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National Energy and Climate Plan of Hungary

(Draft)

COURTESY TRANSLATION

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1. PROCESS OF REVIEWING AND DRAWING UP THE PLAN

1.1. Summary

i. Political, economic, environmental, and social context of the plan

The European Commission published the so-called Energy Winter Package at the end of November 2016, which, in addition to setting out several new regulatory proposals concerning climate and energy policy, called on Member States to draw up National Energy and Climate Plans (NECP) based on a single methodology, with uniform content. In the opinion of the Commission, the NECP may rely on the climate and energy strategies, and action plans of Member States in effect, if these are compatible with the EU 2030 climate and energy policy objectives and greenhouse gas emission reduction obligations arising from the Paris Agreement.



In the course of drawing up the NECP, Hungary conducted wide-ranging professional, CSO and social consultations to ensure that the plan is implemented with public support. Integrated planning spans the dimension of decarbonisation, energy efficiency, energy security, the internal energy market, research, innovation and competitiveness.

In the course of drawing up the NECP, Hungary has taken into account current national plans, measures and policies. It is closely related to the contents and development process of the new National Energy Strategy, which is drawn up concurrently with the NECP. The plan is also in harmony with policy measures set out in the second National Climate Change Strategy, approved by Parliament in the autumn of 2018, and in the related first climate change action plan, which is in the development phase. As regards the plan, the Government of Hungary has authorised the Ministry of Innovation and Technology (hereinafter 'MIT') to draw up the appropriate policy programmes and vision, requiring political decision-making, determining the future of the energy sector and of other sectors involved in decarbonisation; to determine national objectives and Hungarian commitments relating to energy and climate change, with particular regard to reducing emissions, energy efficiency and the share of renewable energy, the fulfilment of the objectives of the Energy Union, and compliance with the Paris Agreement.

ii. Overview table with key objectives, policies and measures of the plan

The table below summarises Hungary's key, quantified objectives and the main measures supporting these.

1 – Objectives of Hungary and main measures supporting these

Hungary's objectives compared to EU objectives		2020		2030		Main measures supporting national objectives
						
Share of renewable energy		20 %	14.65 %	32 %	20 %	Photovoltaic panel (PV), Greening of transport (E-mobility) Modernisation of heat market (district heating)
Energy efficiency – Reduction of energy consumption		20 % indicative ¹	1 009 PJ ²	32.5 % indicative ³	8–10 % ⁴	Reduction of end-use (energy management in buildings) Promotion of industrial energy efficiency investments
Change in GHG emissions	Gross total vs 1990	-20 %	-	-40 %	-40 %	Climate-friendly modification of electricity mix
	ESD/ESR vs 2005	-10 %	+10 %	-30 %	-7 %	

** Primary and/or final energy

The main objectives of the Hungarian NECP are summarised below, grouped according to the dimensions of decarbonisation, energy efficiency, security of supply, internal market and innovation-competitiveness.

Dimension of decarbonisation

GHG emissions and removals⁵

The EU climate and energy framework approved by the European Council in October 2014 provides for a 40 % GHG emissions reduction on an EU level by 2030, compared to the figure for 1990. In the long term, Hungary plans a minimum 52 % reduction of gross emissions by 2050 based on the second National Climate Change Strategy approved by Parliament in October 2018, noting that the preferred rate of reduction is 85 % compared to

¹ Reduction of primary energy consumption compared to the 'business as usual' scenario (measures aimed at reducing energy consumption are not implemented)

² Primary energy consumption of Hungary

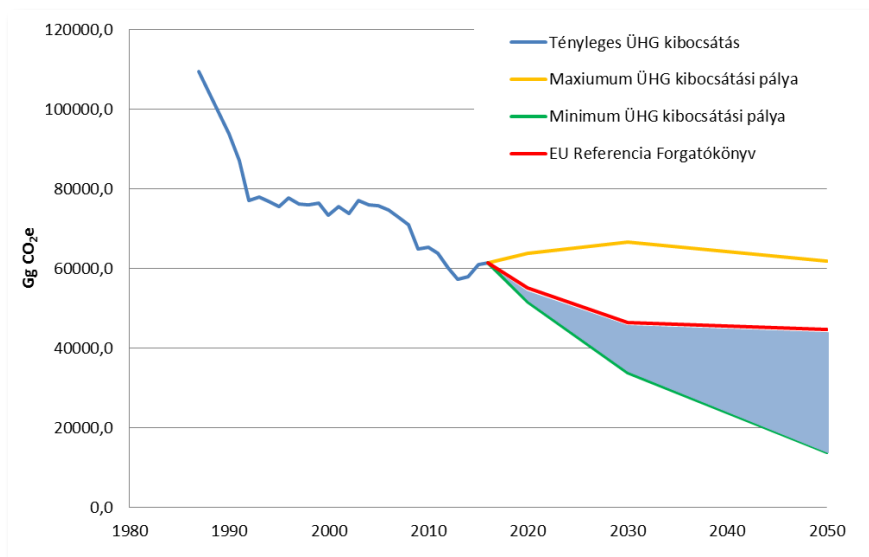
³ Reduction of energy consumption compared to 'business as usual' scenario

⁴ Reduction of energy consumption compared to 'business as usual' scenario

⁵ Consistency to be ensured with long-term strategies pursuant to Article 15.

1990, if enabled by the country's economic potential, i.e. a gross GHG emission reduction of 52–85 % should be achieved by 2050 compared to 1990 (REF _Ref536096926 \h Figure 1).

1 – GHG reduction scenarios outlined in the second National Climate Change Strategy (NCCS-2).



Source: NCCS-2

HU	EN
Tényleges ÜHG kibocsátás	Actual GHG emissions
Maximum ÜHG kibocsátási pálya	Maximum GHG emission reduction trajectory
Minimum ÜHG kibocsátási pálya	Minimum GHG emission reduction trajectory
EU Referencia Forgatókönyv	EU Reference Scenario

As an intermediate goal, GHG emissions should be reduced by at least 40 % by 2030 compared to 1990, which requires the reduction of 64.44 million tCO₂e in 2017 by an additional 8.2 million tCO₂e.

The emissions of non-ETS sectors (energy management in buildings, waste sector, transport, agriculture) are regulated by the Effort Sharing Decision (Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020; hereinafter 'Effort Sharing Decision', 'ESD') up to 2020. Pursuant to such regulation, between 2013 and 2020, i.e. during the ESD period, Hungary may increase its emissions by 10 % compared to the emissions levels of 2005. Irrespective of the above, Hungary is expected to reduce emissions by 30 % during this period, and may, as a result, realise a CO₂ equivalent quota surplus of 96 million tonnes.

After the expiry of the ESD in 2020, the European Commission will regulate the emission reductions of non-ETS sectors by way of its Effort Sharing Regulation of May 2018 (Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013; hereinafter ‘Effort Sharing Regulation’, ‘ESR’) relating to the 2021–2030 period, which determines GDP/capita-proportionate national emission reduction targets for Member States. Pursuant to the Regulation, Hungary's reduction target is -7 % during the ESR period.

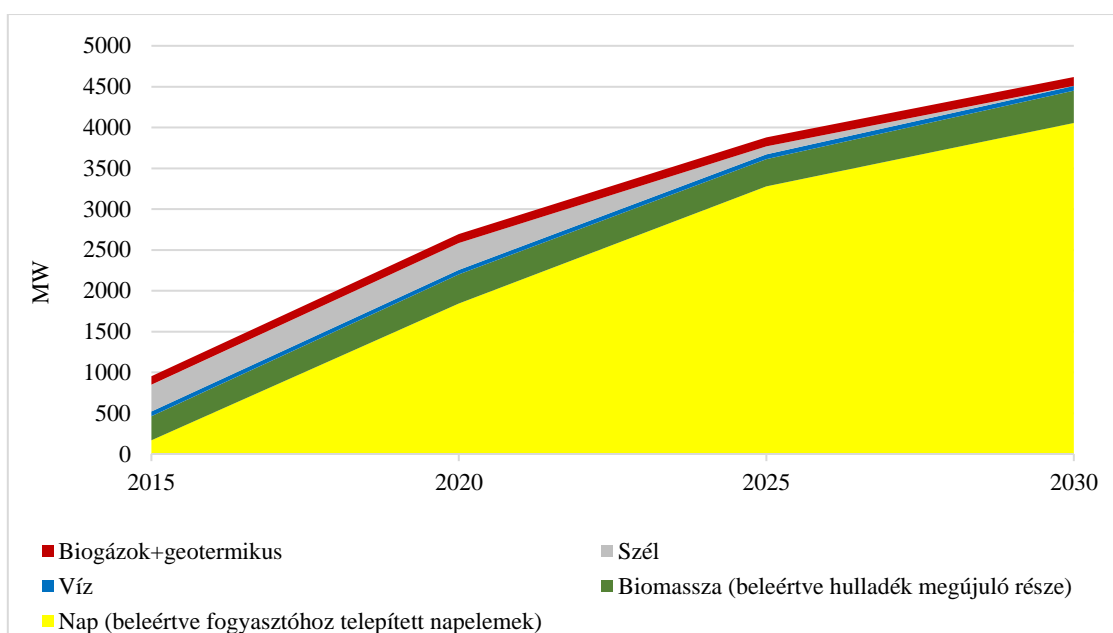
Renewable energy

Hungary set the target of reaching a 20 % share of renewable energy sources within primary energy consumption by 2030.

In 2016 the share of renewable energy sources equalled 20.76 % within energy consumption for heating and for cooling purposes, 7.2 % within electricity consumption, and 7.44 % within energy consumption in transport. The consumption of renewable energy exceeded the sub-target by approximately 11.5 percentage points in relation to energy consumption for heating and for cooling purposes – exceeding the share set for 2020 each year since 2011, primarily as a result of consumed biomass quantities – and by 0.8 percentage points in relation to energy consumption in transport.

According to forecasts, as a result of the existing policy measures, the installed capacity of electricity generating units generating from renewable sources will exceed 4 600 MW by 2030, with more than 4 000 MW attributable to photovoltaic panels. In 2030, the quantity of electricity from renewable resources is expected to exceed 6 500 GWh, with approximately 70 % of such quantity attributable to photovoltaic panels. According to the forecast, the share of renewable energy use will amount to 12.8 % of gross final electricity consumption in 2030 (RES-E).

2 - Projection of installed capacity of electricity generation from renewable sources, in consideration of the impact of existing policy measures



HU	EN
Biogázok+geotermikus	Biogases + geothermal energy
Víz	Water
Nap (beleértve fogyasztóhoz telepített napelemek)	Solar (including PV panels installed at consumers)
Szél	Wind
Biomassza (beleértve hulladék megújuló része)	Biomass (including renewable portion of waste)

The share of renewable energy use equalled 0.9 % in the transport sector in 2005, increasing to 6 % in 2010 and to 7 % in 2015. Growth is primarily attributable to the use of biodiesel produced from first generation biofuels and used frying oil. The use of biofuels in Hungary is determined by the mandatory blending ratio stipulated by law. To increase the use of biofuels, the mandatory blending ratio will increase from 4.9 % to 6.4 % in 2019 (taking into account multiplication). Projection took into account the permanency of the blending ratio in force as of 2019 for the 2019–2030 period. As a result of the existing policy measures, the share of using renewable energy may reach 8.1 % in 2030 in the transport sector.

In the 2014–2020 period, investment in the construction of heat generating facilities based on renewable energy sources is subsidised in Hungary, which contributes to increasing biomass based and geothermal generation of district heating. Although the share of district heating generation (excluding industrial heating) may decline by 8 % between 2015 and 2030 under the existing policy measures, the share of district heating generation based on renewable

sources and waste is expected to reach 28 % by 2030. The change may be even greater as a result of the implementation of the new policy measures: According to the forecast, demand for district heating may decline by 20 % between 2015 and 2030, while the combined share of district heating generation based on renewable sources and waste may reach 60 %.

Dimension of energy efficiency

Based on the national objective of Hungary, energy consumption in 2030 should not exceed the value for 2005 (gross final energy consumption of 27.6 Mtoe). The energy efficiency measures will reduce the value of expected energy consumption – without the measures – in 2030 by approximately 8–10 %.

With the existing policy measures, final energy consumption may increase by 14 % between 2015 and 2030 based on the forecast. The increase is attributable to the rise in industrial production and higher fuel consumption resulting from increasing income, while household energy consumption is expected to decrease. The weight of electricity and petroleum products is expected to increase within the end consumer energy mix, while the share of other energy sources will decline.

Dimension of energy security

Due to the geographical characteristics of Hungary and its lacking capacity to recover reserves of traditional energy sources competitively and in a climate-friendly manner, the objective of the long-term maintenance of the security of supply is a priority. Therefore, to establish a climate-friendly electricity sector, the supply of electricity should rely on a secure availability of an electricity mix based on energy sources at the lowest possible price, including a decarbonisation programme that takes into account fiscal sustainability. Nuclear energy, the growing role of renewable energy and Hungary's connection to the European electricity system plays a key role in guaranteeing the security of supply and the decarbonisation of the electricity sector. Cross-border capacities exceed 47 % of national gross installed capacities, which is significantly higher than the EU target. The Government has set the objective⁶ of creating a renewed vision for the electricity market, which, *inter alia*, may provide answers to challenges caused by the lasting high share of imports and weak investment in power plants.

⁶ Government Decision No 1772/2018 of 21 December 2018 on decisions serving foundations for a new National Energy Strategy.

The further increase of the security of supply on the natural gas market is a national objective, which can be implemented through route and source diversification. This will also support the establishment of a liquid natural gas market. Natural gas-fired power plants – with their flexibility – can support balancing the varying availability of renewable energy sources, contributing to the establishment of a climate-friendly energy sector. Hungarian natural gas storage facilities have a stabilising effect on natural gas supply in the whole region; Hungary aims to integrate these in the European trade of natural gas.

Dimension of the internal energy market

The appropriate operation of the internal energy market primarily depends on three components: level of interconnection, or necessity of its increase, the level of market coupling, and its reduction of prices and price volatility, and the liquidity of the Budapest electricity and gas exchange.

Hungary is already significantly surpassing the EU target relating to electricity interconnection. It follows that the Government of Hungary does not consider it necessary to define a new quantified target. The increase of cross-border capacities, however, is justified, as an interconnected energy network operated with neighbouring countries improves the national security of supply. The implementation of PCI projects also serves this purpose. Cross-border capacities already enables trade to balance demand and supply disparities on markets, reduce price disparities and to promote the optimal use of balancing capacities.

A number of cross-border capacities have been built in recent years, but the construction of additional ones are planned, based on the positive experience of significant price stabilisation provided by the interconnected SK-CZ-RO-HU day-ahead electricity market.

Dimension of research, innovation and competitiveness

Hungary aims to maximise the ability of the Hungarian energy and RDI sectors to fulfil the energy and climate policy objectives of Hungary and the European Union. To this end Hungary assigns a priority to the objective of improving innovation, maximising the economic development opportunities underlying energy innovation and climate change. Related key sub-tasks of this process: development of the system integration of electricity generation capacities based on renewable sources, development of household and industrial scale energy storage technologies, support of the development of energy efficient technologies, digitisation and promotion of smart metering.

Key planned measures serving the above objectives:

- Climate-friendly transformation of the energy sector by reducing electricity generation methods with high GHG emissions and promoting solar energy
- Development of household-scale small power plants combined with smart metering and electricity storage
- Promotion of network electricity storage facilities with a larger capacity
- Ensuring of systemic demand for reserves in conformity with requirements arising from increasing PV panel capacities
- Greening of transport by supporting electromobility and developing rail and other public transportation vehicle fleets
- Promotion of the modernisation of household heating equipment and of the use of modern biomass based heating fuels to ensure the sustainable use of fuel wood
- Increasing the budget of energy efficiency programmes for energy management in buildings and improving the effectiveness of their distribution of funds
- Support of housing construction
- Development of the efficient generation of district heating based on renewable energy sources
- Promotion of industrial energy efficiency investments

1.2. Overview of current policies

i. National and Union energy system and policy context of the national plan

The European Council approved the **climate and energy framework for the 2021–2030 period** in October 2014; based on the framework, the debate of sectoral legislation determining the climate and energy policy of the EU between 2021 and 2030 – considered to be primary legislation – was concluded at the end of 2018, with the exception of certain energy policy provisions.

In the case of Hungary, the National Energy Strategy 2030⁷ and the second National Climate Change Strategy⁸ are the key national documents in conformity with the climate and energy policy objectives and directions of the EU for the year 2030.

ii. Current energy and climate policies and measures relating to the five dimensions of the Energy Union

Pursuant to the second National Climate Change Strategy, adopted by Parliament by way of Decision No 23/2018 of 31 October 2018 of Parliament, relating to the 2018–2030 period, and providing a projection of the period up to 2050, a gross GHG emission reduction of 52–85 % should be achieved by 2050 over the figure for 1990. In addition to the National Decarbonisation Road Map, this strategy also contains the National Adaptation Strategy and the ‘Climate Partnership’ Awareness Raising Plan. Climate Change Action Plans – relating to three-year periods – are drawn up to fulfil the objectives set out in the second National Climate Change Strategy. The first Climate Change Action Plan aims to implement tasks determined by the short-term directions of action of the NCCS–2, and to prepare long-term measures. It also has the important task of determining optimal directions of cost-effective emission reduction that best support sustainable development. The Climate Change Action Plan determines the main areas of intervention by relying on the three pillars of mitigation, adaptation and awareness raising.

Pursuant to the RED⁹, the mandatory share of **renewable energy sources** should reach 13 % in gross final energy consumption in 2020, but Hungary has voluntarily increased this value to 14.65 % in the Renewable Energy Action Plan. During the current budgetary period of the EU, several operational programmes were launched in Hungary to support the environment, and climate and renewable energy sources, with a development budget of HUF 760 billion. The new Hungarian aid scheme for electricity generated from renewable energy sources (RESS) was launched in January 2017. The RESS is in conformity with national needs and with EU guidelines concerning State aid for the environment and energy in the 2014–2020 period.

⁷ <http://2010-2014.kormany.hu/download/4/f8/70000/Nemzeti%20Energiastrat%C3%A9gia%202030%20teljes%20v%C3%A1ltozat.pdf>

⁸ http://doc.hjegy.mhk.hu/20184130000023_1.PDF

⁹ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC (text with EEA relevance)

The **energy efficiency** target of Hungary for 2020 is currently 1 009 PJ/year, equalling 26.51 Mtoe/year under Government Decision No 1274/2018 of 15 June 2018. A number of measures have been introduced:

- Within the framework of the Warm Home Programme, the energy installations of 130 000 households were modernised since 2014 with HUF 29 billion in aid;
- implementation of the network of energy engineers in 58 districts of 18 counties;
- mandatory employment of energy engineers prescribed for large companies, and introduction of tax advantages for corporate energy investments;
- improvement of energy efficiency at public institutions (renovation).

The Government of Hungary considers the guarantee of **energy supply**, and as such, the **security** of the supply of natural gas to be a top priority. Hungary operates an adequate gas infrastructure to satisfy the stagnant, moderately declining rate of natural gas consumption. As a result of regulatory changes and infrastructure investments implemented in the past decade, a diversified supply model has evolved on the basis of multiple sources of supply. As indication of the success of implemented gas market diversification efforts (including construction of the Slovakian-Hungarian, Hungarian-Croatian and Hungarian-Romanian interconnected pipelines), import diversification and the establishment of competition on the wholesale market has eliminated the competitive disadvantage of Hungarian gas consumers compared to Western European consumers since early 2014.

iii. Key issues of cross-border relevance

Hungary has limited fossil fuels and is therefore reliant on substantial imports. Hungary imports 80 % of its natural gas, most of which originates from Russia, therefore the issue of natural gas deliveries from Russia is of paramount importance for Hungary. The Russian-Ukrainian conflict, the expected decline in transiting through Ukraine, in particular, projects possible long-term changes to traditional transit routes after 2019. These developments may also modify transits to Serbia and Bosnia, which are currently realised exclusively through Hungary.

Due to the integration level of electricity systems in Central Europe, fluctuating production in German power plants based on renewable energy sources has a direct, substantial effect on the electricity systems of other States in the region. The interconnection of European electricity markets aims to resolve this problem by increasing and optimising, and improving the

efficiency of electricity trade between countries. In 2018 the German, Austrian and Polish energy authorities approved the launch of the project serving the connection of the Hungarian-Czech-Slovakian-Romanian markets (4M) to the already interconnected Western European markets.

A large share of demand is satisfied with imports, in addition to domestic production capacities. Hungary needs to be aware that it is critically exposed to adverse regional events that also affect countries that are its import sources.

iv. Administrative structure of implementing national energy and climate policies

The Ministry of Innovation and Technology (MIT) – called as such since May 2018¹⁰ – is competent to carry out most tasks relating to the plan’s implementation. The functions and authority of the minister responsible for innovation and technology cover, *inter alia*, the following fields: State infrastructure investments, mining, energy and climate policy, use of European Union funds, construction economy, economic development, sustainable development, waste management, industry, trade, transport, regional development and coordination of science policy. Within the scope of his responsibility for energy policy, the minister establishes strategic conditions for sustainable economic development, energy efficiency and energy management, and drafts legislation relating to climate policy. Within the scope of his responsibility for industry, the minister, *inter alia*, draws up decisions supporting the spread of electromobility in Hungary, carries out tasks concerning the allocation and settlement of European GHG emission allowances in relation to the emissions trading scheme of the European Union, the operation of the emissions trading scheme, and arranges for their execution. Additional institutions and actors involved in the implementation and monitoring of the plan:

- Research Institute of Agricultural Economics
- Ministry of Agriculture
- Ministry of Foreign Affairs and Trade
- Építésügyi Minőségellenőrzési Nonprofit Kft.
- Hungarian Mining and Geological Service
- Hungarian Energy and Public Utility Regulatory Authority

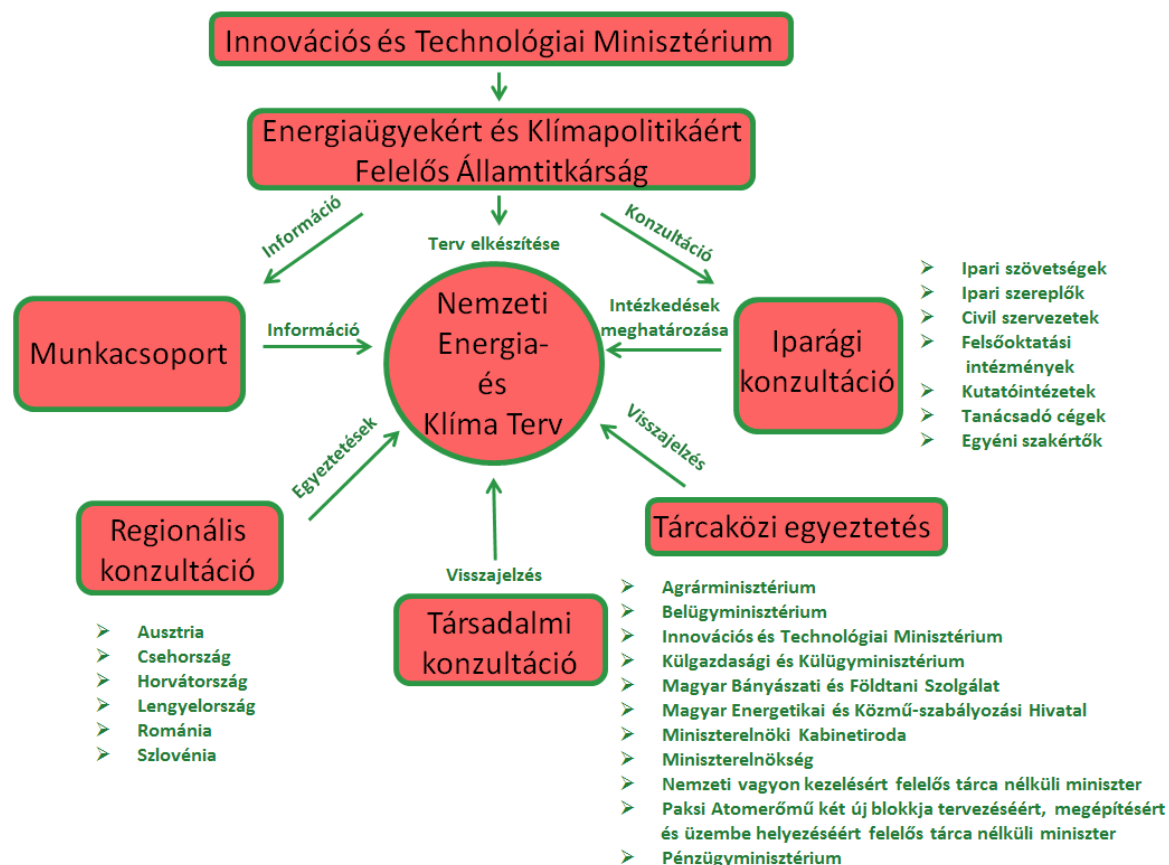
¹⁰ The Ministry of Innovation and Technology, within the meaning of Act V of 2018 on the listing of the ministries of Hungary and on the amendment of certain related acts, shall continue to operate by renaming of the Ministry of National Development under Act XX of 2014 on the listing of the ministries of Hungary.

- Hungarian Hydrocarbon Stockpiling Association
- Centre for Energy Research of the Hungarian Academy of Sciences
- Hungarian Chamber of Engineers
- Prime Minister's Office (government offices)
- National Research, Development and Innovation Office
- Minister without portfolio in charge of national assets
- Hungarian Atomic Energy Authority
- Hungarian Meteorological Service
- Minister without portfolio in charge of the design, construction and commissioning of the two new units of the Paks Nuclear Power Plant
- Ministry of Finance

1.3. Consultations and involvement of national and EU entities and their outcome

A large group of stakeholders were involved in the consultation process for drawing up the NECP. (Figure 3)

3 - The NECP consultation process



HU	EN
Innovációs és Technológiai Minisztérium	Ministry of Innovation and Technology
Energiaügyekért és Klímapolitikáért Felelős Államtitkárság	State Secretariat for Energy and Climate Policy
Információ	Information
Egyeztetések	Consultations
Munkacsoport	Working group
Regionális konzultáció	Regional consultations
Ausztria	Austria
Csehország	Czechia
Horvátország	Croatia
Lengyelország	Poland
Románia	Romania
Szlovénia	Slovenia
Terv elkészítése	Drafting of plan
Nemzeti Energia és Klíma Terv	National Energy and Climate Plan
Visszajelzés	Feedback
Társadalmi konzultáció	Social consultations
Konzultáció	Consultations

Intézkedések meghatározása	Determination of measures
Visszajelzés	Feedback
Iparági konzultáció	Sectoral consultations
Tárcaközi egyeztetés	Interministerial consultations
Agrárminisztérium	Ministry of Agriculture
Belügyminisztérium	Ministry of the Interior
Innovációs és Technológiai Minisztérium	Ministry of Innovation and Technology
Külgazdasági és Külügyminisztérium	Ministry of Foreign Affairs and Trade
Magyar Bányászati és Földtani Szolgálat	Hungarian Mining and Geological Service
Magyar Energetikai és Közmű-szabályozási Hivatal	Hungarian Energy and Public Utility Regulatory Authority
Miniszterelnöki Kabinetiroda	Cabinet Office of the Prime Minister
Miniszterelnökség	Prime Minister's Office
Nemzeti vagyon kezeléséért felelős tárca nélküli miniszter	Minister without portfolio in charge of national assets
Paksi Atomerőmű két blokkja tervezéséért, megépítéséért és üzembe helyezéséért felelős tárca nélküli miniszter	Minister without portfolio in charge of the design, construction and commissioning of the two new units of the Paks Nuclear Power Plant
Pénzügyminisztérium	Ministry of Finance
Ipari szövetségek	Industrial associations
Civil szervezetek	CSOs
Felsőoktatási intézmények	Higher education institutions
Kutatóintézetek	Research establishments
Tanácsadó cégek	Consultancy firms
Egyéni szakértők	Individual experts

i. Involvement of the national parliament

The Hungarian Parliament has not discussed the draft NECP.

ii. Involvement of local and regional authorities

Local and regional authorities were involved in the drafting of the plan, and will also take part in social consultations serving its finalisation.

iii. Consultations of stakeholders, including social partners, and engagement of civil society and the general public

In April 2016, a working group managed by the Department of Strategic and Energy Policy, with the involvement of several partner departments and external collaborators responsible for modelling, was set up by the former Ministry of National Development to ensure more efficient cooperation. The main groups and topics were defined as part of planning the national consultation processes.

Within the framework of the one-month sectoral consultations, the request of the ministry for proposals concerning the national targets, and the policies and measures considered necessary for their fulfilment was forwarded to 134 stakeholders in the summer of 2018. The partners requested to cooperate include industrial associations, industrial operators, civil society organisations, higher education institutions, research institutes, consulting firms and individual experts. The national objectives and targets undertaken under the NECP, and the policies and measures serving their fulfilment were defined in consideration of the professional processing and evaluation of the 50 proposals received as part of the sectoral consultations.

iv. Consultations with other Member States

Hungary is conducting regional consultations with neighbouring Member States and with the Visegrad countries (V4) in relation to the fields concerned. Consultations aim to efficiently exploit advantages resulting from the similar geopolitical position of the Member States concerned and from ad hoc joint action.

As a first step of consultations, in November 2018, Hungary participated at the NECP consultations¹¹ organised by the V4 countries and Austria in Bratislava. The meeting offered an opportunity to discuss – on a regional level – the progress of Member States in drawing up the NECP. In addition to practical aspects of preparing the NECP, the following topics were also discussed: renewable energy sources, climate change, energy efficiency, internal energy market and energy security.

In 2019 the Government is planning further regional consultations concerning the NECP. The related Consultation Plan discusses the fields, Member States and, in some cases, the groups with which Hungary is developing closer cooperation. Results of regional consultations are described in greater detail in the final plan.

v. Iterative process with the Commission

In April 2017, the delegation of the European Commission visited Hungary to obtain information and to clarify a few technical matters. In the course of successful bilateral consultations, the ministry reported on progress relating to the NECP.

¹¹ Pentilateral consultations between Austria (AT), Czechia (CZ), Poland (PL), Slovakia (SK) and Hungary (HU).

The iterative process with the Commission is conducted between 1 January 2019 and 30 June 2019. The recommendations will be subsequently integrated.

1.4. Regional cooperation in preparing the plan

i. Elements subject to joint or coordinated planning with other Member States¹²

NECP consultations were held as described in point 1.3.iv. In addition, regional consultations are held regularly in relation to the energy union dimension. These are presented under the relevant points of Chapter 3.

ii. Explanation of how regional cooperation is considered in the plan

Regional consultations regarding the plan will continue in 2019. The results of consultations will be taken into account in the plan's final version.

2. TARGETS AND OBJECTIVES

2.1. Dimension of decarbonisation

2.1.1. GHG emissions and removals¹³

i. Elements set out in point (a)(1) of Article 4

The emissions of non-ETS sectors (energy management in buildings, waste sector, transport, agriculture, small industrial emitters and F-gases) are regulated by the **Effort Sharing Decision** up to 2020. Pursuant to the Decision, between 2013 and 2020, i.e. during the ESD period, Hungary may increase its emissions by 10 % compared to the emission levels of 2005.

The **Effort Sharing Regulation** was adopted in May 2018, which sets national emission reduction targets for Member States for the 2021–2030 period, relative to the base year of 2005. To this end, GDP/capita-proportionate targets were set for Member States in the range of 0–40 %. Pursuant to the Regulation, Hungary's reduction target is 7 % between 2021 and 2030, i.e. during the ESR period.

ii. Where applicable, other national objectives and targets consistent with the Paris Agreement and existing long-term strategies; Where applicable, contribution to the EU commitment aimed at reducing greenhouse gas

¹² For details see relevant points of Chapter 3 in relation to specific dimensions.

¹³ Consistency to be ensured with long-term strategies pursuant to Article 15.

emissions, other objectives and targets, including sectoral targets and adaptation targets, if available.

Based on the ‘Roadmap for moving to a competitive low-carbon economy in 2050’ drawn up by the EU in 2011, by 2050 GHG emissions in the entire economy of the EU should decrease to 80 % of the level measured in 1990. The EU targets are determined by the 2030 climate and energy framework approved by the European Council in October 2014. The document declares that the EU will reduce GHG emissions by at least 40 % by 2030 compared to 1990. Hungary plans the 52–85 % reduction of emissions by 2050 compared to 1990 based on the second National Climate Change Strategy adopted by Parliament in October 2018.

To this end, in addition to the targets referred to in point 2.1.1.i., this document sets out the following national objectives, targets and areas of intervention.

GHG emissions should be reduced by at least 40 % by 2030 compared to 1990, i.e. gross emissions in 2030 may not exceed the gross value of 56.28 million tCO₂e (the value for 2017 is 64.44 million tCO₂e based on the preliminary inventory report, indicating a need to achieve an emission reduction of 8.2 million tCO₂e). This requires the following:

- phasing out of traditional coal-fired power plant operations in the energy industry¹⁴ and the reduction of GHG emissions to 7.30 million tCO₂e;
- capping of GHG emissions at 15.66 million tCO₂e in transport¹⁵, with control of the current trend of strong growth;
- reduction of GHG emissions to 8.07 million tCO₂e relating to buildings¹⁶;
- in industry¹⁷ we aim to limit the increase of emissions to 11.37 million tCO₂e. Within the above figure, energy emissions should stay below 5.05 million tCO₂e, notwithstanding an increase in production, while emissions from industrial processes should remain below 6.32 million tCO₂e;
- in agriculture¹⁸ we aim to limit the increase of GHG emissions to 9.28 million tCO₂e, which consists of 1.59 million tCO₂e energy emissions and 7.69 million tCO₂e non-energy emissions;
- we aim to reduce GHG emissions to 2.97 million tCO₂e in waste management¹⁹;
- we aim to reduce GHG emissions to 1.63 million tCO₂e in other sectors²⁰.

¹⁴ Category 1.A.1 based on the inventory.

¹⁵ Category 1.A.3 based on the inventory.

¹⁶ Category 1.A.4 (a,b) based on the inventory.

¹⁷ Category 1.A.2 (energy) and 2.A-C (emissions from industrial processes) based on the inventory

¹⁸ Category 1.A.4.c (energy) and 3. (non-energy) based on the inventory.

¹⁹ Category 5 based on the inventory.

