 2017, this ratio had decreased in the Visegrád region, while the share of total expenditure on food and non-alcoholic beverages as a fraction of total expenditure had significantly increased – with the exception of Poland. Nevertheless, the absolute data call attention to changes in other

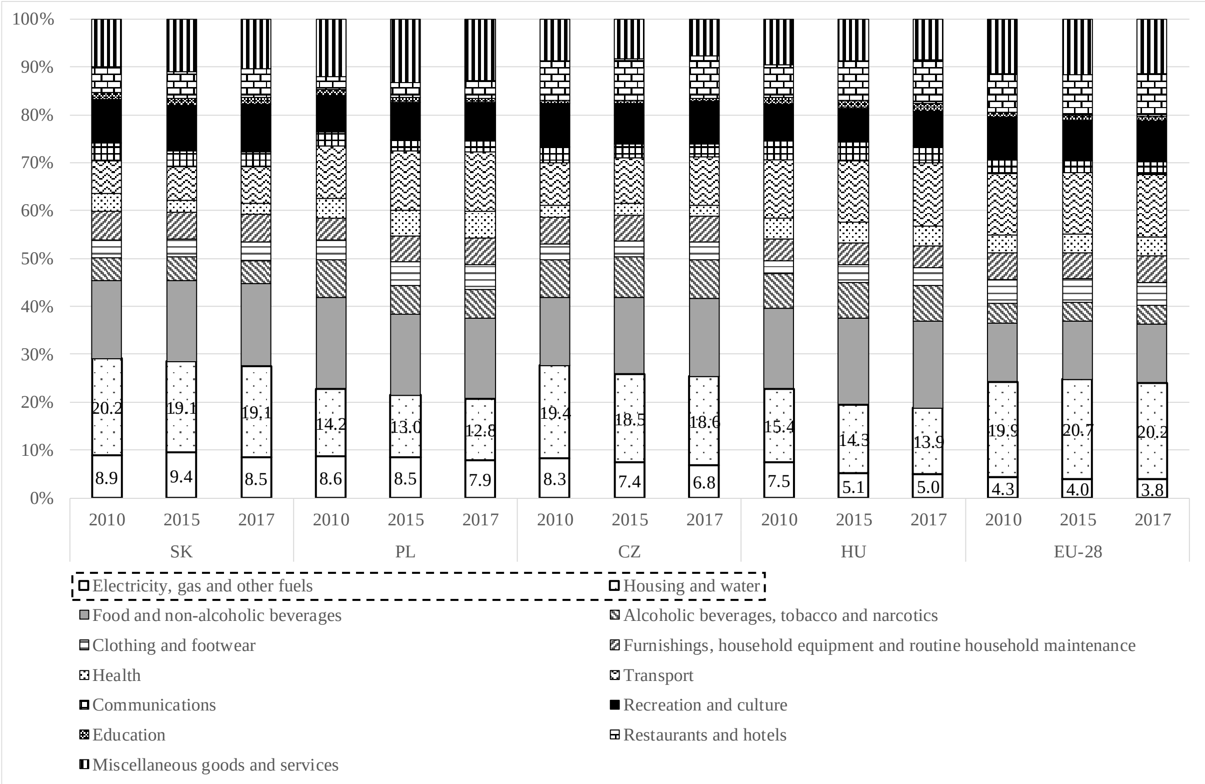



**Fig. 1.** Final consumption expenditure of households by consumption purpose in the Visegrád countries, 2010, 2015 and 2017 (%)
*Source:* Own compilation based on *Eurostat* (2019h).

directions, since in current prices, household expenditure on electricity, gas and other fuels increased by more than 10% in Slovakia and Poland between 2010 and 2017, but decreased by 2.9% in Czechia and by 22.0% in Hungary.

According to the *REKK* (2013), the high rate of housing and energy expenditure in Hungary can be explained by two factors – the high energy prices and the relatively low levels of disposable income. However, *LaBelle and Georgiev* (2016) add one more to this list, namely the poor (technically obsolete and deteriorating) buildings. This means that there are three points of intervention to reduce this ratio: decrease energy prices and/or increase disposable income and/or increase the energy efficiency of dwellings in the residential sector. The Hungarian government has used all three options, but with different intensities and results. In the following, we deal with the question of electricity and gas prices (*Figs. 2 and 3*).

In terms of electricity and gas prices for households measured in current prices (similarly to *REKK*, 2013), Hungary belonged to the middle range of EU countries and also

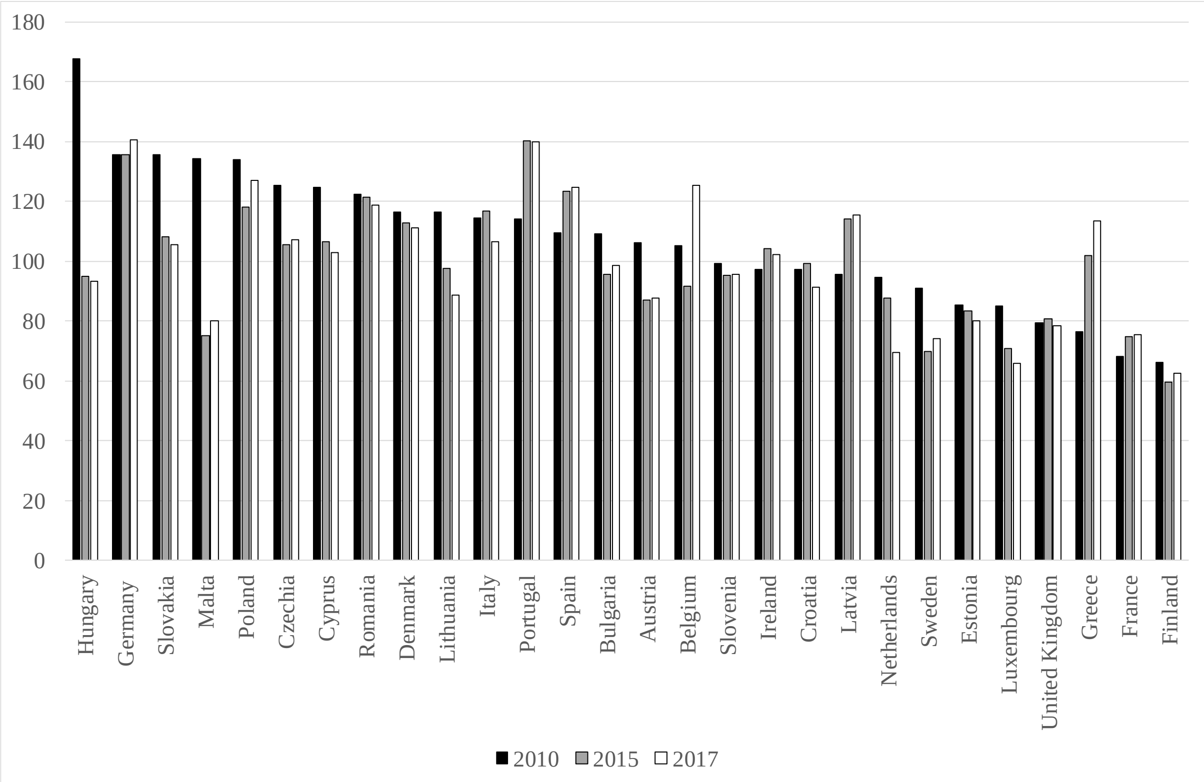



**Fig. 2.** Electricity prices (including all taxes and levies) for medium-sized household consumers (with an annual consumption of between 2,500 and 5,000 kWh) in the EU member states, 2010, 2015 and 2017 (EU-28=100; EUR, PPS per GJ)
*Source:* Own compilation based on *Eurostat* (2019e).

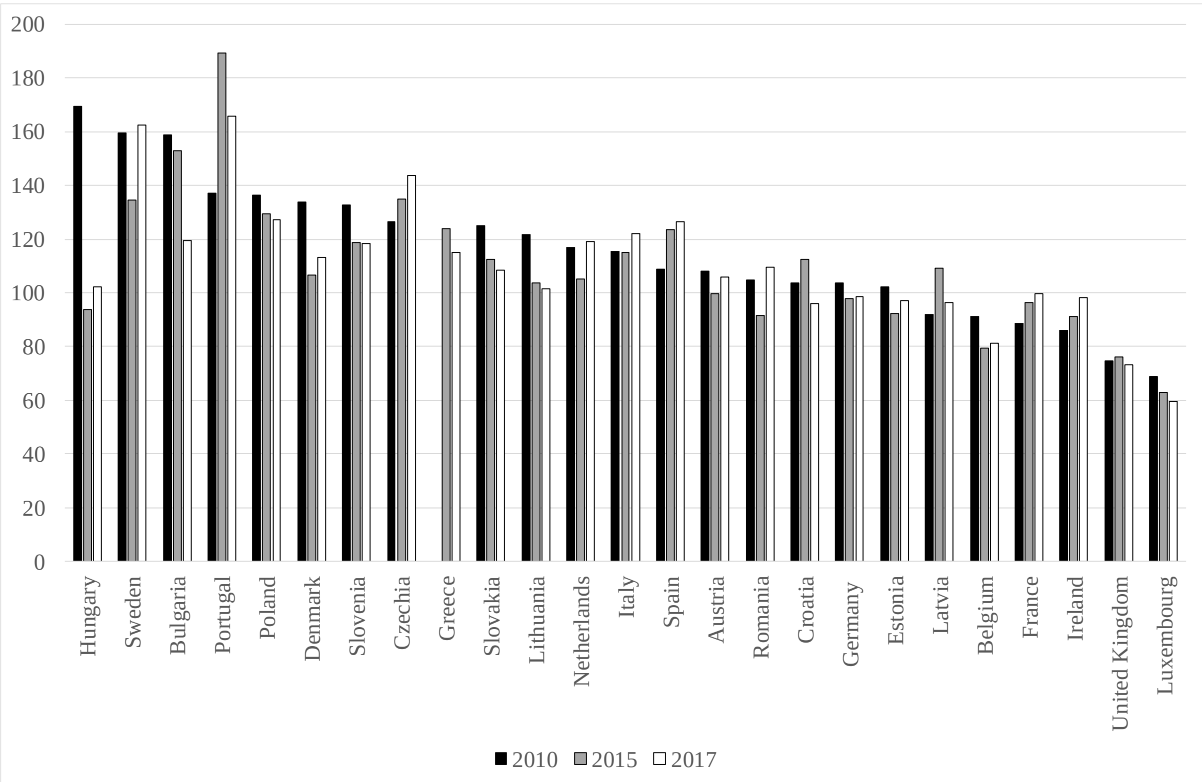



**Fig. 3.** Gas prices (including all taxes and levies) for medium-sized household consumers (with an annual consumption of between 20 GJ and 200 GJ) in the EU member states, 2010, 2015 and 2017 (EU-28=100; EUR, PPS per GJ)
*Source:* Own compilation based on *Eurostat* (2019l).

of the OECD in 2010. But the picture changes dramatically if figures are expressed in PPS. In this case, in 2010, the highest gas and electricity prices were reported in Hungary, which experienced the negative consequences of this. On the contrary, by 2017, Hungary had drastically improved its position, ranked in the middle third range of EU countries both in terms of gas and electricity prices: Hungary ranked 17th for electricity prices and 15th for gas prices (*Figs. 2 and 3*). *Böcskei* (2015) emphasises that as a result of the high energy prices and the low levels of disposable income, the number of households with accumulated debt towards energy utility companies significantly increased in 2011–2012. Similar tendency as regards debts can be observed in Slovakia as well (*Strakova*, 2014; *Isaacs and Molnar*, 2017). However, in Poland and Slovakia, gas prices for household consumers slightly decreased from 2010 to 2017, while in Czechia prices increased. In Czechia and Poland, a short decline in electricity prices was followed by slight growth from 2015 to 2017, as opposed to a decline in Hungary and Slovakia during the latter period.

### 2.3. The policy background

The legal framework for the Hungarian energy policy is represented by the National Renewable Energy Action Plan 2010–2020 (approved in 2010; *NFM*, 2010), the Energy and Climate Awareness Raising Action Plan (2015; *NFM*, 2015a), the National Building Energy Performance Strategy (2015; *NFM and ÉMI*, 2015), the Fourth National Energy Efficiency Action Plan until 2020 (2017; *NFM*, 2017), the new National Energy Strategy (NES) 2030 with an Outlook to 2040 (2020; *ITM*, 2020c) and the NECP (*ITM*, 2020a, 2020b). Thus, the latter two are the latest strategy documents, specifying the actual directions of the national energy policy. The draft NECP was submitted to the European Commission in January 2019 (*ITM*, 2018a, 2018b, 2018c), followed by the Commission's assessment and recommendations in June 2019 (*European Commission*, 2019a). The Hungarian government approved the final version in January 2020. However, the new NES is not discussed here, because it basically only summarises the main findings of the NECP. Further, the Fourth National Energy Efficiency Action Plan can be considered as a slightly modified, improved and revised version of the Third National Energy Efficiency Action Plan until 2020 (2015; *NFM*, 2015b). Since the fourth action plan, being a follow-up version, does not repeat the main target goals and other findings of the third one, it is necessary to present both action plans here.

An evolutionary development can be observed in the discussion of state intervention and utility cost reduction in the Hungarian energy policy documents. In 2010–2012, one of the main objectives was clearly to improve social conditions of the poorest income deciles, and the measure in question was not included in the policy documents. In contrast, the potential negative effects of such a measure were highlighted. Post-2013, utility price cuts have appeared more and more prominently in the energy policy documents. Seemingly, strategy makers have tried to catch up with the existing measures. They intend to provide an objective justification of the programme, and thus the issue of energy poverty has become more pronounced.

Among the strategies currently in place, the oldest one is the 2010 National Renewable Energy Action Plan. The EU's 2009 Renewable Energy Directive sets out the common framework for the promotion of energy from renewables. It puts a legally binding obligation on Hungary to include a 13% minimum share of renewables in gross final energy consumption by 2020 (*European Parliament and Council*, 2009). In contrast, the National Renewable Energy Action Plan sets a target of 14.65% by 2020, and explains how Hungary intends to do it. Despite the fact that renewables are the focus of this document, it also admits the high share of household expenditure on electricity, gas and other fuels:

> *Compared to the average of the EU-15, Hungarian households spend a larger percentage of their income on energy sources. Thus, until incomes catch up, it will not be justified to increase consumer price. (NFM, 2015c: 41)*

In parallel, it declares that funding opportunities for households related to renewable investments are also limited:

> *The scope of the financial incentives that can be provided through support and financing means is limited. As regards financial means, a separate limitation is represented by the incentive framework financed by the consumers, as this amount cannot be increased significantly. (NFM, 2015c: 41)*

Until January 2020, the National Energy Strategy 2030 with an Outlook to 2050 was Hungary's valid energy strategy. This was approved in 2011, one year after the approval of the National Renewable Energy Action Plan, and was Hungary's third energy strategy since the fall of the communist regime. The first was approved in 1993 and remained valid for one and a half decades. Approved in 2008, the second energy strategy, for the period 2008–2020, was short-lived compared to the first one. The main purpose of the 2011 NES was to seek ways out of energy dependency. In doing so, the approach is to increase state presence and state control, and to implement an economic development policy based on cheap nuclear energy (*Felsmann*, 2011). In Section 7.4 ('Social and welfare considerations'), it describes in detail the situation of energy poverty in Hungary. The issue of regulated prices appears here in a differentiated tariff system to be implemented in the medium term:

> *In the future, social benefits targeting the elimination of energy poverty should be allocated on a needs basis. While social policy interventions should be adapted to energy policy, they should not be entrusted to energy providers. [...] In the medium term, a consumption-based, differentiated tariff system requires some further fine-tuning. For the consumer groups in need a limited minimum amount of energy indispensable for basic subsistence should be supplied at a price significantly lower than the market price. The lost revenue will be compensated by the other consumer groups. Wealthier consumers will thus be involved in the financing of energy efficiency and renewable energy utilisation projects that can be implemented on a market basis. (NFM, 2012: 97–98)*

However, the separation of welfare considerations from energy objectives is emphasised for the long term, and strategy developers are fully aware of the negative consequences of regulated prices:

> *In the case of certain groups of consumers, subsidised energy prices may encourage excess consumption. On a system level, this may lead to problems in terms of the security of supply, since the revenues will not cover the costs of the implementation of new capacities. Therefore, it is recommended to move toward support schemes furthering savings through energy efficiency rather than consumption. (NFM, 2012: 97)*

When the Third National Energy Efficiency Action Plan was developed in 2015, the utility cost reduction programme had already started. This document considers the potential financial savings of households generated by the decreasing utility costs as a good basis for the refurbishment of buildings to improve energy efficiency, which is crucial for reducing energy poverty:

> *For residents, the most important benefit is additional significant and sustainable reduction in the amount of utility bills, which will in turn open new potentials for growth by releasing purchasing power. (NFM, 2015b: 61)*

This statement also appears in the 2015 National Building Energy Performance Strategy. This document serves as a basis for implementing energy efficiency improvements in buildings and for decreasing energy poverty. One of the main overarching strategic objectives is the modernisation of buildings as a means to reduce the utility costs of the population:

> *The utility cost reduction programme launched in 2013 and the improvement of the energy performance of buildings will jointly allow for a dramatic decrease in the utility costs payable by Hungarian households. The implementation of the NABEPS [National Building Energy Performance Strategy] is a significant step towards this aim. (NFM and ÉMI, 2015: 4)*

Both the 2011 and 2020 NES and both the 2015 and 2017 National Energy Efficiency Action Plan set the highest energy saving target values for the household sector (until 2020 and 2030) (*NFM*, 2012: 61; *NFM*, 2015b: 19; *NFM*, 2017: 70; *ITM*, 2020c), although the *European Commission* (2019d) states that energy consumption per square metre in residential buildings in Hungary was still lower in 2016 than the EU average. In addition, one should bear in mind that a higher level of the human development index (HDI) is associated with higher energy consumption, and a strong correlation can be exhibited between these two variables. The Hungarian HDI was measured at 0.845 in 2018 (*UNDP,* 2020). According to *Arto et al.* (2014), a HDI value of 0.9 can be a turning point for the energy use. Until this point, energy consumption per capita (more or less) stagnates, but a new wave of growth may be experienced when the HDI level of 0.9 is exceeded. At HDI level of 0.9, the minimum per capita primary energy consumption is approximately 120 GJ, while Hungary's per capita primary energy consumption amounted to 113.9 GJ in 2017 (based on *MEKH*, 2019c). In our point of view, the additional energy demand originated from the potential human development should also be considered, and this confirms the necessity of more intensive energy efficiency measures in the residential sector to counterbalance this push effect.