2.1.2. Renewable energy

i. Elements set out in point (a)(2) of Article 4

Hungary set the **target of a 20 % share** of using renewable energy sources **by 2030**.

Electricity

The development of photovoltaic systems is a priority of the national plan, with the aim of increasing roughly 700 MW installed capacity in 2018 to a total capacity of 3 000 MW by 2022 and 2023. The expected steady decline in the technology's costs offers an opportunity for the sector's growth at a similar pace until 2030.

In addition to realising substantial growth in the use of photovoltaic systems, we aim to boost geothermal electricity generation, and to create possibilities for using biological materials – produced locally and in a sustainable form – for electricity generation under continuous monitoring.

Heating and cooling

Decentralised energy generation and the district heating sector are key areas for greening the heating and cooling sector. The efficient use of biomass in heating equipment and options for using ambient heat through heat pumps should be exploited for decentralised energy generation. The development of geothermal technology in Hungary and the recovery of biodegradable municipal waste for useful heat generation is also promising; consumers of district heating systems can appropriately use these resources in parallel with energy efficiency measures.

Transport

In the transport sector, beyond the expected development of new biofuels, electromobility based on renewable electricity will also play a more prominent role in fulfilling national renewable energy consumption targets.

2 - Estimated trajectories for the sectoral share of renewable energy in gross final energy consumption

	2016	2023	2025	2027	2030
Cooling and heating	20.8 %	22 %	22 %	24 %	26.9 %
Electricity	7.2 %	14 %	17 %	18 %	19.1 %
Transport*	7.4 %	12 %	12 %	13 %	15.0 %
Total	14.2 %	17 %	18 %	18 %	20.0 %

²⁰ Categories 1.A.5, 1.B, 2.D-H based on the inventory.

* A 2.5 multiplying factor was considered up to 2020 for determining the renewable energy recovery value of electricity consumption by rail; the value of the multiplying factor will decrease to 2 from 2021 under the new EU regulation.

- ii. *Estimated trajectories for the sectoral share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector*

See the previous point.

- iii. *Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectoral trajectories for renewable energy from 2021 to 2030, including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW*

The tables below provide information relating to the issue.

3 - Projection of the use of renewable energy per sector

(Mtoe)	2015	2023	2025	2027	2030
Renewable energy	2.62	3.29	3.5	3.65	3.88
Renewable energy – cooling and heating	2.17	2.26	2.34	2.43	2.57
Renewable energy – electricity	0.25	0.56	0.66	0.69	0.75
Renewable energy – transport*	0.2	0.48	0.5	0.53	0.57

Note: Aggregate sectoral values and forecasts – presented below in the breakdown of technology – will be adjusted in 2019 after coordination with market participants.

4 - Technological breakdown of electricity generation capacities installed for the use of renewable energy sources (installed capacity)

(MW)	2015	2020	2021	2022	2025	2027	2030
Water energy	57	57	57	57	57	57	57
Geothermal energy	0	3	3	10	15	20	20
Solar energy	168	1 842	2 000	3 000	5 307	6 000	6 645
Wind energy	329	329	329	329	98.7	50	0
Solid biomass	295	357	357	357	370	370	449
Biogas	80	80	80	80	80	80	80

5 - Technological breakdown of heating and cooling energy produced from renewable energy sources

(Mtoe)	2015	2023	2025	2027	2030
Geothermal	0.096	0.143	0.161	0.180	0.215
Solar energy	0.011	0.013	0.014	0.015	0.016
Solid biomass	2.027	2.071	2.123	2.190	2.283
Biogas	0.016	0.021	0.023	0.025	0.029
Aerothermal heat pump	0.001	0.007	0.009	0.014	0.020

Geothermal heat pump	0.003	0.003	0.004	0.004	0.004
Hydrothermal heat pump	0.001	0.001	0.001	0.001	0.001
Total renewable thermal energy and cooling energy generation	2.154	2.259	2.335	2.429	2.570
Of which: district heating	0.163	0.294	0.329	0.377	0.451
Of which: household biomass	1.765	1.611	1.611	1.611	1.611

6 - Transport energy generated from renewable energy sources in the breakdown of fuels (Mtoe)

(Mtoe)	2015	2023	2025	2027	2030
Traditional biofuel	0.188	0.426	0.439	0.457	0.471
Electricity – from renewable energy	0.025	0.125	0.175	0.215	0.275
Biogas	0	0.003	0.005	0.006	0.008
Hydrogen – from renewable energy	0	0.000	0.001	0.003	0.008

- iv. *Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply by feedstocks and origin (distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink*

To be planned in 2019.

- v. *Where applicable, other national trajectories and objectives, including those that are long term or sectoral (e.g. share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, energy communities and renewables self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)*

To be planned in 2019.

2.2.Dimension of energy efficiency

- i. *Elements set out in point (b) of Article 4*

As a national objective, primary energy consumption for energy purposes in 2030 – not including the project’s statistical decomposition effect of the Paks 2 nuclear power plant, increasing the use of nuclear energy – should not exceed the level of energy consumption in 2005.²¹

²¹ Primary energy consumption equalled 25 Mtoe in 2015; this value would increase to above 30 Mtoe by 2030 without the current and additional energy efficiency measures, without the statistical decomposition effect of Paks II.

The energy efficiency measures will reduce the value of expected energy consumption – without the measures – in 2030 by approximately 8–10 %.

- ii. Milestones relating to 2030, 2040 and 2050, not involving commitments; measurable result indicators drawn up on a national level and their contribution to the EU energy efficiency objectives, once these are included in the trajectories determined in long-term strategies aimed at the renovation of privately and publicly owned residential and non-residential buildings, in harmony with Article 2(a) of Directive 2010/31/EU*

The drawing up of the long-term energy efficiency roadmap relating to Hungary's building stock is in progress. The drawing up of the roadmap may commence after the approval and processing of Commission guidelines concerning Article 2(a), enacted after the amendment of Directive 2010/31/EU in 2018. In the course of determining the milestones, the Government will primarily rely on the achieved results and proposals of the Energy Innovation Council expected in the spring of 2019, which launches work in the autumn of 2018. The renewed survey of the national building stock, based on the building certification method modified in consideration of new international standards, is expected to be carried out in 2020.

- iii. Where applicable, other national objectives, including long-term targets or strategies and sectoral targets, and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling*

The development of efficient district heating in accordance with the Energy Efficiency Directive (EED) is a priority objective; it provides district heating services to consumers that are affordable in the long term, environmentally friendly and guarantee the security of supply on a high level.²²

In the field of transport, acceleration of the spread of electromobility, i.e. the electrification of road transport for reaching the renewed 20 % target (450 000 electric cars, and 45 000 public normal and high-capacity charging points by 2030); the reduction of the use of motor vehicles and of the unit energy consumption of traditional motor vehicles is a priority.

²² Government Decision No 1772/2018 of 21 December 2018 on decisions serving foundations for a new National Energy Strategy.

The detailed targets are defined on the basis of the NECP's planned professional debates, proposals of the Energy Innovation Council, recommendations of the Commission and internationally recommended sets of indicators (Odyssey programme, IEA indicators).

2.3. Dimension of energy security

i. Elements set out in point (c) of Article 4

Further strengthening of the security of energy supply in Hungary is a priority objective of the new National Energy Strategy. It is therefore necessary to establish a regulatory environment that guarantees the continuous and cost-effective security of supply in Hungary during the energy transition.

The high share of imports is a determining factor in the energy supply of Hungary (see Chapter 4.4). Significant dependence on hydrocarbon imports carries serious risks related to the security of supply and prices. Therefore, as regards the security of supply, one of the main tasks of the Government of Hungary is to **reduce the dependence on hydrocarbon imports** and to **maintain the share of imports at a manageable level**. In the course of reducing dependence on hydrocarbon imports, Hungary places emphasis on improving energy efficiency (see Chapter 2.2 on energy efficiency), maximising the exploitation of (conventional and unconventional) national hydrocarbon assets and renewable resources (see Chapter 2.1), and on at least maintaining the level of nuclear capacities. Exposure, however, will still remain high; Hungary plans to mitigate the inherent risks **by developing a diversified supply portfolio**.

At the present time, adequate natural gas and electricity import capacities are available. Owing to the above, the high level of interconnection and substantial natural gas storage capacities, the so-called N-1 principle is fulfilled in relation to the supply of both electricity and natural gas. As a major risk on the natural gas market, the future of the largest, Ukrainian supply route has become uncertain primarily for geostrategic and geopolitical reasons, and problems may also arise in connection with the technical condition of the Ukrainian transmission network. Thus, new development projects may be necessary to guarantee the security of gas supply. The launch of Romanian offshore gas extraction and access to LNG terminals may genuinely contribute to the diversification of natural gas sources, therefore it is necessary to strengthen diversification efforts to access alternative Black Sea and liquefied natural gas sources. As an important development relating to the latter, reverse flows are

under implementation from Croatia, and the construction of the Hungarian-Slovenian-Italian corridor is also included among diversification plans.

The development of a diversified national production portfolio and market integration are the two basic pillars of the security of electricity supply in Hungary. The vision of the electricity sector is determined by decarbonisation, decentralised production and the spread of digitisation.

An increase of the use of weather-dependent renewable energy at an appropriate pace requires an improvement of the electricity system's flexibility, enhancement of the system's intelligence and the resolution of regulatory problems. It is necessary to ensure that the dynamically increasing renewable energy capacities are integrated within the electricity system with a minimal rise in costs, and that the launch of new power plants and the expiry of the service life of others does not pose a risk to the security of supplying domestic consumers. As a general principle, the available import capacities should ensure flexibility and manoeuvring room for the Hungarian electricity system (preferably from as many directions as possible), and the Hungarian system should provide sufficient capacities for pan-European trade in electricity.

The Government has set the objective²³ of creating a renewed vision for the electricity market, which, *inter alia*, may provide answers to challenges caused by the lasting high share of imports and weak investment in power plants. We need to ensure the continuous availability of national electricity generation capacities in an appropriate volume and composition, necessary for the secure supply of electricity.

- ii. National objectives for achieving improvement in the following fields:
increased diversification of energy sources and of energy supply originating from third countries for the purpose of increasing the resilience of regional and national energy systems*

The Government is currently devising a vision for the security of supply as part of the drafting of the National Energy Strategy. New directions of energy strategy were defined in 2018 in parallel with the launch of substantive work. For further details see Chapter 2.3.

²³ Government Decision No 1772/2018 of 21 December 2018 on decisions serving foundations for a new National Energy Strategy.

iii. Where applicable, national objectives aimed at reducing dependency on energy imports from third countries to increase the resilience of regional and national energy systems

The Government is currently devising a vision for the security of supply as part of the drafting of the National Energy Strategy. New directions of energy strategy were defined in 2018 in parallel with the launch of substantive work. For further details see Chapter 2.3.

iv. National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage

Based on the rising number of inflexible, weather-dependent producers relying on renewable energy sources and the possible decline in the number of national gas power plants, it is essential to have available the widest possible range of means to ensure flexibility.

As part of developing the new National Energy Strategy, Hungary is currently exploring possibilities for improving the national energy system's flexibility. In this process it places emphasis on the following:

- System integration of renewable energy production.
- Development of additional means of electricity interconnection and strengthening of market integration to improve the national energy system's operation and flexibility.
- Advancement and facilitation of demand response.
- Improved use of regulatory capabilities (e.g. demand response) available in the distribution networks.
- Improvement of innovative technologies, particularly technological and regulatory conditions allowing the use of electricity stored in batteries.
- Spread of digitisation and smart equipment.

In addition to the involvement of government actors, representatives of industry and science were collaborating in the establishment of the Energy Innovation Council in 2018, which will put forward proposals for measures supporting the fulfilment of objectives in 2019.

2.4. Dimension of the internal energy market

2.4.1. Interconnection of electricity networks

i. The level of electricity interconnectivity that the Member State aims for in 2030 in consideration of the electricity interconnection target for 2030 of at least 15 %, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10 % and the following indicators of the urgency of action:

(1) Price disparities between Member States, regions or bidding zones on the wholesale market, exceeding the threshold value exclusive of the 2 EUR/MWh commitment;

(2) Nominal transmission capacity of interconnectors below 30 % of peak load;

(3) Nominal transmission capacity of interconnectors below 30 % of installed renewable energy generation.

Each new interconnector shall be subject to a socio-economic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs.

Hungary is already significantly exceeding the 15 % EU target relating to the interconnection of electricity systems; the share of cross-border capacities, nominal installed power plant capacities exceeds 47 %. It follows that the Government of Hungary does not consider it necessary to define a new quantified target. The increase of cross-border capacities, however, is justified, as an interconnected energy network operated with neighbouring countries improves the national security of supply. In the event of any disruption within the national system, namely, the risk of disruptions in service in large areas is reduced. The establishment of market interconnection may also reduce the cost of system operation through the more efficient use of balancing capacities jointly with neighbouring countries.

2.4.2. Energy transmission infrastructure

- i. *Key electricity and gas transmission infrastructure projects, and, where relevant, modernisation projects, which are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy*

Electricity market

Major infrastructure investments have been launched in Hungary in recent years. Electricity projects with Hungarian involvement on the (third) list of PCIs in effect:

- Interconnection of Žerjavenec (HR)/Hévíz (HU) and Cirkovce (SI);
- Increase of the electricity interconnection capacity of Hungary and Slovakia between Gabčíkovo (SK) and Gönyű (HU) and Veľký Ďur (SK);
- Interconnection of Hungary and Slovakia between Sajóvánka (HU) and Rimavská Sobota (SK).

Natural gas

Natural gas projects with Hungarian involvement on the (third) list of PCIs in effect:

- Interconnection between Poland, Slovakia, Czechia and Hungary with the related internal reinforcements, including one or more of the following PCI groups:
- Increase of the transmission capacities of the Slovakia-Hungary interconnection (Szada-Balassagyarmat);
- Hungary–Slovenia interconnection (Nagykanizsa – Tornyiszentmiklós (HU) – Lendava (SI) – Kidričevo);
- In the reverse flow corridor of Bulgaria-Romania-Hungary-Austria – phased increase of capacity (currently known as the ‘ROHUAT/BRUA’ project) aimed at enabling the transmission of 1.75 billion m³/year and 4.4 billion m³/year of natural gas in phase 1 and phase 2, respectively, and the exploitation of new resources in the Black Sea;

- ii. *If applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)²⁴*

²⁴ In accordance with Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 (OJ L 115, 25.4.2013, p. 39).

Electricity projects

The grid development plan of the electricity system – ‘Grid Development Plan of the Hungarian Electricity System – 2017’²⁵ (MAVIR) – sets out other investments – not on the PCI list – planned in the future.

Natural gas projects

FGSZ Zrt., as Transmission System Operator, has drawn up its ten-year development proposal relating to the Hungarian interconnected natural gas system based on proposals received from system operators involved in operating the high-pressure natural gas transmission system, and on other relevant information. Public consultations concerning the Hungarian ten-year development plan are still under way.²⁶

The proposal covers conditional projects planned to be implemented between 2019 and 2022.

The Ten-Year Development Plan of MGT ZRT. Zrt. – as Transmission System Operator – of 2018 is also being drawn up.

2.4.3. Market integration

- i. National objectives related to other aspects of the internal energy market, such as increasing system flexibility, in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a time-frame for when the objectives shall be met*

The increase of cross-border capacities and the establishment of harmonised rules allowing efficient flows of electricity and natural gas between countries are the two prioritised objectives of energy market integration in the region. The drawing up of regulations enhancing the efficiency of wholesale and balancing markets should be continued; the framework of the above is provided by the implementation of European operational and operating regulations.

²⁵ https://www.mavir.hu/documents/10258/15454/HFT_2017.pdf/8826edb7-d17a-463e-8983-29b616337f76

²⁶ <https://fgsz.hu/partnereink/rendszeruzemeltetok/rendszerfejlesztessel-kapcsolatos-egyuttmukodes>

Electricity market

The limited cross-border capacities on the electricity market limit imports of cheaper electricity from Austria and Slovakia; positive and negative price disparities alternate at the other border points. Although wholesale electricity prices decreased by 16.3 % between 2013 and 2016 in Hungary, in 2016 the annual average wholesale price of electricity in Hungary (35.4 EUR/MWh) was still significantly higher than in neighbouring countries. (Comparison to the average wholesale price in other countries in 2016: 29.2 EUR/MWh in Austria, 31.5 EUR/MWh in Slovakia, 33.2 EUR/MWh in Romania and 36.6 EUR/MWh in Slovenia.) This difference is attributable to the fact that imports of cheaper sources are limited due to limited cross-border capacities.

The increase of Slovakian capacities has already been resolved with the construction of two 400 kV cross-border power lines at Sajóivánka and Gönyű. Diminishing limits on cross-border capacities are likely to reduce price disparities between the Hungarian and Slovakian markets.

Gas market

Efforts aimed at ensuring the security of supply – presented in point 2.3.i. – also advance regional gas market integration through the diversification of sources and routes. Hungarian wholesale gas prices significantly decreased as a result of infrastructure investments and regulatory changes in recent years: While gas cost 6 EUR/MWh more on the Hungarian wholesale market than in Germany in 2011, the difference is now reduced to 1–2 EUR/MWh. The key objective is the management of risks that threaten these favourable conditions due to the uncertainty of the route of Russian deliveries to Europe. Hungary also aims to support gas market integration by devising a regional sales model for its storage capacities and by exploring regional market coupling possibilities.

- ii. Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets, including a time-frame for when the objectives are to be met*

Taking into account Hungary's geographical and climate characteristics, among renewable energy sources a high priority is assigned to the use and spread of photovoltaic energy.

Hungary places emphasis on improving regulatory measures on the demand side and on drawing up harmonised rules allowing the efficient flow of electricity between countries.

The Government is currently devising a vision for the security of supply as part of the drafting of the National Energy Strategy. New directions of energy strategy were defined in 2018 in parallel with the launch of substantive work.

iii. Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters

The Government of Hungary is redefining energy independence in the context of consumers and supports decentralised autogeneration based on renewable energy sources, whereby it offers consumers a choice of alternatives, contributes to the cost-effective supply of energy, supports the reduction of overhead costs for programme participants, reduces energy import dependence, supports the fulfilment of climate targets, and creates new business opportunities for equipment manufacturing companies and installation service providers.

To ensure the effective implementation of the above, Hungary is building on state-of-the-art technology. As a strategic objective, the development of smart metering systems, a shift to digitisation in consumer administration and the creation of possibilities for simplification should reduce the burdens of service providers and, in so doing, those of consumers, and offer a greater freedom of choice for consumers.

iv. National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a time-frame for when the objectives shall be met

The reserve demand of the electricity system and the determination of technical reserve requirements is in each case adjusted to the characteristics of the current system, in accordance with Regulation (EU) 2017/1485, including the share of renewables. Such determination takes into account the maximum expected contingency and the expected balancing demand, together with the related probability distribution. At least 50 % of demand for balancing reserve capacity – determined according to the methodology of the Regulation – must be provided from national sources.

- v. *Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector*

The new National Energy Strategy focuses on consumers. The aim is to provide clean, smart and affordable energy to consumers. In this effort it is necessary to take into account that consumer needs today are varied; there are significant differences in the characteristics, income and living conditions of specific consumer groups, and in their readiness to embrace modern technologies. It is therefore necessary to draw up complex, differentiated energy policy solutions and diversified service packages for each consumer segment. The above process also contributes to allowing a broad range of Hungarian energy consumers to exercise the right to freely choose energy providers.

In relation to households the main objective is to offer controlled, competitive prices.

In relation to non-household consumers, the Government has set the priority objective of strengthening conditions of competition for consumers.

The Government of Hungary is also planning to ensure the supply of electricity and gas to eligible protected consumers at regulated prices in the long term.

2.4.4. Energy poverty

- i. *Where applicable, national objectives with regard to energy poverty, including a time-frame for when the objectives are to be met*

Specific objectives are not defined. The Government measures launched in January 2013, however, concerning consumers falling within the scope of universal services, have been guaranteeing affordable energy supply and financial foreseeability to consumers of universal services through fixed universal service tariffs for more than half a decade. As a result of reduced energy overhead costs, district heating, gas and electricity became extremely cheaper compared to the year 2013, thus the household energy costs of Hungarian consumers are one of the lowest in Europe.

We aim to maintain sustainable overhead costs for Hungarian households in the future, while also ensuring the earning power of energy companies. The simultaneous fulfilment of the two objectives demands a complex strategy that extends to energy efficiency, an increase in the use of 'home-made' heating solutions and in the penetration of power generation, and the optimisation of supply methods. Strengthening competition on the domestic and regional commodity markets, the improved cost-effectiveness of grid operation and development – e.g.

based on ‘smart’ equipment and the elimination of duplication – and the promotion of digital solutions in serving consumers may offset the recent rise in international energy prices.

2.5. Dimension of research, innovation and competitiveness

- i. National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union, including, where appropriate, a time-frame for when the objectives are to be met*

The Government of Hungary is committed to the innovative transformation of the energy sector. A key objective is to increase energy related RDI output and to maximise the economic development opportunities underlying energy innovation and climate change.

The Government has launched a consultation process within the sector to assess innovation opportunities. The National Energy Strategy is to play a major role in determining the directions of energy innovation, the implementation of supporting regulatory changes and in the creation of financing opportunities for innovative projects.

- ii. Where applicable, national objectives relating to the year 2050, supporting the spread of clean energy technologies, and national objectives – including long-term targets (for 2050) – relating to the introduction of low CO₂ emissions technologies, including decarbonising technologies for energy-intensive and carbon-intensive industrial sectors, and to the related CO₂ transport and storage infrastructure*

- iii. Where applicable, national objectives relating to competitiveness.*

Hungary assigns a priority to strengthening the framework of qualitative growth and to the further strengthening of Hungary’s innovation-driven competitiveness; these efforts will result in more successful enterprises, more jobs, greater added value, and ultimately in a higher standard of living and a better quality of life.

Hungary’s characteristics offer a favourable background for establishing innovation-driven competitiveness. By building on the Hungarian undertakings playing a leading role in the manufacture of electrical machinery, the automotive industry and in IT solutions, Hungary will not only be a user of new technology, but could become an active player on the innovative energy market.

3. POLICIES AND MEASURES

Annex 1 includes all information relating to the policies and measures; this chapter only summarises the main directions of energy policy.

3.1. Dimension of decarbonisation

3.1.1. GHG emissions and removals

- i. Policies and measures to achieve the target set under Regulation (EU) 2018/842, as referred in point 2.1.1, and policies and measures to comply with Regulation (EU) 2018/841, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement*

In the end-use sector, greenhouse gas emissions (GHG emissions) are determined by the quantity of consumed energy and the unit emission factor of energy sources. It follows that a decline in GHG emissions results from policy measures aimed at decreasing energy consumption and increasing the use of renewable energy sources. These policy measures and their effect on energy consumption and the use of renewable energy are discussed in the subheadings of the dimension of energy efficiency and renewable energy.

GHG emissions in the energy industry (generation of electricity and heat, petroleum processing, production of solid energy resources) are determined by the quantity of energy used in processes and the unit emission factor of energy sources. GHG emissions can be reduced by decreasing the quantity of consumed energy, increasing the use of renewable energy sources, and by replacing fossil energy sources – with a higher emission factor – with nuclear energy or with other energy sources with lower emission factors.

Pursuant to the intergovernmental agreement between Hungary and the Russian Federation, two new nuclear power plant units will be built in Hungary by 2030, each with a capacity of 1 200 MW (Paks 2). The new nuclear power plant units – providing carbon-free generation – will allow the phasing out of coal-based power generation in Hungary. In parallel with the existing policy measures, by 2030 coal-based power generation will be limited to power plants supplying lower capacity industrial heat and district heating.

- ii. Regional cooperation in this field, if applicable*

- iii. If applicable, without prejudice to the applicability of State aid rules, financing measures, including EU support and the use of EU funds, in this area at national level*

3.1.2. Renewable energy

- i. In relation to renewable energy, policies and measures necessary for implementing the national contribution to the mandatory EU target set for 2030, the trajectories referred to in subpoint (2) of Article 4(a), and – if applicable or available – elements referred to in point 2.1.2, including sector and technology specific measures²⁷*

The increase in **electricity generation** for the grid in Hungary was primarily boosted by the so-called feed-in system (FIS) until the end of 2016, which provides support of an operational nature (guaranteed feed-in tariff higher than the market price). This system was replaced by the Renewable Energy Support Scheme (RESS) in 2017, which also provides operational support and supports the market integration of renewable energy generation as well. In addition supporting the construction of new units, the RESS also supports the use of renewable energy (so-called brown bonus).

It is the priority policy objective of the Government to encourage electricity generation from renewable sources in a more cost-effective and competitive form. As part of this objective, the first RESS tenders are expected to be announced in the first half of 2019. We support the photovoltaic panel investments of households and autoproducer SMEs with investment aid tenders; we aim to achieve an even faster increase of PV capacities by simplification of these schemes and the availability of supplementary financing.

Government Decision No 1772/2018 of 21 December 2018 on decisions serving foundations for a new National Energy Strategy also prescribes, *inter alia*, the drafting of policy programmes supporting the promotion and network integration of electricity generation from renewable sources. The package of proposals ensuring the improved flexibility of the Hungarian electricity system and the strategy defining directions for the innovative development of the electricity system will therefore be ready this year. We also aim to encourage ‘home-made’ energy production, i.e. renewable energy generated from sources available on-site, and to draw up a comprehensive concept of renewable energy communities.

²⁷ When planning these measures, Member States must take into account the end of the life-cycles of existing installations and the potential for repowering.

As pointed out in the policy document entitled ‘Cost-benefit analysis of high-efficiency district heating generation’, sent to the European Commission on 24 October 2017, the replacement of existing natural gas based district heat generation **with renewable heat generation** will not be implemented in Hungary on a market basis; its support is possible only with substantial investment aid. In the 2014–2020 period, the construction of heat generating facilities based on renewable energy sources receives investment aid in Hungary, which contributes to the significant increase in biomass based and geothermal generation of district heat.

Government Decision No 1772/2018 of 21 December 2018 on decisions serving foundations for a new National Energy Strategy prescribes the drafting of a policy programme relating to efficient district heating in accordance with the Directive 2012/27/EU (EED), which enables consumers to access environmentally friendly district heating services that are affordable in the long term and guarantee the security of supply on a high level. Our policy objectives in this field:

- We wish to encourage the construction of new biomass and geothermal district heating generation capacities with high-intensity non-refundable aid after the 2014–2020 programming period as well;
- By connecting isolated district heating districts, we aim to establish the infrastructural conditions necessary for increasing the utilisation rate and heat output of district heating generating facilities based on renewable energy sources;
- We wish to facilitate the use of energy from non-recyclable waste for district heating generation.

In **transport**, the use of biofuels in Hungary is determined by the mandatory blending ratio stipulated by law. To increase the use of biofuels, the mandatory blending ratio will increase from 4.9 % to 6.4 % in 2019 (taking into account multiplication). Electric transport on roads (electromobility) is already receiving substantial State aid (non-refundable aid and tax advantages for the purchase of pure electric vehicles, support of electric charging points etc.). Additional policy objectives in this field:

- Reduction of cost disparities between electric and traditional vehicles by means of aid and taxation instruments;

- Acceleration of the charging network's implementation and thereby its market maturity with the involvement of market participants, and the establishment of conditions for travel by electric vehicles in the country as soon as possible;
- Promotion of the use of electric vehicles by means of traffic management;
- Establishment of foreseeable, incentive price controls and a legal environment in the long term.

ii. Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources that could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Hungary is involved in several forms of regional cooperation serving the purpose of increasing the use of renewable energy and developing joint regional energy storage solutions in the future: Council of the Baltic Sea States (CBSS), Strategy for the Danube Region²⁸, Black Sea Economic Cooperation (BSEC), Global Green Growth Institute (GGGI), Organisation for Economic Cooperation and Development (OECD), Central European Initiative (CEI), International Atomic Energy Agency (IAEA), International Renewable Energy Agency (IRENA), Silk Route cooperation with China.

iii. Specific measures on financial support, where applicable, including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

Currently applied financial incentives and future plans relating to renewable energy sources:

- Operating aid for electricity generation
 - o based on already issued FIS decisions,
 - o within the framework of the RESS, with continuous reduction of aid per unit resulting from tendering and technological development.
- Investment aid
 - o Within the framework of operational programmes

²⁸ For details see point 3.2(vii)

- Support of electric vehicle purchases through use of emissions trade revenue due to the State
- Corporation tax rebate/write-off
- Repayable instruments
 - Zero-interest credit of the Hungarian Development Bank
- iv. *Where applicable, assessment of the support of electricity from renewable energy sources which Member States are to provide pursuant to Article 6(4) of Directive (EU) 2018/2001.*

The issue will be processed in 2019.

- v. *Specific measures to introduce one or more contact points, rationalise administrative procedures, provide information and training, and to facilitate energy purchase agreements*

Summary of policies and measures within the support framework to be established by Member States to promote and facilitate the development of autoproduction and renewable energy communities pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/2001

- vi. *Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable sources.*

Under legal regulations in force, household-scale small power plants may carry out net metering; this option is essentially adequate for encouraging household photovoltaic panel investments.

Incentives for renewable energy-based heat generation are already regulated by decrees through discounted electricity tariffs (H Tariff).

As regards the establishment of renewable energy communities, the question of vulnerable consumers and the security of supply is assigned a priority; the legal environment should allow even a miniature-scale district heating district to fulfil these two criteria.

- vii. *Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation, taking into account:*

- *availability of biomass, including sustainable biomass: both domestic production and imports from third countries;*
- *other biomass use by other sectors (agriculture and forestry-based sectors); and measures aimed at the sustainability of biomass production and use.*

Currently approximately 80 % of Hungary's renewable energy output originates from biomass use. Planning assigns a priority to improving the efficiency of boilers and other combustion installations using biomass, in parallel with improving the energy performance of buildings. The use of solid biomass for individual heating is also a social issue, as a social fuel wood programme is launched each year. Owing to the complexity of the issue, the detailed planning of measures will be carried out in 2019.

3.1.3. Other elements of the dimension

- i. Where applicable, national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS*
- ii. Policies and measures to achieve other national targets, if applicable*
- iii. Policies and measures to achieve low emission mobility (including the electrification of transport)*
- iv. Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels*

3.2. Dimension of energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of a financial nature) to promote the energy performance of buildings, in particular with regard to the following:

- i. Energy efficiency obligation schemes and alternative policy measures referred to in Articles 7(a) and 7(b) of Directive 2012/27/EU, to be drawn up in accordance with Annex II of this Directive*

We are of the view that the introduction of an energy efficiency obligation scheme – supporting the integrated use of consumer, service provider and EU funds – would result in major progress in the field of energy efficiency; we would explore this possibility within the framework of a pilot project to be drawn up in 2019. The large-volume ESCO programme, involving private funding, improving the energy performance of buildings, and a large-volume, multi-year household building energy programme, with the possible inclusion of the transport sector, could be implemented as part of the obligation scheme. The combination of these measures will allow a reduction of heating/cooling energy consumption by several digits, currently accounting for 40 % of domestic primary energy consumption, and will also produce results in the growing transport sector.

At the time of the drawing up of the NECP draft, the 3-year data set for energy statistics was not yet available for accurately determining the target referred to in Article 7 of the EED relating to the year 2030, nor was the newly adopted guideline of the European Commission accessible, but it may be necessary to also achieve at least the following energy efficiency results in the course of fulfilling the obligation:

7 - Obligation under Articles 7(a) and 7(b) of Directive 2012/27/EU and its expected main targets, based on preliminary estimates (PJ)

Year	Residential buildings	Industry	Transport	Other	Awareness raising	Small-scale electricity generation from renewable sources	Distribution/R empowering/Production, other measures
2021	3.30	1.49	0.397	0.10	0.6	0.30	0.50
2022	3.34	1.50	0.398	0.10	0.5	0.40	0.50
2023	3.34	1.50	0.398	0.12	0.5	0.50	1.00
2024	3.38	1.50	0.399	0.12	0.4	0.60	1.00
2025	3.38	1.50	0.399	0.15	0.4	0.62	1.50
2026	3.30	1.49	0.397	0.15	0.6	0.62	1.70
2027	3.47	1.50	0.402	0.15	0.2	0.72	2.00
2028	3.47	1.50	0.402	0.15	0.2	0.72	2.50
2029	3.51	1.51	0.404	0.15	0.1	0.82	2.70
2030	3.51	1.51	0.404	0.15	0.1	0.82	2.99
Total	34.0	15.0	4.0	1.3	3.6	6.1	16.4

- ii. *Long-term renovation strategies to support the renovation of the national stock of residential and non-residential buildings in private and public ownership²⁹, including policies and measures promoting cost-effective deep renovations*

²⁹ In accordance with Article 2(a) of Directive 2010/31/EU.

aimed at the worst performing segments of the national building stock, in accordance with Article 2(a) of Directive 2010/31/EU

- iii. Policies and measures promoting energy efficiency services in the public sector, and description of measures aimed at eliminating regulatory and non-regulatory barriers impeding the uptake of energy performance contracting and other energy efficiency service models³⁰*

The Energy Innovation Council – established in the autumn of 2018 – will provide a detailed answer to the question; the Ministry of Innovation and Technology also aims to establish an international cooperation programme within the framework of the Structural Reform Support Programme (SRSP) of the European Commission.

When assessing the policy options, the Government will rely on the evaluation of experience relating to the HORIZON 2020 projects and on relevant national positive and negative experience.

- iv. Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030, and other objectives referred to in point 2.2 (e.g. measures to promote the exemplary role of public bodies, energy-efficient public procurement, measures promoting energy audits and energy management systems³¹, measures to inform consumers and to provide training³², and other measures promoting energy efficiency³³)*

To be detailed in 2019, jointly with the issue of renewable energy communities.

- v. Where applicable, a description of policies and measures to promote the role of local renewable energy communities in contributing to the implementation of policies and measures in points i., ii., iii. and iv.*
- vi. Description of measures aimed at exploiting the energy efficiency potential of the natural gas and electricity infrastructure³⁴*

³⁰ In accordance with Article 18 of Directive 2012/27/EU.

³¹ In accordance with Article 8 of Directive 2012/27/EU.

³² In accordance with Articles 12 and 17 of Directive 2012/27/EU.

³³ In accordance with Article 19 of Directive 2012/27/EU.

³⁴ In accordance with Article 15(2) of Directive 2012/27/EU.

To be described in 2019, in consideration of the price increase of CO₂ emissions quotas in 2018, derogation provided under points 10(c) and 10(d) of the Directive, and institutions of the Modernisation Fund.

vii. Regional cooperation in this field, if applicable

viii. Financing measures, including Union support and the use of Union funds, in the area at national level

3.3. Dimension of energy security³⁵

i. Policies and measures related to elements set out in point 2.3³⁶

ii. Regional cooperation in this area

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

3.4. Dimension of the internal energy market³⁷

3.4.1. Electricity infrastructure

i. Policies and measures to achieve the targeted level of interconnectivity as set out in point (d) of Article 4

ii. Regional cooperation in this area³⁸

iii. Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

3.4.2. Energy transmission infrastructure

i. Policies and measures relating to elements defined in point 2.4.2, including, if applicable, individual measures aimed at enabling the implementation of PCIs and other key infrastructure projects

³⁵ Policies and measures must reflect the 'energy efficiency first' principle.

³⁶ Consistency must be ensured with the preventive action and emergency plans under Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (OJ L 280, 28.10.2017, p. 1), and with the risk preparedness plans under Regulation (EU) 2018/... [as proposed by COM(2016)0862 on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC].

³⁷ Policies and measures must reflect the 'energy efficiency first' principle.

³⁸ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

- ii. *Regional cooperation in this area*³⁹
- iii. *Where applicable, financing measures in this area at national level, including Union support and the use of Union funds*

3.4.3. Market integration

- i. *Policies and measures related to elements set out in point 2.4.3*
- ii. *Measures to increase the flexibility of the energy system with regard to renewable energy production, e.g. smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets*
- iii. *Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including, inter alia, via aggregation, on all energy markets*

In the new National Energy Strategy under preparation, Hungary is drawing up policy programmes establishing the technological conditions enabling the influence of consumer demand, the use of innovative technologies and, in particular, of the storage of electricity in batteries, and the regulatory framework incentivising their use.

- iv. *Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market*
- v. *Description of measures to enable and develop demand response, including those addressing tariffs to support dynamic pricing*⁴⁰

Hungary is defining the regulatory framework for encouraging demand response in the new National Energy Strategy.

³⁹ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.

⁴⁰ In accordance with Article 15(8) of Directive 2012/27/EU.

3.4.4. Energy poverty

- i. *Where applicable, policies and measures to achieve the objectives set out in point 2.4.4*

See point 2.4.4.

3.5. Dimension of research, innovation and competitiveness

- i. *Policies and measures related to elements set out in point 2.5*
- ii. *Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context*
- iii. *Where applicable, financing measures in this area at national level, including Union support and the use of Union funds*

4. PRESENT SITUATION AND FORECASTING WITH EXISTING POLICIES

4.1. Projected evolution of main exogenous factors influencing energy system and GHG emission developments

- i. *Macroeconomic forecasts (GDP and population growth)*

The GDP is continuing to grow. The GDP in 2030 is expected to exceed the value for 2015 by 76 %. Growth is expected in industry, the construction sector and services, while added value from the agricultural sector will be stagnant.

Hungary's population has been decreasing for years, and forecasts suggest that the trend will continue up to 2030. Hungary had 9.86 million inhabitants in 2015, which is expected to decrease to 9.48 million in 2030.

8 - Expected changes in population and GDP up to 2030

	2015	2020	2025	2030
GDP (EUR million) **	99 074	119 159	145 324	174 845
Sectoral gross value added (including main industrial, construction, services, and agriculture sectors) [EUR million] **	85 943	103 302	126 509	152 811

Of which:				
<i>Agriculture (%) **</i>	3.8	3.2	2.6	2.1
<i>Construction (%) **</i>	4.4	4.4	4.4	4.4
<i>Services (%) **</i>	64.8	65.7	64.6	64.6
<i>Industry (%) **</i>	27.0	26.8	28.4	28.9
Population (million) *	9.86	9.73	9.66	9.48

* The forecast is determined in a 5-year breakdown; annual values were determined by linear interpolation within the 5-year period.

** Up to 2020 – Eurostat data. In relation to data pertaining to the 2020–2030 period: based on estimates of the Ministry of Finance. Data are based on prices in 2005.

Source: Central Statistical Office (CSO) (population), Ministry of Finance (GDP).

See also Annexes 2 and 3.

ii. Sectoral changes expected to affect the energy system and GHG emissions

In relation to agriculture, both demand and supply factors underscore the declining weight of the sector, therefore the share of the agricultural sector within the national economy is expected to further decrease until 2030. The share of construction and services will remain the same, with a moderate strengthening of the industrial sector. The rise in services and business solutions better adapting to innovative consumer needs will contribute to the quality and consumer-oriented transformation of the tertiary sector.

iii. Global energy trends, international fossil fuel prices, EU ETS carbon price

With regard to global energy trends, Hungary takes into account the analyses and forecasts of the International Energy Agency (IEA) and International Renewable Energy Agency (IRENA). The publications of the IEA – World Energy Outlook, World Energy Investment and Technology Roadmap – and the publications of the IRENA – Innovation OUTLOOK and Rethinking Energy – provide useful guidance for developing the Hungarian energy policy and energy strategy.

The two tables below show forecasts relating to the international prices of fossil fuels and the price of CO₂ quotas.

9 - International import prices of oil, natural gas and carbon fuels (EUR/toe)

	2015	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Oil	353.28	549.92	577.17	586.57	604.75	617.29	624.24	639.83	653.92	663.51	678.55	687.67
Natural gas (NCV)	284.44	318.70	331.00	332.08	337.43	341.66	344.81	350.27	355.37	361.04	366.72	374.98
Coal	84.11	104.88	110.94	114.29	117.44	121.34	125.32	130.12	134.91	139.87	144.88	150.40

10 – CO₂ quota price forecast based on ICIS forecast

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CO2 quota price forecast (EUR/tonne CO₂)	19.94	24.42	27.70	32.80	37.00	40.40	38.80	36.30	30.90	26.40	22.40	18.80	15.20

See also Annexes 2 and 3.

iv. Changes to technological costs

This point is detailed in the final document.

The table below contains indicative key technological costs accounted for by Hungary.

11 – Changes to technology costs

	Unit costs
Installation of PV panels feeding into the grid – unit investment costs (HUF million/MW)	300–350
Installation of PV panels for household-scale power plants – unit investment costs (HUF million/MW)	350–400
Storage capacity necessary for connection to system – unit investment cost of storage + super-capacitor necessary for household-scale power plant integration (HUF million/MW)	440–460
Installation of heat pump in households with modern energy installations – Unit investment cost (HUF/GJ)*	80 000–120 000
Installation of renewable energy-based district heating generation facilities – Biomass, unit investment costs (HUF million/MW)	100–120
Installation of renewable energy-based district heating generation facilities – Geothermal heat, unit investment costs (HUF million/MW)	150–300
Transport – Investment cost of new electric cars (HUF million/car)	8–10
Transport – Investment cost of new electric buses (HUF million/bus)	150–170
Transport – Investment cost of new electric small lorries (HUF million/lorry)	12–15

* Depends on type of heat pump

4.2. Dimension of decarbonisation

4.2.1. GHG emissions and removals

- i. Trends in current GHG emissions and removals in the EU ETS, in sectors falling within the scope of the Effort Sharing Regulation, LULUCF sectors and in different energy sectors*

In 2016 the (gross) GHG emissions of Hungary, not including LULUCF, equalled 61.46 million tonnes CO₂ equivalent over the 93.80 million tonnes CO₂ equivalent in 1990 (decrease of 34.5 %). Only the preliminary inventory is available for 2017 for the time being,

which does not contain detailed data. Emissions increased from 2016 to 2017 based on the preliminary inventory, reaching 64.44 million tCO_{2e} (decrease of 31.3 % over the year 1990).

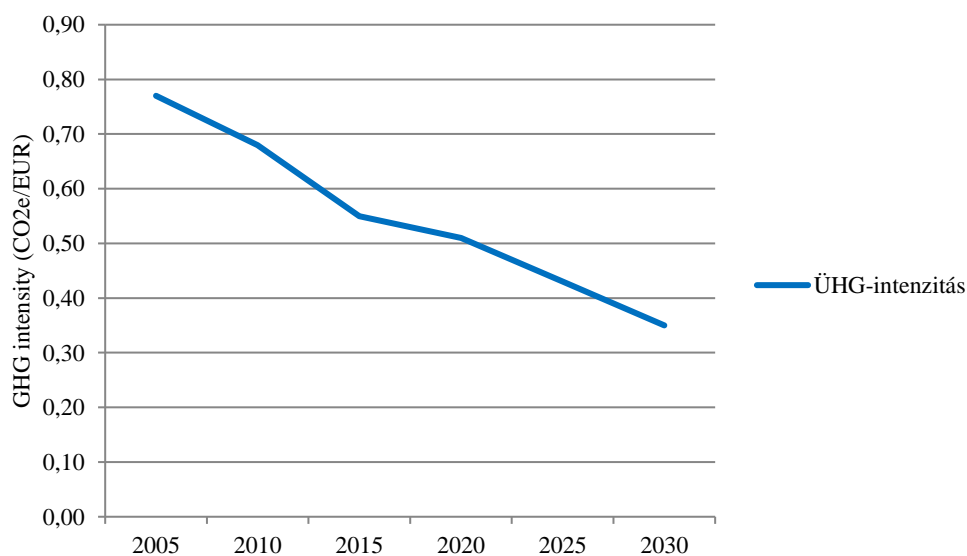
The sharp decline compared to emission levels in 1990 is mainly attributable to the regime change. Emissions decreased by 20 % between 1990 and 1992 in consequence of the decline in energy, industrial and agricultural production.

Thereafter, Hungary's GHG emissions remained relatively stable for 14 years (1992–2005), followed by a further significant 24 % decrease in such emissions between 2005 and 2013. The global economic crisis in 2008 and 2009 significantly affected Hungarian economic performance, and fundamentally determined national GHG emissions. Hungary's emissions declined by 9 % between 2008 and 2009. After a temporary, moderate increase of GHG emissions, these continued to decrease each year after 2010. In contrast, the economy began to grow at a slow pace from the second quarter of 2010, reaching the pre-crisis level in 2014, and exceeding it in 2015.

The declining trend in emissions was disrupted in 2014, with a 5 % increase measured in 2015, and a continuing rise in 2016 and 2017. Despite the growth, emissions in 2017 remained significantly lower (by 15 %) than in 2005.

Between 2005 and 2015 the GHG emission intensity of the Hungarian economy and primary energy intensity decreased by 29 % and 17 %, respectively (Figure 4, Figure 5).

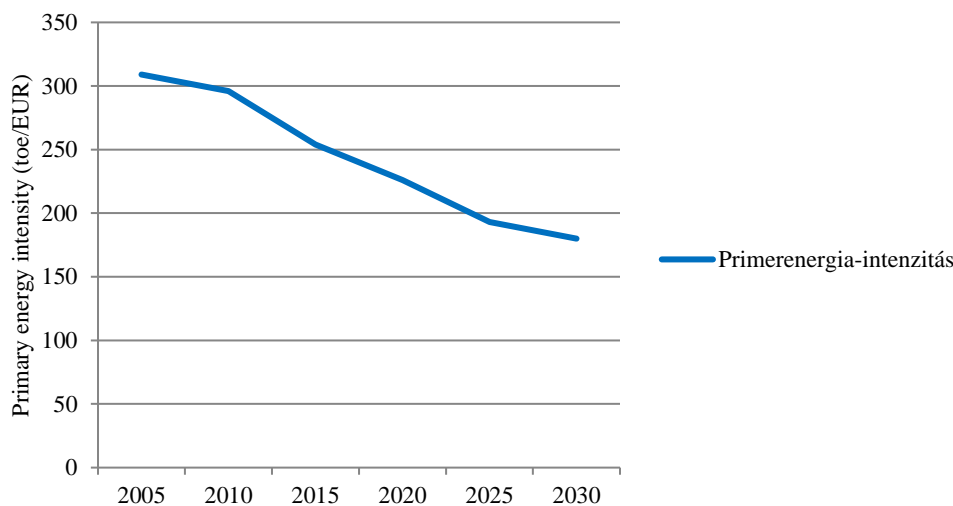
4 - GHG emission intensity of the Hungarian economy



HU	EN
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ÜHG-intenzitás (CO ₂ e/EUR)	GHG intensity (CO ₂ e/EUR)
ÜHG-intenzitás	GHG intensity

5 - Primary energy intensity of the Hungarian economy (2005–2015)



HU	EN
Primerenergia-intenzitás (toe/EUR)	Primary energy intensity (toe/EUR)
Primerenergia-intenzitás	Primary energy intensity

Carbon dioxide is the most important greenhouse gas of anthropogenic origin, accounting for 77 % of total emissions. Carbon dioxide is mainly produced in the energy sector through the burning of fossil fuels. Hungary's CO₂ emissions decreased by 44 % since the mid-1980s.

Energy sector

The energy sector holds the largest share of total emissions (72.6 %), where emissions equalled 44.6 million CO₂ equivalent in 2016.

Carbon dioxide from fossil fuels accounts for the largest share (96 %) of GHG emissions in the energy sector. Within the energy sector, the largest emissions are produced by the energy industry (30 %), followed by consumption of the service industry, households and agriculture (29 %) and emissions from transport (28 %). Energy sector emissions increased by 3 % in 2016 following a 5 % increase in Hungarian electricity generation.

Land-use, land-use change and forestry (LULUCF)

The LULUCF sector is regarded overall as a sink, owing to the substantial CO₂ capture of forests resulting from significant volumes of forestation and sustainable forest management in recent decades. A trend cannot be identified in the sector's net sink rate due to the complex dynamics of the accounted processes; results significantly fluctuated between 1985 and 2016. (The average sink rate equalled 3.6 million CO₂ equivalent.) In 2016, forests captured 4.4 million tonnes CO₂.

Effort Sharing Decision (ESD)

Emissions under the ESD, covering sectors not falling within the scope of the EU's Emissions Trading System (ETS), totalled 42.1 million tonnes in 2016. This indicates a 12.5 % decrease compared to 48.3 million tonnes in the base year of 2005, which is 20.5 % and 6.4 % lower than our targets for 2020 and 2030, respectively. The preliminary ESD figure for 2017 equals 43.8 million tCO_{2e}, which still remains below the 2020 and 2030 targets, and the 2005 base figure.

Most of emissions under the ESD are attributable to transport, buildings, agriculture and waste management sectors, but emissions from industrial energy consumption and F-gases are also contributors.

Emissions from the transport sector indicated a rising trend between 1996 and 2007, followed by a 23 % decrease between 2007 and 2013. Emissions increased at a rapid rate after 2013. The value in 2016 was 24 % higher than in 2013, albeit exceeding the level in 2005 only by 4 %.

At the same time, emissions from fuel consumption in the service industry, agriculture and by households decreased by 29 % over the year 2005. Following the typically declining trend of recent years, however, household emissions increased in 2015, primarily as a result of the 13 % rise in gas consumption.

In 2016 agriculture accounted for 11 % of total emissions. Agricultural activities result in CH₄ and N₂O emissions; most of Hungary's N₂O emissions (87 %) are produced in this sector. The GHG emissions of agriculture have been steadily increasing since 2011, mainly as a result of increases in fertiliser use, the bovine population and dairy production per cow.

The waste sector accounts for 6 % of total emissions. The disposal of solid waste in landfills accounts for most of emissions (85 %), followed by wastewater treatment (10 %), composting

(4 %) and waste incineration not for energy purposes (1 %). Emissions declined by 20 % between 2005 and 2016.

Industrial energy consumption and emissions increased by 13 % in 2016. Emissions from products containing F-gases declined sharply in 2016 (following a significant increase in 2015).

EU ETS emissions

The ETS GHG emissions (not including air transport) of Hungary amounted to 19.4 million tonnes CO₂ equivalent in 2016, decreasing by 26 % over the year 2005. Hungary's EU ETS GHG emissions continuously declined between 2009 and 2014, with the exception of a minor shift in 2010. This trend was disrupted with a 4 % increase in 2015, followed, however, by a resumed decrease of 1 % in 2016. The preliminary figure for the year 2017, however, indicates a value of 20,6 million tCO_{2e}, which is significantly higher than in the previous year. The Inventory Report of Hungary provides details of historical changes in GHG emissions.⁴¹

ii. Projections of sectoral developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

Annex 4 contains the detailed results of GHG projections. In relation to the LULUCF categories, one scenario without measures (WOM), one with existing measures (WEM) and one with additional measures (WAM) was drawn up. In relation to the agriculture and waste sectors, the WAM scenario does not include actual additional measures; the difference between the WEM and WAM is attributable to emissions reduction required in the sectors.⁴² Only a WEM scenario was prepared in relation to the other categories. The base for forecasting is not uniform. In relation to the categories of energy and disposal of solid waste in landfills, the base year is 2016, while the year is 2015 in relation to all other categories. The final version of the NECP – to be drawn up in 2019 – will apply a uniform base year. Annex 5 contains the description of forecasting methodology.

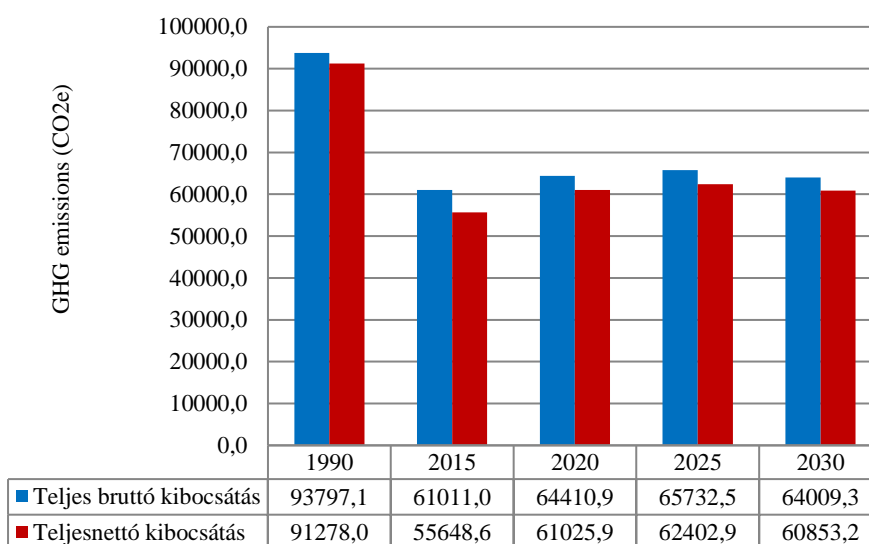
Summary

⁴¹<https://unfccc.int/process-and-meetings/transparency-and-reporting/reporting-and-review-under-the-convention/greenhouse-gas-inventories-annex-i-parties/national-inventory-submissions-2018>

⁴² The base for forecasting is not uniform. In relation to the categories of energy and disposal of solid waste in landfills, the base year is 2016, while the year is 2015 in relation to all other categories. The final version of the NECP – to be drawn up in 2019 – will apply a uniform base year.

Under the WEM scenario, by 2030 the total gross GHG emissions of Hungary – without LULUCF – will increase by 4.7 % over the year 2015, to 64 thousand kt, indicating a 31.76 % decrease compared to 1990, falling short of the minimum 40 % target. Under the WEM scenario, total net emissions – with LULUCF – will increase by 9.1 %. GHG intensity is expected to decrease from 0.55 tCO₂e/GDP⁴³ in 2015 to 0.35 tCO₂e/GDP in 2030.

6 - GHG emissions with existing policies and measures (2015–2030)

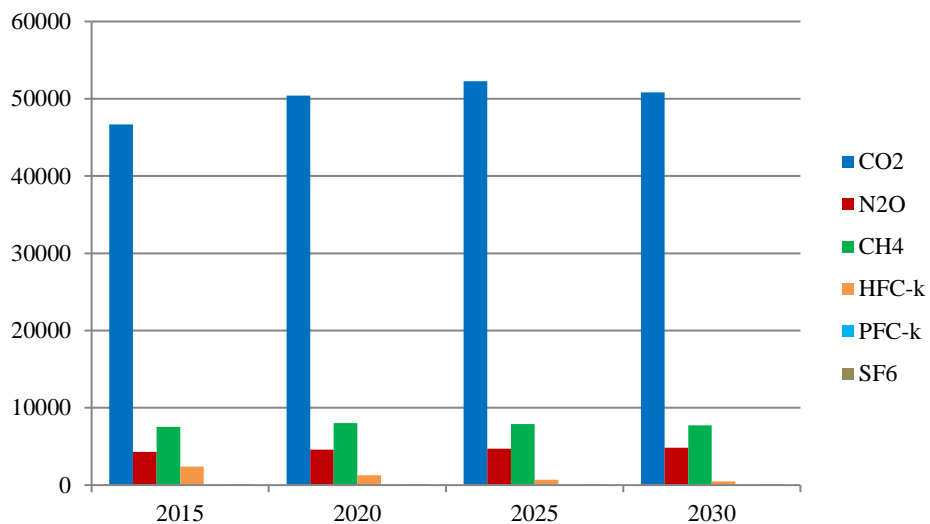


HU	EN
Teljes bruttó kibocsátás	Total gross emissions
Teljes nettó kibocsátás	Total net emissions

Under the WEM scenario, obviously CO₂ will remain the largest GHG, increasing by 8.9 %. CH₄ and N₂O emissions will increase by 12.3 % and 2.6 %, respectively, while F-gas emissions will decrease by 74.65 %. We are not accounting for the appearance of NF₃ in the Hungarian inventory.

7 - Gross GHG emissions per gas, with existing policies and measures (2015–2030)

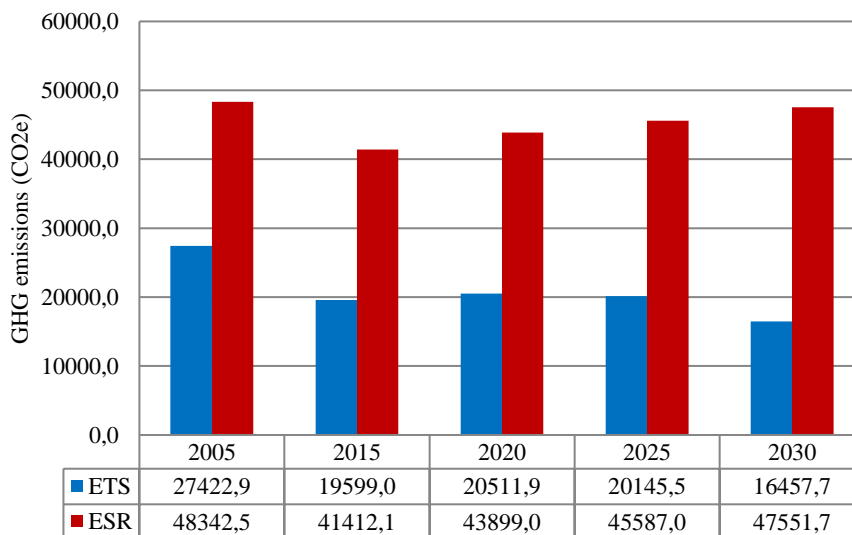
⁴³ In million EUR.



HU	EN
HFC-k	HFCs
PFC-k	PFCs

EU ETS emissions decreased by 14 % over the year 2015, while ESD/ESR emissions increased by 14.8 % under the WEM scenario.

8 - ETS and ESR emissions with existing policies and measures (2005–2030)



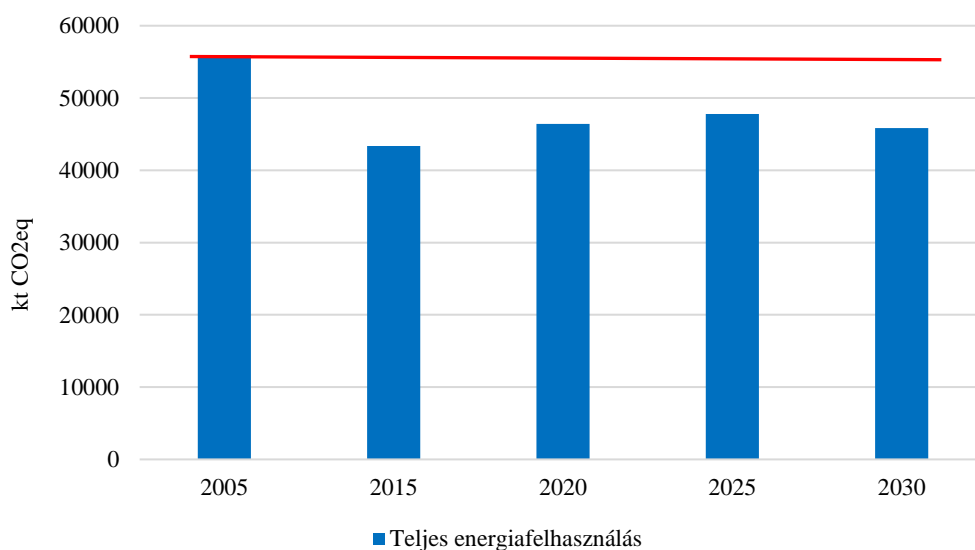
HU	EN
ETS	ETS
ESR	ESR

The LULUCF sector will remain a net sink, but CO₂ capture will decrease by 52 % by 2030.

Energy

Taking into account the impact of existing policy measures, the value of GHG emissions from the use of energy may fall to 45.8 million tCO_{2e} by 2030 from 55.9 million tCO_{2e} in 2005, indicating an 18 % decline. The emissions forecast for 2030 will exceed the level for 2015 by 5.8 % (9).

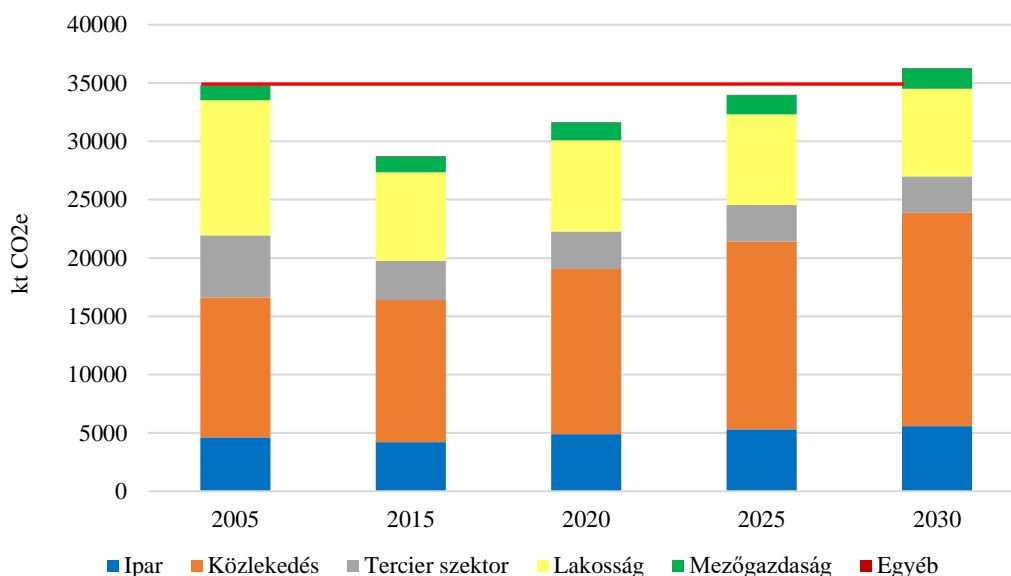
9 – Projection of GHG emissions from the use of energy (total energy) in consideration of the impact of existing policy measures



HU	EN
Teljes energiafelhasználás	Total energy consumption

GHG emissions from the use of energy in the end-use sector may increase from 28.7 million tonnes CO_{2e} in 2015 to 36.3 million tonnes CO_{2e} by 2030 resulting from changes to energy consumption and the structure of energy sources under existing policy measures, indicating a 26 % increase (**Error! Reference source not found.**).

10 - Projection of GHG emissions from the use of energy in the end-use sectors, in consideration of the impact of existing policy measures

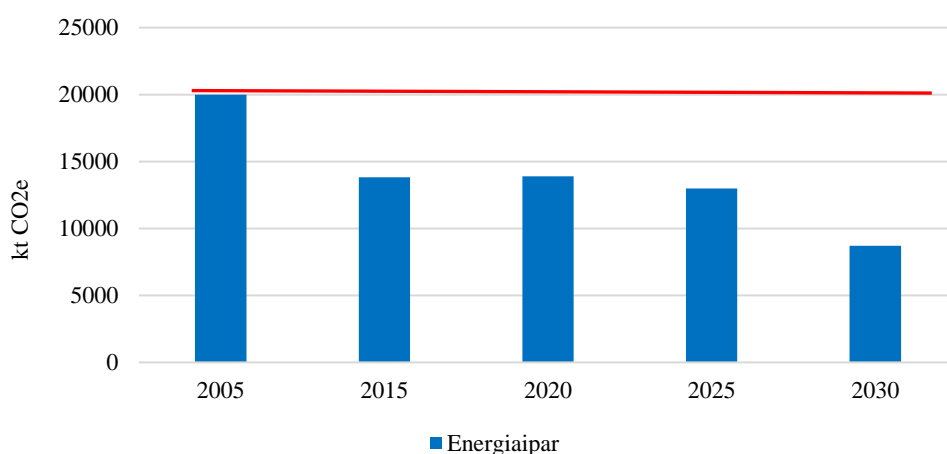


HU	EN
Ipar	Industry
Közlekedés	Transport
Tercier szektor	Tertiary sector
Lakosság	Households
Mezőgazdaság	Agriculture
Egyéb	Other

The rise in emissions is attributable to two factors. Firstly, the quantity of fuel used in road transport is increasing at a dynamic rate as a result of the 4 % annual average increase of the GDP (and the resulting rise in incomes). Secondly, the 5 % annual average increase in industrial production also entails a rise in used energy quantities. GHG emissions forecast for 2030, however, exceed the value measured for 2005 only by 5 % in relation to end consumer sectors.

The combined effect of the construction of the new nuclear power plant units, the increase in renewable energy-based electricity generation capacities and policy measures supporting the reduction of electricity and heat demand may lead to an 8.7 million CO_{2e} decrease in GHG emissions in the energy industry by 2030, which is 56 % and 37 % lower than levels in 2005 and 2015, respectively (11).

11 Projection of GHG emissions in the energy industry in consideration of the impact of existing policy measures



HU	EN
Energiaipar	Energy industry

Non-energy emissions

In 2030, emissions from industrial processes and product usage are expected to exceed the level in 2015 by 4.1 %. Thus, major changes are not expected in total emissions based only on this category; this is attributable, however, to two completely different trends. Emissions from industrial processes sharply declined after the 2008 economic crisis and remain relatively low. By 2030, however, they are expected to exceed the level for 2015 by 33 %. Fluorinated greenhouse gas emissions will significantly decrease by 2030 as a result of prohibitions of relevant EU regulations and the hydro-fluorocarbon quota scheme.

Emissions are expected to increase in agriculture. The sector is expected to emit 18 % more GHGs in 2030, attributable to a growing animal population.

Emissions relating to waste will decline by 12 % by 2030. The decrease is mainly driven by the declining quantity of waste disposed in landfills. Due to the expected rise in demand, emissions from international air transport will be 58 % higher in 2030 than in 2015.

4.2.2. Renewable energy

- i. *Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport), and per technology in each of these sectors*

In 2016 Hungary significantly overachieved its share of renewable energy use – on a prorated basis – prescribed by the EU. According to Eurostat data, namely, the share of energy from

renewable energy sources within gross final energy consumption equalled 14.19 % in 2016, which significantly exceeds the 9.3 % value set originally for that year. The modification of the statistical methodology in 2017 – approved by Eurostat – also played a major role in the accounting of a current biomass share that is higher than previous estimates.

12 - Share of renewable energy in gross final energy consumption per sector in 2016

Sector	ktoe	Share (%)
(a) Electricity	275.9	7.2
(b) Cooling, heating	2 176.0	20.8
(c) Transport	323.4	7.4
(a) + (b) + (c)	2 637.8	14.2

Source: HEA.

Hungary's possibilities for using renewable energy are mainly exploited in the heating sector; in 2016, 83 per cent of renewable energy was used for heating and cooling, 9 per cent for electricity generation and 8 per cent for transport.

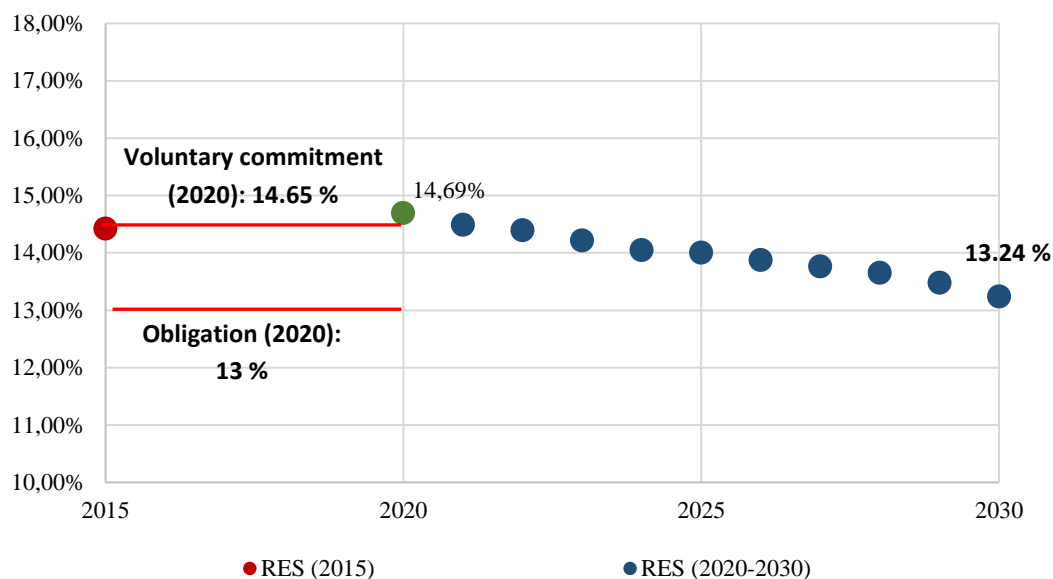
Hungary is progressing well on a prorated basis for reaching the mandatory 10 % share of renewable energy in transport in 2020, as the value equalled 7.4 % in 2016, with a 4.9 % blending ratio.

ii. Indicative forecasting of development based on existing policies until 2030 (outlook up to 2040)

Summary

The ratio of renewable energy use to gross final energy consumption will be 14.69 % in 2020 in consideration of existing policy measures (WEM), which exceeds both the EU obligation for Hungary (13 %) and Hungary's voluntary commitment (14.65 %). Without additional measures, the share may decrease to 13.24 % in 2030, mainly resulting from a decline in the use of fuel wood by households (12).