In the timeline, the next relevant strategy is the Energy and Climate Awareness Raising Action Plan. However, from our point of view, this document is not so important, since it does not address the relationship between prices and environmental awareness at all.

As suggested, 2018–2019 was the time for all EU member states to prepare their NECPs covering the period from 2021 to 2030. This document was required to be consistent, and it must be clear and predictable for investors (*European Commission*, 2019a). The quality of the document is highly important, because it will serve as a basis for EU-funded projects in the sector related to the multiannual financial framework for the period 2021–2027.

The differences between the 2019 draft and the 2020 final version are worth highlighting. Both versions aim to maintain the utility cost reduction programme in the household sector for the long run, despite the fact that the Commission's assessment of the draft NECP requires the Hungarian government to present existing and planned actions to phase out energy subsidies (*European Commission*, 2019a: 4) and thus to withdraw the utility cost reduction programme at some point in the future and instead apply other tools, as well as a complex strategy to reduce energy poverty.[6] Although the final version contains the requested list of subsidies, some contradiction is noticeable. The NECP declares that fossil fuels are not subsidised directly in Hungary. Rather, subsidies are indirectly granted to products and services on the market (*ITM*, 2020b: 253). However, Fig. 79 of the NECP calls attention to the high share of subsidies to fossil-fuel-use related general services as a percentage of total fossil-fuel subsidies when compared to other OECD members. The NECP says that conceptual transformation may be necessary in the price regulation of electricity, gas and district heating, but preserving the results of the utility cost reduction programme is paramount (*ITM*, 2020b: 72).

The draft NECP differentiated between households based on their needs for different levels of services. According to this, households with higher expectations could have chosen more innovative and more expensive market-priced services (*ITM*, 2018a: 89). Nevertheless, neither the term 'higher expectations' nor the framework of this system were defined in the draft. The final version also refers to the freedom of choice for electricity consumers, but the implementation of this remains uncertain (*ITM*, 2020b: 50, 72–73).

Residential energy consumption will decrease in both scenarios of both the draft and the final NECP (*Tables 7 and 8 in Section 5.4*) (*ITM*, 2018b, 2018c, 2020a). In the case of the draft, it is not entirely clear how to simultaneously reduce residential energy use and maintain the tariff system. Although the final version is supplemented with some flagship

[6] The latter is in line with the requirements of the EU's 2018 Regulation on the Governance of the Energy Union and Climate Action (*European Parliament and Council*, 2018b).

projects and initiatives and a stronger focus is put on energy efficiency improvements, it is far from being well thought out and is still not convincing.

Evaluating the draft NECP, the Commission also asked the Hungarian government to define specific objectives related to energy poverty (*European Commission*, 2019a: 3, 10). As feedback, the final version links energy poverty directly to the utility cost reduction programme (*ITM*, 2020b: 73–74). It determines the main vulnerable social groups: large families living in detached houses in small communities and retired people living alone in multi-family residential buildings (and sometimes in detached houses).

The utility cost reduction programme not only appears in strategic documents, but it determines the government's approach to strategic issues debated at European Union level. In November 2018, the European Commission presented its Communication on the EU long-term decarbonisation strategy ('A Clean Planet for all'). This contains the potential measures (eight scenarios for emissions reduction) to reach net-zero emissions by 2050 (*European Commission*, 2018; *Morgan*, 2019). However, as mentioned, in June 2019 Poland, Hungary, Estonia and Czechia were reported to have blocked it, and as a result the target of carbon neutrality was not accepted at the summit in Brussels. The Hungarian government argued that there was no reason to hurry, and that it had prevented a 30–40% rise in electricity bills of households, and its decision had saved the utility cost reduction programme (*Bolcsó*, 2019; *Horváth*, 2019). Finally, in December 2019, EU leaders agreed on the 2050 carbon-neutrality goal, but Poland was exempted from the commitment for the time being (*BBC*, 2019).

## 3. Methodology and data

Residential energy consumption is affected by many factors, such as energy prices, household income, willingness to save money, energy structure (mix), urbanisation, energy efficiency of residential buildings and household devices and consumer habits. Since the pioneering work of *Haas* (1997), there have been a number of studies on the decomposition of residential energy consumption (*Achao and Schaeffer*, 2009; *Chung et al.*, 2011; *Liu and Zhao*, 2015). In the last few years, many countries, including China, Iran and Kyrgyzstan, have made significant efforts to reform pricing for residential energy and to liberalise energy markets. Consequently, a separate group of studies has emerged focusing on the assessment of the impacts of government measures (*Yuan et al.*, 2010; *Zhao et al.*, 2012; *Gassmann and Tsukada*, 2014; *Du et al.*, 2015; *Moshiri*, 2015). A wide range of methodologies in residential energy consumption can be found, such as analysis based on input-output models or econometric and index decomposition methods. The latter approach was elaborated after the 1973 oil crisis to quantify the factors affecting the energy and environmental indicators (*Liu and Zhao*, 2015). Generally, the following factors are calculated: population, income, prices, energy intensity and energy mix (structural change). In most cases, energy consumption is climate corrected, though sometimes weather is an independent factor in the index decomposition analysis (*Hojjati and Wade*, 2012).

Two broad categories of the decomposition techniques can be distinguished: the structural decomposition analysis (SDA) and the index decomposition analysis (IDA). Both of these techniques have many types. Typically, the SDA approach is used when data are at a lower disaggregated level (such as data based on input-output tables), while the IDA utilises data mainly at higher level of aggregation (*Hoekstra and Bergh*, 2003; *Zhao et al.*, 2010).

Index decomposition analysis is a widely used tool to assess residential energy consumption (*Yuan et al.*, 2010; *Chung et al.*, 2011; *Zhao et al.*, 2012; *Liu and Zhao*, 2015) and carbon dioxide emission (*Fan and Lei et al.*, 2017). With IDA, both absolute (additive approach) and relative (multiplicative approach) change can be decomposed, and the effects can be quantified. Hereinafter, these approaches are shown.

Let $V$ be an energy-related aggregate. We assume that it is affected by $n$ variables, so $x_1$, $x_2$,… $x_n$. The aggregate can be divided into $i$ subsectors (here income deciles) where the changes take place. The connection among the subsectors can be described by:

$$V = \sum_i V_i = x_{1,i} x_{2,i} \dots x_{n,i}. \qquad (1)$$

By the multiplicative method, we decompose the relative changes (*Ang*, 2005: 867):

$$D_{tot} = \frac{V^T}{V^0} = D_{x1} D_{x2} \dots D_{XM}, \quad (2)$$

where

$$V^0 = \sum_i x_{1,i}^0 x_{2,i}^0 \dots x_{n,i}^0, \quad (3)$$

$$V^T = \sum_i x_{1,i}^T x_{2,i}^T \dots x_{n,i}^T. \quad (4)$$

By the additive method, we decompose the absolute changes:

$$\Delta V_{tot} = V^T - V^0 = \Delta V_{x1} + \Delta V_{x2} + \dots + \Delta V_{xn}, \quad (5)$$

where

$$V^0 = \sum_i x_{1,i}^0 x_{2,i}^0 \dots x_{n,i}^0, \quad (6)$$

$$V^T = \sum_i x_{1,i}^T x_{2,i}^T \dots x_{n,i}^T. \quad (7)$$

The methodology of index decomposition analysis has been significantly improved in the last few years, and many kinds of methods are available simultaneously, such as the Laspeyres, Paasche, Marshall-Edgeworth, Walsh, Fisher Ideal, Drobish, LMDI and the arithmetic mean Divisia index (AMDI) methodology. The detailed mathematic deduction can be found in *Granel* (2003), as well as in *Liu and Ang* (2003). The LMDI method is employed in this paper:

$$\Delta V x_1 = \sum_i L(V_i^0, V_i^T) * \ln(\frac{x_{1i}^T}{x_{1i}^0}), \quad (8)$$

$$L(a,b) = \frac{a-b}{\ln(a)-\ln(b)}, for\ a \neq b \text{ and}$$

$$= a, for\ a = b. \quad (9)$$

This method has several major advantages, such as the ability to handle zero values, path independency, consistency in aggregation and perfectness in decomposition (the calculation does not result in residual terms) (*Ang*, 2005; *Zhao et al.*, 2010; *Liu and Zhao*, 2015).

Similarly to *Zhao et al.* (2012), the identity of the decomposition analysis in this paper is as follows:

$$E = \sum_i \sum_j \frac{E_{ij}}{Y_{ij}} \frac{Y_{ij}}{Y_i} \frac{Y_i}{L_i} \frac{L_i}{P_i} P_i, \tag{10}$$

where

$E$ is the final energy consumption of the household sector (climate corrected; unit: PJ);

$Y$ is the residential energy expenditure (annual per capita expenditure on electricity, gas and other fuels; unit: HUF);

$L$ is the annual total expenditure (unit: HUF);

$P$ is the population (unit: capita);

$i$ is the income deciles; and

$j$ is the type of energy consumed by residents, such as solid fuels, total petroleum products, gas (piped and bottled), electricity and district heating.

*Zhao et al.* (2012) examine the urban residential energy consumption, and apply data with regard to energy-using activities and energy-using products as subcategories. However, in our case, income deciles and the type of energy sources are the levels of aggregation. These choices are justified by both the available data and our preliminary assumption that changes in the residential energy consumption between 2010 and 2017 were influenced mainly by the prices and by disposable income. Here, we note that regional differences (regarding Hungarian counties as well as urban and rural areas) are not taken into consideration, which is primarily justified by the objective of the research. This kind of level of aggregation would go beyond the scope of this study.

For a clearer presentation, we introduce five new intermediate terms to present the five previous terms in *Eq. (11)*, respectively, so:

$$E = \sum_i \sum_j PR * S1 * S2 * EP * PO. \quad (11)$$

Applying the additive form of LMDI, changes in residential energy consumption between any two years (*t* and *t-1*) are:

$$\Delta E_{tot} = E_t - E_{t-1} = \Delta E_{PR} + \Delta E_{S1} + \Delta E_{S2} + \Delta E_{EP} + \Delta E_{PO}, \quad (12)$$

where

$\Delta E_{PR}$ is the price effect;

$\Delta E_{S1}$ is the intensive structure effect;

$\Delta E_{S2}$ is the extensive structure effect;

$\Delta E_{EP}$ is the expenditure effect; and

$\Delta E_{PO}$ is the population effect.

Each of these effects shows the impact of a specific factor on the residential energy consumption by income deciles. However, it is important to highlight that the methodology is suitable only for measuring these impacts on the final energy consumption of the selected sector, and does not provide detailed information on the energy use by different energy sources. The *price effect* represents the impact of energy price change; the *intensive structure effect* refers to the change of energy expenditure share on energy sources by income deciles; the *extensive structure effect* is the change in the share of energy expenditure in total expenditure by income deciles; the *expenditure effect* means the change in per capita total expenditure by income deciles, and, finally, the *population effect* is the change in population size by income deciles. These specific factors can be expressed as follows:

$$\Delta E_{PR} = \sum_i \sum_j W_{ij,t} \ln\left(\frac{PR_{ij,t}}{PR_{ij,t-1}}\right), \quad (13)$$

$$\Delta E_{S1} = \sum_i \sum_j W_{ij,t} \ln\left(\frac{S1_{ij,t}}{S1_{ij,t-1}}\right), \quad (14)$$

$$\Delta E_{S2} = \sum_i \sum_j W_{ij,t} \ln\left(\frac{S2_{i,t}}{S2_{i,t-1}}\right), \tag{15}$$

$$\Delta E_{EP} = \sum_i \sum_j W_{ij,t} \ln\left(\frac{EP_{i,t}}{EP_{i,t-1}}\right), \tag{16}$$

$$\Delta E_{PO} = \sum_i \sum_j W_{ij,t} \ln\left(\frac{PO_{i,t}}{PO_{i,t-1}}\right), \tag{17}$$

where $W_{ij,t}$ is the logarithmic weighting scheme in year $t$, specified as:

$$W_{ij,t} = L\left(E_{ij,t}, E_{ij,t-1}\right) = \frac{(E_{ij,t} - E_{ij,t-1})}{\ln(E_{ij,t}/E_{ij,t-1})}. \tag{18}$$

Assuming that

$$E_{ij,t} \neq E_{ij,t-1}, \tag{19}$$

if

$$E_{ij,t} = E_{ij,t-1}, \tag{20}$$

then

$$W_{ij,t} = E_{ij,t}. \tag{21}$$

The sample period is from 2010 to 2017, which is justified by the limitation in data availability. Annual data as listed below are applied in the calculations collected from Eurostat and the Hungarian Central Statistical Office (KSH):

– final energy consumption of the households by energy sources, such as solid fossil fuels, total petroleum products, gas, electricity, derived heat, primary solid biofuels and other renewables (unit: PJ; source: *Eurostat*, 2019f);

– heating degree days by NUTS 2 regions which include actual heating degree days and mean heating degree days over the period 1980–2004 (unit: day; source: *Enerdata Odyssee*, 2017; *Eurostat*, 2019d);

– annual per capita expenditure by COICOP (Classification of Individual Consumption According to Purpose) and income deciles (unit: HUF; source: *KSH*, 2019b);[7]

– total population on 1 January (unit: capita; source: *KSH*, 2019d).

Here, we note that the annual per capita expenditure data by COICOP classification do not contain information on renewables. The available subcategories are electricity, gas (piped and bottled), liquid fuels, solid fuels and district heating, but the category of solid fuels also includes household expenditures on solid fossil fuels and on primary solid biofuels (the latter referring primarily to firewood) (*KSH*, 2019b). In contrast, in energy statistics provided by Eurostat, solid fossil fuels do not include solid biomass and waste (firewood, charcoal and plastic), since during the data collection these data should be reported in the Renewables and Waste Questionnaire (*OECD/IEA*, 2004). Because of this limitation, energy use data should be harmonised with household expenditure data categories. In doing so, energy sources are grouped as follows: electricity, gas, total petroleum products, solid fuels (including both solid fossil fuels and primary solid biofuels) and derived heat. Consumption data on primary solid biofuels contains illegally collected and/or traded firewood, since a significant part of the firewood used by residential consumers derives from illegal forest activity. In this paper, only legally harvested and traded firewood is considered, because expenditure data could cover only that.