12 - Projection of the ratio of renewable energy use to gross final energy consumption, in consideration of the impact of existing policy measures



Electricity (RES-E)

Renewable energy accounted for a share of 4.4 % in electricity consumption in 2005, increasing to 7.1 % in 2010 and to 7.3 % in 2015. The quantity of electricity from renewable resources is steadily increasing in Hungary. The increase of the share of renewable energy use, however, came to a slowdown from 2010, caused by rising electricity demand accompanying dynamic economic growth after the crisis. Until 2015 and 2016, biomass and wind power stations accounted for most of electricity generation from renewable sources in Hungary. From 2017 and 2018, the rise in electricity generation from renewable sources resulted from the spike in the installed capacities of PV panels.

13 - Capacity of household-scale small power plants (MW)

Year	2011	2012	2013	2014	2015	2016 ²	2017
Weather-dependent technologies	3.1	12.9	31.7	68.7	128.4	164.8	240.7
of which: solar energy	2.9	12.5	31.2	68.1	127.7	164.1	240.0
of which: wind energy	0.1	0.3	0.4	0.5	0.6	0.6	0.6
of which: water energy	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Non-weather-dependent technologies¹	0.1	0.1	0.4	0.6	0.6	0.7	0.7
Total	3.2	13.0	32.1	69.3	128.9	165.5	241.4

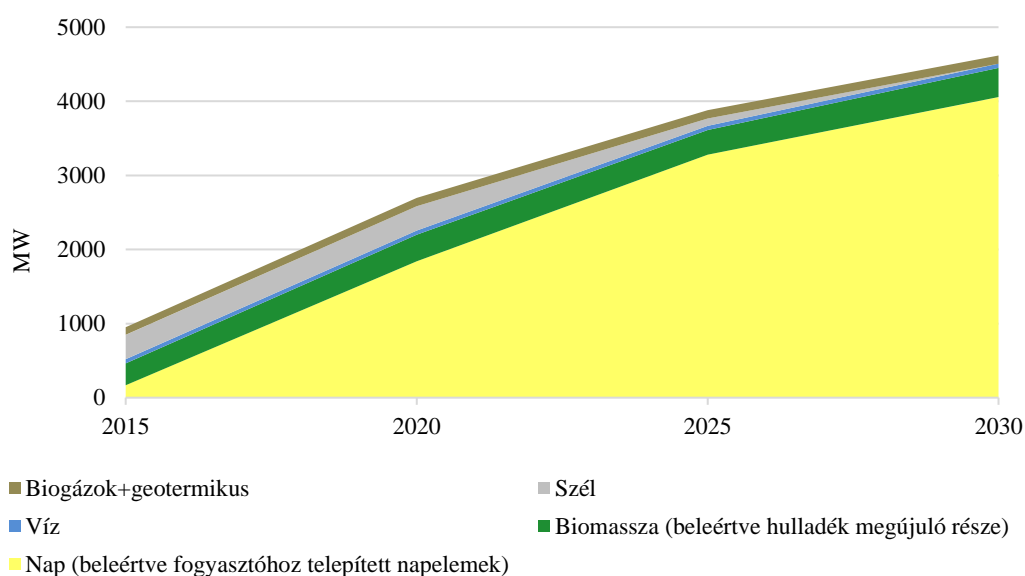
¹ Natural gas, biogas, thermal methane etc.

² Data have been clarified compared to the publication of the previous year.

As a result of the existing policy measures, the installed capacity of electricity generating units generating from renewable sources will exceed 4 600 MW by 2030, with more than

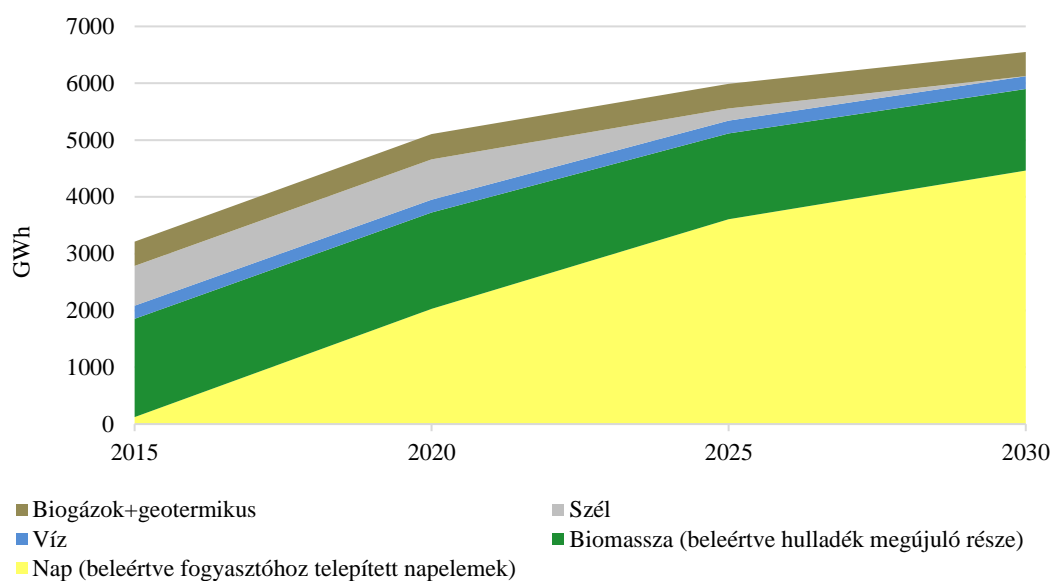
4 000 MW attributable to photovoltaic panels. In 2030, the quantity of electricity from renewable resources is expected to exceed 6 500 GWh, with approximately 70 % of such quantity attributable to photovoltaic panels. According to the forecast, the share of the use of renewable energy will amount to 12.8 % of gross final electricity consumption in 2030 (RES-E).

13 - Projection of installed capacity of electricity generation from renewable sources, in consideration of the impact of existing policy measures



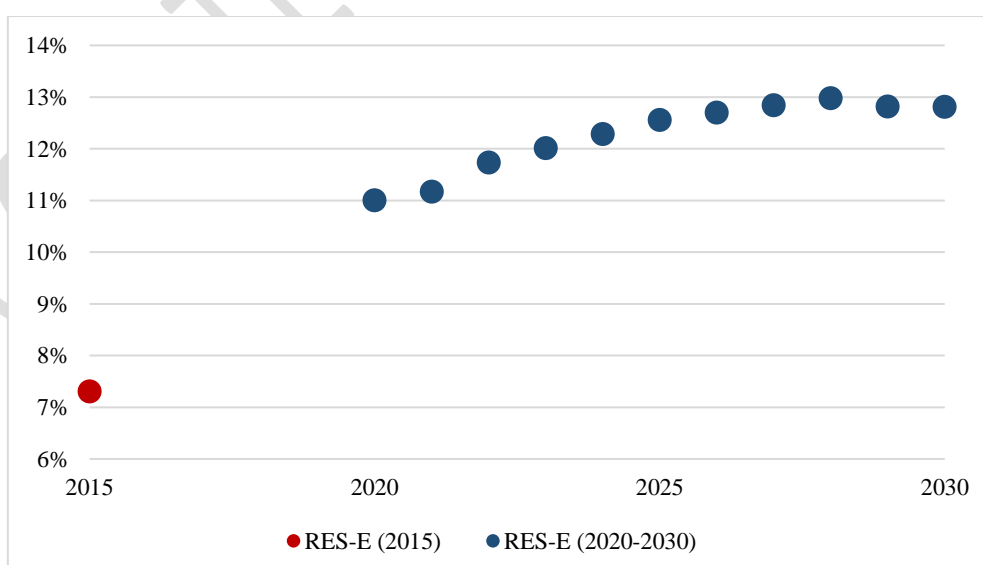
HU	EN
Biogázok+geotermikus	Biogases + geothermal energy
Víz	Water
Nap (beleértve fogyasztóhoz telepített napelemek)	Solar (including PV panels installed at consumers)
Szél	Wind
Biomassza (beleértve hulladék megújuló része)	Biomass (including renewable portion of waste)

14 - Projection of electricity generation from renewable sources, in consideration of the impact of existing policy measures



HU	EN
Biogázok+geotermikus	Biogases + geothermal energy
Víz	Water
Nap (beleértve fogyasztóhoz telepített napelemek)	Solar (including PV panels installed at consumers)
Szél	Wind
Biomassza (beleértve hulladék megújuló része)	Biomass (including renewable portion of waste)

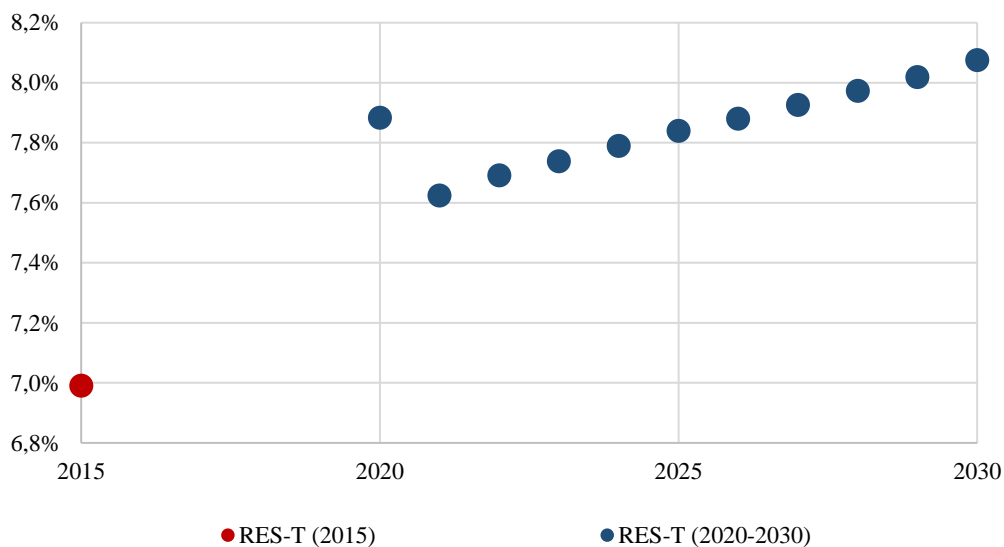
15 - Projection of the share of electricity generation from renewable sources, in consideration of the impact of existing policy measures



Transport (RES-T)

The share of renewable energy use equalled 0.9 % in the transport sector in 2005, increasing to 6 % in 2010 and to 7 % in 2015. Growth is primarily attributable to the use of biodiesel produced from first generation biofuels and used frying oil. As a result of the existing policy measures, the share of using renewable energy may reach 8.1 % in 2030 in the transport sector. The visible decline of the share in 2021 is caused by the modification of the previous multiplying factor of 2.5 to the value of 2 in relation to rail transport.

16 - Projection of the share of renewable energy use in the transport sector, in consideration of the impact of existing policy measures



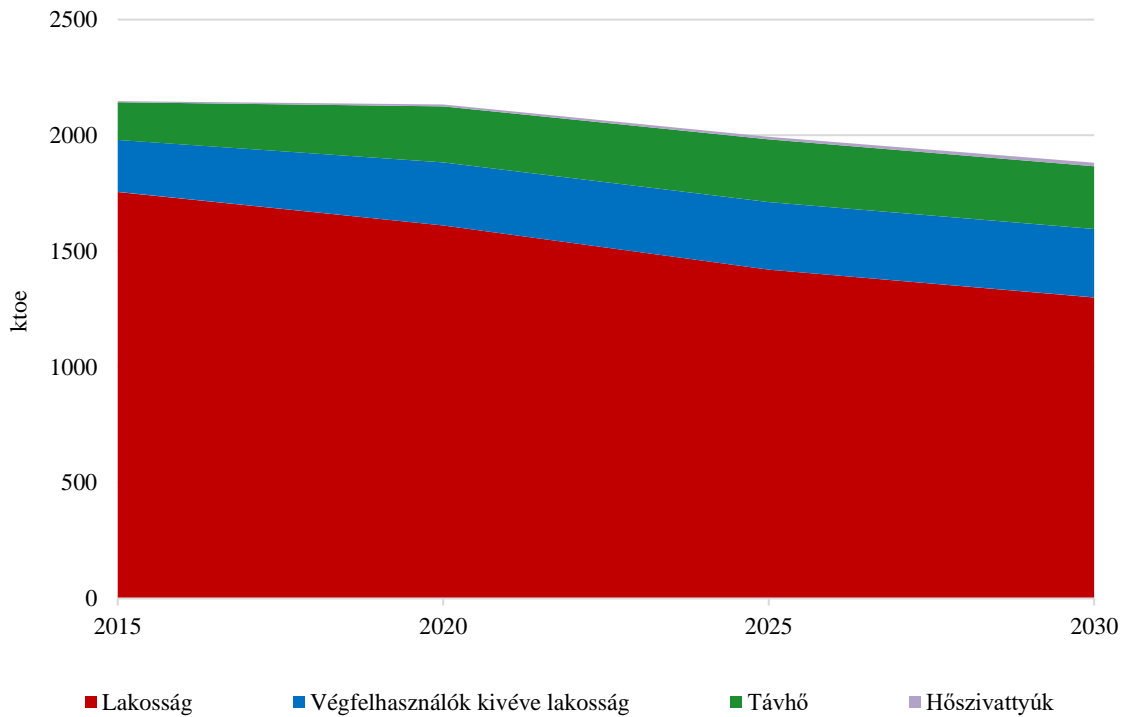
Heating and cooling (RES - H&C)

In Hungary more than 80 % of renewable energy is used in the heating and cooling sector, therefore changes to this value have a determining effect on the total share of renewable energy use. The share of renewable energy use in the heating and cooling sector equalled 9.9 % in 2005, 18.1 % in 2010 and 21.2 % in 2015.

The figures below show the results of the forecast (REF _Ref535428681 \h Figure 17, Figure 18).

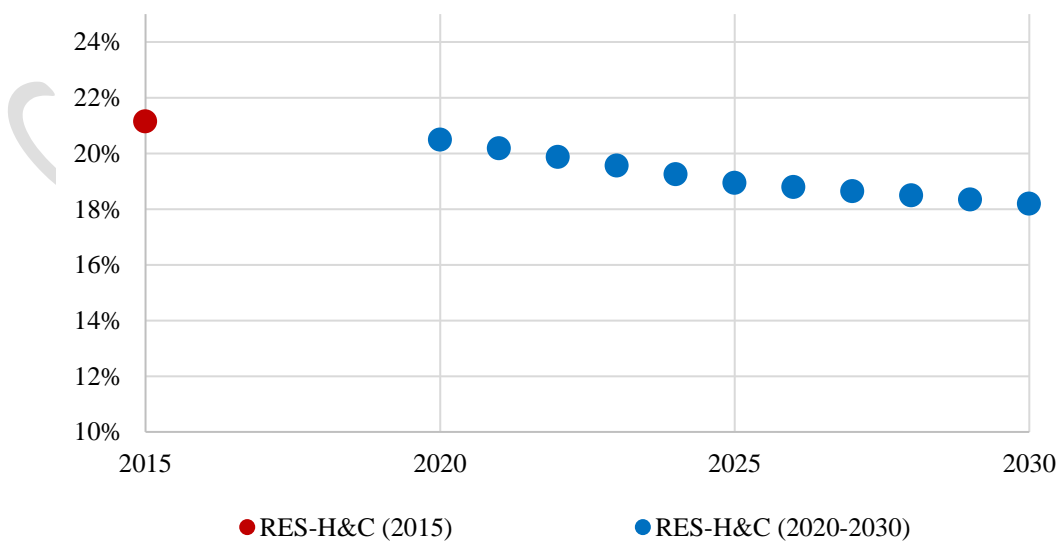
The figures project a decline in the heating and cooling sector despite an increase in renewable energy-based district heating generation and in the use of renewable energy in industry and agriculture, which is exclusively attributable to the decrease in the household use of fuel wood. Taking into account the existing policy measures, the share of renewable energy use within the heating sector may fall to 18.2 % in 2030.

17 - Projection of renewable energy use in the heating and cooling sector, in consideration of the impact of existing policy measures



HU	EN
Lakosság	Households
Végfelhasználók kivéve lakosság	End users excluding households
Távhő	District heating
Hőszivattyúk	Heat pumps

18 - Projection of the share of renewable energy use in the heating and cooling sector, in consideration of the impact of existing policy measures



4.3.Dimension of energy efficiency

- i. *Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)*

14 - National annual energy balance (2014-2017)

(PJ)	2014	2015	2016	2017
1. Primary energy consumption	998	1 055	1 071	1 116
2. Final energy consumption	665	710	728	751
2(a) Industrial sector	158	166	169	182
2(b) Transport	164	177	181	189
2(c) Households	230	250	258	263
2(d) Commerce and services	89	92	91	90
2(e) Agriculture	25	24	27	26
2(f) Other	0	1	1	1
3. Non-energy use	79	82	80	94

Source: HEA.

- ii. *Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling⁴⁴*

To determine the potential it is necessary to update the assessment referred to in Article 14(1) of Directive 2012/27/EU.

- iii. *Projections considering existing energy efficiency policies, measures and programmes as described in point 1.2.ii. for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)⁴⁵*

The forecast per sector will be determined in 2019.

Summary

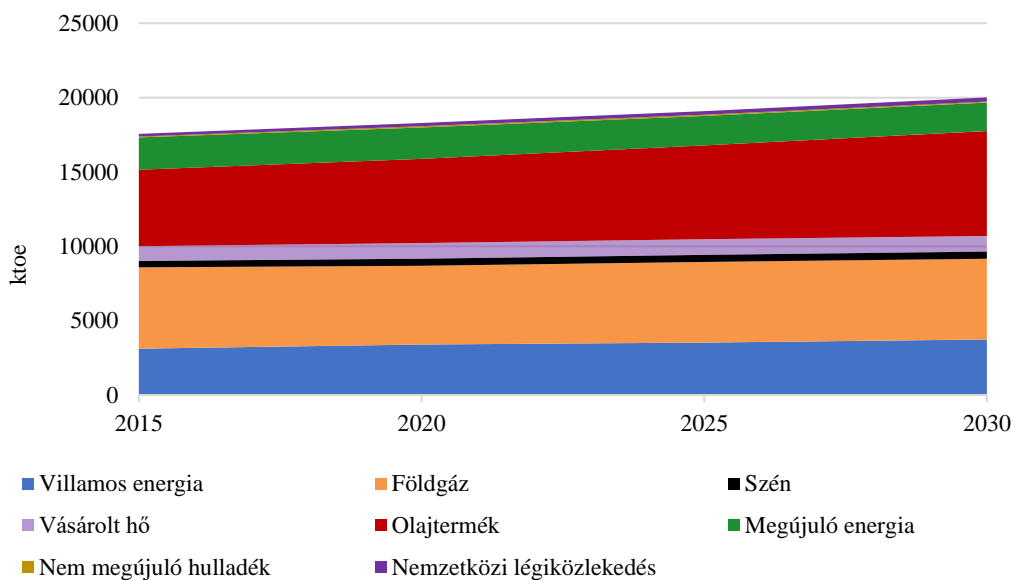
With the existing policy measures, final energy consumption may increase by 15 % between 2015 and 2030 based on the forecast. The increase is attributable to the rise in industrial production and higher fuel consumption resulting from increasing income, while household energy consumption is expected to decrease. The weight of electricity and petroleum products

⁴⁴ In accordance with Article 14(1) of Directive 2012/27/EU.

⁴⁵ This 'business as usual' reference forecast will be the basis for the 2030 final and primary energy consumption target (described in point 2.3) and conversion factors.

is expected to increase within the end consumer energy mix, while the share of other energy sources will decline.

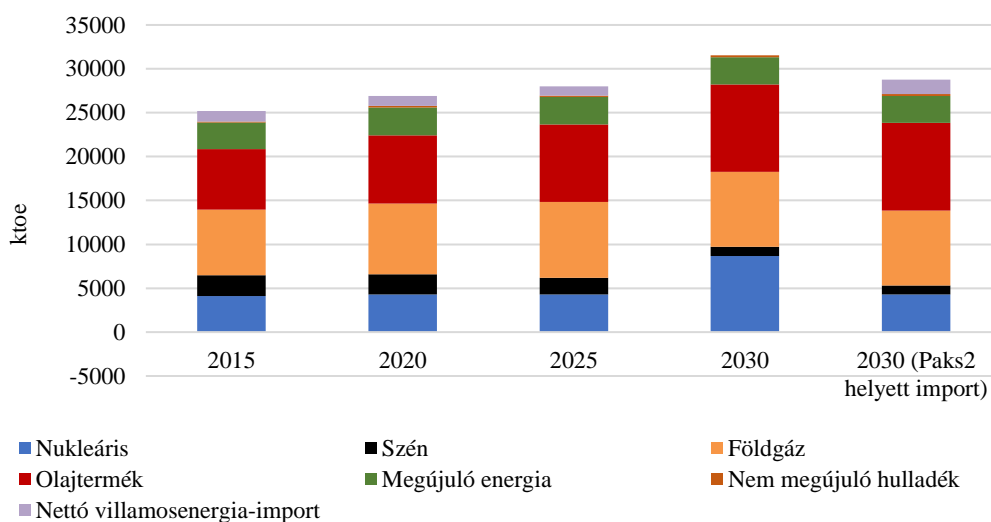
19 - Projection of final energy consumption, in consideration of the impact of existing policy measures



HU	EN
Villamos energia	Electricity
Vásárolt hő	Purchased heat
Nem megújuló hulladék	Non-renewable waste
Földgáz	Natural gas
Olajtermék	Petroleum products
Nemzetközi légitörlekedés	International air transport
Szén	Coal
Megújuló energia	Renewable energy

Based on the forecast, primary energy consumption may exceed the value for 2015 by 25 % in 2030, in consideration of the impact of existing policy measures (**Error! Reference source not found.**). Approximately one half of the increase is attributable to the generation of the new nuclear power plant units, which will replace the substantial electricity imports measured in 2015; as a result, repowering loss must be settled in Hungary. If electricity generated by the new nuclear power plant units would be imported, in 2030 primary energy consumption would exceed the value for 2015 only by 14 % (similarly to final energy consumption).

20 - Projection of primary energy consumption, in consideration of the impact of existing policy measures

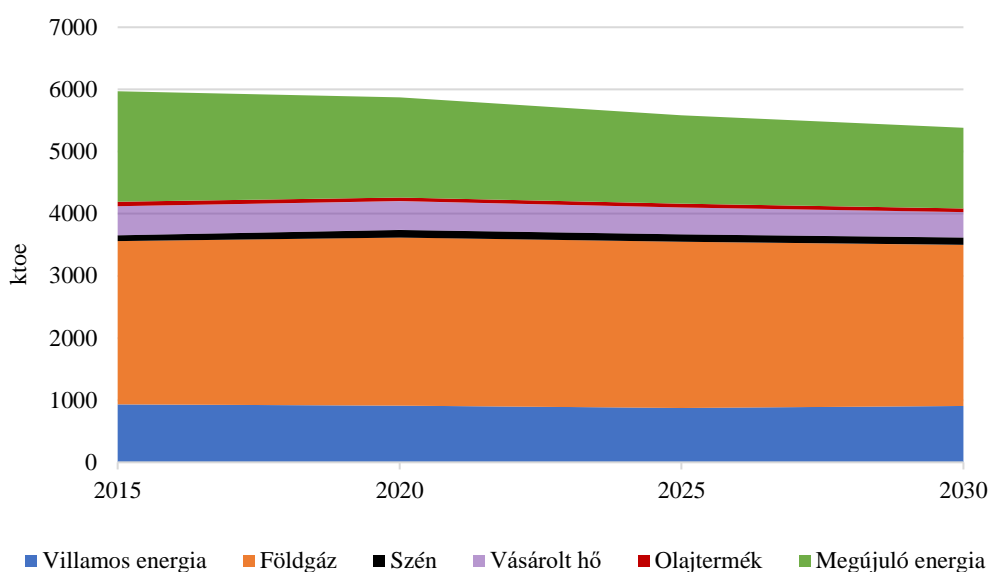


HU	EN
Nukleáris	Nuclear
Olajtermék	Petroleum products
Nettó villamosenergia-import	Net electricity imports
Szén	Coal
Megújuló energia	Renewable energy
Földgáz	Natural gas
Nem megújuló hulladék	Non-renewable waste
(Paks2 helyett import)	(Imports in place of Paks 2)

Households

Household energy consumption declined in Hungary by roughly 15 % between 2005 and 2015.

21 - Projection of household energy consumption, in consideration of the impact of existing policy measures



HU	EN
Villamos energia	Electricity
Földgáz	Natural gas
Szén	Coal
Vásárolt hő	Purchased heat
Olajtermék	Petroleum products
Megújuló energia	Renewable energy

As a result of the existing policy measures, household energy consumption is expected to decrease by 10 % between 2015 and 2030. The decline is attributable to lower heating demand; other energy consumption may be close to stagnant in the reviewed period.

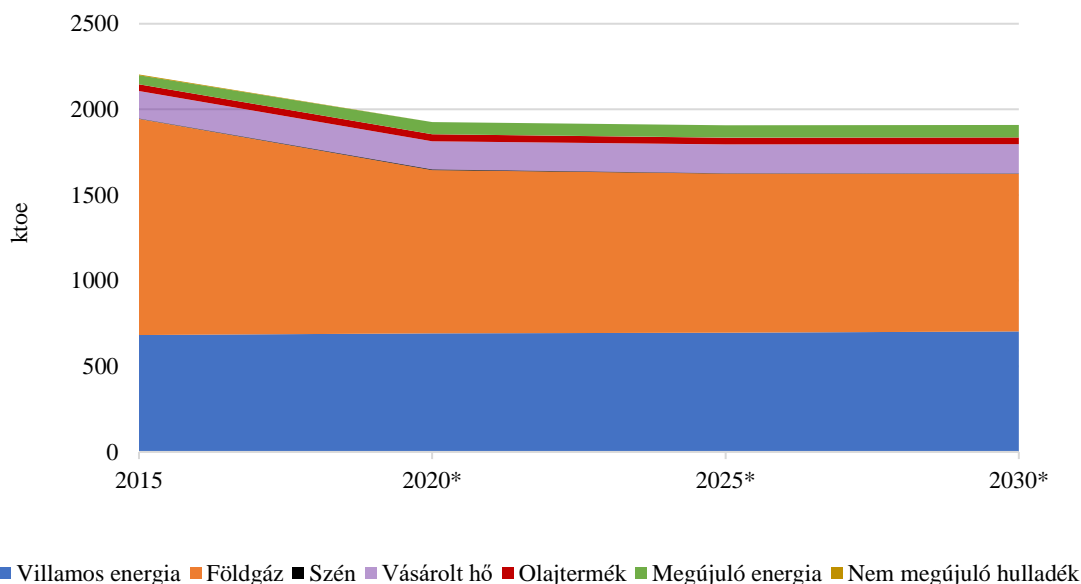
Tertiary sector

The quantity of energy consumed in the tertiary sector declined by a total of 37 % between 2005 and 2015, primarily affecting natural gas consumption. Similarly to households, energy is mainly consumed for heating purposes in the tertiary sector, accounting for two thirds of energy consumption in the sector.

Apart from adjustment of statistical differences, where the distribution of final energy consumption between the SME and tertiary sectors changed in 2015, with unchanged total consumption, energy consumption is close to stagnant in the tertiary sector in consideration of existing policy measures (**Error! Reference source not found.**). Energy consumption will increase in the market services sector as a result of growing added value and physical

infrastructure, while implemented investments will lead to declining energy demand in public services.

22 - Projection of energy consumption in the tertiary sector, in consideration of the impact of existing policy measures



* Values adjusted with statistical differences

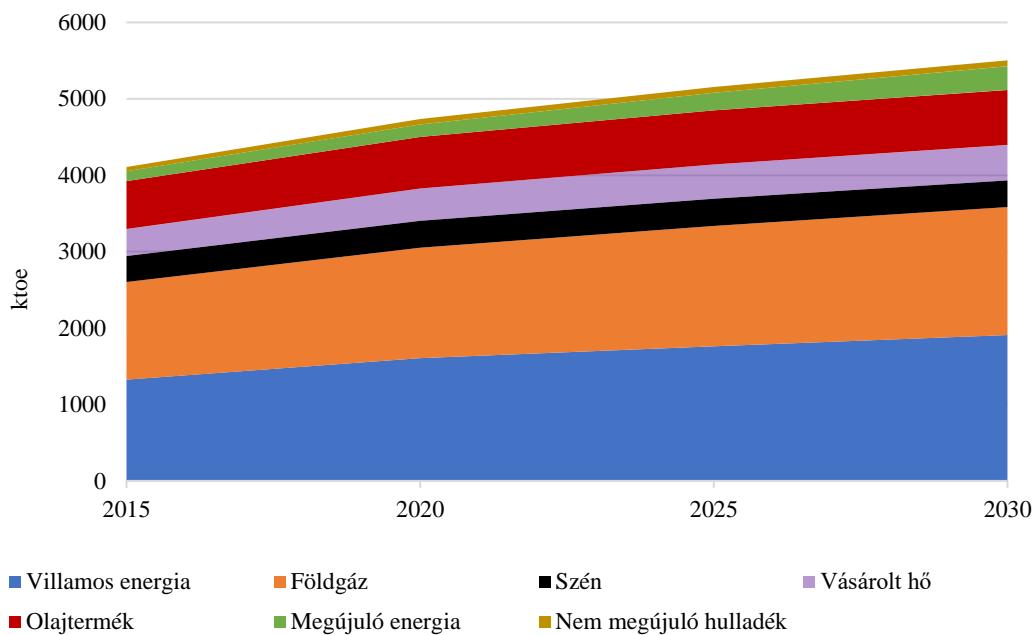
HU	EN
Villamos energia	Electricity
Földgáz	Natural gas
Szén	Coal
Vásárolt hő	Purchased heat
Olajtermék	Petroleum products
Megújuló energia	Renewable energy
Nem megújuló hulladék	Non-renewable waste

Industry

The energy quantity used in the industrial sector was close to stagnant in the years preceding the economic crisis, then decreased by more than one fifth during the crisis as a result of the downturn in the economic cycle. Thereafter Hungarian industrial production rebounded at a rapid pace, followed by dynamic growth from 2013, attributable to the launch of new capacities in the manufacturing industry. In 2015, energy consumption in the industrial sector exceeded the value measured in 2005 by 25 %. The rise in energy consumption is predominantly attributable to electricity consumption, which significantly increased within the industrial energy mix.

Based on the forecast, in 2030 energy consumption in the industrial sector will be one third higher than the value for 2015, under existing policy measures (**Error! Reference source not found.**).

23 - Projection of energy consumption in the industrial sector, in consideration of the impact of existing policy measures



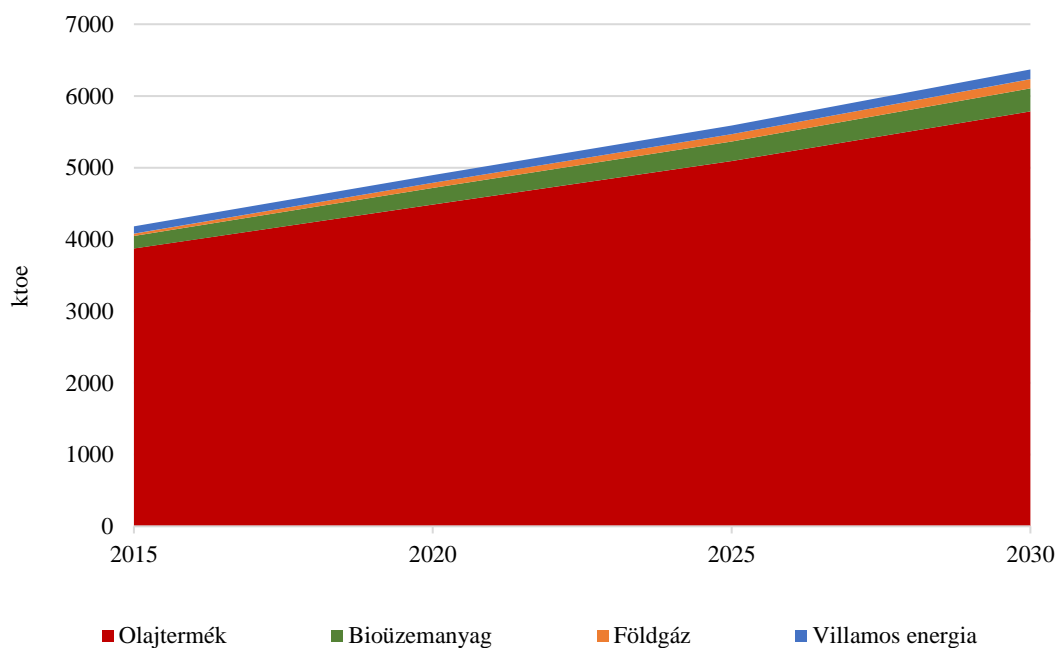
HU	EN
Villamos energia	Electricity
Földgáz	Natural gas
Szén	Coal
Vásárolt hő	Purchased heat
Olajtermék	Petroleum products
Megújuló energia	Renewable energy
Nem megújuló hulladék	Non-renewable waste

Transport

The energy quantity used in the transport sector dynamically increased in the years preceding the economic crisis, then significantly declined during the crisis. After 2013, energy consumption in the transport sector sharply increased as a result of rapidly growing household income and rising investment, and again exceeded the value for 2005 in 2015.

Under the existing policy measures, in 2030 energy consumption in the transport sector will be one and a half times higher than in 2015 as a result of the dynamically growing GDP and incomes, becoming the sector with the highest energy demand. Traditional petrol and diesel fuel will continue to account for more than 90 % of consumed energy quantities despite the promotion of alternative propulsion and other efforts aimed at reducing vehicle use.

24 - Projection of energy consumption in transport, in consideration of the impact of existing policy measures (excluding international air transport)



HU	EN
Olajtermék	Petroleum products
Bioüzemanyag	Biofuels
Földgáz	Natural gas
Villamos energia	Electricity

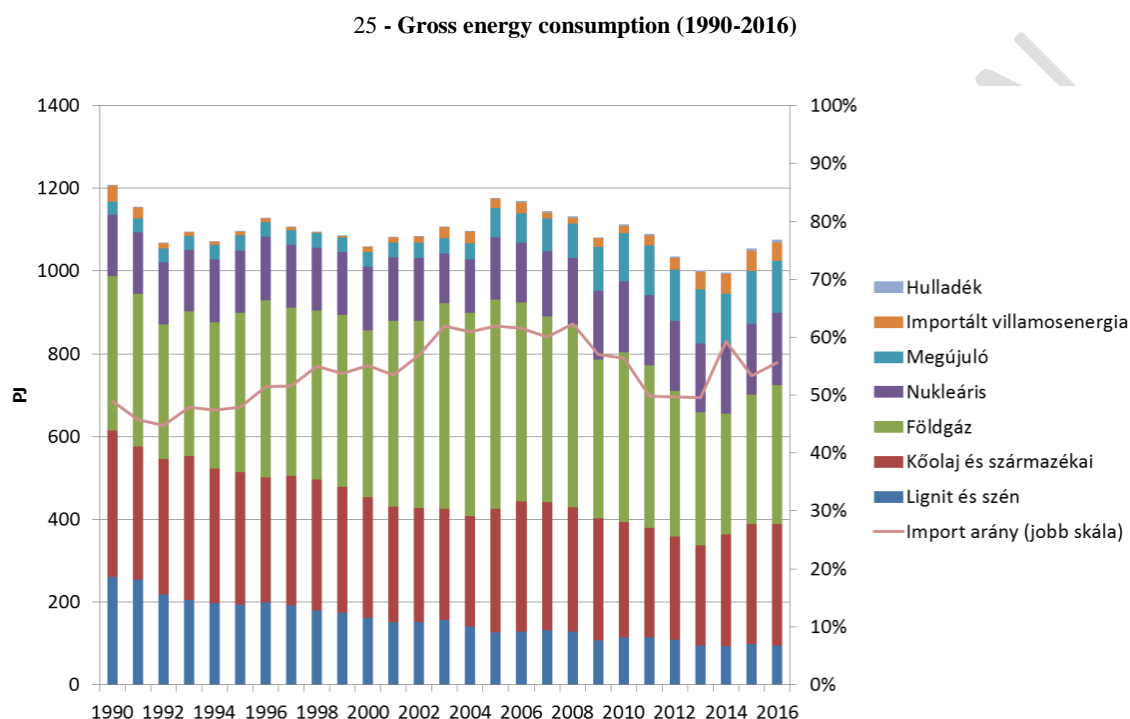
iv. Cost-optimal levels of minimum energy performance requirements resulting from national calculations, in accordance with Article 5 of Directive 2010/31/EU

To be determined in 2019.

4.4. Dimension of energy security

- i. *Current energy mix, domestic energy resources, import dependency, including relevant risks*

The figure below shows changes in primary energy consumption for years between 1990 and 2016.



Source: HEA.

HU	EN
Hulladék	Waste
Importált villamosenergia	Imported electricity
Megújuló	Renewable
Nukleáris	Nuclear
Földgáz	Natural gas
Kőolaj és származékai	Oil and derivatives thereof
Lignit és szén	Lignite and coal
Import arány (jobb skála)	Share of imports (right scale)

In 2017 gross primary energy production of Hungary equalled 11.04 Mtoe. The country's gross primary energy consumption, however, amounted to 26.7 Mtoe. The larger share of Hungary's energy consumption is satisfied with imports. Hungary's dependence on energy imports fluctuated between 50 % and 63 % since the turn of the 21st century. This value

equalled 60 % in 2017. Hungary is ranked among EU countries with average energy import dependence. Exposure to imports of primary energy sources, however, is extremely high (90 % for oil, 80 % for natural gas).

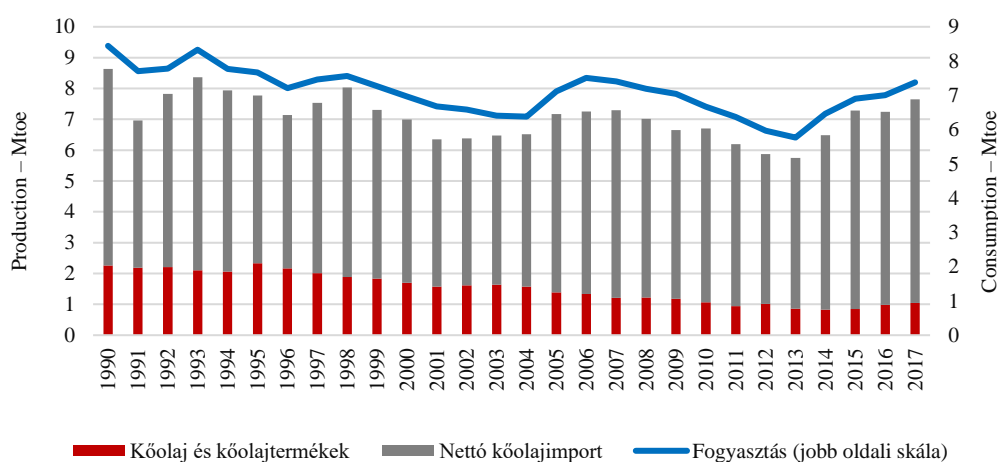
Oil

Hungary currently receives oil through two main pipelines:

- the Druzhba oil pipeline from the east,
- and the Adria oil pipeline from the south.

Oil production in Hungary has been declining since the 1990s. In 2017, 0.98 million tonnes of oil were produced in Hungary, covering one tenth of domestic consumption. Imports play a determining role in Hungary's supply of oil and petroleum products. In 2017 Hungary imported oil at a net value of 6.6 million tonnes.

26 - Consumption, production, net imports of oil (1990-2017)



Source: HEA.

HU	EN
Kőolaj és kőolajtermékek	Oil and petroleum products
Nettó kőolajimport	Net oil imports
Fogyasztás (jobb oldali skála)	Consumption (right scale)

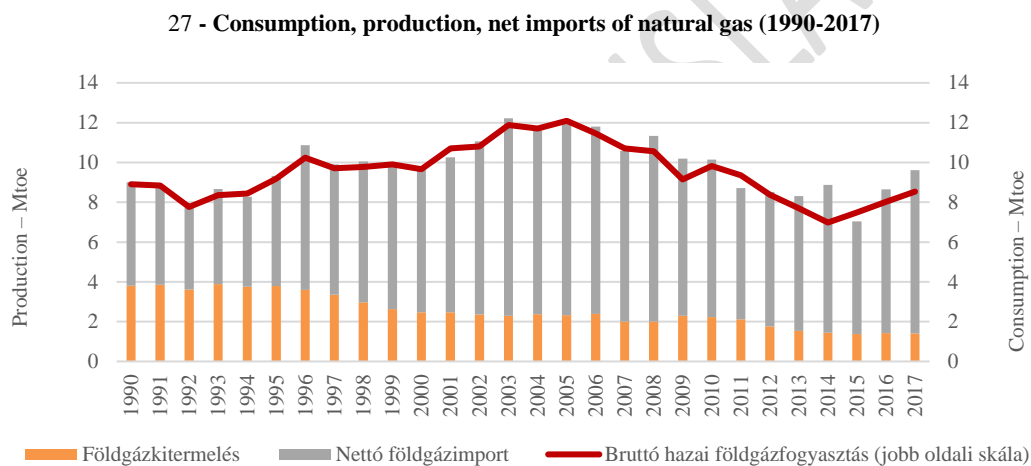
In 2017, 80 % of imported oil (total imports: 9.8 million tonnes) was supplied from Russia, indicating a decline compared to a 95 % dependence on Russian imports in 2012. Reduction of dependence on Russian imports and use of new sources of oil supply for Hungary. Owing to the reconstruction of the section of the Druzhba I pipeline between Šahy and Százhalombatta, larger quantities of Russian oil are received through Slovakia.

Natural gas

Hungary's natural gas consumption amounted to 8.5 Mtoe in 2017 (approximately 9.4 billion m³), which is high relative to GDP and the population, compared to the European average. This is mainly attributable to high household consumption; only large gas producing countries use gas in similar quantities for household heating.

Hungarian gas production declined in the past two decades at a steady pace (1.04 Mtoe in 2017 / approximately 1.5 billion m³); currently 17 % of consumer demand can be met with domestic sources. Owing to the recent successful concession tenders, the decline is expected to end in the coming years, followed by an increase in production.

The largest share of natural gas imports is imported from Russia, but the remaining share on the Hungarian market is – on a molecular basis – also natural gas of Russian origin.



Source: HEA.

HU	EN
Földgáztermelés	Extraction of natural gas
Nettó földgázimport	Net natural gas imports
Bruttó hazai földgázfogyasztás (jobb oldali skála)	Gross domestic natural gas consumption (right scale)

Although the underground gas storage facilities play a key role in guaranteeing the security of natural gas supply and the satisfaction of winter peak demand (on a colder winter day, namely, roughly half of Hungary's natural gas is supplied from gas storage facilities), high exposure to imports, dependence on a single supplier, and the central role of Ukrainian transits expose Hungary to price volatility on international markets and to risks inherent to the security of supply.

Pursuant to Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply, if a fault occurs in the Member State's largest gas infrastructure, the existing infrastructure should be capable of satisfying demand on a day with exceptionally high demand for gas. This condition is met if the N-1 indicator reaches the value of 100 %. In Hungary this value equalled 129 % in 2015.

Hungary operates a well-developed and adequately integrated natural gas transmission system and underground gas storage capacities significantly exceeding capacities required for guaranteeing the security of supply, therefore it is even in the position to carry out a regional role in the security of supply. The Hungarian gas network is connected to all neighbouring countries, except for Slovenia. Not all pipelines, however, operate with reverse flows; transmission from Romania and Croatia to Hungary is enabled by the system only in minimal quantities or not at all.

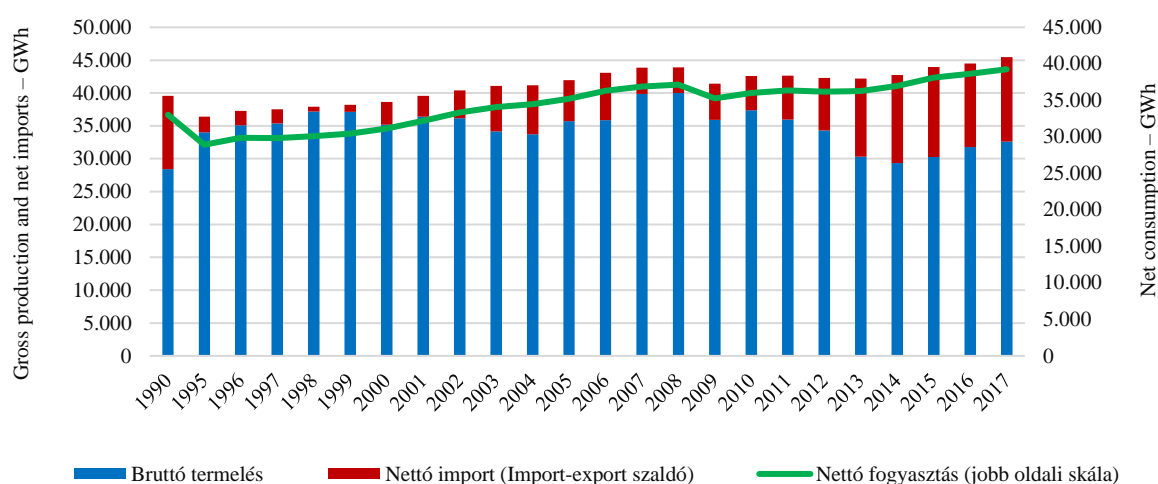
Future diversification plans cover the construction of the Hungarian-Slovenian-Italian corridor, which is important in terms of trade and the security of supply. Review of the further development of the cross-border pipeline is in progress in relation to the transportation of natural gas from Hungary to Ukraine to also ensure non-interruptible capacity in place of currently available interruptible capacity.

Risks include the shutdown of Russian natural gas deliveries from Beregdaróc, and their diversion in a northern or southern direction. According to preliminary estimates, Hungary is capable of fulfilling the N-1 principle even if the entry point at Beregdaróc is unavailable for a prolonged period.

Electricity

Hungary is a net importer of electricity as well: In 2017 gross domestic electricity production amounted to 32 584 GWh, with net electricity consumption equalling 39 252 GWh.

28 - Consumption, production, net imports of electricity (1990-2017)



Source: MAVIR Hungarian Independent Transmission Operator Company Ltd. (2017): Data on the Hungarian electricity system (ES), 2017.

HU	EN
Bruttó termelés	Gross production
Nettó import (Import-export szaldó)	Net imports (import-export balance)
Nettó fogyasztás (jobb oldali skála)	Net consumption (right scale)

The reliability of the electricity system is primarily ensured through requirements/standards applicable to transmission networks and to their system operators. The enforcement of the N-1 principle⁴⁶ is the key requirement concerning the security of the transmission system, which means that the electricity system must be able to operate without interruption upon the contingency of a critical network element or a large power plant. Hungary is fully fulfilling the N-1 requirement.

In terms of the security of supply, the electricity system can also be defined with the frequency (System Average Interruption Frequency Index – SAIFI) and duration (System Average Interruption Duration Index – SAIDI) of interruptions per consumer. The SAIFI – calculated by the HEA – continuously improved from 2012 to 2016, with a moderate decline in 2014, while the exemption⁴⁷ rate decreased by approximately 8 % compared to the year 2015. The SAIDI value declined in 2015 after a rise in 2014, followed by a further decrease in 2016, with less exemptions. As a result, the three-year average value also decreased further in 2016.

⁴⁶ Pursuant to the Operating Regulation of MAVIR, by application of the N-1 principle, '[the] design of the electricity system prevents both interruptions at customers during the single unavailability of the transmission network [upon failure of a system constituent], and the occurrence of overloading, voltage or frequency disturbances in the remaining operational network'.

⁴⁷ Value of all exemptions issued by the Authority to licence holders due to extraordinary weather conditions. These values are not taken into account in the evaluation of licence holder capacities.

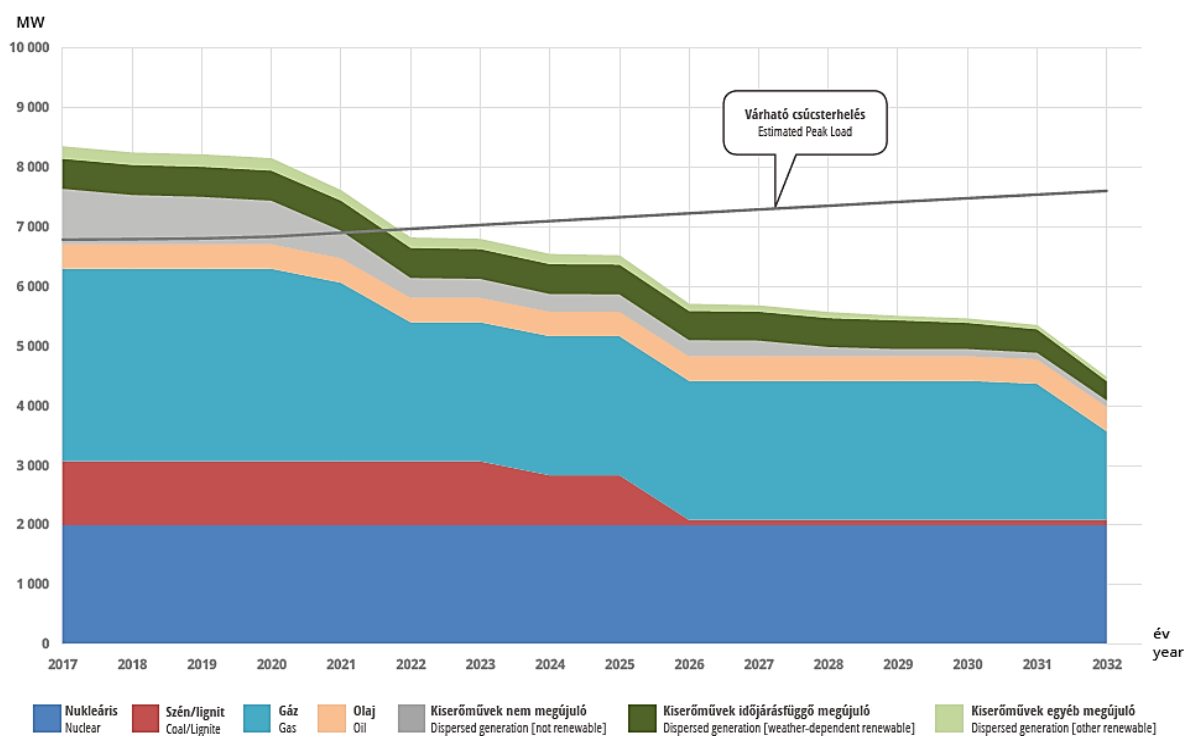
ENTSO-E applies so-called remaining capacity to measure the operational security of electricity systems. Remaining capacity corresponds to actually available capacity, less peak load and upstream system operator reserves. The required rate of remaining capacity varies for countries, typically between 5 % and 10 % of installed capacity. Based on the capacity of the largest domestic units, in Hungary the system operator takes into account 500 MW, corresponding to more than 5 % of installed capacity calculated on 1 January 2018. Originally only domestic generating capacities are considered for calculating remaining capacity. Thus, at certain times of the year Hungary would not only fall short of the required rate, but would even produce a negative capacity. Remaining capacity adjusted with the necessary export-import balance value, calculated in the manner referred to above, is in this case, by definition, sufficient even with the highest expected consumer demand.

In summary, the cross-border power line capacities necessary for imports were available. The periodically inadequate technical characteristics of necessary reserves pose a risk in case of further high amounts of imports expected in the future.⁴⁸

Coal and gas-fired production in Hungary significantly declined in the recent decade. This process was generally attributable to obsolete technology and high natural gas prices, as the production of temporarily or permanently closed power plants was not competitive on the electricity market. In the next decade several Hungarian power plant units will reach the end of their service life (29).

⁴⁸ Annual gross capacity plan of Mavir Zrt. – 2019.
(http://mavir.hu/documents/10258/229076503/%C3%89ves+kapacit%C3%A1sterv_2019_janu%C3%A1r_EL%C5%90ZETES.pdf/a8c26566-bc20-8073-8d4a-ef747f0a9ee1)

29 - Projected power plant capacities and peak loads (2017-2032)

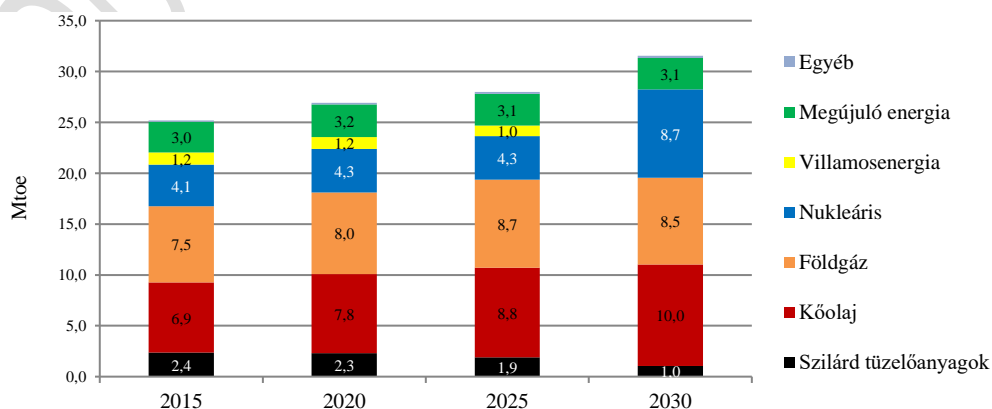


Changes to installed capacity per technology, based on the expiry date of generation licenses
Source: Mavir Zrt.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Primary energy consumption is expected to exceed 30 Mtoe in 2030. This would correspond to a 25 % increase. Approximately one half of the increase would be attributable to the generation of the new nuclear power plant units, which will replace the substantial electricity imports in 2015; as a result, repowering loss must be settled in Hungary.

30 - Projection of primary energy consumption, in consideration of the impact of existing policy measures



HU	EN
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Egyéb	Other
Megújuló energia	Renewable energy
Villamos energia	Electricity
Nukleáris	Nuclear
Földgáz	Natural gas
Kőolaj	Oil
Szilárd tüzelőanyagok	Solid fuels

Imports and import dependency is expected to increase in the next ten years. Production may moderately increase. The energy mix is expected to change.

15 - Projection of production and imports (2015-2030)

Energy supply		2015	2020	2025	2030
Production	Mtoe	11.196	10.889	10.095	12.893
Solid fuel	Mtoe	1.518	1.413	1.006	0.182
Oil	Mtoe	0.850	0.704	0.421	0.229
Natural gas	Mtoe	1.369	0.927	0.885	0.292
Nuclear energy	Mtoe	4.104	4.281	4.281	8.680
Renewable energy	Mtoe	3.355	3.565	3.503	3.510
Net imports	Mtoe	13.630	16.235	18.098	18.812
Solid fuel	Mtoe	0.803	0.906	0.886	0.860
Oil	Mtoe	6.432	7.061	8.406	9.741
Natural gas	Mtoe	5.218	7.113	7.767	8.251
Electricity	Mtoe	1.177	1.154	1.038	-0.040
Import dependency		56 %	60 %	64 %	59 %

Major changes are not expected in oil consumption up to 2020. Although motor fuel-type petroleum products will remain important in the long term, as a result of regulatory changes and the rising number of electric cars, the Hungarian oil and petroleum product market is expected to grow with substantial petrochemical and chemical product manufacturing investments until 2030, entailing the rising share of non-motor fuel-type products. By 2030 domestic oil production will decrease to less than one third of the current level.

16 - Projection of petroleum product consumption, oil production, net imports (2015-2030)

(Mtoe)	2015	2020	2025	2030
Domestic consumption of petroleum products	6.718	7.862	8.947	10.124
Oil production	0.850	0.704	0.421	0.229
Net oil imports	6.432	7.061	8.406	9.741

The moderate rise in natural gas consumption and decline in production is expected to continue. Import dependency will therefore increase.

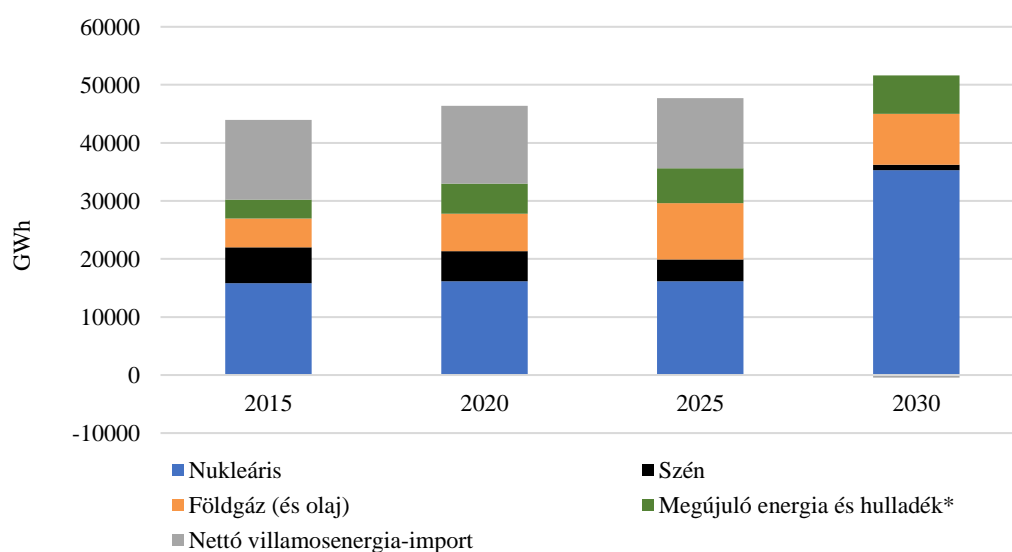
17 - Projection of natural gas consumption, production, net imports (2015-2030)

(Mtoe)	2015	2020	2025	2030
Gross final natural gas consumption	5.15	5.73	6.04	6.31
Extraction of natural gas	1.37	0.93	0.89	0.29
Net natural gas imports	5.21	7.11	7.77	8.25

The structure of natural gas consumption is also expected change in the projection period. According to the projection, the share of households will decrease from 36 % to 27 %, while the share of power plants will increase from 16 % to 26 %.

Electricity supply in Hungary may undergo substantial changes between 2015 and 2030. As a result of engaging the new power plant unit capacities of 2 400 MW in production, production may increase from 30 226 GWh to 51 598 GWh between 2020 and 2030, and Hungary may become self-sufficient.

31 - Projection of electricity production and net electricity imports, in consideration of the impact of existing policy measures



HU	EN
Nukleáris	Nuclear
Földgáz (és olaj)	Natural gas (and oil)
Nettó villamosenergia-import	Net electricity imports
Szén	Coal
Megújuló energia és hulladék*	Renewable energy and waste*

4.5. Dimension of the internal energy market

4.5.1. Electricity interconnectivity

i. Current interconnection level and main interconnectors⁴⁹

With the exception of Slovenia, the Hungarian electricity system is directly connected to all neighbouring countries. (See the map showing the transmission network in Chapter 4.5.2 and Chapter 2.4.1.)

The tables below summarise interconnector voltage levels and annual physical flows.

18 - Cross-border lines and their voltage levels, 2017

Interconnector	Lines and voltage levels
Ukraine	750 kV line
	400 kV line
	220 kV double circuit line
Slovakia	Two lines, each with 400 kV
Romania	Two lines, each with 400 kV
Serbia	400 kV double circuit line
Croatia	Two double circuit lines, each with 400 kV
Austria	400 kV double circuit line
	220 kV double circuit line

Source: MAVIR (2017): Data on the Hungarian electricity system (ES), 2017.

19 - Annual physical flows, 2017

Interconnector	Annual trade – GWh		
	Imports	Exports	Balance
Ukraine	4 563.43	23.20	4 540.23
Slovakia	9 458.85	6.36	9 452.48
Romania	358.50	907.98	-549.48
Serbia	305.53	971.18	-665.65
Croatia	31.05	4 883.18	-4 852.13
Austria	5 085.21	134.42	4 950.79
Total	19 802.56	6 926.32	12 876.24

Source: MAVIR Hungarian Independent Transmission Operator Company Ltd. (2017): Data on the Hungarian electricity system (ES), 2017.

The currently available transmission capacities enable flexibly diversifiable commercial transactions.

⁴⁹ With reference to overviews of the existing transmission infrastructure by Transmission System Operators (TSOs).

ii. Projections of interconnector expansion requirements (including for the year 2030)⁵⁰

The construction of the Slovenian-Hungarian electricity interconnector is planned in the next years within the framework of PCIs. (For details see Chapter 2.4.2.)

Chapter 2.4.2 and the grid development plan of the electricity system ('Grid Development Plan of the Hungarian Electricity System – 2017' (MAVIR Hungarian Independent Transmission Operator Company Ltd.)) provide information on additional planned international interconnection projects.

Based on the capacity calculations, with the development projects proposed in the ten-year development plan, the international interconnections and transmission capacities of the Hungarian electricity system – in conformity with ENTSO-E requirements – allow the conducting of sufficient, secure and flexibly diversifiable commercial transactions, and do not limit electricity trade of a rational volume or the operation of the single electricity market.

4.5.2. Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas⁵¹

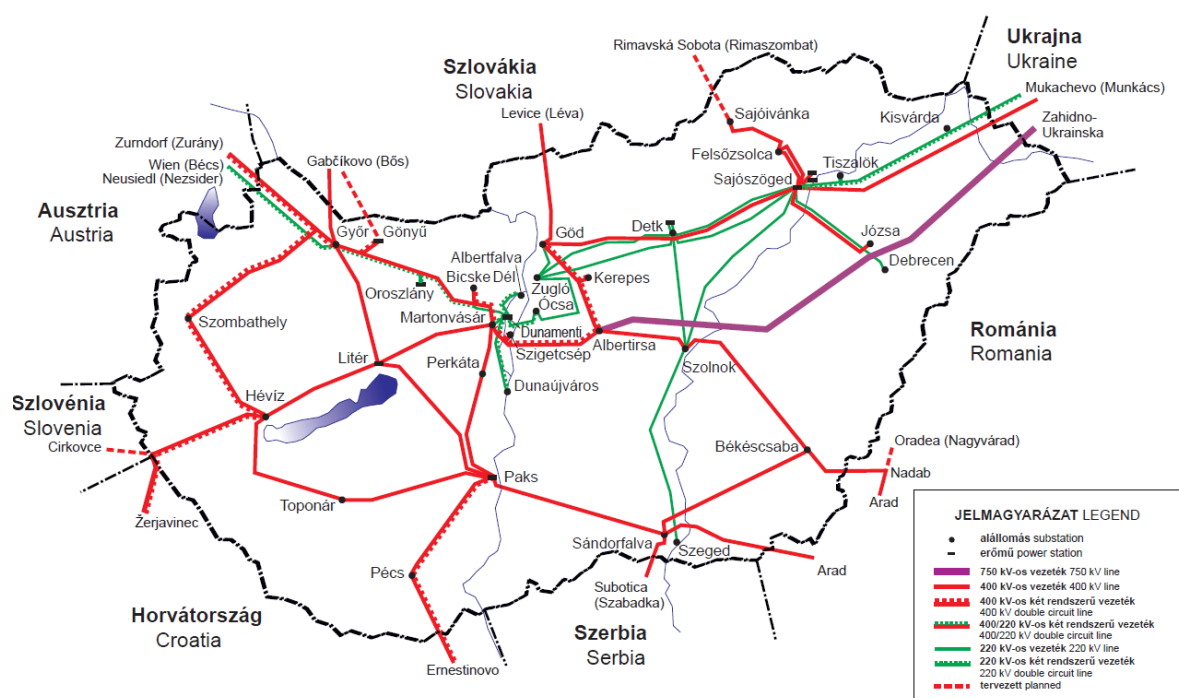
Electricity

The map and table below present the Hungarian electricity transmission network.

⁵⁰ With reference to national network development plans and regional investment plans of TSOs.

⁵¹ With reference to overviews of the existing transmission infrastructure by TSOs.

32 - The Hungarian electricity transmission network on 31 December 2017



Source: Mavir (2017): Data on the Hungarian electricity system (ES), 2017.

20 - Route length of transmission networks

	2013	2014	2015	2016	2017	2017 (2016=100 %)
	km	km	km	km	km	%
Total high-voltage overhead lines and cables	3 810	3 810	3 810	3 811	3 813	100.1 %
Total high-voltage overhead lines	3 793	3 793	3 793	3 794	3 797	100.1 %
of which:						
750 kV overhead lines	268	268	268	268	268	100.0 %
400 kV overhead lines	2 284	2 284	2 284	2 284	2 287	100.1 %
220 kV overhead lines	1 099	1 099	1 099	1 099	1 099	100.0 %
132 kV overhead lines	142	142	142	142	142	100.0 %
Total high-voltage cables (132 kV)	17	17	17	17	17	100.0 %

Source: Mavir (2017): Data on the Hungarian electricity system (ES), 2017.

See for more details: Mavir: In the publication entitled 'Data on the Hungarian electricity system (ES), 2017' and in the related statistical tables.⁵²

Natural gas

⁵² <http://mekh.hu/a-magyar-villamosenergia-rendszer-ver-2017-evi-adatai>

The Hungarian natural gas infrastructure is adequately developed; the system would be able to serve consumption well in excess of current demand. Hungary's interconnection with neighbouring markets is satisfactory. In theory it is possible to physically transfer more than 34 million m³ a day of natural gas from Hungary to its five neighbouring countries, while more than 82 million m³ of natural gas a day could be physically transferred from three neighbouring countries to Hungary.

The 6.33 billion m³ capacity of Hungarian gas storage facilities is large relative to the country's annual consumption, and significant even on a regional level.

Pursuant to Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010, the Transmission System Operators must enable permanent physical capacity allowing reverse flows of gas on all interconnections between Member States.

Hungary operates interconnector points with a reverse flow capacity with Romania, Croatia and Slovakia among Member States.

Hungary is granted exemption for an indefinite period in relation to the Hungarian-Austrian cross-border point.⁵³

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)⁵⁴

The projection up to 2040 carries a number of uncertainties, therefore it is not possible to specifically define the network expansion requirements. It may be realistically assumed that consumer demand will not increase significantly by the end of the projected period, only net electricity consumption is expected to rise at a more balanced, declining pace.

Chapter 2.4.2 discusses electricity projects planned up to 2023. The further development of the line system is not necessary yet; the cross-border capacities should be developed only to the extent necessary for allowing the diversification of purchase routes. This would only be necessary if development is implemented on a market basis (with transit transmission, or resource-exchange is possible with a net profit). Projects on the list of natural gas PCIs are also discussed in Chapter 2.4.2.

⁵³ https://ec.europa.eu/energy/sites/ener/files/table_reverse_flows_-_for_publication.pdf

⁵⁴ With reference to national network development plans and regional investment plans of TSOs.

4.5.3. Electricity and gas markets, energy prices

i. Current situation of electricity and gas markets, including energy prices

Electricity market

Power plant companies sell generated electricity to traders and universal service providers, who either resell it on the wholesale market or supply electricity to consumers. Electricity is transferred from the producer to the consumer through the transmission and distribution network. Separate companies carrying out transmission and distribution activity may not carry out production or trading activity. Participants of the Hungarian electricity market are fully compliant with unbundling rules.

As an important part of electricity market liberalisation in Hungary, HUPX Zrt. launched activity in July 2010 as a subsidiary company of the Transmission System Operator, MAVIR Zrt. HUPX Zrt. is a leading, innovative operator of the regulated Hungarian electricity market, with a good reputation in Central Eastern Europe. Based on its regulatory and accepted trading framework, it contributes to strengthening the liquidity and improving the efficiency of the Hungarian energy market, and also supports the flow of working capital within the sector on a regional level.

The tables below show the development of electricity sales.