The final energy consumption of the household sector is climate corrected so the heating degree days are used to normalise the energy consumption. In making these calculations, the following formula was applied (similarly to Enerdata Odyssee and Eurostat):

$$E = E_{wc} * 1/(1 - k * \left(1 - \frac{DD}{DD_n}\right)), \tag{22}$$

where

$E$ is the energy consumption (climate corrected);

$E_{wc}$ is the energy consumption;

[7] This represents the above-mentioned limitation, since coherent time series for such data are available only for the period 2010–2017.

*k* is the heating share for normal year;

*DD* is the heating degree days; and

$DD_n$ is the average number of heating degree days for the 25-year period of 1980–2004.

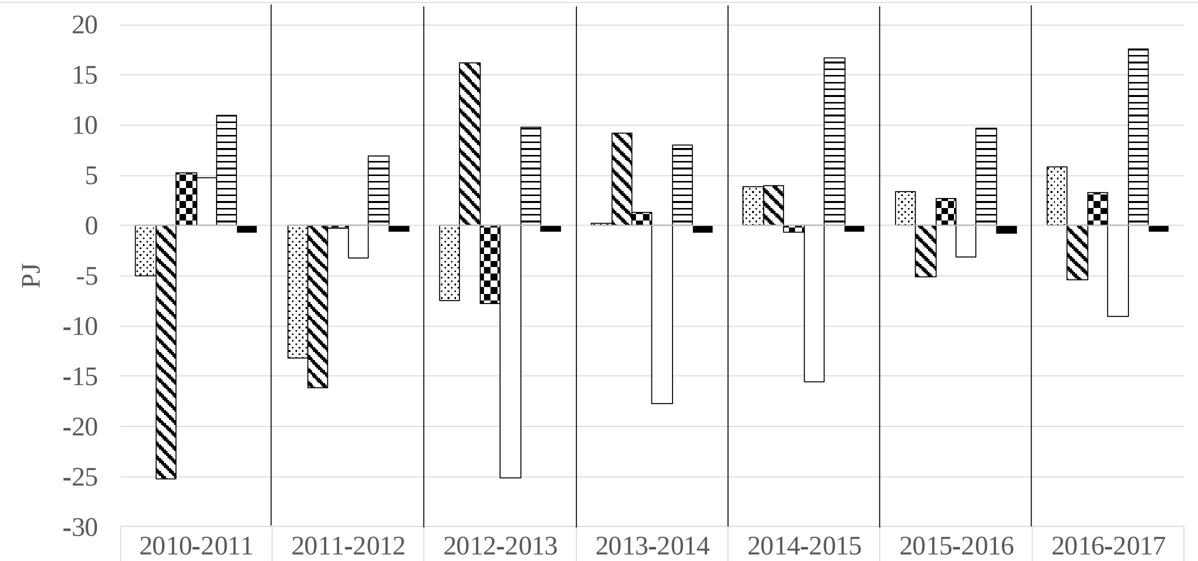
The *k* reference value is 0.6, which was determined by using the KSH's data collection results in 2008 (*KSH*, 2010: 32).

Statistical data for biomass consumption and thus the share of renewables in final energy consumption were significantly modified in 2017, since the EU's 2009 Renewable Energy Directive allows the member states to begin new, more detailed surveys and capture more data on biomass consumption of households (*REKK*, 2017). Therefore, the national energy regulator moved from using supply-side statistics to statistics referring to household energy consumption, resulting in drastically increased residential biomass (firewood) consumption and thus total final energy consumption (*Fig. A2 in the Appendix*), consequently reflected in the share of energy from renewables (*Eurostat*, 2017; *REKK*, 2017).

## 4. Results

*Figure 4* shows changes in the residential energy consumption and the impact of price effect ($\Delta E_{PR}$), the intensive structure effect ($\Delta E_{S1}$), the extensive structure effect ($\Delta E_{S2}$), the expenditure effect ($\Delta E_{EP}$) and the population effect ($\Delta E_{PO}$) on the shift. Any of these effects eventually show how much the specific component would have contributed to changes in the dependent variable (assuming other factors were fixed). In our case, the outcome variable is the residential energy consumption (climate corrected). In the following, possible explanations of the effects are discussed in a broader context.

The final energy consumption (climate corrected) of the Hungarian household sector declined between 2010 and 2013, but growth was seen in the period 2014–2017. Being negative, the *price effect* had a negative impact on the residential energy consumption between 2010 and 2012, but the situation was significantly changed after 2013 as a result of price drops and decreasing energy expenditure. If there was no structural, expenditure




| | 2010-2011 | 2011-2012 | 2012-2013 | 2013-2014 | 2014-2015 | 2015-2016 | 2016-2017 |
|---|---|---|---|---|---|---|---|
| ΔEtot | -5.0 | -13.2 | -7.4 | 0.2 | 3.9 | 3.4 | 5.8 |
| ΔEPR | -25.3 | -16.1 | 16.2 | 9.2 | 4.0 | -5.1 | -5.4 |
| ΔES1 | 5.2 | -0.2 | -7.8 | 1.3 | -0.7 | 2.7 | 3.3 |
| ΔES2 | 4.7 | -3.2 | -25.1 | -17.7 | -15.5 | -3.2 | -9.0 |
| ΔEEP | 10.9 | 7.0 | 9.8 | 8.1 | 16.7 | 9.7 | 17.6 |
| ΔEPO | -0.7 | -0.7 | -0.6 | -0.7 | -0.6 | -0.8 | -0.6 |

**Fig. 4.** Decomposition results of residential energy consumption in Hungary, 2010–2017 (PJ)
*Source:* Own calculation.

and population effect, then the price effect itself would have increased the dependent variable by 16.2 PJ in 2013, 9.2 PJ in 2014 and 4.0 PJ in 2015. The 2015 National Energy Efficiency Action Plan set up an energy saving target of 40 PJ to be achieved in the residential energy consumption in the period of 2010–2020. But the energy use growth caused by the price drop is so notable that it is already difficult to meet the target. However, in 2016–2017, the effects of the utility cost reduction programme were exhausted. The size of the price effect became negative at -5.1 PJ in 2016 and -5.4 PJ in 2017. We assume that households have incorporated lower energy prices into their expectations and their energy consumption stabilised at a higher equilibrium level. Overall, the utility cost reduction programme generated an extra energy use of 29.4 PJ in the residential sector during the period of 2013–2015 (18.9 PJ between 2013 and 2017).

Hereinafter, the main energetic features are shown that are necessary for the interpretation of the structural effect. In empirical studies using the IDA method, the energy structure is assigned priority, which significantly affects the final energy consumption. Obviously, both the structure of residential energy consumption and that of energy expenditure should be considered (*Table 1*).

**Table 1.** The structure of residential energy consumption and expenditure by energy sources in Hungary, 2010–2017 (PJ, HUF, %)

| | 2010 | | | 2011 | | | 2012 | | | 2013 | | | 2014 | | | 2015 | | | 2016 | | | 2017 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) | PJ | % (PJ) | % (HUF) |
| Gas | 136.5 | 49.0 | 39.8 | 124.2 | 45.2 | 39.8 | 113.2 | 42.4 | 38.3 | 105.2 | 40.5 | 37.1 | 97.2 | 42.3 | 36.8 | 109.9 | 44.0 | 36.8 | 117.8 | 45.7 | 38.1 | 124.4 | 47.2 | 39.3 |
| Total petroleum products | 5.6 | 2.0 | 0.0 | 4.4 | 1.6 | 0.0 | 3.3 | 1.2 | 0.0 | 3.6 | 1.4 | 0.0 | 3.1 | 1.3 | 0.0 | 3.1 | 1.2 | 0.0 | 2.5 | 1.0 | 0.0 | 3.1 | 1.2 | 0.0 |
| Derived heat | 23.9 | 8.6 | 10.7 | 22.1 | 8.0 | 11.2 | 22.5 | 8.4 | 11.3 | 21.9 | 8.4 | 11.4 | 18.1 | 7.9 | 10.7 | 19.6 | 7.8 | 10.0 | 20.6 | 8.0 | 9.5 | 20.9 | 7.9 | 9.2 |
| Solid fossil fuels | 6.2 | 2.2 | 12.2 | 7.2 | 2.6 | 13.3 | 6.4 | 2.4 | 15.4 | 5.6 | 2.1 | 16.1 | 4.3 | 1.9 | 18.4 | 4.0 | 1.6 | 19.2 | 5.0 | 2.0 | 19.0 | 5.9 | 2.2 | 18.4 |
| Primary solid biofuels | 65.6 | 23.6 | | 76.2 | 27.7 | | 83.0 | 31.1 | | 85.3 | 32.8 | | 69.1 | 30.1 | | 73.9 | 29.6 | | 72.0 | 27.9 | | 68.0 | 25.8 | |
| Other renewables | 0.2 | 0.1 | 0 | 0.3 | 0.1 | 0 | 0.3 | 0.1 | 0 | 0.4 | 0.1 | 0 | 0.4 | 0.2 | 0 | 0.4 | 0.2 | 0 | 0.5 | 0.2 | 0 | 0.9 | 0.3 | 0 |
| Electricity | 40.3 | 14.5 | 37.3 | 40.7 | 14.8 | 35.8 | 38.2 | 14.3 | 35.0 | 38.1 | 14.6 | 35.4 | 37.5 | 16.3 | 34.1 | 39.0 | 15.6 | 34.0 | 39.4 | 15.3 | 33.5 | 40.5 | 15.4 | 33.2 |
| *Total* | *278.4* | *100.0* | *100.0* | *275.1* | *100.0* | *100.0* | *266.9* | *100.0* | *100.0* | *260.0* | *100.0* | *100.0* | *230.0* | *100.0* | *100.0* | *250.0* | *100.0* | *100.0* | *257.8* | *100.0* | *100.0* | *263.7* | *100.0* | *100.0* |

*Source:* Own compilation based on *Eurostat* (2019f) and *KSH* (2019b).

*Note:* The *Eurostat* (2019f) and *KSH* (2019b) databases are compatible with each other, and only a small difference can be seen. *KSH* (2019b) merges expenditure data of solid fossil fuels and primary solid biofuels into one category called solid fuels. 'Primary solid biofuels and other renewables' is equal to 'renewables and wastes'.

In Hungary, the largest part of the residential final energy consumption is covered by gas (47.2% in 2017), followed by primary solid biofuels and other renewables (26.1%), electricity (15.4%), derived heat (7.9%), solid fuels (2.2%) and oil and petroleum products (2.2%) (*Table 1*) (*Eurostat*, 2019j). Most of the energy (74.0% in 2017) is used for heating homes. The remaining share of energy is almost exclusively for water heating (12.0%) and use of lighting and electrical appliances (excluding the use of electricity for powering the main heating, cooling or cooking systems) (9.4%). Space cooling still accounts for a negligible proportion of residential final energy consumption (0.1%). Gas (53.3% in 2017) and primary solid biofuels and other renewables (34.4%) cover the bulk of the energy needs for space heating. The share of derived heat was 8.2% in 2017, while solid fuels contributed 3.0% to the total. The principal fuels for water heating are electricity and gas (39.3% each). 15.5% of water heating relied on derived heat in 2017. Cooking is mainly done by using gas (68.2%). Oil and petroleum products (including LPG) (19.3%) and electricity (12.4%) are the alternative energy sources for cooking (*Table 2*) (*Eurostat*, 2019j).

The volume of electricity consumption per household consumer decreased slightly during the period 2009–2014, but it has been growing again since 2015. The household gas consumption peaked at 4.6 billion cubic metres (bcm) in 2005 and declined to 3.7 bcm as of 2017. The average volume of gas consumption per household consumer reached its peak of 127 cubic metres (cm) per month in 2003, falling to 94 cm per month in 2017. Despite this long-run downward trend, the volume of gas consumption per household consumer has shown high volatility over the last few years, and natural gas has continued to constitute the largest part of the energy consumption. Between 2014 and 2017, the volume of gas consumption per household consumer increased by 36%, partly due to consumers switching back from firewood to gas. In 2017, the share of household consumption in total electricity and piped gas supplies stood at 29% and 41%, respectively. The number of dwellings connected to hot water and district heating networks has remained unchanged since 1990, though derived heat consumption increased by 19% between 2014 and 2017 (*KSH*, 2018b). Primary solid biofuels and other renewables play a significant part in residential energy consumption, with the highest shares (over 30%) seen in each year between 2012 and 2014 (*Eurostat*, 2019f).

**Table 2.** Residential final energy consumption by type of end use and the share of fuels used for space, water heating and cooking in Hungary, 2017 (%)

| | Type of end-use | Share of fuels | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Space heating | 74.0 | Gas | Primary solid biofuels and other renewables | Derived heat | Solid fuels | Electricity | Total petroleum products | *Total* |
| | | 53.3 | 34.4 | 8.2 | 3.0 | 0.8 | 0.2 | *100.0* |
| Water heating | 12.0 | Electricity | Gas | Derived heat | Primary solid biofuels and other renewables | Total petroleum products | Solid fuels | *Total* |
| | | 39.3 | 39.3 | 15.5 | 4.5 | 1.4 | 0.0 | *100.0* |
| Lighting and appliances | 9.4 | | | | | | | |
| Cooking | 4.5 | Gas | Total petroleum products | Electricity | Primary solid biofuels and other renewables | Solid fuels | Derived heat | *Total* |
| | | 68.2 | 19.3 | 12.4 | 0.2 | 0.0 | 0.0 | *100.0* |
| Space cooling | 0.1 | | | | | | | |
| Other end uses | 0.0 | | | | | | | |
| *Total* | *100.0* | | | | | | | |

*Source: Eurostat* (2019j).

Nevertheless, the picture looks slightly different when one takes into account the prevailing share of firewood and estimates that 50-60% of the firewood consumed is of unknown origin and potentially sourced from illegal logging (*REKK*, 2009, 2017). This is highlighted by the sum of domestic firewood, energy crops production and firewood imports that does not match the total for firewood used (*Bartek-Lesi et al.*, 2019b: 22–25). The share of solid fuels (mostly including firewood) exceeded 20% of the energy expenditures in 2017 not only of those households in the bottom deciles (i.e., the poorest families) but also even in the seventh income decile (i.e., the upper-middle class) as well (*Fig. A3 in the Appendix*).

In 2000, households still spent only 17.7% of their total expenditure on housing and energy, compared to over 25% in 2010, as reported by the *KSH* (2019b), exhibiting slightly higher figures than *Eurostat* (2019h). By comparison, households spent 27.8% of their total expenditure on food and non-alcoholic beverages in 2000 and 22.8% in 2010. The shift between the two items can be explained by decreasing food-related expenses of households. Accordingly, stagnating or declining incomes force consumers to change their buying habits in favour of cheaper products. However, since expenditure on housing and energy is inelastic in the short term (and only relatively elastic in the long term), households face a great burden to adapt to such challenges (*KSH*, 2010: 11). Since 2013, the two ratios seem to have been moving in opposite directions. In 2017, the expenditure on food and non-alcoholic beverages accounted for the biggest item, having 24.7% share of the total, while the share of expenditure on housing and energy declined to 20.0%.

According to the KSH's micro-census, in 2010 space heating represented two-thirds of residential energy costs, while the remaining one-third was spent on such energy costs as water heating, cooking, lighting and the operation of electrical appliances for every income group. Per capita energy expenditure increases proportionally with the income level, and there are huge differences in the share of energy in the total expenditure. While the energy share was only 8.8% in the highest income decile in 2017, compared to the average of 12.1%, those in the lowest income decile spent 15.2% of their budget on energy, which may confirm the presence of energy poverty in the Hungarian society. However, the 2017 figures show a significant improvement from the 2010 rates of 12.4%, 16.7% and 19.4%, respectively. In general, the higher the standard of living of a household, the smaller the expenditures on basic items, such as food, housing and transport (*KSH*, 2018a). These data are significantly higher than results found in *Fig. 1*. The reasons for this difference are clearly presented in *Sebestyén Szép* (2017).

Explanation of this context contributes to understanding the *structural effect*, which can be divided into two main parts, the intensive ($\Delta E_{S1}$) and extensive parts ($\Delta E_{S2}$). The intensive part (the change of energy expenditure share on energy sources) is affected by two factors, the price change between various energy sources and the structural shift in the energy mix (*Zhao et al.*, 2012 and *Eq. (10)*). The extensive part shows the energy intensity development, i.e., the energy expenditure per unit of annual total expenditure. The change in the extensive structural effect can be caused by changes in either the counter (the energy expenditure) or the denominator (annual total expenditure), or in both. The energy expenditure of a household can change for four reasons: (1) the change in consumer habits (through modification of energy-using activities); (2) energy efficiency changes; (3) changes in the price of different energy sources; and (4) using coping strategies (this is the least favourable when the household is living in energy poverty and it has to develop coping strategies and limit its energy-related expenditures).

The positive extensive structural effect can show the following. Although households buy energy-efficient appliances and devices, their energy consumption grows because of a shift toward more energy-intensive activities. For example, a family moves into a larger house where it will need to heat more space, or where every room is equipped with an air-conditioning unit. However, in Hungary, typically the negative extensive structural effect can be discerned, which can be explained by the improving energy efficiency to a lesser extent and by the energy expenditure decline due to price reduction to a greater extent. Next, we discuss this in more detail.

Between 2010 and 2011, the *intensive structural effect* was positive. This suggests that during these two years there was an increasing demand for cheaper energy sources, and many families switched to the less modern but more favourably priced firewood as fuel. During 2011–2015, this effect became negative, which could be due to the increasing demand for higher quality energy sources, mainly electricity and gas (in parallel, their share in the residential energy expenditures was highly volatile and it did not always follow the changes in absolute data). In contrast, in 2016–2017, an opposite trend could be observed, again with positive results. At that time, not only a higher use of electricity, gas and derived heat could be observed, but their share in the residential energy expenditures was growing steadily.

The *extensive structural effect* was positive between 2010 and 2011, which could be attributed to the increasing share of energy expenditure in the total annual expenditure. At that time, approximately 36% of the households used solid fuels for heating, compared to only 14% in 2005 (*Bouzarovski et al.*, 2016). This phenomenon is called energy degradation, referring to replacing the higher quality energy sources with lower ones. A significant part of households were forced to adopt coping strategies to avoid or at least limit energy poverty (see the fourth reason for changes in household energy expenditure). In our case, generally, electricity or natural gas was substituted by firewood. In 2012, the extensive structural effect became negative (even if no price cuts occurred at that time), with opposite changes observed among the income deciles. Energy expenditures increased in deciles 2, 7 and 10, and decreased in deciles 1, 3, 4, 5, 6, 8 and 9, which signals that these latter households restrained their consumption and used cheaper energy sources. Typically, expenditure increased on solid fuels, especially firewood. Probably high energy prices hit these households the hardest. Between 2013 and 2017, the energy expenditure declined in all income deciles because of the price cuts, so the effect was negative (*Fig. 5*).

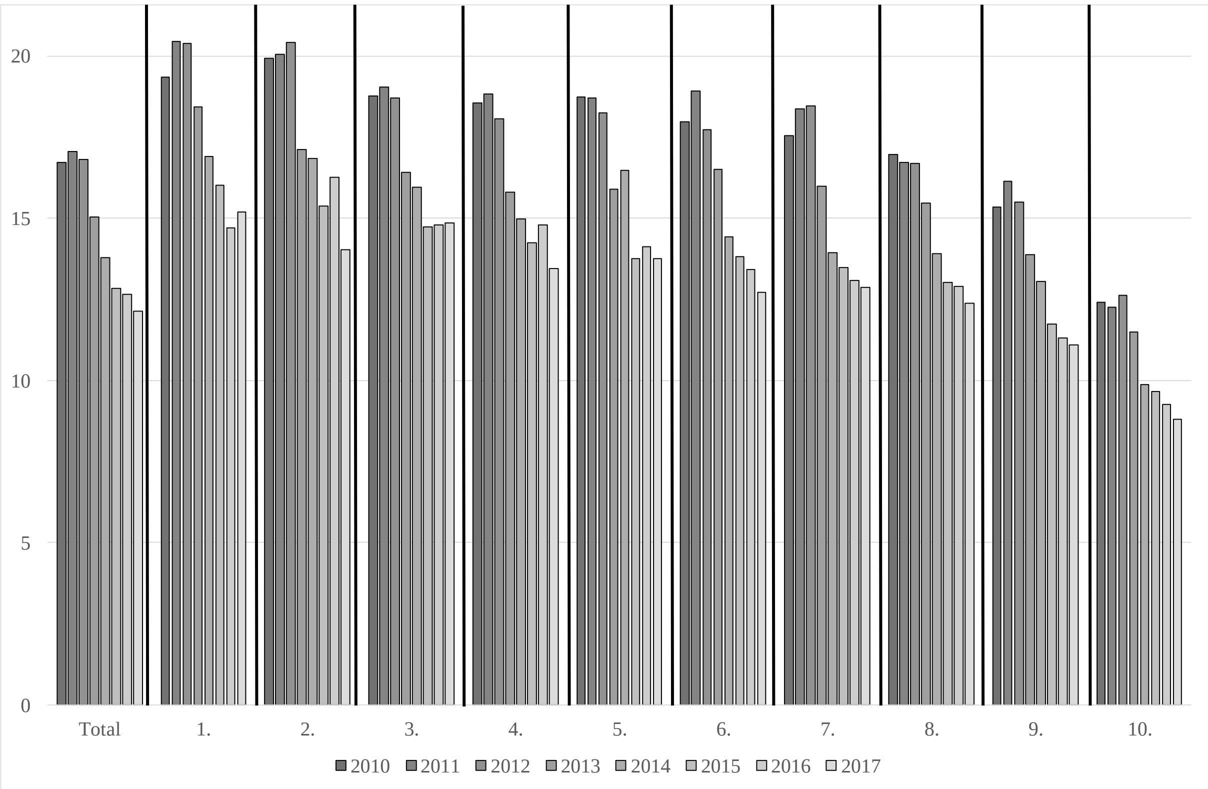



**Fig. 5.** Share of expenditure on electricity, gas and other fuels to the annual per capita expenditure in Hungary, by deciles, 2010–2017 (%)
*Source:* Own compilation based on *KSH* (2019b).

On the other hand, the *expenditure effect* had a positive impact on residential energy consumption in every year, which can be explained by the rising income and standard of living. Finally, Hungary's constantly declining population can be detected in the *population effect*. In all of the examined years, it had a negative impact on residential energy consumption. The values are similar to each other, scattering around 0.6 PJ. International emigration of Hungarians – a palpable phenomenon in the analysed period with 505,000 Hungarians living in other European countries in 2017, compared to the 215,000 of 2010 (*Bucsky*, 2019) – would certainly change the results of our analyses, but the lack of data on emigration per income deciles prevents us from making precise calculations. Further, different sources give varying data even on the number of Hungarians living abroad.

## 5. Discussion

### 5.1. Poverty, energy poverty and social disparities

There is no general agreement about the linguistic description of the condition expressed as 'fuel poverty', 'domestic energy deprivation', 'energy precariousness' or 'energy poverty', or the definition of what these mean. Among these interchangeably used constructs, we use the term 'energy poverty' which, according to *Bouzarovski* (2014: 277), generally refers to 'the inability of a household to secure a socially and materially necessitated level of energy services in the home'. The UK and Ireland were the only two EU states where the material existence and political voice of the energy poor have been widely recognised in public debates, policies and research. Yet recent years have seen the rise of a growing public awareness (*Bouzarovski*, 2014). As the conditions of different countries and data availability vary widely, the EU requires member states to locally identify and measure this phenomenon. Currently, there is no official definition or established method for measuring energy poverty in Hungary (*Kőszeghy and Feldmár*, 2019). However, energy poverty has become a recurring thought in Hungarian policy documents and strategies, though this problem was not given major attention (although, as mentioned, some documents acknowledge its existence – see *Section 2.3*) until 2013 (and the 2014 parliamentary elections). Not surprisingly, no complex, strategic approaches to reducing energy poverty have been worked out, which may be considered as the failure of policy makers to recognise the causes and to handle the consequences in an efficient way (*LaBelle and Georgiev*, 2016). For this, first of all, it would be important to acquire a more precise understanding of the scope and types of people that are concerned with energy poverty. *Kőszeghy and Feldmár* (2019) suggest that there is a need for simultaneous management of social and energy efficiency problems, and thus differentiated interventions.

According to *Eurostat* (2019q), the share of the population having difficulty obtaining the necessary energy in their home to meet their basic needs decreased from 10.7% in 2010 to 6.8% in 2017 (and further to 6.1% in 2018), compared to the EU average of 7.8% in 2017 (7.3% in 2018) (*Fig. A4 in the Appendix*). The other three Visegrád countries registered better figures, with Czechia having 3.1% in 2017 (2.7% in 2018), Slovakia 4.3% in 2017 (4.8% in 2018) and Poland 6.0% in 2017 (5.1% in 2018).

The NECP calculates an under-heating ratio that indicates how much less heating energy the population uses compared to what would be required to keep the buildings' temperature at a minimum of 20°C throughout the whole year. This ratio varies from building to building and is between 35% and 42%. In addition, the NECP says that Hungary will measure the effectiveness of policies aimed at reducing heating difficulties by monitoring the share of households that spend at least 25% of their income on energy costs (which amounted to 9.8% in 2016) (*ITM*, 2020b: 73, 151).

Though there are specific features in each of its countries, in the UK a household is generally considered to be energy poor if it needs to spend more than 10% of its income on energy costs to maintain an adequate standard of warmth, which is defined as 21°C for the main living area and 18°C for other occupied rooms (*BEIS*, 2019). However, if this 10% indicator were applied to Hungary, then most households would be energy poor. Therefore, in 2012, Energiaklub, a Budapest-based energy policy think tank, proposed a complex definition for Hungary based on the following three criteria: (1) the annual income of the household is less than 60% of the median household income in Hungary; (2) the ratio of the theoretical annual cost of energy for heating an apartment to 20°C and providing hot water to the total income of the household is more than double the median value of the actual declared data of all households; (3) the energy performance certificate rating of the building is below 'F'[8] (*Fellegi and Fülöp*, 2012). A composite indicator has been formed by *OpenExp* (2019). Its European Energy Poverty Index (EEPI) for scoring and ranking the member states' progress in alleviating energy poverty shows that despite the positive tendency indicated by *Eurostat* (2019j) for Hungary, the effectiveness of the utility cost reduction programme is only relative. Irrespective of the Hungarian government's efforts, Hungary ranked last among EU members in 2018, while Czechia came in at 11th place, Poland at 12th and Slovakia at 24th.

Energiaklub's definition points to the three main factors of energy poverty (and also to the three points of intervention in order to reduce the high ratio of residential expenditure on energy services to total expenditure): inadequate household income, high energy costs

[8] However, the classification changed in 2016. Since then, there is no 'F' category.

and obsolete housing stock from an energy efficiency perspective. Regarding the first two issues (the third one is discussed in *Section 5.4*), one can see that in the 2010s, household income and consumption have grown at a rapid pace and poverty has decreased substantially, while social disparities have deepened in Hungary.

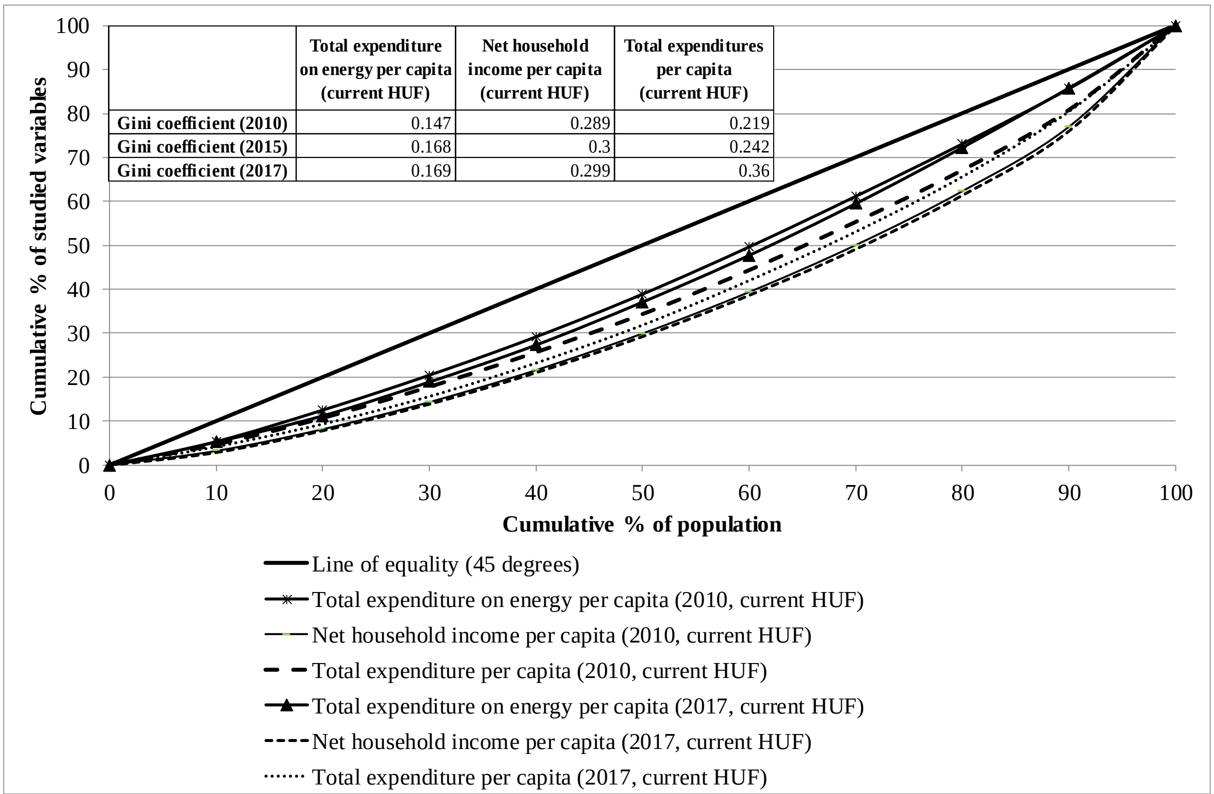
We estimate that the utility cost reduction programme resulted in a total of HUF 598.5 billion savings to Hungarian households during the period 2013–2017. This represents an average of 0.35% of annual GDP between 2013 and 2017.

In Hungary, per capita adjusted gross disposable income of households, measured in purchasing power standard, grew in real terms an average 3.1% annually between 2010 and 2018, but in absolute terms, the other three Visegrád countries are better off than Hungary (*Eurostat*, 2020a). Actual individual consumption per capita increased in real terms at an average annual rate of 2.6% from 2010 to 2018 in Hungary (*Eurostat*, 2020c), but, again, in absolute terms, the other Visegrád countries are ahead of Hungary, and even the Romanian level surpassed that of the Hungarian (which was 64% of the EU average in 2018, according to the first estimates) (*Eurostat*, 2019k). However, the gross debt-to-income ratio of households fell from 67.9% in 2010 to 33.4% in 2018 in Hungary (*Eurostat*, 2019b). The utility cost reduction programme largely contributed to lower inflation that went negative in 2014 (-0.2%) and 2015 (-0.1%) from the high of 5.7% in 2012 (*piacesprofit.hu*, 2014), though it has been rising since 2016. Meanwhile, the base rate set by Hungary's central bank declined from 7% at the end of 2011 to 0.9% in May 2016, and has been at that level ever since.

Regarding poverty, the share of the total population at risk of poverty or social exclusion dropped from 31.5% or 2.948 million in 2010 (34.8% or 3.272 million in 2012) to 19.6% or 1.887 million in 2018 (25.6% or 2.465 million in 2017). In 2018, this ranked Hungary in the middle range of poverty across EU member states, while Czechia (12.2%) and Slovakia (16.3%[9]) were seated on the podium, and Poland was also better placed (18.9%) than Hungary. Nevertheless, this rate has improved the most in Hungary since 2010 (*Portfolio*, 2018a; *Eurostat*, 2019a, 2019c, 2019o, 2019p). In contrast, the decline in the extreme poverty rate – i.e., the combination of (1) being at risk of poverty after government benefits and support (income poverty), (2) severely materially deprived and

[9] This is a 2017 figure, since data for 2018 are not yet available.