21 - Quantity of electricity sold to consumers served within the framework of universal service (GWh)

	2014	2015	2016	2017
Total consumers	10 919	11 068	11 070	11 318
of which: Total household consumers	10 112	10 421	10 470	10 716
of which: household consumers with annual consumption of less than 1 MWh	684	734	671	697
household consumers with annual consumption of 1–2.5 MWh	3 124	3 162	3 117	3 079
household consumers with annual consumption of 2.5–5 MWh	3 821	3 961	4 011	4 018
household consumers with annual consumption of 5–15 MWh	2 221	2 254	2 330	2 542
household consumers with annual consumption of 15 MWh or more	262	310	341	380
of which: Total non-household consumers	807	647	600	602
of which: Consumers with annual electricity consumption of less than 20 MWh	457	412	398	430
Consumers with annual electricity consumption of 20–500 MWh	290	211	188	160
Consumers with annual electricity consumption of 500–2 000 MWh	34	17	11	8
Consumers with annual electricity consumption of 2 000–20 000 MWh	25	7	3	4
Consumers with annual electricity consumption of 20 000–70 000 MWh	1	-	-	-
Consumers with annual electricity consumption of 70 000–150 000 MWh	-	-	-	-
Consumers with annual electricity consumption of more than 150 000 MWh	-	-	-	-

Source: Mavir (2017): Data on the Hungarian electricity system (ES), 2017.

22 - Quantity of electricity sold to consumers purchasing on the open market (GWh)

	2014	2015	2016	2017
Total consumers	24 317	25 389	25 828	26 522
of which: Total household consumers	333	301	303	259
of which: household consumers with annual consumption of less than 1 MWh	13	12	26	16
household consumers with annual consumption of 1–2.5 MWh	105	95	81	65
household consumers with annual consumption of 2.5–5 MWh	136	123	114	92
household consumers with annual consumption of 5–15 MWh	64	58	66	63
household consumers with annual consumption of 15 MWh or more	16	13	17	24
of which: Total non-household consumers	23 984	25 088	25 525	26 262
of which: Consumers with annual electricity consumption of less than 20 MWh	2 329	2 217	1 231	992
Consumers with annual electricity consumption of 20–500 MWh	5 128	5 175	4 529	4 319
Consumers with annual electricity consumption of 500–2 000 MWh	3 641	3 742	3 408	3 474
Consumers with annual electricity consumption of 2 000–20 000 MWh	5 678	5 672	6 657	7 170
Consumers with annual electricity consumption of 20 000–70 000 MWh	2 991	3 265	3 631	4 117
Consumers with annual electricity consumption of 70 000–150 000 MWh	1 319	1 547	1 874	1 776
Consumers with annual electricity consumption of more than 150 000 MWh	2 897	3 470	4 195	4 413

Source: Mavir (2017): Data on the Hungarian electricity system (ES), 2017.

Natural gas market

Pursuant to the provisions of Act XL of 2008 on the supply of natural gas and Government Decree No 19/2009 of 30 January 2009 implementing Act XL of 2008 on the supply of natural gas, the Transmission System Operators, natural gas storage facility licence holders and natural gas distributors operate an interconnected natural gas system.

Ten regional distribution companies operate the natural gas distribution systems; five large companies carry out most of regional distribution, geographically dividing the country's territory. As a result of the natural gas market's liberalisation in 2004, the retail market is of a dual structure. Prices are determined by the market in the open market segment. Consumers eligible for universal service may purchase natural gas at (capped) administrative prices.

Consumers eligible for universal service are household consumers, other consumers with purchased capacities of up to 20 m³/h, local authorities, and persons living in municipal rented dwellings for up to the amount necessary for their habitation. Consumers not eligible for universal service either purchased energy from the open market in the past, or entered the open market upon termination of their right to use universal service (consumers with low and medium consumption, and district heating generators).

The table below indicates data on natural gas consumers receiving universal service and those purchasing on the open market.

23 - Data on consumers receiving universal service and consumers purchasing on the open market

Data on consumers receiving universal service [million m ³]				
Year	2014	2015	2016	2017
Total	3 097	3 535	3 869	4 014
Total household consumers	2 747	3 133	3 451	3 625
Total non-household consumers	350	402	418	389
Data on consumers purchasing on the open market [million m ³]				
Year	2014	2015	2016	2017
Total	4 515	4 513	4 677	5 040
Total household consumers	85	57	0	0
Total non-household consumers	4 430	4 456	4 677	5 040

Source: FGSZ (2017): Data on the Hungarian natural gas system, 2017.

NKM Földgázszolgáltató Zrt. is alone responsible for providing retail services.

Concentration on the Hungarian wholesale natural gas market has significantly decreased; the Herfindahl-Hirschman-index decreased from 4 813 to 2 501 between 2014 and 2017.

24 – Natural gas market concentration

	2014	2015	2016	2017
Data on sales to non-household end users				
Number of companies selling to non-household end users (No)	29	32	33	28
Share of undertakings with a share of more than 5 % [%]	86 %	73 %	70 %	83 %
Total share of undertakings with the 3 largest shares [%]	48 %	49 %	49 %	46 %
Herfindahl–Hirschman-index: ¹	1 096	1 078	1 205	1 170
Data on sales to household end users				
Number of companies selling to household end users (No)	7	7	4	2
Share of undertakings with a share of more than 5 % [%]	97 %	98 %	100 %	100 %
Total share of undertakings with the 3 largest shares [%]	81 %	82 %	100 %	100 %
Herfindahl–Hirschman-index: ¹	2 569	2 628	4 202	10 000
Data on wholesale selling ²				
Number of companies selling on the wholesale market [No]	20	28	37	40
Share of undertakings with a share of more than 5 % [%]	89 %	88 %	84 %	82 %
Total share of undertakings with the 3 largest shares [%]	84 %	88 %	84 %	69 %
Herfindahl–Hirschman-index: ¹	4 813	5 677	4 839	2 501

¹ Herfindahl–Hirschman-index: index determined by the ratio of the number of market participants to sales; the index equals 10 000 for one market participant.

² Sales on the CEEGEX are not included.

Source: FGSZ (2017): Data on the Hungarian natural gas system, 2017.

The liquidity and price indicator role of CEEGEX, the Hungarian gas exchange, has recently strengthened mainly as a result of Ukraine's European gas purchases, although most of wholesale is conducted through bilateral transactions.

Point 4.6.iii. provides further details relating to electricity and natural gas prices.

ii. Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

The integration efforts still in progress facilitate the implementation of more efficient trade flows, the balancing of demand and supply side volatility between countries, and improve the security of supply. Market integration also supports the minimisation of the cost of satisfying Hungarian electricity demand.

This year we will assess whether the current market mechanisms provide sufficient incentives for ensuring the continued future availability of flexible capacities necessary for the secure operation of the electricity system, or State intervention may be necessary for guaranteeing the security of supply.

The new National Energy Strategy – in the drawing-up process – aims to ensure clean, smart and affordable energy services. To this end, by maintaining the results of the overhead cost policy based on reduced regulated prices, we plan to create the freedom of choice for households with demand that goes beyond basic services, to allow them to also choose from among innovative, but market-priced services in the future, in addition to the providing the availability of universal service.

See also point ii. of Chapter 4.4 and Annex 2 in relation to projections.

4.6. Dimension of research, innovation and competitiveness

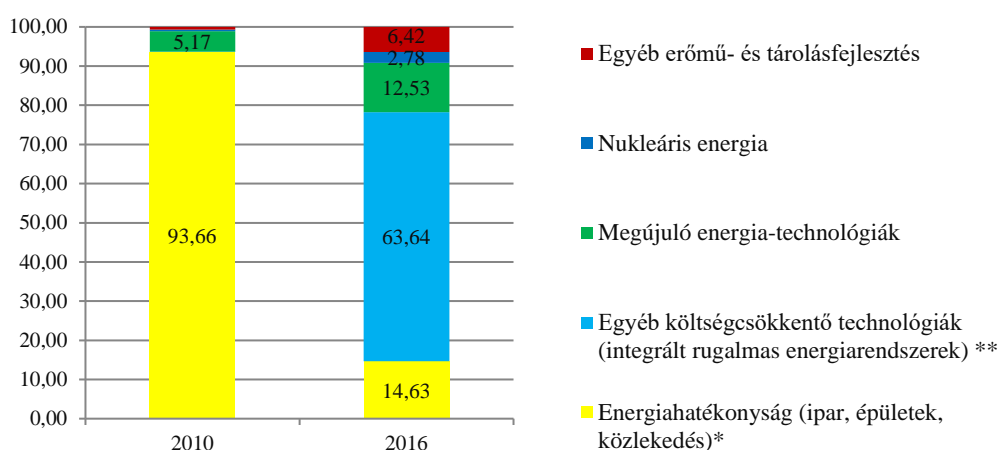
i. Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

Current key priorities of energy research in Hungary: energy efficiency, renewable energy, storage of energy and fuel, nuclear development – consistently with improved energy security and reduced dependence on energy imports.

The main directions of RDI were defined on the basis of the distribution of State R&D and innovation expenditures and the distribution of R&D aids awarded under tendering schemes.

The distribution of State R&D and innovation expenditures was reviewed on the basis of data provided to the IEA.

33 - Distribution of State-financed R&D and innovation expenditures per technology (2016)



Source: IEA (<http://wds.iea.org/WDS/TableView/tableView.aspx>).

* A reliable detailed breakdown is not available for energy efficiency.

** Other cost-cutting technologies: Energy system analysis, basic research, activity not classified elsewhere.

HU	EN
Egyéb erőmű- és tárolásfejlesztés	Other power plant and storage development
Nukleáris energia	Nuclear energy
Megújuló energia-technológiák	Renewable energy technologies
Egyéb költségcsökkentő technológiák (integrált rugalmas energiarendszerek)**	Other cost-cutting technologies (integrated flexible energy systems)**
Energiahatékonyság (ipar, épületek, közlekedés)*	Energy efficiency (industry, buildings, transport)*

Efficiency research and development is the key R&D field. Expenditures serving the development of energy efficiency and other cost-cutting technologies account for 78 % of total energy research financing. The share of renewable energy sources already exceeded 12.5 % in 2016. (It equalled only 5 % in 2010.) Nuclear R&D accounted for approximately 4 % of total R&D expenditures in the same period. The category of other activity – with a 6.4 % share – is dominated by the development of electricity generation and storage technologies (98-99 %).

The R&D aids awarded under the tendering scheme operated by the National Research, Development and Innovation Office (NRDIO) indicate similar shares.

25 - Distribution of the 'NRDI Fund' and RDI development funds of the EU ('Széchenyi 2020 RDI'), based on a primary research focus (2015–2018)

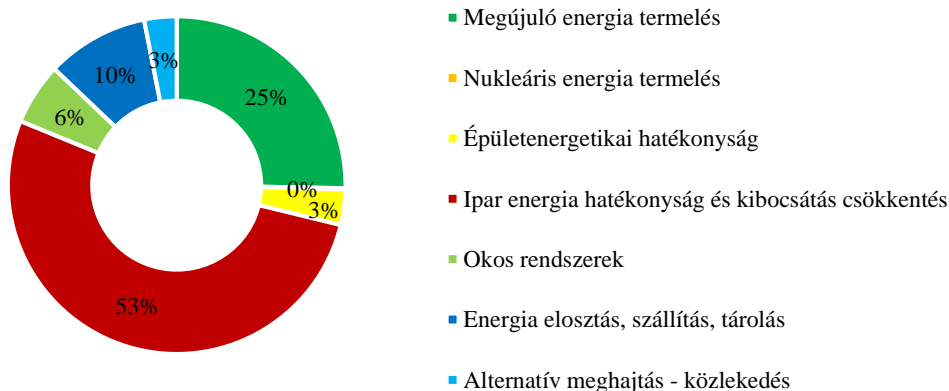
Fields of research	Share (%)
Alternative propulsion, transport	3.2
Distribution, transmission, storage of energy	10.3
Energy efficiency	50.5
Industrial / production energy efficiency / emission reduction	29.8

Energy management in buildings	12.4
<i>Energy efficiency – lighting technology</i>	2
<i>Energy efficiency – heating/cooling/ventilation</i>	2.3
<i>Energy efficiency – other energy management in buildings</i>	8.1
Smart systems, solutions improving energy efficiency	6.8
Renewable energy	16.2
Renewable energy – solar energy	3.1
Renewable energy – bio-energy, biomass and biofuels	11.5
Renewable energy – geothermal energy	0.4
Renewable energy – wind energy	0.4
Renewable energy – water energy	0.9
Renewable energy – hydrogen	0.2
Nuclear energy	4.2
N.e.c. (mainly projects aimed at emission reduction)	14.9

Own calculation based on sources. Source: NRDIO (<https://nkfih.gov.hu/palyazoknak/palyazatok/tamogatott-projektek>).
(Total aid paid specifically for energy development: HUF 56.3 billion)

Projects supported under the Horizon 2020 programme should also be noted when assessing Hungary’s energy related R&D activity. Up to 24 October 2018, 43 projects with Hungarian relevance received a total of 236 439 903 EUR in aid in the ‘Secure, clean and efficient energy’ category.⁵⁵

34 - Distribution of H2020 projects with Hungarian relevance – awarded aid in the ‘Secure, clean and efficient energy’ category – based on project objectives



N=43. Of the two projects relating to energy distribution and transport, one involves a smart solution as well.
Source: https://cordis.europa.eu/project/rcn/207192_en.html

HU	EN
Megújuló energia termelés	Renewable energy production

⁵⁵ https://cordis.europa.eu/project/rcn/207192_en.html

Nukleáris energia termelés	Nuclear energy production
Épületenergetikai hatékonyság	Building energy performance
Ipar energia hatékonyság és kibocsátás csökkentés	Industrial energy efficiency and emission reduction
Okos rendszerek	Smart systems
Energia elosztás, szállítás, tárolás	Distribution, transmission, storage of energy
Alternatív meghajtás – közlekedés	Alternative propulsion – transport

- ii. *Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers*

RDI financing

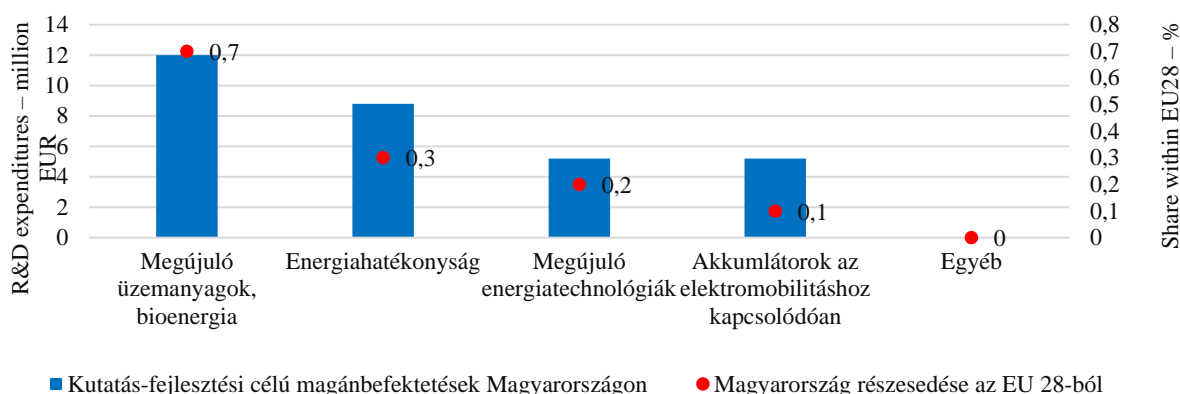
R&D expenditures financed in Hungary by the State amounted to HUF 427 billion in 2016. Two point two per cent (2.2 %) of State R&D expenditures (HUF 9.4 billion⁵⁶) were related directly to energy objectives. Sixty per cent (60 %) of State energy expenditures arose in the business sector. R&D institutes and other budgetary research establishments accounted for approximately one third of energy R&D expenditures in 2016. Research institutes in higher education managed the remaining 7 % of funds.

Only estimates can be used for assessing private RDI investments. According to a report⁵⁷ also serving as a basis for a 2017 Commission report, in 2013 (last available year) the value of private investments serving the research and technological development priority areas of the EU equalled 31 million EUR (0.2 % of similar private investments in the EU). The focus was on sustainable transport, accounting for 53 % of such investments. The above segment was followed by development investments in efficient systems (28 %). The report estimated the share of renewable energy sources at 17 %.

35 - Distribution of R&D private investments covering SET Plan activity in 2013

⁵⁶ CSO data. Nominal value adjusted to 2017 prices: approximately HUF 9.6 billion. This value approximates EUROSTAT data.

⁵⁷ JRC Science Hub – European Commission (2017). JRC. Science for Policy Report. Energy R&I financing and patenting trends in the EU. Country dashboards 2017 edition. (2017) <https://ec.europa.eu/jrc>



Source: JRC Science Hub – European Commission (2017). JRC. Science for Policy Report. Energy R&I financing and patenting trends in the EU. Country dashboards 2017 edition. (2017) p. 34. (<https://ec.europa.eu/jrc>)

HU	EN
Megújuló üzemanyagok, bioenergia	Renewable fuels, bioenergy
Energiahatékonyság	Energy efficiency
Megújuló energiatechnológiák	Renewable energy technologies
Akkumulátorok az elektromobilitáshoz kapcsolódóan	Batteries relating to electromobility
Egyéb	Other
Kutatás-fejlesztési célú magánbefektetések Magyarországon	R&D private investments in Hungary
Magyarország részesedése az EU 28-ból	Hungary's share within the EU28

Staff size in R&D

A full database is not available for the size of R&D staff exclusively in the field of energy. The Central Statistical Office (CSO) only aggregates the number of researchers at companies classified in the category of electricity, gas and steam supply, air conditioning and water supply, collection and treatment of wastewater, waste management, decontamination. In 2016 there were 96 researchers employed full-time (not including assistant staff). Data collected on research institutes in Hungary are broken down into scientific fields. The background to energy is primarily, but not exclusively based on fields in technology and the natural sciences. In 2016, 1 826 researchers were registered by research institutes in technology and 6 520 in natural sciences. Results in a given scientific field can be utilised in several economic sectors. Major results of technological research utilised in the field of energy are achieved in the electrical, electronics and IT engineering sciences (research staff in 2016: 165), engineering sciences (research staff in 2016: 306), chemical engineering, pharmaceutical, rubber and plastics sciences (research staff in 2016: 310) and materials sciences (research staff in 2016: 121).

Patent data

The table below aggregates data on patents registered in Hungary in relation to low CO2 emissions energy technologies.

26 - Data on patents registered in Hungary in relation to low CO2 emissions energy technologies (2014-2018)

Technological fields, technologies	Number of patent applications in Hungary					European patents validated in Hungary					Applications with definitive patent protection on 24.10.2018
	2014	2015	2016	2017	2018	2014	2015	2016	2017	2018	
Wind energy	4	3	2	2	1	0	0	0	0	0	76
Solar and geothermal energy	3	7	7	1	0	3	2	1	0	0	43
Sea water energy	1	1	0	1	0	1	0	0	0	0	9
Water energy	2	3	1	0	0	0	0	0	0	0	3
Biomass	0	1	0	0	0	0	0	0	0	0	12
Waste recovery for energy purposes	2	12	7	1	0	12	3	1	0	0	151
Automotive technologies	1	0	7	1	3	4	6	0	0	0	65
Energy efficiency	5	4	2	1	0	10	1	0	0	0	146
Storage, battery technology	2	1	1	0	0	14	4	1	0	0	83
Other technologies relevant to climate change (capture of methane, nuclear energy)	0	1	0	0	0	8	1	0	0	0	73

The table is meaningful only horizontally, as a specific invention may simultaneously belong to several technological fields.
Source: Hungarian Intellectual Property Office.

The international comparison is based on the number of applications received by the European Patent Office.

27 - Hungarian low CO2 emissions energy technology patents reported to the European Patent Office

	Reported Hungarian patents				Share within the EU28 (%)			
	2014	2015	2016	2017	2014	2015	2016	2017
Renewable energy	3	1	2	0	0.36	0.18	0.39	0.00
Wind energy	0	1	2	0	0.00	0.25	0.52	0.00
Solar energy	1	0	0	0	0.57	0.00	0.00	0.00
Water energy	1	0	0	0	1.96	0.00	0.00	0.00
Recovery of waste for energy purposes	1	0	0	0	0.29	0.00	0.00	0.00
Other	0	0	0	0	0.00	0.00	0.00	0.00
Automotive technologies	1	3	0	0	0.07	0.26	0.00	0.00
Electric and hybrid vehicles	1	0	0	0	0.15	0.00	0.00	0.00
Fuel injection	0	3	0	0	0.00	0.48	0.00	0.00
Energy efficiency	0	3	0	0	0.00	0.68	0.00	0.00
Energy storage: rechargeable batteries, fuel cells	0	2	2	0	0.00	0.26	0.35	0.00
Other technologies relevant to climate change* (capture of methane, nuclear energy)	4	0	1	0	0.53	0.00	0.19	0.00

* : In the reviewed years: methane capture.

The table is meaningful only horizontally, as a specific invention may simultaneously belong to several technological fields.

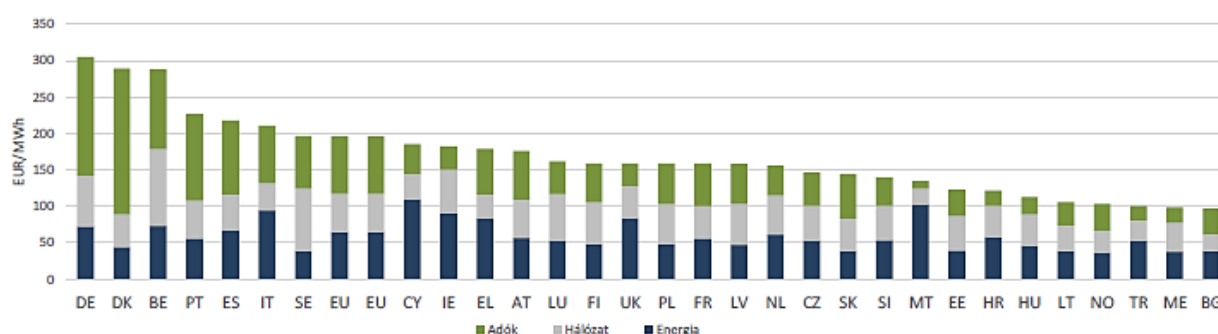
Source: <https://data.epo.org>

iii. Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

Electricity prices

Owing to price regulation, the retail price of household electricity is the third lowest in Europe (Hungarian prices were 6th lowest in 2017). The network access fee (42 %) and energy fee (36 %) account for the largest share of household electricity prices. The tax component is fairly low. As a basis for comparison: Taxes and levies make up 40 % of average EU electricity prices.

36 – Household electricity prices in 2017 (most representative consumption band)

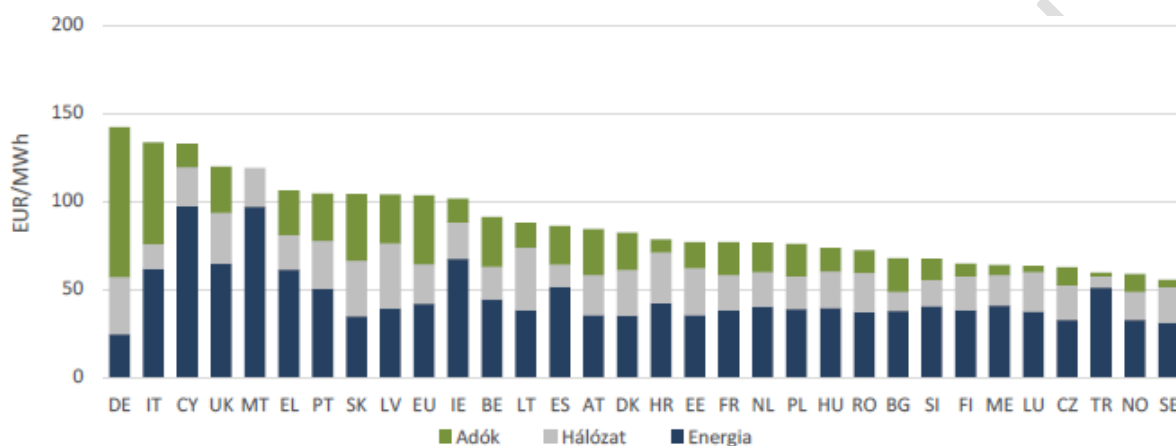


Source: Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Energy prices and energy costs in Europe (page 4).

HU	EN
Adók	Taxes
Hálózat	Grid
Energia	Energy

Industrial electricity prices are significantly lower than household prices. The figure below illustrates differences in price composition among Member States. The main price component for participants of the industrial sector is the price of energy (as product) itself. The taxes and levies on electricity are low for competitiveness reasons, and the share of the network access fee is also lower compared to household prices.

37 – Industrial electricity prices in 2017



Source: Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Energy prices and energy costs in Europe (page 4).

HU	EN
Adók	Taxes
Hálózat	Grid
Energia	Energy

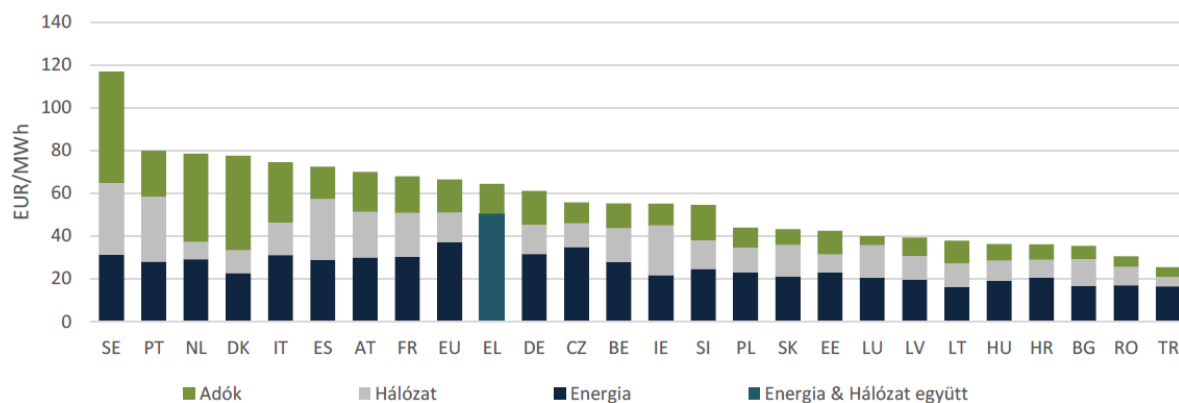
The average price paid by industrial consumers in Hungary was similar to the EU average price.

Price of natural gas

While electricity prices are partly determined by fossil fuel prices (together with other, typically national or regional price factors), natural gas prices are based exclusively on global fossil fuel – including oil – prices.

The figures below provide information relating to the price components of household natural gas.

38 – Household gas prices in 2017 (most representative consumption band)



Source: Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Energy prices and energy costs in Europe (page 6).

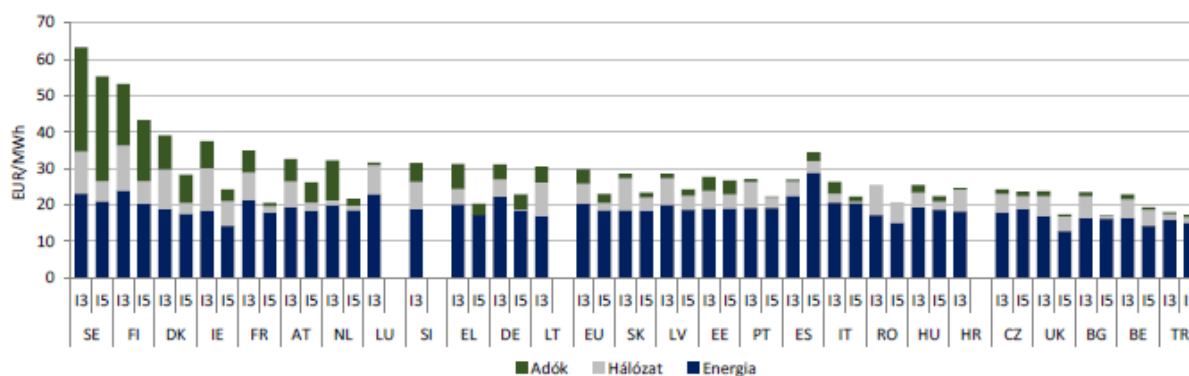
HU	EN
Adók	Taxes
Hálózat	Grid
Energia	Energy
Energia & Hálózat együtt	Energy & Grid combined

Owing to price regulation, household gas prices are among the lowest in the European Union; in 2017 prices were lower only in Bulgaria and Romania.

Taking into account that most Hungarian households heat with gas, a low tax component is essential. Retail prices are therefore determined to a significant degree by wholesale product prices. This ratio approximates 80 % in Hungary.

Error! Reference source not found. provides information on gas prices paid by medium-sized and large industrial companies.

39 – Gas prices of medium-sized and large industrial consumers in 2017 (most representative consumption band)



Source: Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Energy prices and energy costs in Europe (page 7).

HU	EN
Adók	Taxes
Hálózat	Grid

The taxes and levies of large industrial energy consumers are lower than those of medium-sized consumers.

iv. Description of energy subsidies, including for fossil fuels

The feed-in system (FIS) was introduced to encourage electricity generation from renewable energy sources and waste, where electricity may be sold with a statutory feed-in tariff that is higher than the market price. Due to legislative changes, however, new FIS subsidy eligibility is no longer granted for applications lodged after 31 December 2016.

The RESS scheme, serving the subsidisation of electricity generated from renewable energy sources⁵⁸, entered into effect on 1 January 2017; it was extended and modified as a result of legislative changes in October and November of 2017. RESS subsidy is provided for the generation of renewable electricity, except for the brown bonus and household-scale small power plants, which is related to new investment, and implementation is not commenced before application for the subsidy. Multi-fuel firing power plants and waste incinerator power plants are eligible for subsidies only for electricity generated from renewable energy sources.

Subsidies are not provided for the consumption of fossil fuels in Hungary.

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES

5.1. Effects of planned policies and measures described in Section 3 on energy systems and GHG emissions and removals, including comparison to projections with existing policies and measures (as described in section 4).

- i. Projections of the development of energy systems and GHG emissions and removals and, where relevant, of emissions of air pollutants in accordance with Directive (EU) 2016/2284 under the planned policies and measures, at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant Union policies and measures*

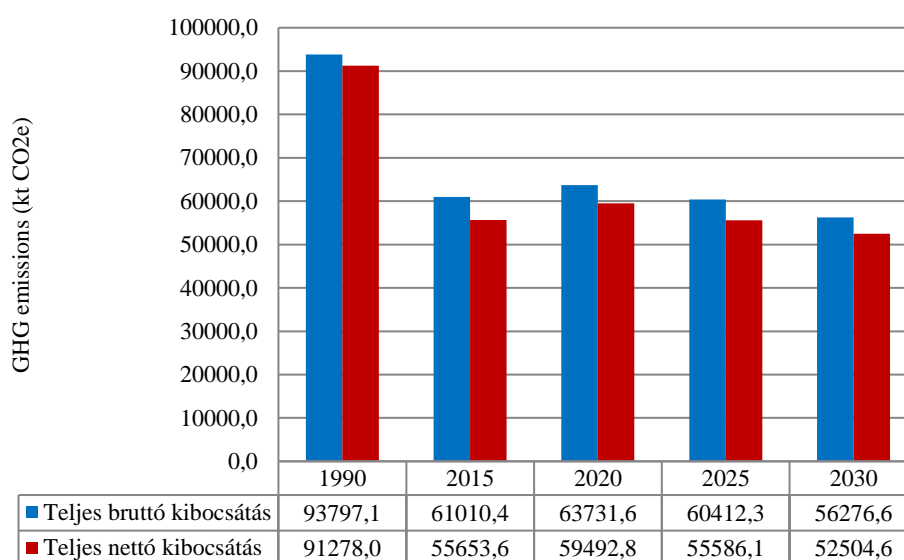
GHG emission

⁵⁸ Decree No 13/2017 of 8 November 2017 of the HEA on operating aid provided for electricity generated from renewable energy sources.

Summary

The total gross GHG emissions of Hungary, calculated without the LULUCF sector, under the scenario taking into account additional policies and measures (WAM), are expected to decrease by 7.8 % to 56.3 thousand kt compared to the year 2015, which is 40 % less than in 1990. As a result of the planned measures, there will be 4.6 thousand kt CO₂ less GHG emissions in 2030 than under the WEM scenario. Total net emissions calculated with LULUCF will decline by 5.7 % under the WAM scenario. GHG intensity is expected to decrease from 0.55 tCO₂e/GDP⁵⁹ in 2015 to 0.3 tCO₂e/GDP in 2030 under the WAM scenario.

40 - GHG emissions with additional policies and measures (1990–2030)

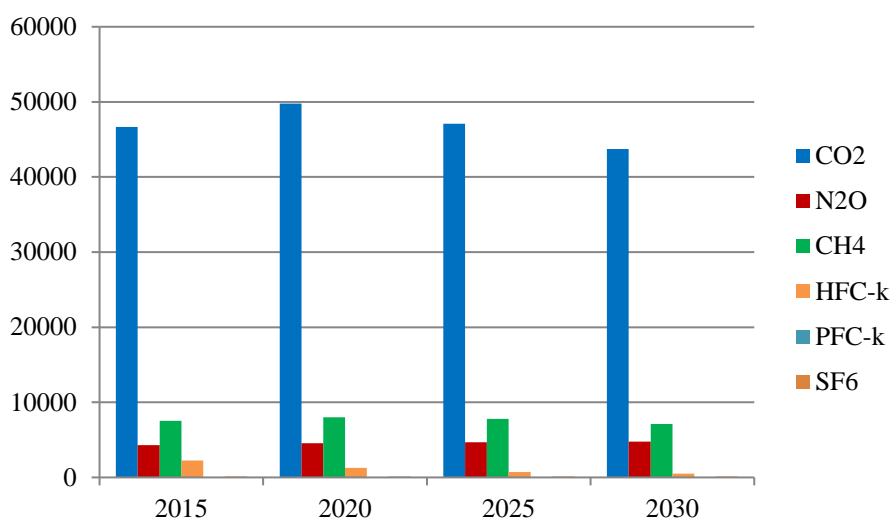


HU	EN
Teljes bruttó kibocsátás	Total gross emissions
Teljes nettó kibocsátás	Total net emissions

Under the WAM scenario, obviously CO₂ will remain the largest GHG, decreasing by 6.3 % compared to 2015. CH₄ emission is expected to increase in the next few years, but will fall below the level measured in 2015 (-5.3 %) by 2030. N₂O emission will decrease by 10.9 %, while F-gas emissions will decline by 73.39 %. NF₃ is not expected to appear in the Hungarian inventory.