(3) living in households with very low work intensity – seems suspiciously drastic in Hungary and, for a significant part, is really attributable to statistical measurement reasons, since those employed in the public works programme drop out of the statistical category of people living in households with very low work intensity, and are no longer considered to be in severe material deprivation. Therefore, one can only estimate the real extent of extreme poverty in Hungary. Accordingly, if the 2017 official figures of around 100,000 people are corrected by adding those employed in public work schemes, then the number of people living in extreme poverty could be estimated at over 300,000 (*Portfolio*, 2018b). Moreover, Zsuzsa Ferge, the most respected researcher on poverty in Hungary, argues that although Hungarian data are incomplete and inaccurate, the real picture is that nearly four million people are living in poverty, including 1.3 million in extreme poverty, which strongly contradicts the official data (*Komócsin*, 2018).




| | Total expenditure on energy per capita (current HUF) | Net household income per capita (current HUF) | Total expenditures per capita (current HUF) |
|---|---|---|---|
| Gini coefficient (2010) | 0.147 | 0.289 | 0.219 |
| Gini coefficient (2015) | 0.168 | 0.3 | 0.242 |
| Gini coefficient (2017) | 0.169 | 0.299 | 0.36 |

**Fig. 6.** Lorenz curves and Gini coefficients in the Hungarian household sector, 2010, 2015 and 2017
*Source:* Own compilation based on *KSH* (2019b, 2019c).

To assess social disparities, we first examined whether the price decline or the reallocation between expenditure items reduced the inequalities. The Lorenz curve is especially suitable for graphical representation of social disparities, and this has become a popular tool to illustrate not only income, but also expenditure-related inequalities (*Finn et al.*, 2009; *Dollman et al.*, 2015). *Figure 6* illustrates growing inequalities for all three indicators (energy expenditure, total expenditure and net household income) during the period of 2010–2017, confirmed by the Gini coefficient. However, in the case of energy expenditure and total expenditure, the disparities were lower compared to the net household income until 2015, which suggests that households have the ability to borrow and save money to offset temporary changes. In 2016, these favourable tendencies changed, as a significant growth in inequalities can be observed regarding the total expenditures per capita.

### 5.2. The gas issue: the beginning and end of all things

The residential sector accounts for the largest share of Hungary's gas consumption (*MEKH*, 2019d). More than 90% of the settlements are supplied with piped gas. Between 3.2 and 3.3 million households use piped gas, amounting to almost three-quarters of the housing stock (*KSH*, n.d.).[10] Gas consumption started to spread increasingly in Hungary from the 1960s and onwards, partly due to booming domestic gas production, but mainly based on the Hungarian–Soviet gas supply contracts signed in the 1970s and 1980s. Consequently, gas became the dominant fuel of urban heating. The housing factory programme for production of prefabricated apartment blocks and the subsequent housing construction campaigns were based on cheap gas. Because of the low price of gas, these houses were not designed with proper insulation and heating systems. Supported by the EU's PHARE programme, in the early 1990s the gas pipeline network was greatly extended in Hungary, reaching the poorest regions as well. In these areas, many houses have not even been connected to the network, because the cost of the connection is above the ability of a substantial proportion of families to finance (*Lovas*, 2012). In the household sector, significant changes in fuel consumption took place between 1990 and 1998, when tile stoves and solid-fuel-burning and oil-fired boilers were being massively replaced by new high-efficiency gas-fired boilers. Subsidised domestic gas prices significantly contributed to the massive penetration of gas in households.

[10] There are around 4.2 million households and 4.4 million dwellings in Hungary (*ITM*, 2020b: 147–148).

In *Section 4*, we provided a snapshot of the changes in residential gas consumption. However, regarding the whole domestic gas consumption, we should note that, with a couple of exceptions, it grew until 2006. The decline started in 2007, and gas consumption had diminished to 57.7% of its 2006 peak level by 2014. Since 2015, demand has been increasing again (*Eurostat*, 2018a; *MEKH*, 2019d). Gas consumption reached 10.3 bcm in 2017 (*MEKH*, 2019a: 28). Consequently, the role of gas in the energy/electricity/heat mix decreased significantly, though recently an increase has taken place. The sharp decline in gas consumption between 2007 and 2014 was mainly due to the evolution of (relative) gas prices and the 2008–2009 economic crisis. This has been reflected in the gas consumption of both the energy transformation sector and of end users, such as industry and the populace. Although the role of gas in energy consumption has declined over the last 15 years (*Eurostat*, 2020b), gas consumption remains significant. Dependence on gas imports and import prices and thus the over-politicisation of domestic gas prices are ongoing problems.

The price of gas is a matter of very serious political debates in Hungary. The process of market opening started in 2004, and the gas market was fully opened to competition in 2007. By now, only residential consumers and other customers in possession of a gas meter with a capacity of less than 20 cm per hour are allowed to purchase gas at regulated prices in the so-called ‘universal service’. It was the conservative Fidesz party that campaigned with the slogan of ‘cheaper gas’, while social-liberal coalition governments tried to balance between economic reality and social considerations (*Deák and Weiner*, 2019: 144). As seen, by April 2013 a major change had taken place in the Hungarian government’s approach to regulated energy prices. One and a half years earlier, the 2011 NES explicitly rejected regulated energy prices in the household sector. Instead, it focused on consumer awareness to limit consumption and improve energy efficiency. As a priority, it aimed to design coherent and targeted investment incentives for renewables. Utility rate reduction became Fidesz’s 2014 electoral silver bullet, practically representing the single most prominent slogan by the end of the campaign. Presumably, it was the utility rate cut that boosted Fidesz’s popularity (*Deák and Weiner*, 2019: 144). There is a consensus that the decision on price regulation was mainly politically motivated (*Bouzarovski et al.*, 2016) and later it became a permanent and unavoidable element of energy-related documents. However, the affordability issue can have a significant effect on the outcome of parliamentary elections not only in Hungary. *Nosko and Mišík* (2017: 208) argue that many politicians across the Central and East European region, including also those in Bulgaria, Czechia and Slovakia, have discovered energy's wide-ranging potential for such perspectives. Special mention should be made of major marches organised in Bulgaria in 2013 against high electricity prices.

Declining regulated gas prices in Hungary were first supported by concessions from Russia's Gazprom on gas volumes and prices in 2013 and 2014 (*Deák and Weiner*, 2019: 144–145). Then the decline in oil prices began in mid-2014.[11] Nevertheless, two comments have to be made. On the one hand, the same government raised gas prices before the utility rate cut campaign (*Ember*, 2018), and, on the other, regulated gas prices have remained unchanged, despite the fact that market developments would have justified further cuts (*Fig. 7*). There is a consensus in expert circles about the latter (*Marnitz*, 2017; *24.hu*, 2018). This is also underlined by the fact that Hungarian Gas Trade, the state-owned gas trader, earned a profit of HUF 50.9 billion in 2016, as against HUF 2.3 billion in 2015. According to the data provided by the Hungarian Socialist Party (MSZP), regulated gas prices were higher than justified even during the 2013–2014 utility rate cuts (*Magyari*, 2017b; *MSZP.hu*, 2018). However, Russian import gas prices increased significantly in 2018 (*Jandó*, 2019). Anomalies between regulated and market prices also led to a conflict in the market when Germany's E.ON started selling gas at a lower price than the regulated level. As a response, the Hungarian government accused E.ON of interfering in parliamentary elections on 'Brussels' side'. The government has done everything in its power to hide the above anomaly and emphasised that only its war could save the results of the utility price reduction. In support of the latter, Fidesz first collected signatures amongst the population in 2013, and then the government launched a so-called 'national consultation' survey in 2017. Later, the government referred to the utility price reduction in the interest of its series of completed and planned steps regarding Russian gas imports, Paks II, and also against EU climate targets (*Jenei*, 2018; *Magyari*, 2018). The government is fighting against Brussels on several fronts. In 2016–2017, the government argued that Brussels worked against the utility price reduction (*Kormany.hu*, 2016;

[11] We do not know how important a role oil prices, or to be more precise, oil product prices are now playing in gas pricing, though it has surely decreased drastically (*Weiner*, 2019b).

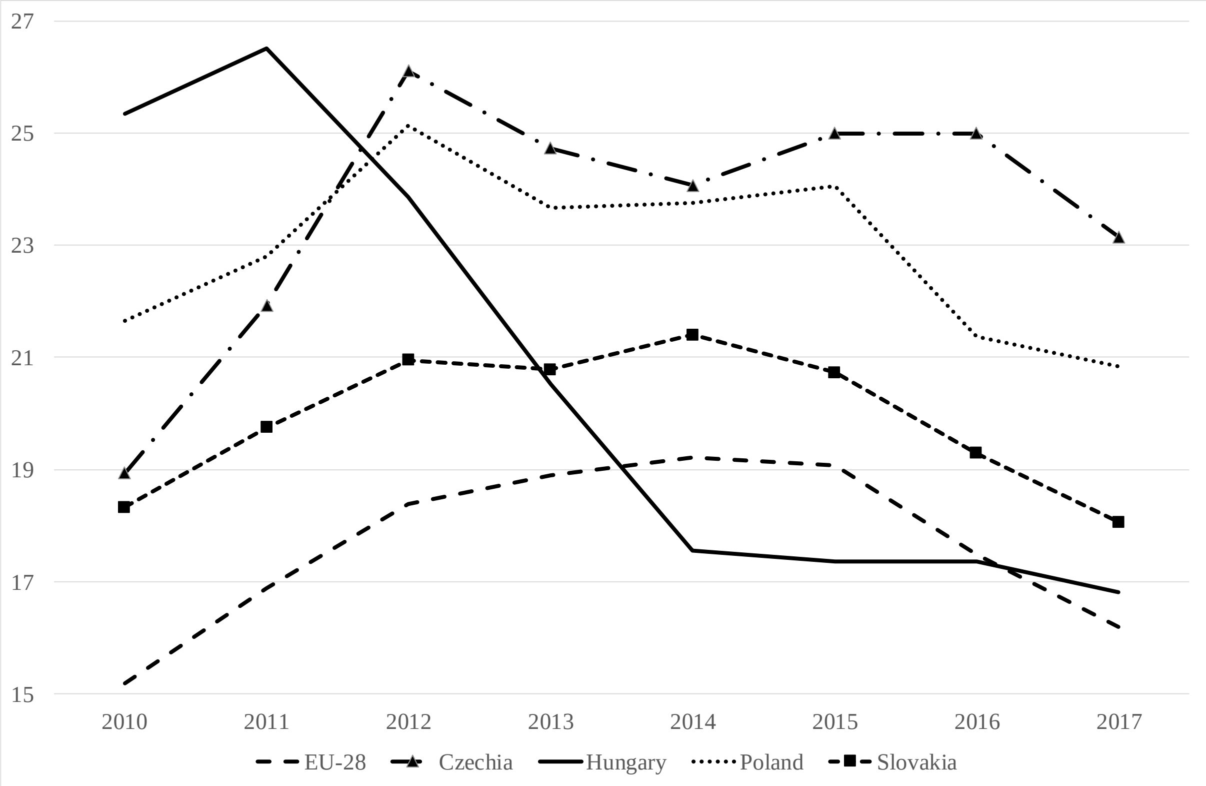



**Fig. 7.** Gas prices (including all taxes and levies) for medium-sized household consumers (with an annual consumption of between 20 GJ and 200 GJ) in the EU member states, 2010–2017 (EUR, PPS per GJ)
*Source:* Own compilation based on *Eurostat* (2019h).

*Portfolio*, 2016; *Magyari*, 2017a). This statement was based on the fact that as part of its legislative proposal on common rules for the internal market in electricity, the European Commission proposed that electricity prices would have to be market-based and freely determined by suppliers. However, like in the case of gas prices, regulated electricity prices are not necessarily cheaper than market rates, as has already been experienced in Hungary. Despite this fact, the Hungarian parliament passed a resolution against the above and other related plans of 'Brussels' within this EU legislation in May 2017, and a compromise was reached in the Council at the end of 2017, which meant Hungary had essentially won this battle (*Magyari*, 2016, 2017a; *Council of the European Union*, 2017; *Eurelectric*, 2017; *European Parliament Think Tank*, 2019).

The NECP aims to decrease gas consumption and the role of gas both in residential individual heating and district heating by the combination of energy efficiency measures and fuel mix diversification. In district heating, the NECP wants to reduce the role of gas by introducing more renewables such as biomass and geothermal energy. In addition, more emphasis is planned to be put on the recovery of energy from non-recyclable waste and the use of biogas from sewage, landfills and agricultural waste materials for district heating (*ITM*, 2020b).

### 5.3. The firewood issue: (energy) poverty and renewable energy consumption

Solid biomass represents the second most important energy source for household energy use. Firewood and coal use is overrepresented among low-income households and is most prevalent in districts having a worse social situation. Moreover, heating poverty was further exacerbated by some 29% increase in the price of both firewood and coal experienced between 2011 and 2017, while the costs of piped gas and district heating fell (*Bajomi*, 2018; *Biró*, 2018; *Palocsai*, 2018). Despite these, heating costs of a significant portion of homes, including those using firewood, coal, but also bulk and bottled LPG, was not supported until the winter utility cost reduction had been introduced. Their heating costs could still be subsidised through electricity tariffs, if electric heating was used, but this type of heating is expensive and not common in Hungary, as mentioned earlier. Taking into account the above and considering that the 2018 extended utility cost reduction was only a one-off event, a very striking part of the population has been unable to enjoy the benefits of the original programme.

The 2018 extended utility cost reduction programme should not be confused with the issue of the 'social fuel' programme for receiving firewood or brown coal. Introduced in 2011, currently this is the only form of central support specifically dedicated to housing maintenance. It is claimed by the municipalities from the interior ministry and then distributed by them on the basis of social criteria. In 2016, 180,000 households received such support, compared to 45,000 in 2011. In parallel, the number of municipalities involved grew from 456 in 2011 to 1,625 in 2012 and 2,255 in 2017. The total budget of the programme increased from HUF 3 billion in 2016 to HUF 4 billion in 2017 and HUF 5 billion in both 2018 and 2019. Particularly noteworthy is the low budget of the programme when compared to Hungary's total housing budget (just 1.6% of it in 2017) or the family housing allowance scheme (1.9%) – the latter is primarily used for middle-class housing and is typically unavailable to people living in poverty (*Bajomi*, 2018).

Heating subsidies are also important because of the effects of poverty on health and environment. These subsidies can reduce the health risks associated with cold homes and the number of deaths due to cold, and can also indirectly reduce school and work absences, as both children and adults recover faster from respiratory diseases in a properly heated home, and thus the risk of complications can be decreased. In low-income households, problems may arise not only from insufficient heating but also from inadequate thermal insulation and heating systems. Households using inadequate heating equipment face high heating costs, release more harmful emissions into the air and have higher health risks. The latter problem is exacerbated if waste or low-quality fuels are burned, which significantly worsen the air quality not only around but also within the building. Ambient (outdoor) and household air pollution is estimated to have caused about 15,000 premature deaths in 2015 (*MEHI*, 2019b). The level of household air pollution from solid fuel combustion is also influenced by the quality and efficiency of heating appliances and also by heating practices, the latter referring to how the fuel is inserted into the heating equipment and the moisture content of firewood. Therefore, emissions and heating costs can be significantly reduced by increasing the energy efficiency of the building and burning dry hardwood with modern and properly maintained heating equipment (*Bajomi*, 2018). In contrast, the use of lignite – the lowest grade coal with a very high sulphur content – should not be supported, but rather should be eliminated.

Finally, in addition to the relationship between firewood use and poverty, firewood use also has another notable aspect to be addressed. This is related to overall renewable use, since solid biomass accounts for the bulk of Hungary's renewable energy consumption, with a share of 80.8% in Hungary in 2017 (*MEKH*, 2019g). In Hungary, solid biomass almost exclusively refers to firewood, with a 95.7% share in 2016. The remaining part is constituted by straw. In 2016, 73.4% of firewood was used by households for heating purposes. The share of power plants amounted to 15.4%, while district heating was at 5.7% and industrial use at 5.5% (*Bartek-Lesi et al.*, 2019b: 22). This means that Hungary's renewable energy consumption and also the achievement of the EU renewable target mainly depend on firewood used by the population for heating. When the statistical methodology for considering firewood consumption was changed, a bright picture was painted for the share of energy from renewables in gross final energy consumption. However, under the current trends, meeting the 2020 target has become uncertain, but the NECP believes that the 2020 figure will be over 13% (*ITM*, 2020a). According to the

NECP, residential firewood use will be significantly reduced. The NECP, by contrast, intends to encourage further heat pump installations and efficient biomass-heating solutions (*ITM*, 2020b).

### 5.4. Energy consumption and energy efficiency

As an EU member state, Hungary is committed to meet energy efficiency targets by 2020 and 2030. A 20% and a 32.5% EU-wide indicative target were set for 2020 and 2030, respectively, both compared to levels projected in the European Commission's 2007 update of the 'energy baseline' scenario (*European Commission*, 2008; *European Environment Agency*, 2018, 2019). There are three kinds of national targets: (1) an indicative national energy efficiency target, based on either primary or final energy consumption, primary or final energy savings, or energy intensity; (2) a binding renovation target for public buildings; and (3) a binding cumulative end-use energy saving target (*European Parliament and Council*, 2018a; *European Commission*, n.d.-b).