⁵⁹ In million EUR.

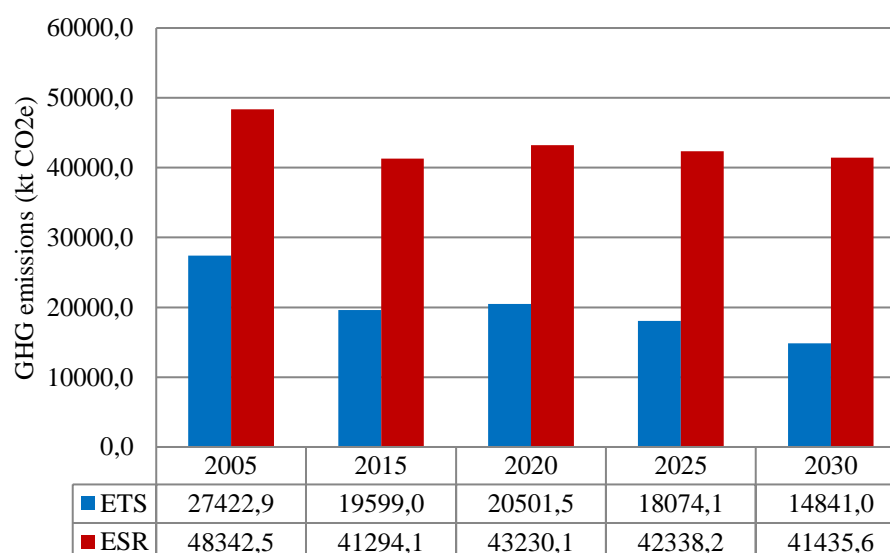
41 - Gross GHG emissions with additional policies and measures, per gas (1990–2030)



HU	EN
HFC-k	HFCs
PFC-k	PFCs

EU ETS emissions will decrease by 24.3 % compared to 2015, while ESD/ESR emissions will increase by 0.3 % under the WAM scenario, therefore these will be 45.9 % and 14.3 % lower than in 2005.

42 - ETS and ESR emissions with additional policies and measures (2005–2030)

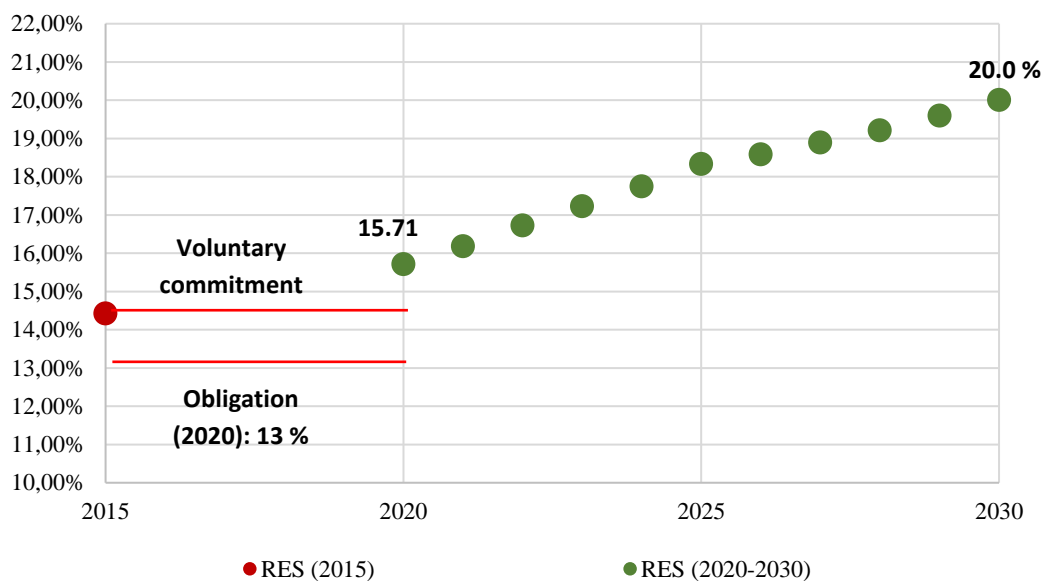


The **LULUCF** sector will remain a net sink, but CO₂ capture will decrease by 29.7 % by 2030.

Energy

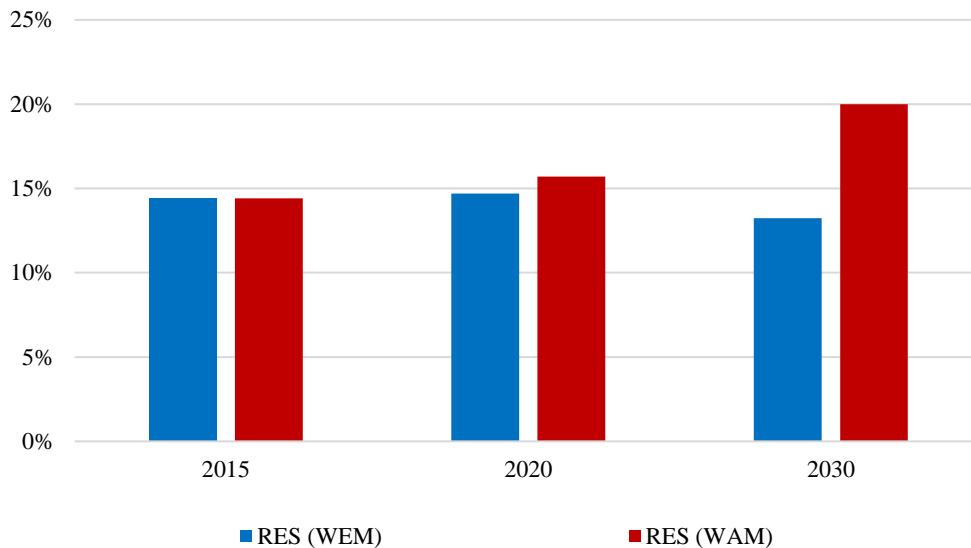
Upon implementation of all policy measures (including energy efficiency investments) assumed under the WAM scenario, the share of renewable energy consumption may rise to 20.0 % by 2030 (43).

43 - Projection of the ratio of renewable energy use to gross final energy consumption, in consideration of the impact of new policy measures (WAM scenario)



The new policy measures relating to electricity, transport and the heating and cooling sector may increase the overall ratio of the use of renewable energy to gross final energy consumption by 6.8 percentage points (44).

44 - Comparison of the ratio of renewable energy use to gross final energy consumption under the WEM and WAM scenarios – impact of new policy measures

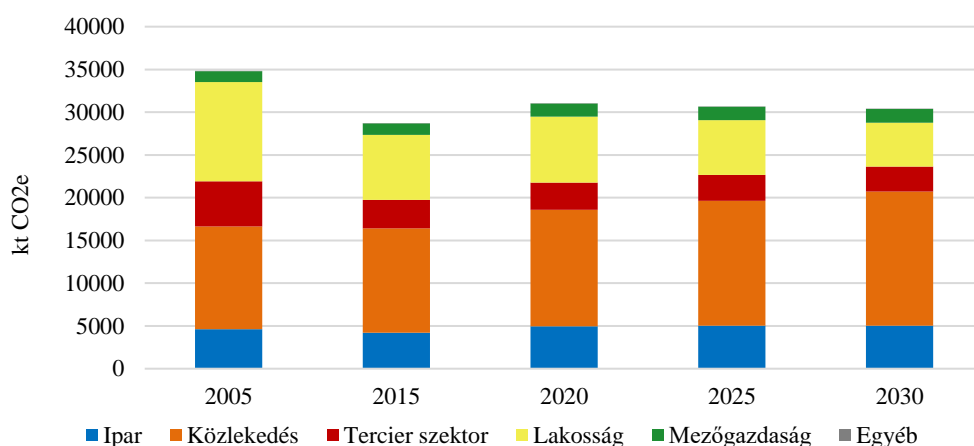


GHG emissions from energy consumption, related to the **end consumer sector**, may increase from 28.7 million CO_{2eq} measured in 2015 to only 30.4 million CO_{2eq} in 2030 if the new policy measures defined in the subheadings of the renewable energy and energy efficiency dimension are implemented. The increase in emissions is mainly attributable to the transport sector (+3.5 million tonnes CO_{2eq}), while the GHG emissions of households will decrease by 2.5 million tonnes CO_{2eq} in the reviewed period, as a result of declining natural gas consumption for heating.

Under the WAM scenario, the GHG emissions of end consumers are 5.9 million tonnes CO_{2eq} lower than under the WEM scenario, i.e. the additional, new measures support the decrease of GHG emissions by 5.9 million tonnes CO_{2eq} (**Error! Reference source not found.**, 46).

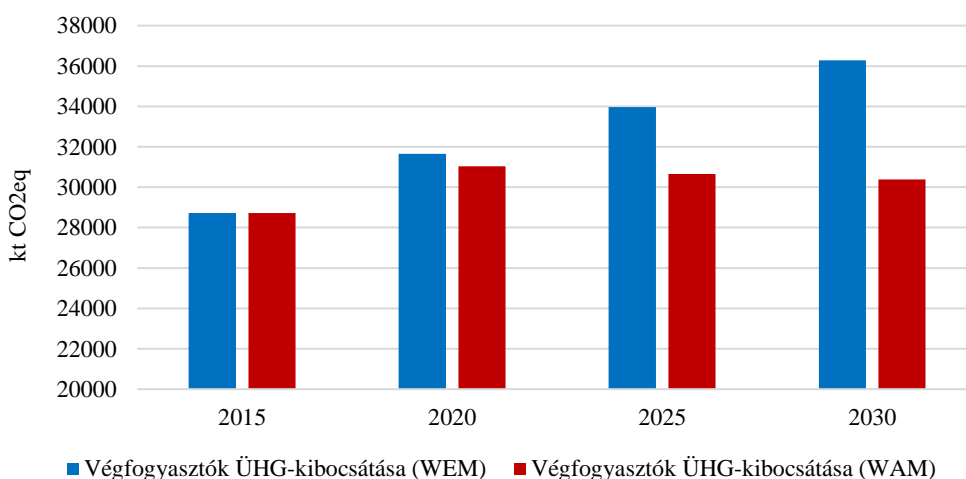
As a result of new policy measures, GHG emissions of end consumers may be 13 % lower in 2030 than in 2005.

45 - Projection of GHG emissions from the use of energy in the end-use sectors, in consideration of new policy measures (WAM scenario)



HU	EN
Ipar	Industry
Közlekedés	Transport
Tercier szektor	Tertiary sector
Lakosság	Households
Mezőgazdaság	Agriculture
Egyéb	Other

46 - Comparison of GHG emissions from the use of energy in the end-use sectors under the WEM and WAM scenarios – impact of new policy measures



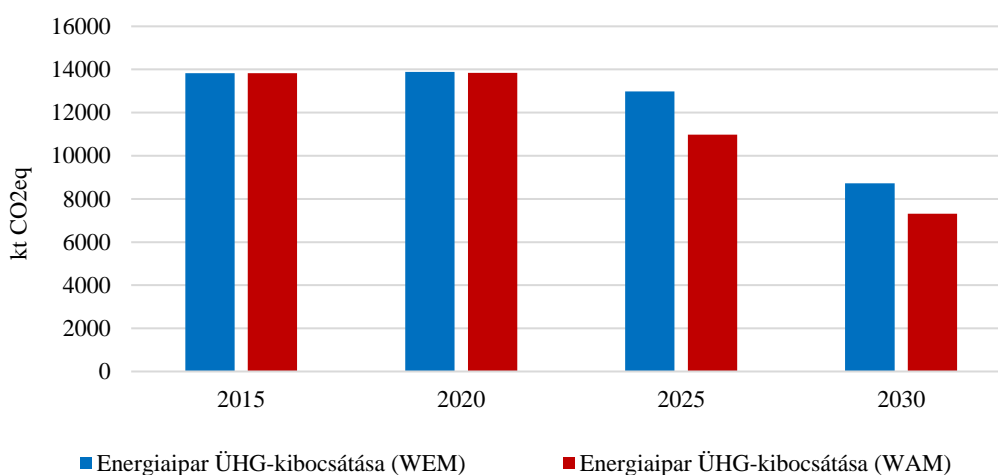
HU	EN
Végfogyasztók ÜHG-kibocsátása (WEM)	GHG emissions of end consumers (WEM)
Végfogyasztók ÜHG-kibocsátása (WAM)	GHG emissions of end consumers (WAM)

Under the WAM scenario, the GHG emissions of the **energy industry** (generation of electricity and heat, petroleum processing, production of solid energy sources) will decrease

to 7.3 million tonnes CO_{2eq} by 2030, from 13.8 million tonnes CO_{2eq} in 2015, i.e. emissions will be halved. The decrease is even greater (63 %) compared to the level in 2005 (47).

The sharp decline in GHG emissions is mainly attributable to the full phasing out of coal used for electricity generation. Taking into account that coal-based power generation will fall to a minimal value by 2030 even under the WEM scenario, the new policy measures result in 1.4 million tonnes CO_{2eq} in overall additional savings of GHG emissions, attributable to the lower energy demand of end consumers, and the growing rate of natural gas substitution with renewable energy sources in district heating generation.

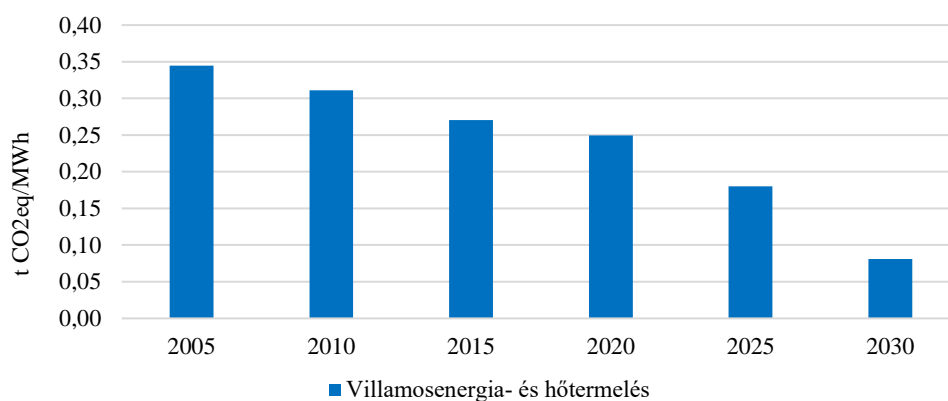
47 - Comparison of GHG emissions in the energy industry under the WEM and WAM scenarios – impact of new policy measures



HU	EN
Energiaipar ÜHG-kibocsátása (WEM)	GHG emissions of energy industries (WEM)
Energiaipar ÜHG-kibocsátása (WAM)	GHG emissions of energy industries (WAM)

Specific GHG emissions from electricity and heat generation, i.e. carbon intensity, will sharply decrease as a result of the growing use of nuclear and renewable energy. The value of the indicator will decrease to 0.08 tCO_{2eq}/MWh in 2030 from 0.27 tCO_{2eq}/MWh in 2015, i.e. carbon intensity will decline by 70 % in energy production (48). The value projected for 2030 amounts to only one quarter of the level for 2005.

48 - Projection of the carbon intensity of electricity and heat production under the WAM scenario



HU	EN
Villamosenergia- és hőtermelés	Electricity and heat generation

Non-energy sectors

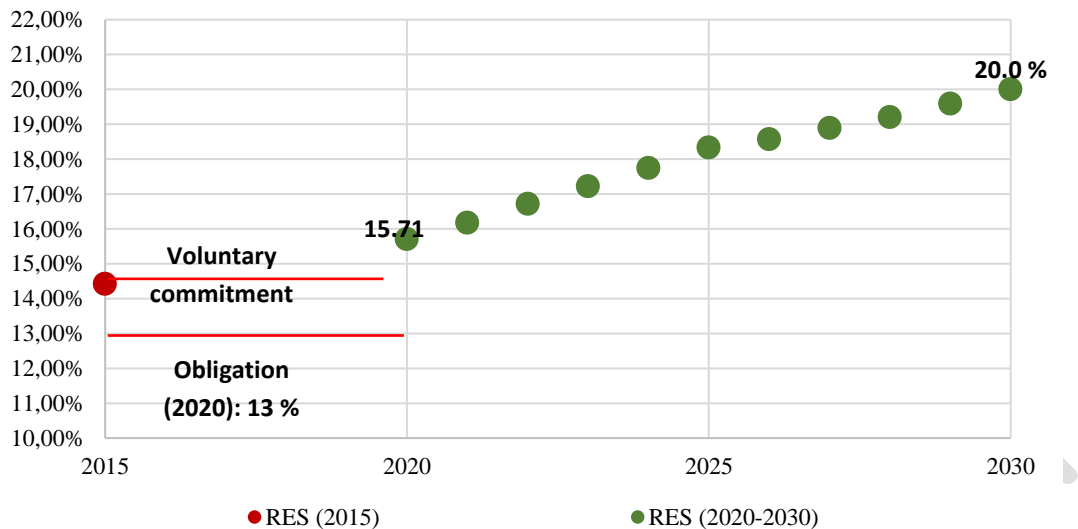
The WAM scenario is not based on modelling in relation to agriculture and waste management. Hungary is planning measures resulting in a 200 kt CO_{2e} reduction in emission in each of the two sectors. These measures will be drawn up in 2019. There is no difference between the WEM and WAM scenarios in relation to industrial processes and product use.

Renewable energy

Summary

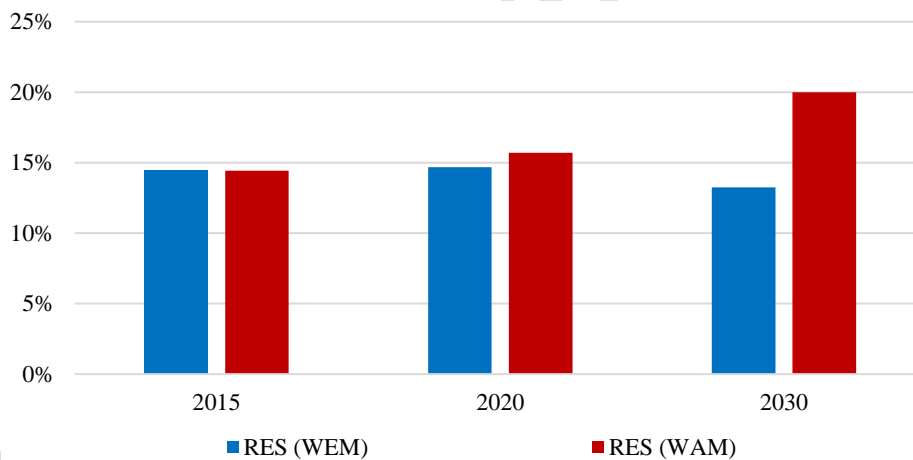
Upon implementation of all policy measures (including energy efficiency investments) assumed under the WAM scenario, the share of renewable energy sources will reach the national target of 20 % by 2030 (49).

49 - Projection of the ratio of renewable energy use to gross final energy consumption, in consideration of the impact of new policy measures (WAM scenario)



The new policy measures relating to electricity, transport and the heating and cooling sector may increase the overall ratio of the use of renewable energy to gross final energy consumption by 6.8 percentage points (Figure 50).

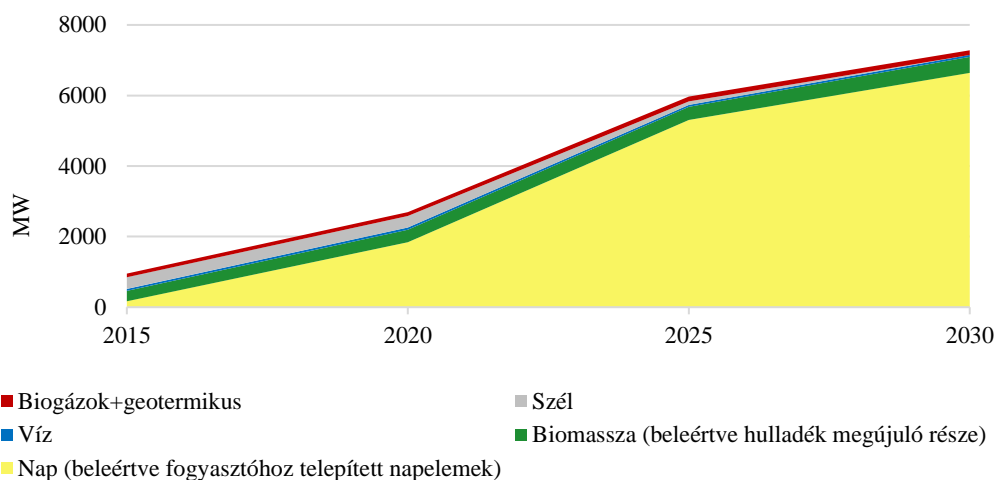
50 - Comparison of the ratio of renewable energy use to gross final energy consumption under the WEM and WAM scenarios – impact of new policy measures



Electricity (RES-E)

With the implementation of the policy measures listed in Chapter 3, the infrastructural barriers to the expansion of PV panel capacities could be eliminated, whereby their installed capacity (including systems installed with consumers) could exceed 6 600 MW in 2030. The total capacity of electricity generation from renewable sources could approximate 7 300 MW; more than 90 % of such capacity is provided by PV panels (**Error! Reference source not found.**).

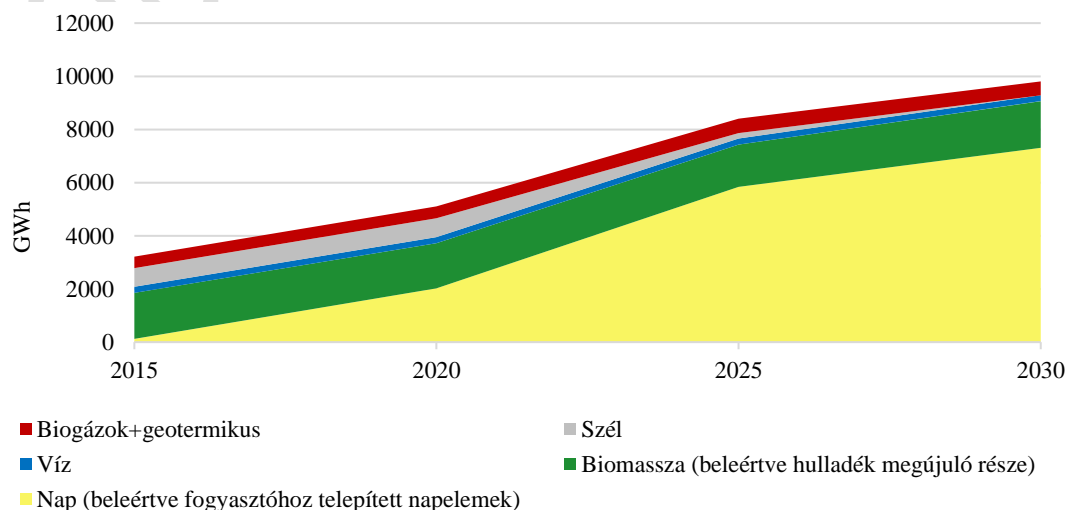
51 - Projection of installed capacity of electricity generation from renewable sources, in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Biogázok+geotermikus	Biogases + geothermal energy
Víz	Water
Nap (beleértve fogyasztóhoz telepített napelemek)	Solar (including PV panels installed at consumers)
Szél	Wind
Biomassza (beleértve hulladék megújuló része)	Biomass (including renewable portion of waste)

The quantity of RES-E may approximate 10 000 GWh annually in 2030 under the WAM scenario, equalling triple the value for 2015 (**Error! Reference source not found.**).

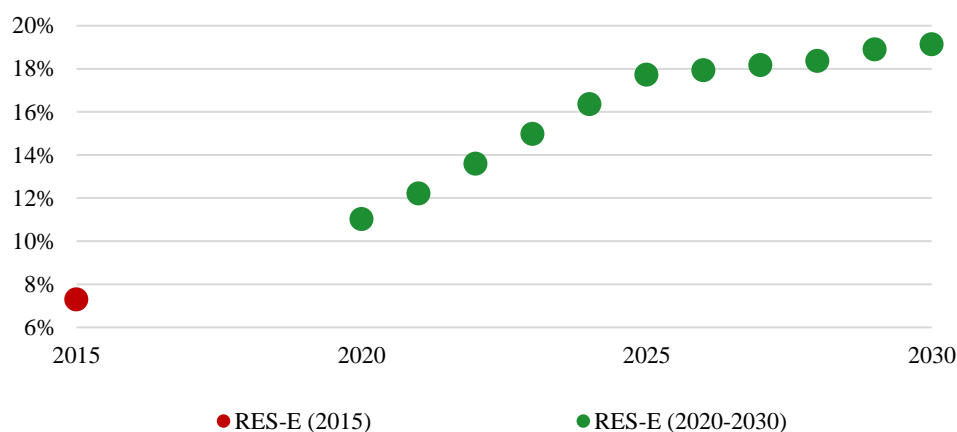
52 - Projection of RES-E, in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Biogázok+geotermikus	Biogases + geothermal energy
Víz	Water
Nap (beleértve fogyasztóhoz telepített napelemek)	Solar (including PV panels installed at consumers)
Szél	Wind
Biomassza (beleértve hulladék megújuló része)	Biomass (including renewable portion of waste)

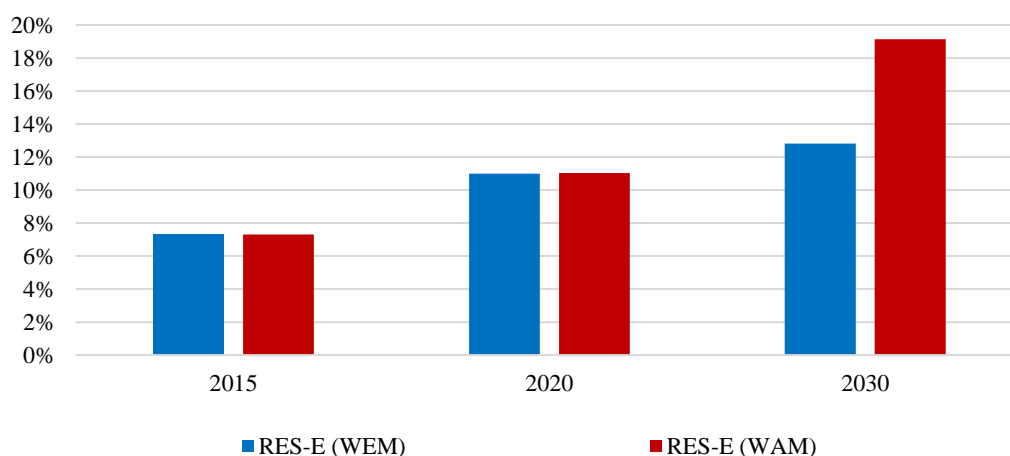
As a result of the implemented new policy measures, the ratio of RES-E to gross final electricity consumption may increase to 19.1 % by 2030 from 7.3 % in 2015 (**Error! Reference source not found.**).

53 - Projection of the share of RES-E, in consideration of the impact of new policy measures (WAM scenario)



As a result of the implemented new policy measures, the ratio of RES-E to gross final electricity consumption could be 6.3 percentage points higher than the value projected under the WEM scenario (54).

54 - Comparison of the share of RES-E under the WEM and WAM scenarios – impact of new policy measures

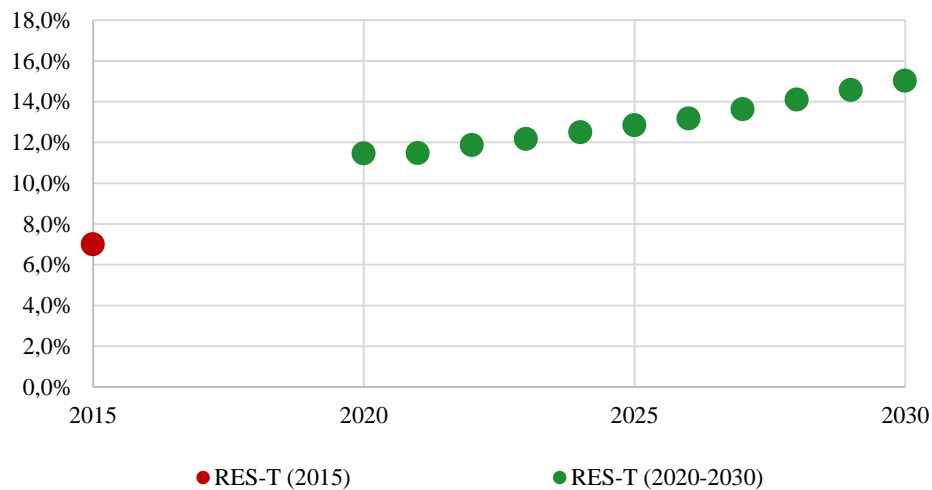


Transport (RES-T)

With the implementation of the measures listed in Chapter 3, the share of the use of renewable energy in transport may increase from 7 % in 2015 to 11.5 % in 2020, and to 15 % in 2030 (**Error! Reference source not found.**).

When calculated in energy value, the share of biofuels could reach 80 % within the use of renewable energy for transport purposes in 2030 with implementation of the new policy measures. When also taking into account multiplying factors in the case of electricity consumption by rail and road, however, this share is 60 %, i.e. 40 % is provided by electricity.

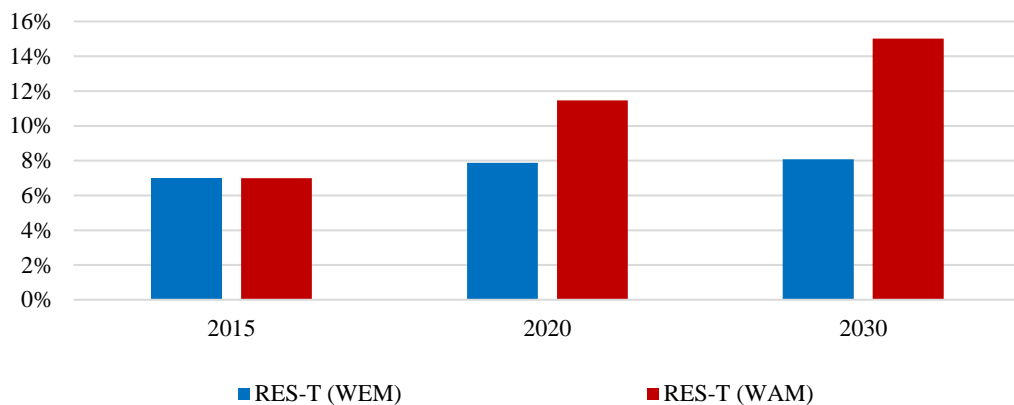
55 - Projection of the share of renewable energy use in the transport sector, in consideration of the impact of new policy measures (WAM scenario)



The new policy measures – facilitating the increased use of biofuels and the spread of vehicles with electric propulsion – support increasing the use of renewable energy by 7 percentage points in the transport sector, compared to the value projected under the WEM scenario (

56).

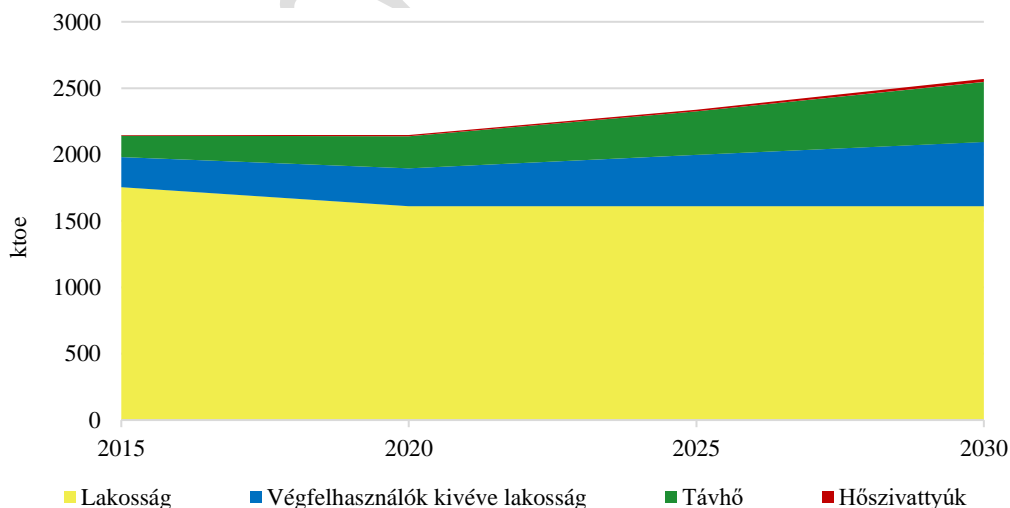
56 - Comparison of the share of using renewable energy in transport under the WEM and WAM scenarios – impact of new policy measures



Heating and cooling (RES - H&C)

With implementation of the new policy measures referred to in Chapter 3, the quantity of renewable energy used in the heating and cooling sector may increase after 2020, and exceed the level for 2015 by approximately 20 % in 2030. Two thirds of the increase will be partly in the district heating sector, and one third related to end users. In relation to households, the measures may result in slowing down and eventually halting the decline in the use of fuel wood (**Error! Reference source not found.**).