Firstly, for 2020, Hungary's primary and final energy consumption targets are 1,009 PJ and 693 PJ, respectively, while primary and final energy savings targets are 92 PJ and 73 PJ, calculated as a difference of the 'policy' scenario (also called the 'joint effort' scenario), involving new policy measures, and the 'business-as-usual' scenario. These figures are from the 2015 updated energy consumption forecasts of the 2011 NES (*Table 3*) (*Government Decree 1160/2015 (III. 20.)*). For a 2030 target, *Government Decree 1772/2018 (XII. 21.)* states that Hungary's final energy consumption shall not exceed the 2005 levels in 2030. This represents a modest commitment in light of the fact that the EU decided to reduce final energy consumption by 20% compared to the 2005 levels (*European Parliament and Council*, 2018a).

Secondly, regarding the public buildings renovation target, the 2012 EU Energy Efficiency Directive requires EU member states to renovate 3% of the total floor area of heated and/or cooled buildings owned and occupied by the central government.

Thirdly, in order to achieve the cumulative end-use energy savings target of the 2012 EU Energy Efficiency Directive by 31 December 2020, Hungary did not choose the standard programme, but rather the implementation of alternative policy measures.

**Table 3.** Energy consumption forecasts for 2020 and 2030 revised in 2015 as part of Hungary's 2011 NES (PJ)

| | 2012 | 2020 | | 2030 | |
|---|---|---|---|---|---|
| | Fact | Business as usual | Joint effort | Business as usual | Joint effort |
| Primary energy consumption | 992 | 1,101 | 1,009 | 1,217 | 1,028 |
| Network losses | 22 | 24 | 23 | 26 | 24 |
| Power plant consumption | 9 | 10 | 9 | 11 | 10 |
| Final energy consumption | 677 | 766 | 693 | 840 | 692 |
| Industry | 96 | 124 | 114 | 139 | 126 |
| Transport | 157 | 161 | 147 | 173 | 151 |
| Households | 215 | 247 | 207 | 284 | 187 |
| Commerce and services | 116 | 126 | 118 | 135 | 121 |
| Agriculture | 17 | 18 | 17 | 19 | 17 |
| Non-energy consumption | 77 | 90 | 90 | 90 | 90 |
| Electricity consumption* | 153 | 170 | 164 | 197 | 181 |

* Gross final electricity consumption, including power plant consumption, network losses and energy industry own use.
*Source: Government Decree 1160/2015 (III. 20.).*

Under the standard system, energy distributors or retail energy sales companies must achieve energy savings at the level of 1.5% of their annual energy sales to end-users between 2014 and 2020, compared to the average final energy consumption in the period 2010–2012 (*European Parliament and Council*, 2012). According to the new 2018 Directive, new annual savings of 0.8% of final energy consumption, averaged over the period 2016–2018, should be realised each year between 2021 and 2030 (*European Parliament and Council*, 2018a).

In 2017, Hungary's primary and final energy consumption reached 1,116 PJ and 751 PJ, respectively,[12] whereas residential final energy consumption was 263 PJ (*Tables 4 and 5*). The 2015 National Energy Efficiency Action Plan specifies the target value of final energy consumption in the residential sector to be at 207 PJ in 2020 (*NFM*, 2015b: 18). However, as of 2017, Hungary was far from this goal (*Table 5*).

Since 2018, thus within a very short period of time, the Hungarian government has made three different forecasts about Hungary's future energy consumption. *Government Decree 1274/2018 (VI. 15.)* updated the energy consumption forecasts of the 2011 NES. It emphasises that primary energy consumption will increase significantly in both the policy

[12] These figures are from the Hungarian Energy and Public Utility Regulatory Authority (MEKH). MEKH data differ from those of Eurostat. See *Table 4* for an explanation of this issue.

**Table 4.** Primary and final energy consumption in Hungary, 1990–2017 (PJ and Mtoe)

| | | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary energy consumption | PJ | 1,147 | 1,105 | 1,000 | 1,028 | 989 | 1,022 | 1,057 | 1,036 | 1,015 | 1,022 |
| | Mtoe | 27.4 | 26.4 | 23.9 | 24.6 | 23.6 | 24.4 | 25.2 | 24.7 | 24.2 | 24.4 |
| Final energy consumption | PJ | 818 | 774 | 678 | 677 | 675 | 676 | 700 | 670 | 674 | 685 |
| | Mtoe | 19.5 | 18.5 | 16.2 | 16.2 | 16.1 | 16.1 | 16.7 | 16.0 | 16.1 | 16.4 |

| | | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary energy consumption | PJ | 990 | 1,023 | 1,015 | 1,045 | 1,043 | 1,103 | 1,088 | 1,063 | 1,053 | 1,003 |
| | Mtoe | 23.6 | 24.4 | 24.2 | 25.0 | 24.9 | 26.4 | 26.0 | 25.4 | 25.2 | 23.9 |
| Final energy consumption | PJ | 676 | 709 | 712 | 741 | 736 | 785 | 773 | 730 | 730 | 715 |
| | Mtoe | 16.2 | 16.9 | 17.0 | 17.7 | 17.6 | 18.7 | 18.5 | 17.4 | 17.4 | 17.1 |

| | | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|
| Primary energy consumption | PJ | 1,031 | 1,021 | 969 | 938 | 921 (998) | 975 (1,055) | 994 (1,071) | 1,025 (1,116) |
| | Mtoe | 24.6 | 24.4 | 23.1 | 22.4 | 22.0 (23.8) | 23.3 (25.2) | 23.7 (25.6) | 24.5 (26.6) |
| Final energy consumption | PJ | 731 | 732 | 690 | 694 | 679 (665) | 728 (710) | 746 (728) | 775 (751) |
| | Mtoe | 17.5 | 17.5 | 16.5 | 16.6 | 16.2 (15.9) | 17.4 (17.0) | 17.8 (17.4) | 18.5 (17.9) |

*Note:* Data from the MEKH are in brackets (*MEKH*, 2019c). As opposed to MEKH data, Eurostat data contain international aviation. Further, according to MEKH, differences between the two data sources may be due to the use of different calorific values for petroleum products (*MEKH*, email communication, 25 July 2019, 12 August 2019).
*Source: Eurostat* (2020b).

**Table 5.** Hungary's final energy consumption by sector, 2014–2017 (PJ)

| | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|
| Primary energy consumption | 998 | 1,055 | 1,071 | 1,116 |
| Final energy consumption | 665 | 710 | 728 | 751 |
| Industry | 158 | 166 | 169 | 182 |
| Transport | 164 | 177 | 181 | 189 |
| Households | 230 | 250 | 258 | 263 |
| Commerce and services | 89 | 92 | 91 | 90 |
| Agriculture | 25 | 24 | 27 | 26 |
| Other | 0 | 1 | 1 | 1 |
| Non-energy use | 79 | 82 | 80 | 94 |

*Source: ITM* (2018a: 66).

scenario and the business-as-usual scenario – by 15.4% or 33.7% by 2030 from 1,055 PJ in 2015, respectively. However, compared to the business-as-usual scenario, in the case of the joint effort scenario, these increases are expected to occur mainly due to the fact that electricity imports will be replaced by domestic production, resulting in increased transformation losses. Final energy consumption would also see an increase in both scenarios – by 6.9% or 28.1% by 2030 from 725 PJ[13] in 2015. Under the business-as-usual scenario, final household energy consumption would increase from 249 PJ[14] in 2015 to 264 PJ in 2020 and 278 PJ in 2030, a 6.0% and a 11.6% increase, respectively, while the joint effort scenario would result in a 2.4% decrease to 243 PJ in 2020 and a 15.7% decrease to 210 PJ in 2030 (*Table 6*) (*Government Decree 1274/2018 (VI. 15.)*).

**Table 6.** Energy consumption forecasts for 2020 and 2030 revised in 2017 as part of Hungary's 2011 NES (PJ)

| | 2015 | 2020 | | 2030 | |
|---|---|---|---|---|---|
| | Fact | Business as usual | Joint effort | Business as usual | Joint effort |
| Primary energy consumption | 1,055 | 1,187 | 1,110 | 1,411 | 1,217 |
| Network losses | 21 | 23 | 21 | 23 | 20 |
| Power plant consumption | 8 | 9 | 8 | 13 | 11 |
| Final energy consumption* | 725 | 822 | 761 | 929 | 775 |
| Industry | 177 | 219 | 201 | 248 | 218 |
| Transport | 182 | 222 | 210 | 277 | 247 |
| Households | 249 | 264 | 243 | 278 | 210 |
| Commerce and services | 91 | 90 | 81 | 94 | 70 |
| Agriculture | 24 | 27 | 26 | 32 | 30 |
| Non-energy consumption | 83 | 97 | 97 | 118 | 118 |
| Electricity consumption** | 158 | 172 | 164 | 191 | 176 |

* Due to rounding, subtotals do not add up to the final energy consumption data.
** Gross final electricity consumption, including power plant consumption, network losses and energy industry own use.
*Source: Government Decree 1274/2018 (VI. 15.).*

The other two forecasts are released as parts of the draft and the final NECPs. We can observe important differences between them. Regarding primary energy consumption, only minor changes were made. However, in the case of final energy consumption, all forecasts were increased in the final NECP, with two exceptions. One exception is transport, where every number for each consumption category was reduced. The other exception is households, where forecasts for 2025 and 2030 were reduced in the WAM ('with additional measures') scenario – for 2025 only moderately, but for 2030 significantly. In its existing policy measures scenario ('with existing measures' or WEM scenario), the final NECP assumes an 18.7% increase in the final energy consumption between 2015 and 2030. And even if additional measures are taken, final energy

[13] MEKH figure for 2015 final energy consumption (710 PJ, *Tables 4 and 5*) is somewhat different from that of *Government Decree 1274/2018 (VI. 15.)* (725 PJ, *Table 6*).
[14] *ITM* (2018a: 66) gives 250 PJ, as shown in *Table 5*.

consumption will still increase by 7.6% in this period. There is only a 9.4% difference between the 2030 final energy consumption data based on WEM and WAM. In contrast, the final NECP expects final household energy consumption to decrease by either 0.8% or 31.7% depending on existing or additional policy measures. In the WAM scenario of the draft NECP, a 20.3% reduction was forecast (*Tables 7 and 8*) (*ITM*, 2018b, 2018c, 2020b).

**Table 7.** Forecasts of the draft NECP for Hungary's primary and final energy consumption based on scenarios with existing measures (WEM) and with additional measures (WAM), 2005–2030 (ktoe)

| | 2005* | 2010* | 2015* | 2020 | 2025 | 2030 |
|---|---|---|---|---|---|---|
| *WEM* | | | | | | |
| Primary energy consumption | 28,112 | 26,599 | 25,184 | 26,918 | 27,987 | 31,499 |
| Final energy consumption | 18,749 | 17,425 | 17,381 | 18,289 | 19,091 | 20,008 |
| Industry | 3,401 | 2,920 | 4,244 | 4,726 | 5,093 | 5,367 |
| Households | 6,974 | 6,649 | 5,970 | 5,871 | 5,581 | 5,384 |
| Services | 3,501 | 3,049 | 2,204 | 1,926 | 1,907 | 1,909 |
| Transport | 4,313 | 4,319 | 4,356 | 4,896 | 5,587 | 6,370 |
| Others | 560 | 488 | 608 | 649 | 679 | 710 |
| *WAM* | | | | | | |
| Primary energy consumption | 28,112 | 26,599 | 25,184 | 26,878 | 26,895 | 30,002 |
| Final energy consumption | 18,749 | 17,425 | 17,381 | 18,252 | 18,318 | 18,585 |
| Industry | 3,401 | 2,920 | 4,244 | 4,762 | 5,048 | 5,311 |
| Households | 6,974 | 6,649 | 5,970 | 5,812 | 5,210 | 4,756 |
| Services | 3,501 | 3,049 | 2,204 | 1,921 | 1,845 | 1,805 |
| Transport | 4,313 | 4,319 | 4,356 | 4,896 | 5,306 | 5,767 |
| Others | 560 | 488 | 608 | 640 | 666 | 679 |

* Actual data.
*Source: ITM* (2018b, 2018c).

**Table 8.** Forecasts of the NECP for Hungary's primary and final energy consumption based on scenarios with existing measures (WEM) and with additional measures (WAM), 2005–2040 (ktoe)

| | 2005* | 2010* | 2015* | 2017* | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|---|---|---|
| *WEM* | | | | | | | | | |
| Primary energy consumption | 26,353 | 24,618 | 23,298 | 24,481 | 27,349 | 27,904 | 31,774 | 30,638 | 30,583 |
| Final energy consumption | 18,742 | 17,450 | 17,400 | 18,506 | 19,068 | 20,043 | 20,661 | 21,221 | 21,463 |
| Industry | 3,098 | 2,605 | 3,948 | 4,347 | 5,144 | 5,651 | 6,170 | 6,666 | 6,966 |
| Households | 6,969 | 6,649 | 5,970 | 6,299 | 6,202 | 6,069 | 5,923 | 5,731 | 5,351 |
| Services | 3,501 | 3,049 | 2,204 | 2,156 | 2,292 | 2,416 | 2,515 | 2,572 | 2,615 |
| Transport | 4,036 | 4,089 | 4,181 | 4,526 | 4,732 | 5,175 | 5,293 | 5,471 | 5,736 |
| Others | 561 | 488 | 608 | 648 | 697 | 732 | 761 | 781 | 794 |
| *WAM* | | | | | | | | | |
| Primary energy consumption | 26,353 | 24,618 | 23,298 | 24,481 | 26,855 | 27,153 | 30,664 | 28,630 | 28,395 |
| Final energy consumption | 18,742 | 17,450 | 17,400 | 18,506 | 18,749 | 18,749 | 18,722 | 18,751 | 18,750 |
| Industry | 3,098 | 2,605 | 3,948 | 4,347 | 5,167 | 5,649 | 6,187 | 6,666 | 6,956 |
| Households | 6,969 | 6,649 | 5,970 | 6,299 | 5,962 | 4,950 | 4,076 | 3,783 | 3,680 |
| Services | 3,501 | 3,049 | 2,204 | 2,156 | 2,292 | 2,407 | 2,518 | 2,572 | 2,508 |
| Transport | 4,036 | 4,089 | 4,181 | 4,526 | 4,632 | 5,012 | 5,181 | 4,949 | 4,812 |
| Others | 561 | 488 | 608 | 648 | 697 | 732 | 761 | 781 | 794 |

* Actual data.
*Source: ITM* (2020a).

As mentioned above, households are the largest consumers of energy in Hungary, and the greatest savings can be achieved in this sector by 2020 and 2030. As already referred to, it will be the fault of this sector if Hungary fails to meet its 2020 energy savings target, since per capita household energy consumption is 12% higher than the EU average, despite income levels being much lower (*European Commission*, 2019a).

Buildings are at the heart of energy savings. The largest potential lies in the renovation of existing residential homes, but there are also great prospects in the refurbishment of public buildings and district heating networks, as well as in small firms (*European Commission*, 2019a). According to Századvég, a pro-government Hungarian think tank, modernisation of buildings can save 70–80 PJ of energy. This is followed by the energy-saving potential of vehicle replacement with 21 PJ, the improvement of industrial energy efficiency with 9–15 PJ, and the replacement of lighting and home appliances with 12 PJ (*Zárándy*, 2014). The 2015 National Building Energy Performance Strategy set the target for saving primary energy in buildings to be achieved at 49 PJ (per year) by 2020 and 111 PJ (per year) by 2030. The 2020 target of 49 PJ consists of 40 PJ of energy savings from renovation of residential and public buildings (the latter also including commercial buildings), 4 PJ from the renovation of buildings of businesses and 5 PJ from other savings in the energy consumption of buildings. The 40 PJ energy savings from renovation of residential and public buildings comprise 38.4 PJ savings from residential buildings (out of which 17.6 PJ from single-family detached homes, 12.8 PJ from prefabricated apartment blocks and 8.0 PJ from traditional multi-family residential buildings) and 1.6 PJ from public buildings (*NFM and ÉMI*, 2015). According to the 2015 National Energy Efficiency Action Plan, nearly 80% of the approximately 4.4 million Hungarian homes fail to meet modern functional technical and thermal engineering requirements, which is one of the reasons why so many families live in energy poverty. The energy efficiency of buildings built between 1946 and 1980 is particularly poor, out of which detached houses are the least efficient (*NFM*, 2015b). *Energiaklub* (2011) found that if households were to make all available energy-efficiency upgrades, they could save 42% (152 PJ) of the energy used (*Fülöp*, 2011). 77% of the theoretical technical potential (117 PJ) could be exploited economically, i.e., in case of most of the investments, the cost of energy saved through investment would outweigh the total cost of investment (*Fülöp et al.*, 2016). In accordance with the government documents, Energiaklub also emphasises that single-family detached homes offer particularly enormous energy-saving potential. These units are also lagging behind in international comparisons. An average Hungarian single-detached dwelling consumes twice as much energy each year as a Polish one (*Sáfián*, 2019). Nonetheless, energy performance standards for new buildings have been significantly strengthened (*MEHI*, 2019b). The 2010/31/EU Directive on the energy performance of buildings determined nearly zero energy requirements for new public buildings from 2019, and for other new buildings, including residential, from 2021 (*European Commission*, n.d.-c).

One of the main recommendations of the *IEA* (n.d.) to Hungary is the elimination of the administratively determined end-user prices. However, the government's approach indicates that the utility cost reduction programme is not expected to be dropped even in the long run, though the main objectives of energy policy documents are to decrease residential energy use and improve energy efficiency, and the Commission also expects the subsidies to be phased out. This shows that there is a significant gap between the strategic objectives and the applied measures. The main question is what tools, either administrative or other incentives, are available to turn back this process.

The draft NECP gives a very modest list of what has been done so far to achieve the 2020 energy efficiency target:

– Since 2014, 130,000 households have been supported, with a total of HUF 29 billion,[15] to invest in energy efficiency within the framework of the so-called 'Warm Home Programme'.

– A network of energy engineers were set up in 58 districts of 18 counties.

– Mandatory employment of energy engineers was introduced for large companies, and tax advantages have been offered for corporate energy investments.

– Energy efficiency improvement (renovation) projects of public buildings have been carried out (*ITM*, 2018a: 16).

Originally, large sums of money were allocated from the budget of the EU's Environment and Energy Efficiency Operational Programme (abbreviated as KEHOP in Hungarian), approved by the Hungarian government and the European Commission for

[15] In contrast, the final NECP mentions only HUF 26 billion (*ITM*, 2020b: 252).

the period 2014–2020, for energy efficiency improvement of Hungarian residential buildings. However, unfortunately, at the end of 2015, the government decided to reallocate these EU funds for modernisation of public buildings instead of residential buildings, despite the fact that more than twice as much energy can be saved by residential buildings as by spending the same money on public buildings. The government claimed that it would have been too complicated for the Hungarian institutional system to implement the programme (*Fülöp et al.*, 2016; *Napi.hu*, 2016). Instead, an interest-free energy-efficiency loan has been offered to households since 2017, a quite different tool, which has not so far proved popular.

Nonetheless, particularly problematic is the unpredictable support system in Hungary. Many investments are delayed because people wait for the opportunity to apply for state-supported energy-efficiency investments. In addition, a significant part of the population has no savings (*Sáfián*, 2019). Meanwhile, investment costs have risen notably due to increasing construction material prices and sectoral wages, the latter being linked to labour shortages, and contractors deliver low-quality results in many cases. These factors and the utility cost reduction increase the payback period, which works against investments, since homeowners expect to have economic benefits from such an investment, as considering other benefits is not yet widespread in Hungary. The Hungarian Energy Efficiency Institute (MEHI) believes that investments in energy-saving renovation of residential buildings and thus the amount of energy savings cannot be expected to increase significantly without adequate financial incentives. If the utility cost reduction programme survives and construction prices do not fall, then only a support programme can deliver results. MEHI thinks that ideally, such a programme should have a non-refundable part which is combined with a market-based financial product, i.e., a specific lower interest rate loan (*MEHI*, 2016, 2018; *Zsuzsanna Koritár*, email and personal communication, 3 December 2019).

The draft NECP suggested that the government was thinking about introducing an intensive support programme which – if implemented and working as intended – could help achieve the 20% reduction in residential energy consumption projected in the WAM scenario by 2030. In contrast, this kind of support programme was left out from of the final NECP, while the 20% forecast increased to more than 30%. This is a fundamental contradiction that cannot be overcome, and we cannot imagine that the 30% goal can be achieved without any serious intervention (*ITM*, 2018b, 2018c, 2020a).

The final NECP proposes a solution to be achieved within the energy efficiency obligation scheme backed by third-party financing through energy-saving companies (ESCOs) and also the strengthening of the network of energy engineers (*MEHI*, 2020). The obligation scheme allows energy distributors or retail energy sales companies a degree of freedom to choose between the clientele of the investment, be it industry, households, public institutions or the service sector. Overall, the NECP intends to address this issue on a market basis. However, more details will only become available when Hungary's long-term renovation strategy is prepared (*ITM*, 2020b).

ESCO is a traditional model for financing energy efficiency. However, innovative energy efficiency financing programmes could also be applied. An example is the so-called 'on-bill financing'. Regardless of the method, the point is that either the utility company, the ESCO or even the customer (backed by an energy savings guarantee agreement by the ESCO) finances the energy efficiency investment in the building, and the cost of renovation is covered by the saved energy costs (*Rugova*, 2016;*European Commission*, n.d.-a, n.d.-d). The customers do not have to pay more than before, while they can live in a more valuable, comfortable apartment. According to MEHI, the problem is that in Hungary it would not be possible to finance deep energy renovations, such as thermal insulation or window replacement, because the return on investment for utility companies or ESCOs would be so slow due to low utility rates that it would not be worth it for them to invest in it. Rather, this design works in countries where energy costs are higher. In Hungary, on the other hand, it would be possible that a district heating company or an ESCO installs heating controls for its customers so that they can turn down the heating instead of losing heat to outdoors through open windows. Thus, the government's proposed ESCO mechanism is not expected to apply to single-family detached homes. At most, customers of multi-family residential buildings could use this. However, the real targets could be companies and municipalities (*Zsuzsanna Koritár*, email and personal communication, 5, 13 February 2020).[16]

[16] *The Prince of Wales's Corporate Leaders Group* (2019) finds that the building stock, both residential and public, built with industrialised/prefabricated technology represents a significant share, thus the standardised solutions can be suitable for energy efficiency renovation.

To change this situation nationwide, many programmes fitting different conditions are needed instead of a one-size-fits-all approach. For example, a family in extreme poverty will probably never be able to obtain a low-cost energy efficiency loan, but such a loan may fit a family with a stable income but living in energy poverty. Another issue is that these kinds of investments are complex from many points of view. The so-called 'one-stop-shop' system, already tested in other countries, would be of help in this. This refers to consultancy offices that would assist homeowners in all aspects of their energy renovation projects. On the one hand, they would give advice on what and how to refurbish, and how much it would cost. On the other hand, they would guide people through the bureaucratic maze (*Szurovecz*, 2019).

Nevertheless, in the meantime, emphasis should be placed on raising the awareness of individuals about both energy efficiency and simply energy conservation. Regarding the former, it should be made clear to households that they should spend their savings on energy efficiency investments, because this is the only way to reduce energy expenditure in the long term. As the 2015 Energy and Climate Awareness Raising Action Plan states, 'for the Hungarian population the cost-oriented motivation is the most appropriate' (*NFM*, 2015a: 45), so the awareness-raising campaigns should focus on that. However, the Hungarian government also needs to recognise that investment in energy efficiency has a wide variety of benefits, many of which are quantifiable. Among others, these include air pollution reduction leading to fewer premature deaths, longer life expectancy and lower greenhouse gas (GHG) emissions. Material resource impacts consist of savings of material resources extracted from nature as inputs, transformed and re-entering the nature world as outputs. Social welfare benefits are realised through avoided premature deaths due to indoor cold and through avoided disability-adjusted life years due to indoor-dampness-related asthma and thus gained additional workdays. Economic impacts are seen in an additional rise in GDP due to investment stimulus, resulting in additional jobs and tax revenues. And, finally, regarding the energy system, energy efficiency gains are driven by lower energy demand and consequent avoided power generation from combustible-based plants, having an impact on energy security due to lower fossil fuel imports (*Thema et al.*, 2019).

Regarding energy conservation, wasting energy is also a relevant factor that exists in parallel to energy poverty. In Hungary, there is a bad habit of overheating residential, public and commercial buildings in the winter. Therefore, in many cases, there is a possibility for energy conservation by reducing the internal temperature. One survey, involving France, Germany, Hungary, Spain and Ukraine, asked about the average temperature of a home during the winter when residents are at home. Although the answer to the question is likely to be largely a subjective estimation, the difference between Hungary and the other countries is quite striking. Nearly 65% of Hungarian households heat their homes to 22°C or above and 24% to 24°C or more, and there is no clear relationship between the controllability of the temperature and the declared temperature levels (*Chubyk et al.*, 2018; *Bartek-Lesi*, 2019). It is also recalled that when a restriction hit the Westend City Center in Budapest as a result of the Russian–Ukrainian gas crisis of January 2009, the mall announced that it would reduce the average internal temperature of 26°C to 20°C. But why was the mall heated up to 26°C in the middle of winter?

### 5.5. Other negative effects of the utility cost reduction programme

Not only do utility rate cuts discourage energy conservation and energy efficiency, but they also erode the competitiveness of renewables and thus make it harder to achieve strategic goals determined by strategic energy documents. Moreover, subsidies impose a significant burden on the energy sector while hampering new energy investment (*Fig. 8*). Utility rate cuts have thus weakened security of supply not only because declining household energy prices have increased energy use, but also due to the lack of investment (*LaBelle and Georgiev*, 2016). Further, as low retail household electricity and gas prices do not recognise some cost elements, utility companies try to recover these costs in the non-household segment, resulting in higher prices for these customers (*European Commission*, 2019c).

Regarding the investment shortage, the government interventions have pushed energy companies into the red (*Deák and Weiner*, 2019: 142). Gross capital formation in the Hungarian electricity, gas, steam and air conditioning supply sector is lagging far behind that of Slovakia and Czechia.[17] In 2010, thus before the introduction of the utility cost

[17] Poland is excluded from this comparison because of absence of data.

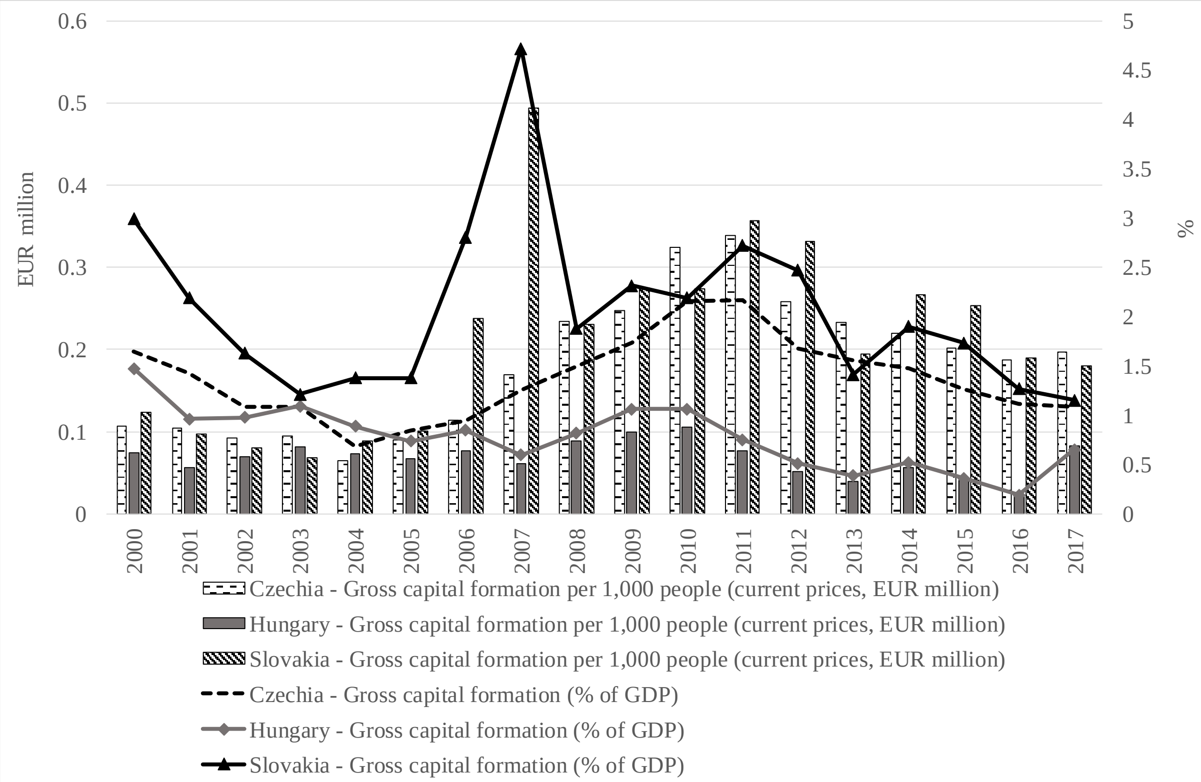



**Fig. 8.** Gross capital formation in electricity, gas, steam and air conditioning supply in the Visegrád countries, 2000–2017 (EUR million in current prices and per cent of GDP)
*Note:* No data are available for Poland.
*Source:* Own compilation based on *Eurostat* (2019n).

reduction programme, gross capital formation per 1,000 people in this sector reached a level of only EUR 0.1 million in Hungary, representing just a third of the Czech data. Sectoral gross capital formation as a share of GDP stood at only a little bit over 1%, compared to the figure of 2.2% in both Slovakia and Czechia. From this already low level, the Hungarian ratio fell further to 0.2% in 2016. However, in 2017, a small rebound was observed in Hungary, as the ratio of sectoral gross capital formation to GDP and sectoral gross capital formation per 1,000 people increased to 0.7% and EUR 0.08 million, respectively. Between 2013 and 2017, a slightly more than EUR 180 million investment disappeared from the electricity, gas, steam and air conditioning supply sector, compared to the 2012 data (*Eurostat*, 2019n).

## 6. Summary, conclusions and policy implications

In 2013, the Hungarian government started to implement a significant utility cost reduction programme, which has been carried out since then. This study aimed to understand the scope, the rationale, the context and positive and negative consequences of this overpoliticised issue by approaching it in a broad context.

Firstly, we examined the scope of the programme. We have found that virtually everyone has been affected but to a very different degree. The programme has reached everyone due to lowered electricity prices, but electricity consumption constitutes only a smaller part of residential energy use, as opposed to non-electricity heating, which accounts for the bulk of residential energy use. However, except for the one-off event of the 2018 winter utility cost reduction, the programme has involved only those customers who heat their homes with gas, electricity or use district heating. Therefore, many of the poorest households, mainly using firewood, have been left out of the programme, while they would have really needed support. At most, they only have the opportunity to apply for social fuel. At the same time, it was decided not to differentiate the utility rate reduction according to the income levels of households. Nevertheless, the question is whether it is a good decision to support the energy use of those who are well-off.

Secondly, we looked at the rationale for the utility cost reduction programme. We have reaffirmed that it was created as an answer to a real problem, reflected in the high share of energy costs relative to total expenditures, imposing a greater burden on vulnerable households, especially the poorest lower-income families. We argue that this situation is due to the combination of three factors: the high energy prices, the relatively low levels of disposable income and the energy inefficient homes. From among these three key intervention points – to reduce energy prices, to increase disposable incomes and to enhance energy efficiency – the government selected one with an immediate effect, accompanied by a vigorous political campaign, continuously communicating the presence and positive impacts of the programme.

Thirdly, we also specified how the utility cost reduction programme relates to the energy policy framework. We have found that this has been performed without a strong policy background and the energy policy documents were only later adjusted to the prevailing situation. Until 2013, the aim was to improve social conditions of the poorest income deciles with direct social policy tools (i.e., public assistance on a need basis). Regulated energy prices were rejected and the potential negative effects of a price cut were highlighted. Post-2013, utility cost reduction has featured increasingly prominently in the energy policy documents in order to justify the programme. The issue of energy poverty has become more pronounced. In the end, by 2020, the utility cost reduction programme had become directly and tightly linked to energy poverty.