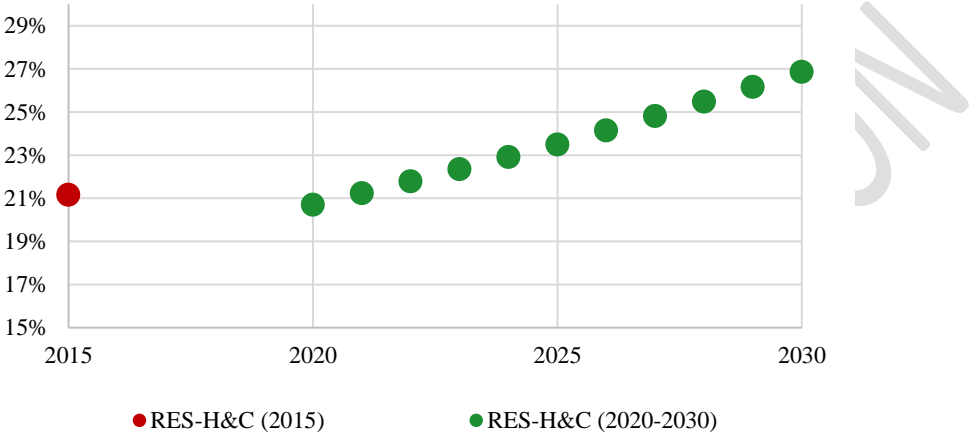
57 - Projection of the share of renewable energy use in the heating and cooling sector, in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Lakosság	Households
Végfelhasználók kivéve lakosság	End users excluding households
Távhő	District heating
Hőszivattyúk	Heat pumps

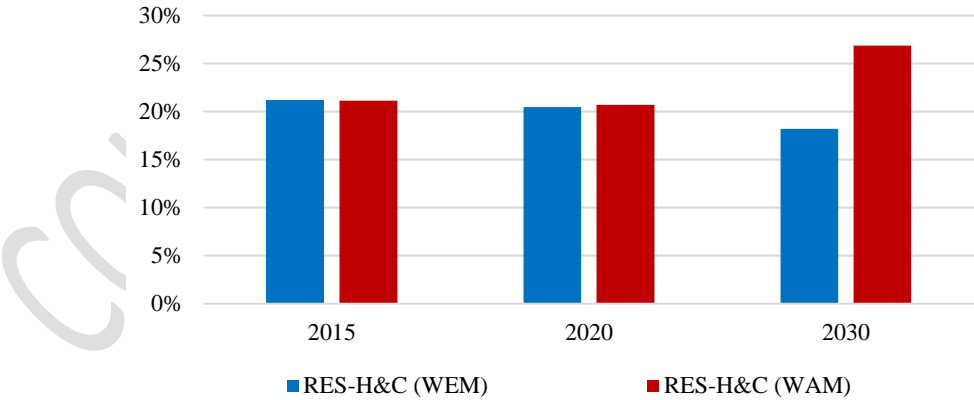
Under the WAM scenario the share of renewable energy use in the heating and cooling sector may increase again after the decline between 2015 and 2020, possibly approximating 27 % in 2030 (**Error! Reference source not found.**).

58 - Projection of the share of renewable energy use in the heating and cooling sector, in consideration of the impact of new policy measures (WAM scenario)



The increase in the use of renewable energy in the heating and cooling sector resulting from the implemented new policy measures is 8.7 percentage points higher than with the existing policy measures (Figure 59).

59 - Comparison of the share of using renewable energy in the heating and cooling sector under the WEM and WAM scenarios – impact of new policy measures



Dimension of energy efficiency

End use

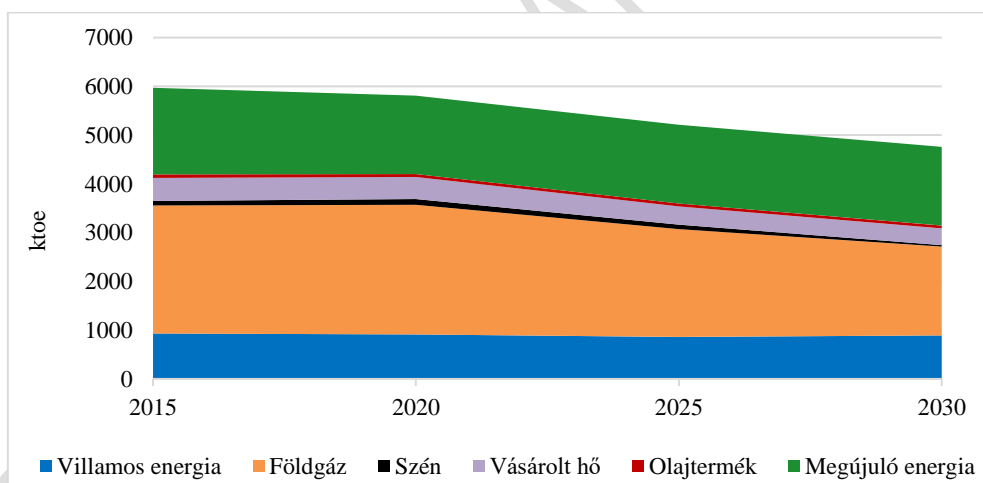
By implementing all of the new policy measures listed in Chapter 3, more than twice the amount of energy conservation may be achieved in the **household sector** than within the

current policy framework, i.e. under the WAM scenario – assuming the implementation of the new policy measures – household energy consumption will decrease by 20 % between 2015 and 2030. The decrease will reach 30 % in relation to natural gas and district heating consumption (**Error! Reference source not found.**,

HU	EN
Villamos energia	Electricity
Földgáz	Natural gas
Szén	Coal
Vásárolt hő	Purchased heat
Olajtermékek	Petroleum products
Megújuló energia	Renewable energy

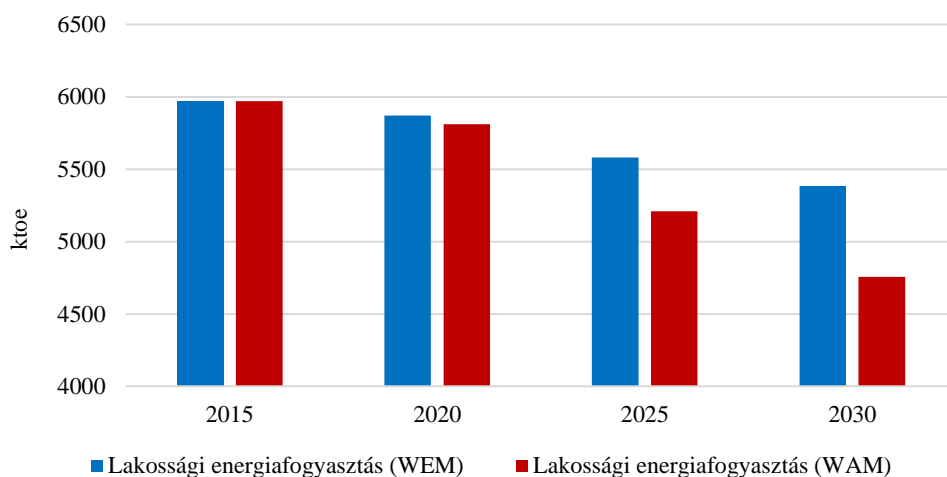
61).

60 - Projection of household energy consumption in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Villamos energia	Electricity
Földgáz	Natural gas
Szén	Coal
Vásárolt hő	Purchased heat
Olajtermékek	Petroleum products
Megújuló energia	Renewable energy

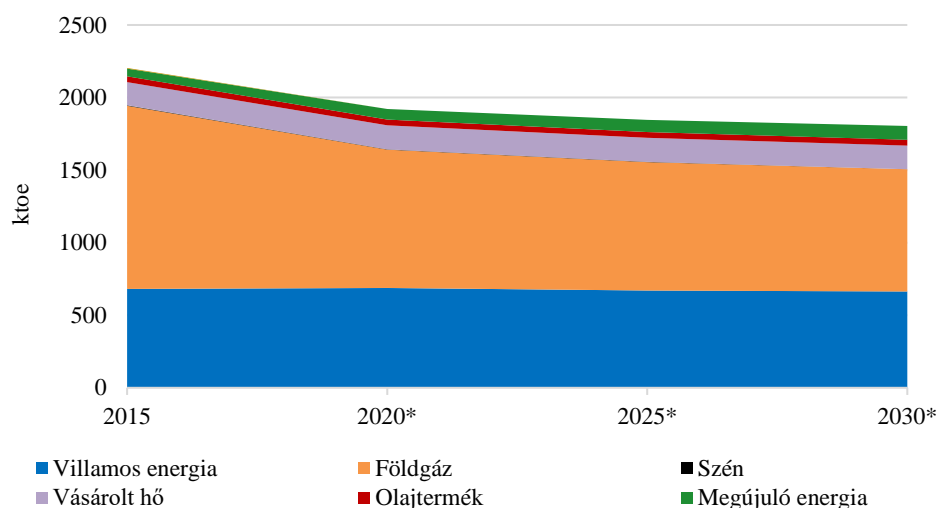
61 - Comparison of household energy consumption under the WEM and WAM scenarios – impact of new policy measures



HU	EN
Lakossági energiafogyasztás (WEM)	Household energy consumption (WEM)
Lakossági energiafogyasztás (WAM)	Household energy consumption (WAM)

In the **tertiary sector**, the energy consumption of public services will decrease further sharply as a result of implemented new policy measures, while the energy consumption of market services may decline despite dynamic growth in added value and related infrastructure. Based on statistically adjusted data (see WEM scenario), the quantity of energy consumed in the tertiary sector will decrease by 8.2 % between 2015 and 2030 under the WAM scenario. All of the projected decrease will be registered in natural gas consumption, in parallel with stagnant electricity and district heating consumption and a rise in renewable energy consumption (**Error! Reference source not found.**).

62 - Projection of energy consumption in the tertiary sector, in consideration of the impact of new policy measures (WAM scenario)

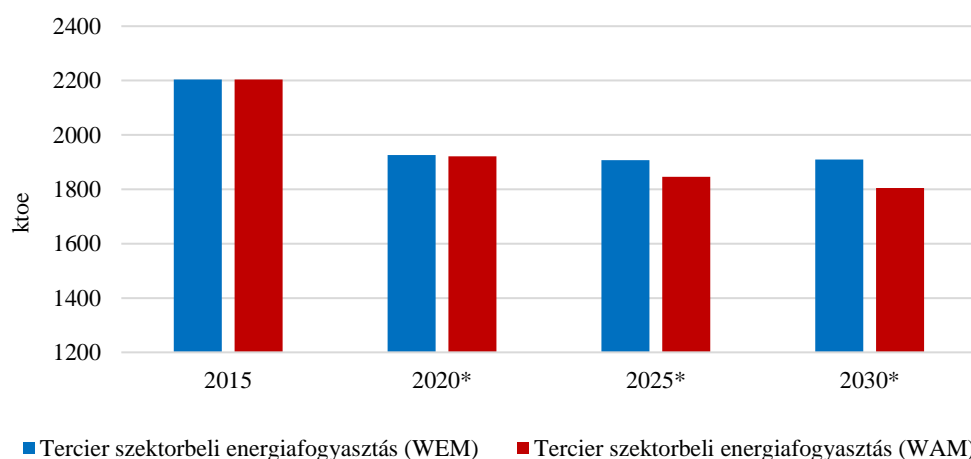


* Values adjusted with statistical differences

HU	EN
Villamos energia	Electricity
Vásárolt hő	Purchased heat
Földgáz	Natural gas
Olajtermék	Petroleum products
Szén	Coal
Megújuló energia	Renewable energy

The new policy measures will decrease energy consumption overall by 5.5 % in the tertiary sector in 2030 compared to the WEM scenario (63).

63 - Comparison of energy consumption in the tertiary sector under the WEM and WAM scenarios – impact of new policy measures



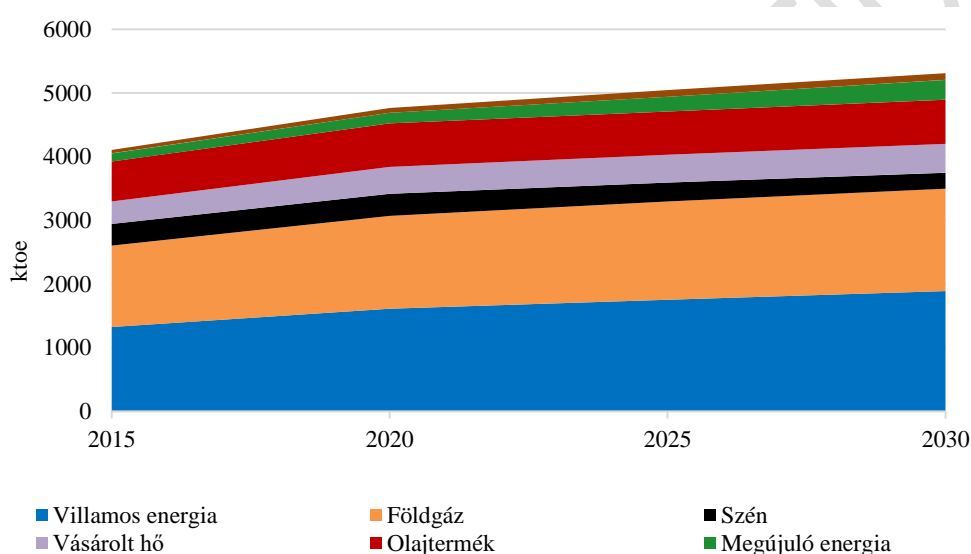
* Values adjusted with statistical differences

HU	EN
Tercier szektorbeli energiafogyasztás	Energy consumption in tertiary sector

(WEM)	(WEM)
Tercier szektorbeli energiafogyasztás (WAM)	Energy consumption in tertiary sector (WAM)

Upon implementation of the new policy measures, energy consumption in the **industrial sector** may increase by 29 % between 2015 and 2030 (**Error! Reference source not found.**). The largest rate of growth is expected in renewable energy and electricity consumption, while a decrease is only projected in the consumption of coal.

64 - Projection of energy consumption in the industrial sector, in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Villamos energia	Electricity
Vásárolt hő	Purchased heat
Földgáz	Natural gas
Olajtermék	Petroleum products
Szén	Coal
Megújuló energia	Renewable energy

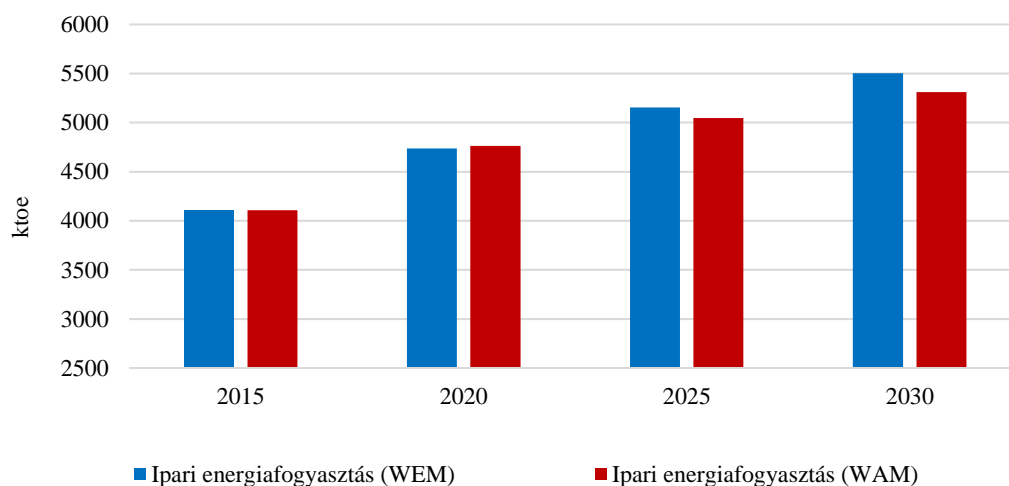
The difference between the WEM and WAM, i.e. in terms of the amount of additional energy conservation achievable with the new policy measures, was smallest in the industrial sector; the energy consumption values expected in 2030 indicate a 3–4 % difference (

65).

The small difference is attributable to the combination of several factors:

- Firstly, the two scenarios assume identical production patterns and an identical increase in production value, i.e. energy efficiency is the only source of the difference;
- The existing energy efficiency aids have substantial incentivising power;
- The tightening standards, which are mandatory in all EU Member States, and provisions of the Energy Efficiency Directive (2012/27/EU) were already considered in the WEM scenario;
- In addition, the new policy measures result in a faster increase in housing construction under the WAM scenario, resulting in higher energy conservation in the household sector, but more energy consumption in the manufacturing of building materials in Hungary.

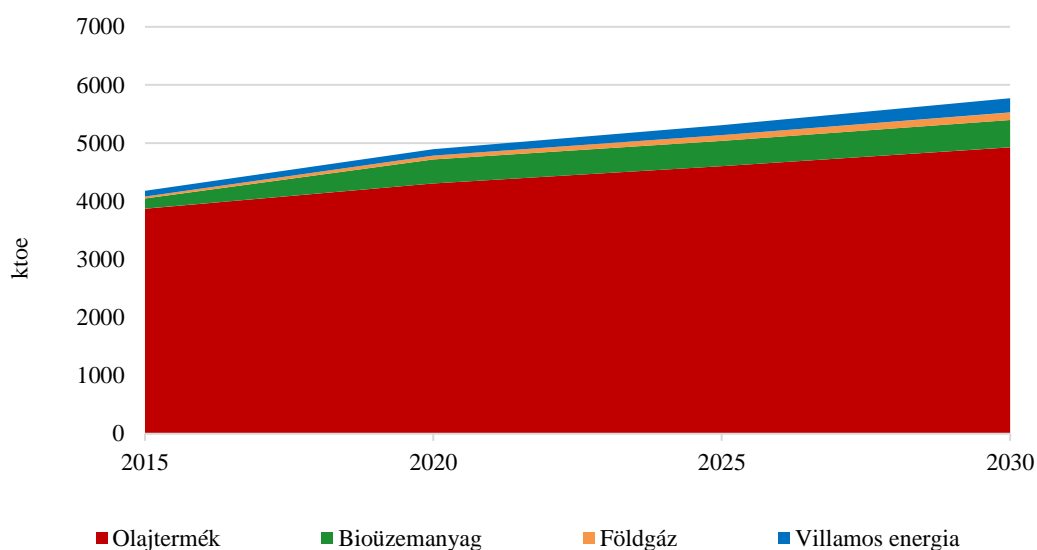
65 - Comparison of industrial energy consumption under the WEM and WAM scenarios – impact of new policy measures



HU	EN
Ipari energiafogyasztás (WEM)	Industrial energy consumption (WEM)
Ipari energiafogyasztás (WAM)	Industrial energy consumption (WAM)

Upon the combined implementation of the new policy measures – resulting in the faster spread of vehicles with electric propulsion and a decline in the fuel consumption of motor vehicles with traditional propulsion – the increase in energy consumption in **transport** may be reduced to 38 % between 2015 and 2030. Under the WAM scenario, the share of the energy value of oil-based fuels may be reduced to 85 % by 2030 in terms of the entire transport sector (**Error! Reference source not found.**).

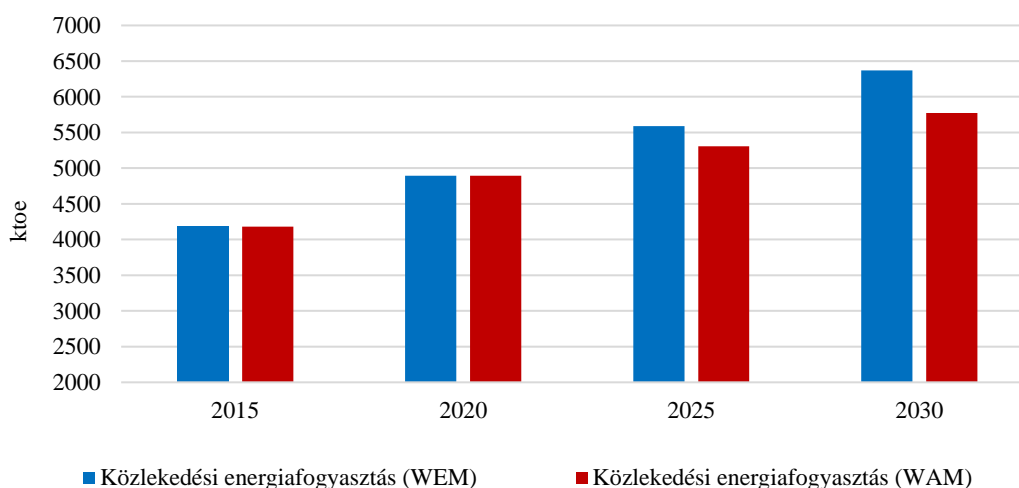
66 - Projection of energy consumption in transport, in consideration of the impact of new policy measures, excluding international air transport (WAM scenario)



HU	EN
Olajtermék	Petroleum products
Bioüzemanyag	Biofuels
Földgáz	Natural gas
Villamos energia	Electricity

The difference between energy consumption in the transport sector in the WEM and WAM scenarios will be approximately 600 ktoe (25 PJ) in 2030, i.e. the new policy measures can reduce energy consumption in transport by 10 % compared to the trajectory under the existing measures (67).

67 - Comparison of energy consumption in the transport sector under the WEM and WAM scenarios – impact of new policy measures

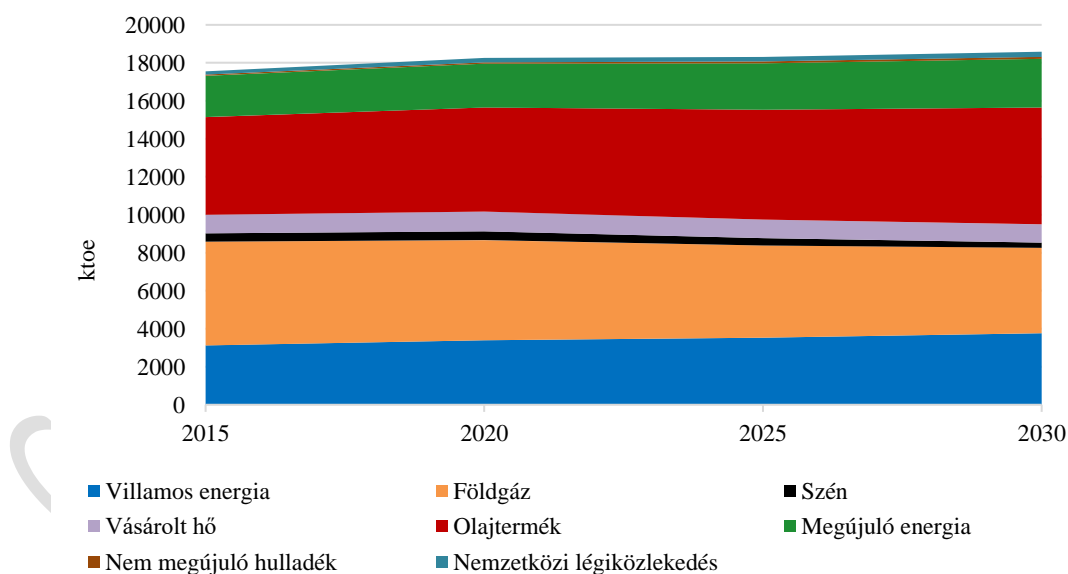


HU	EN
Közlekedési energiafogyasztás (WEM)	Energy consumption in transport (WEM)
Közlekedési energiafogyasztás (WAM)	Energy consumption in transport (WAM)

In consideration of the impact of existing policy measures, a 15 % increase in final energy consumption was projected between 2015 and 2030, without significant changes to the internal distribution of used energy sources.

Implementation of the new policy measures – comprising the boundary conditions of the WAM scenario – would result in only a 7 % increase in final energy consumption between 2015 and 2030, in parallel with a 4 %/year average rise in the GDP (**Error! Reference source not found.**). This means that the value of final energy consumption relative to the GDP, i.e. the energy intensity, will decrease by approximately 40 % between 2015 and 2030 (REF _Ref531693918 \h Figure 69). The energy mix will also change favourably; the share of renewable energy sources and electricity will increase, while that of coal and natural gas consumption will decrease.

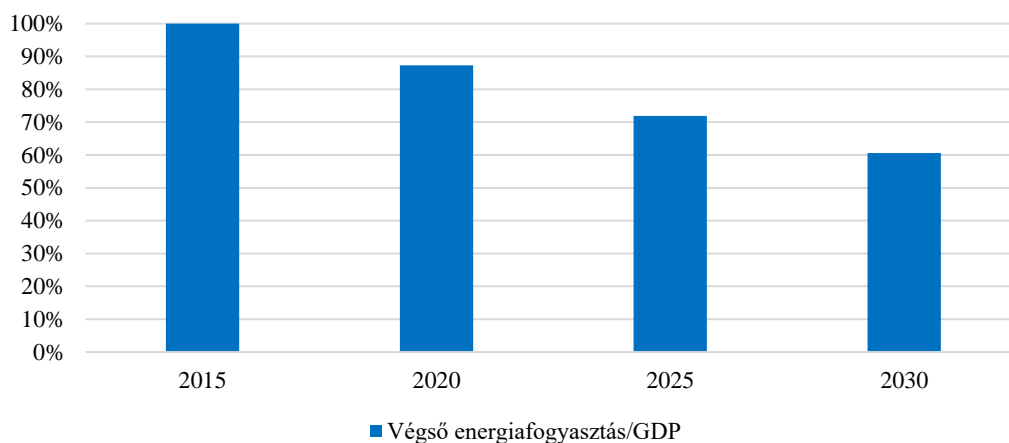
68 - Projection of final energy consumption in consideration of the impact of new policy measures (WAM scenario)



HU	EN
Villamos energia	Electricity
Vásárolt hő	Purchased heat
Nem megújuló hulladék	Non-renewable waste
Földgáz	Natural gas
Olajtermék	Petroleum products
Nemzetközi légit közlekedés	International air transport

Szén	Coal
Megújuló energia	Renewable energy

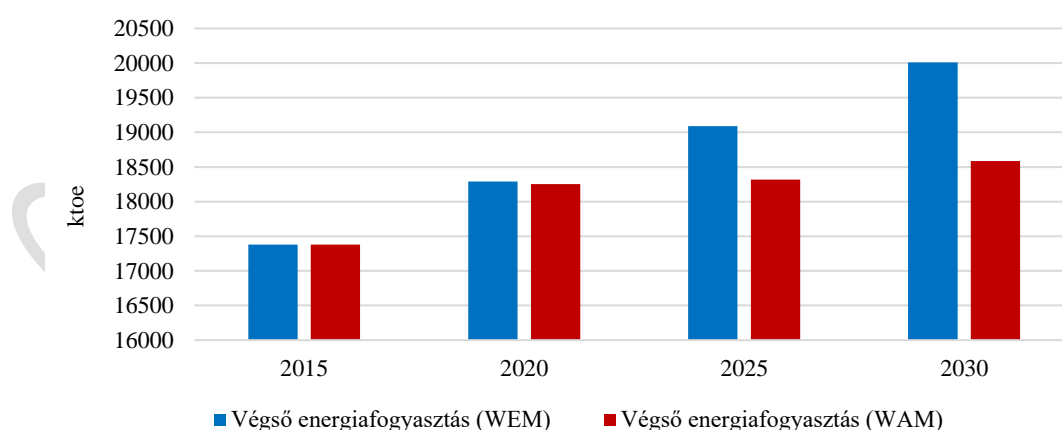
69 - Energy intensity in relation to final energy consumption (WAM scenario, 2015=100 %)



HU	EN
Végő energiafogyasztás/GDP	Final energy consumption/GDP

The value of final energy consumption under the WAM scenario in 2030 is 1 423 ktoe (approximately 60 PJ) less than the value under the WEM scenario, i.e. the increase in energy demand from economic processes can be reduced by more than one half with the new policy measures (Figure 70).

70 - Comparison of final energy consumption under the WEM and WAM scenarios – impact of new policy measures

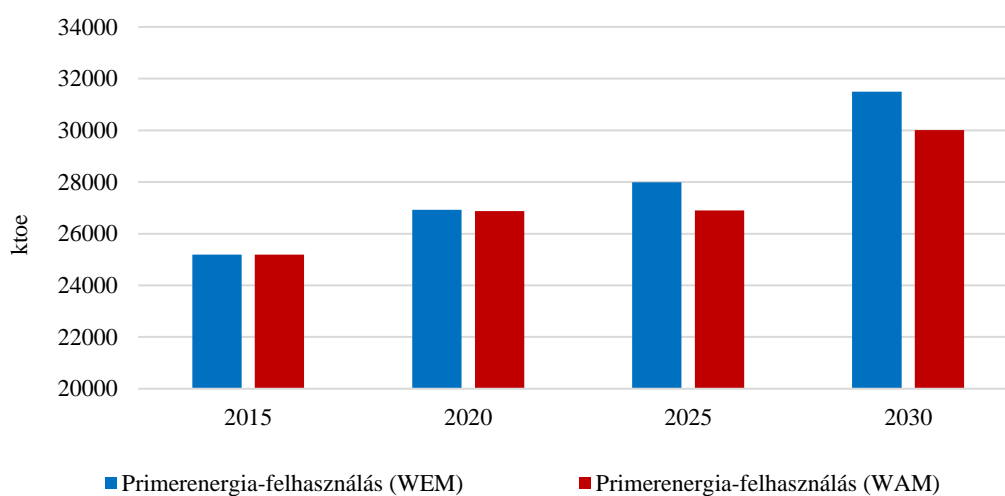


HU	EN
Végő energiafogyasztás (WEM)	Final energy consumption (WEM)
Végő energiafogyasztás (WAM)	Final energy consumption (WAM)

Primary energy consumption

Upon implementation of the new policy measures, the value of primary energy consumption may equal 30 000 ktoe (approximately 1 260 PJ) in 2030, which is 19 % higher than the value for 2015 (**Error! Reference source not found.**). Implementation of the new policy measures would allow 1 500 ktoe in savings of primary energy consumption compared to the trajectory under the existing policy measures (71).

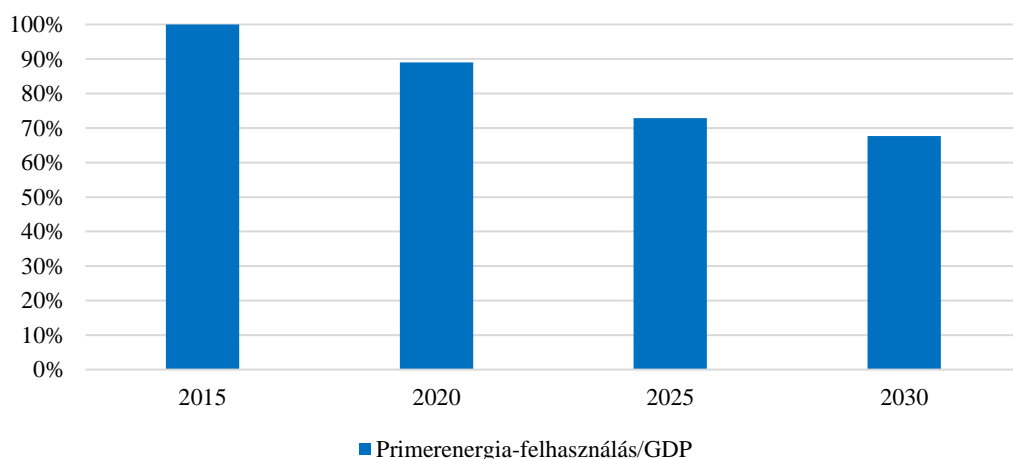
71 - Comparison of primary energy consumption under the WEM and WAM scenarios – impact of new policy measures



HU	EN
Primerenergia-felhasználás (WEM)	Primary energy consumption (WEM)
Primerenergia-felhasználás (WAM)	Primary energy consumption (WAM)

The energy intensity of the Hungarian economy, i.e. ratio of primary energy consumption to the GDP, will decrease by 32.3 % between 2015 and 2030 after implementation of the new policy measures (72).

72 - Projection of the energy intensity of the Hungarian economy (primary energy consumption/GDP) under the WAM scenario



HU	EN
Primerenergia-felhasználás/GDP	Primary energy consumption/GDP

ii. *Assessment of policy interactions (between existing policies and measures and planned policies and measures within a policy dimension, and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency / energy savings policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply*

To be drawn up in 2019, and included in the final version of the plan.

iii. *Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures*

To be drawn up in 2019, and included in the final version of the plan.

5.2. Macroeconomic and, to the extent feasible, the health, environmental, employment and education, skills and social impacts, including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in Chapter 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

The final National Energy and Climate Plan – to be submitted in 2019 – will include the impact assessments.

5.3. Overview of investment needs

i. Existing investment flows and forward investment assumptions with regard to the planned policies and measures

Currently rough cost estimates are available in relation to the fulfilment of energy and climate policy objectives, which will be clarified in 2019 consistently with the drawn up sectoral development plans.

The value of the weighted average cost of capital (WACC) is one of the key factors of cost estimation. Currently the WACC value is 6.04 % in relation to solar power stations. Based on data in literature, the other technologies are considered to carry higher risks, e.g. biogas and biomass power plants are considered with a capital cost of 8.55 % and geothermal electricity generation with 10.55 %. When accounting for geothermal energy, particular attention should be paid to means of reducing the geophysical risks (and their financial risks), where the capital costs are roughly double the costs of solar power stations. The cost of advanced biofuels is currently difficult to estimate due to their limited availability on the market. Costs relating to electric vehicles and batteries – also in relation to transport – are also linked to serious uncertainty factors.

The known barrier to energy efficiency investments is limited construction capacities in the construction sector, and the sharp rise in the cost of building materials and construction in recent years.

In consideration of the above, the total cost of energy efficiency and renewable energy investments necessary for fulfilling the objectives is approximately HUF 14 700 billion, as follows:

- Under the National Building Energy Strategy approved in 2015, energy conservation of 40 PJ is possible with an invested amount of HUF 1 760 billion; its target for 2030 is primary energy conservation of 111 PJ/year in the energy consumption of buildings. In accordance with the above and in consideration of recent years, building energy investment costs considered in the NECP will amount to approximately HUF 5 300 billion up to 2030.
- Renewable energy costs will be similar, equalling HUF 4 700 billion up to 2030. The cost estimate does not include the consumer levies of biofuels, but includes the necessary costs of reserve capacities and network development in addition to the direct subsidisation of weather-dependent producers.
- Electromobility plays a central role in model calculations, assuming approximately 450 thousand cars, and electric small trucks and buses by 2030 at an investment cost of about HUF 4 700 billion.

The total support demand of investments varies per target areas, but support in the overall annual amount of about HUF 800 billion may be necessary for fulfilling objectives.

ii. Sector or market risk factors or barriers in the national or regional context

iii. Analysis of additional public finance support or resources to fill identified gaps identified under point iii.

5.4. Effects of planned policies and measures described in Chapter 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

The final National Energy and Climate Plan – to be submitted in 2019 – will include the impact assessments.

i. Effects on the energy system in neighbouring and other Member States in the region to the extent possible

ii. Effects on energy prices, utilities and energy market integration

iii. Where applicable, impact on regional cooperation