Fourthly, we then quantified the effects of utility rate cuts on household energy use. This impact assessment constitutes the second attempt to do so. Compared to our first study, we have now investigated a longer time period, while certain methodological changes in the available statistics have also made the review necessary. The application of the logarithmic mean Divisia index method allowed us to measure the effect of different factors on residential energy consumption. The most important result of the decomposition is that decreasing household energy prices had a positive impact on energy use, which is in line with our expectations. The utility cost reduction programme generated an extra energy use of 29.4 PJ in the residential sector between 2013 and 2015 (18.9 PJ between 2013 and 2017). This is a serious amount of energy, especially compared to the energy saving target of 40 PJ to be achieved in the period of 2010–2020, but also when compared to the 2017 residential energy consumption of 263 PJ. This makes it even more difficult to reach energy efficiency and saving goals without applying decisive additional measures. However, energy use increased only in the first three years, and then it stabilised at a higher level, probably due to lower energy prices being built into consumers’ expectations. Generally, the welfare growth pushed the residential energy consumption and the results of the expenditure effect just confirmed that. The structural changes regarding the energy mix and energy efficiency showed some positive changes and draw attention to the importance of energy savings and efficiency programmes.

The Discussion section of this paper is focused on the positive social effects of the programme; the issues of gas and firewood, thanks to the major role these fuels play in residential energy consumption; the negative energy efficiency effects of the programme; and other negative effects.

Therefore, fifthly, we have demonstrated that there have indeed been positive effects of the programme. The economic and income situation of the majority, especially that of the middle class, has considerably improved. Lower energy prices have allowed energy-related expenditures to make up a lower share of total expenditures and thus consumer baskets changed. Consumers can spend more on food and non-alcoholic beverages, consumer durables or luxury goods. Declining energy prices have also exerted downward pressure on inflation. However, the efficiency of the applied measures is still doubtful, partly because positive effects have been limited, including those on energy poverty and social disparities, and partly because short-run benefits will disappear in the long run, and the negative effects of regulated energy prices become dominant. Also, it is important to recognise that part of the positive effects could have been achieved on a market basis, due to the advantageous changes in import gas prices and market electricity prices.

Sixthly, due to the massive penetration of gas in Hungary, the leading role of gas in residential energy consumption and the major role of the households in total gas consumption as well as the reliance on Russian gas imports, it is difficult to imagine that gas would not remain the most sensitive and politicised issue directly linked to residential energy consumption. However, some relaxation is likely to take place. The Hungarian government aims to decrease residential gas consumption both directly in individual heating and indirectly in district heating by the combination of energy efficiency measures and fuel mix diversification. At the same time, it would increase domestic gas production and enhance import source diversification. The latter, accompanied with other relevant issues of gas market integration, may help decrease import prices, but such market developments have not been reflected in further price cuts.

Seventhly, firewood and coal are typically the fuels of the poor. While everyone who uses the particular primary or secondary energy source involved in the utility cost reduction programme could enjoy the benefits, firewood and coal users have been burdened by price increases. Thus, it is very contradictory that so far, Hungary's renewable energy achievement has been mainly due to firewood used by the population. Nonetheless, the government foresees a dramatic reduction not only in the use of gas but also in that of firewood. Further, while it is out of question that burning household garbage must be prevented, we argue that the use of lignite should also be eliminated and not in the long run, but as soon as possible.

Eighthly, the utility cost reduction programme discourages energy conservation and energy efficiency. Although the largest energy saving potential lies in the renovation of existing residential homes, only minimal support has been given and is planned by the government. There is an insoluble conflict between the government's ambitious target for reducing residential energy consumption and the applied measures. In this way, residential energy consumption is unlikely to decrease as expected, though it is also questionable whether the target can be taken seriously. However, the utility cost reduction programme theoretically resulted in a total of HUF 598.5 billion savings to Hungarian households between 2013 and 2017, which could serve or could have been used as a basis for energy efficiency improvements.

Finally, and ninthly, we have observed that the list of negative effects is long. They are also apparent as the programme erodes the competitiveness of renewables; reduces gross capital formation in the electricity, gas, steam and air conditioning supply sector; deteriorates security of supply; and increases energy prices for non-household customers. Two things follow from this. On the one hand, the obvious solution would be to eliminate the utility cost reduction programme and instead provide targeted support to those in need, such as to many of those who are left out of the programme. On the other, the third key intervention point, energy efficiency, should be given priority. The reality, however, is that at most some adjustment of the utility cost reduction programme is likely to be put into place, while strong support for the renovation of residential buildings is not presumed.

# Appendix

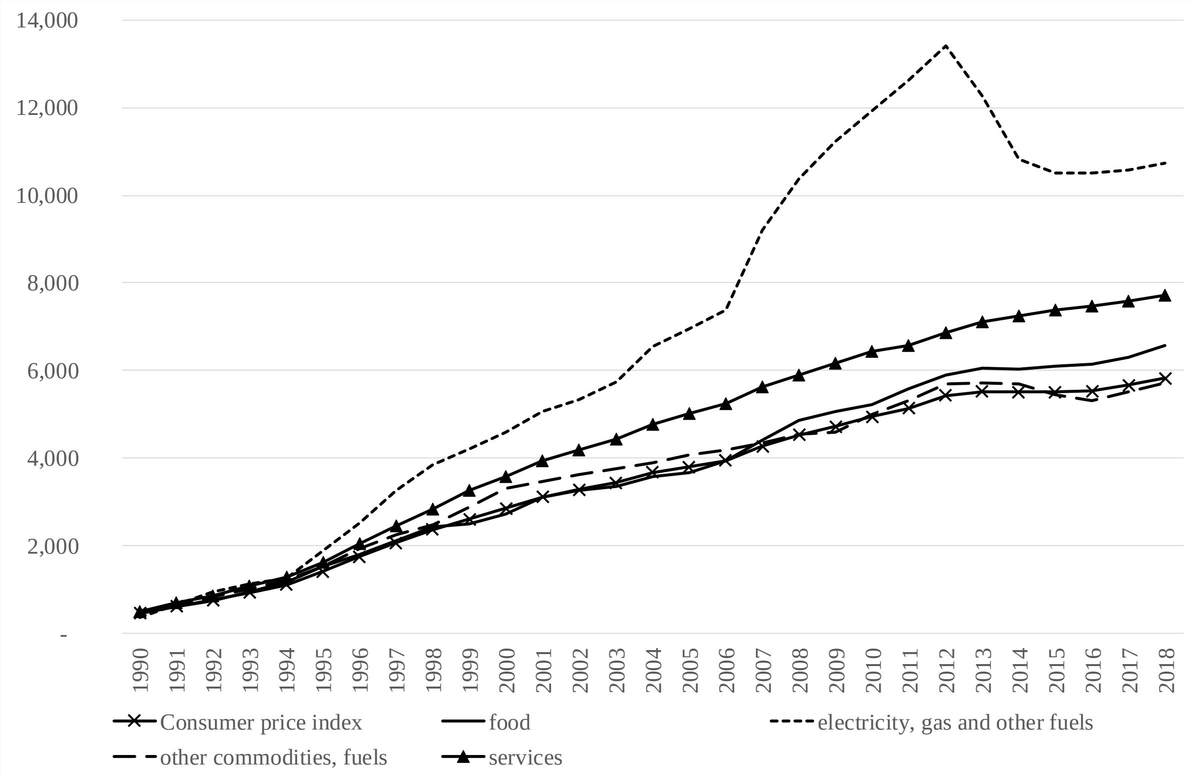
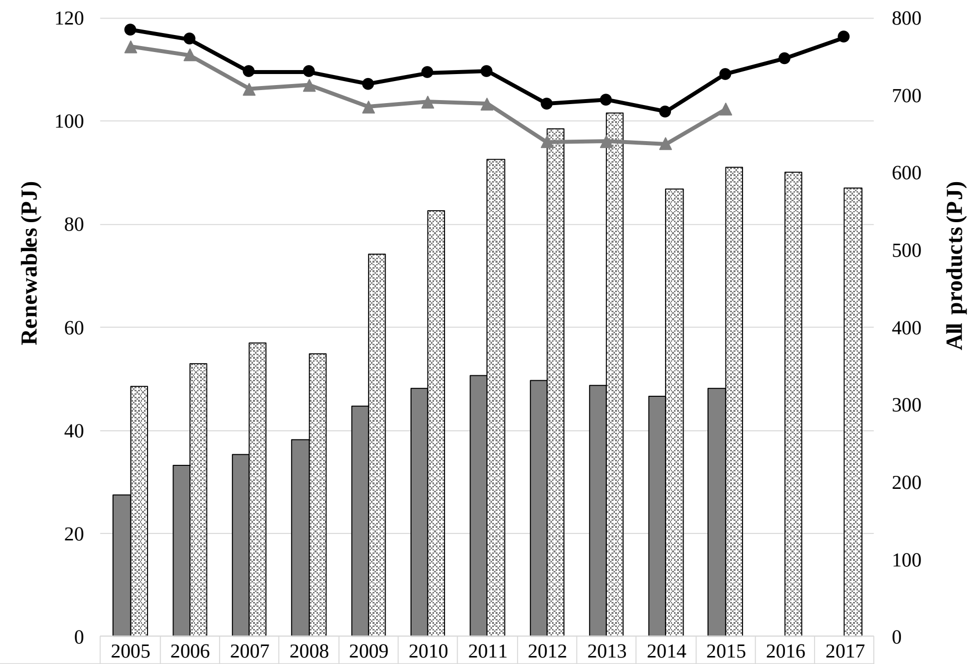



**Fig. A1.** Changes in the consumer price index in Hungary, 1990–2018 (1960=100%)
*Source:* Own compilation based on *KSH* (2019a).




| | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Renewables (old methodology) | 28 | 33 | 35 | 38 | 45 | 48 | 51 | 50 | 49 | 47 | 48 | | |
| Renewables (new methodology) | 48 | 53 | 57 | 55 | 74 | 83 | 93 | 99 | 102 | 87 | 91 | 90 | 87 |
| All products (old methodology) | 763 | 752 | 708 | 713 | 685 | 692 | 689 | 640 | 641 | 638 | 682 | | |
| All products (new methodology) | 785 | 773 | 731 | 730 | 715 | 730 | 731 | 689 | 694 | 679 | 728 | 748 | 775 |

**Fig. A2.** Final energy consumption in Hungary using the old and the new methodology, 2005–2017 (PJ)
*Source:* Own compilation based on *Eurostat* (2017, 2019f).

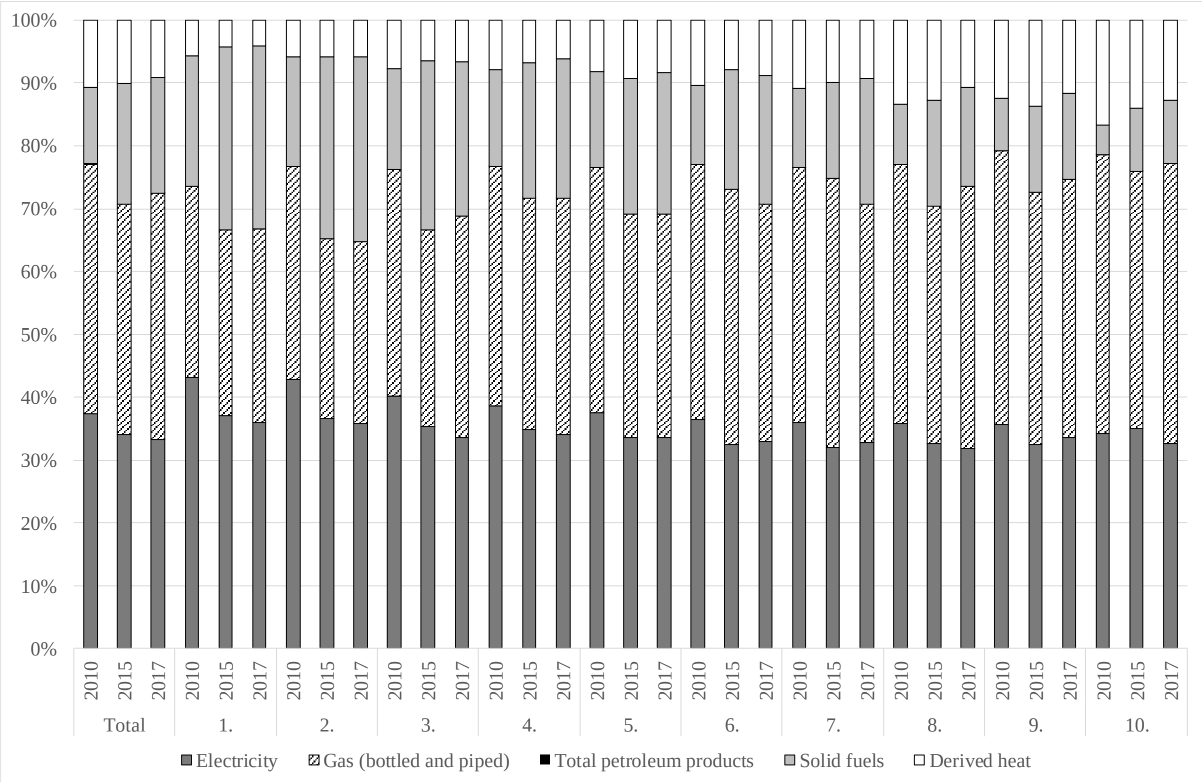



**Fig. A3.** Structure of residential energy expenditure by deciles, 2010, 2015 and 2017 (%)
*Source:* Own compilation based on *KSH* (2019b).

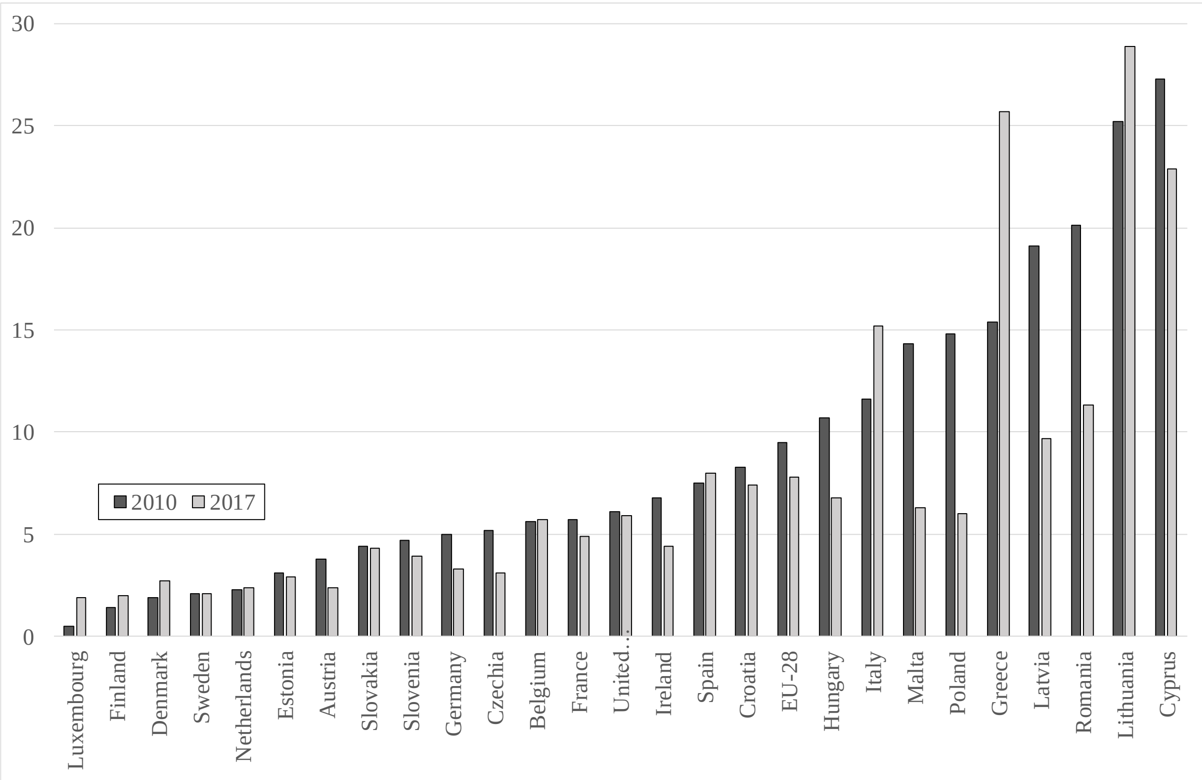



**Fig. A4.** The share of population unable to keep home adequately warm in the EU member states, 2010 and 2017 (%)
*Source:* Own compilation based on *Eurostat* (2019j).

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