DRAFT NATIONAL ENERGY AND CLIMATE PLAN OF THE CZECH REPUBLIC

December 2018

Executive Summary

The Draft National Energy and Climate Plan of the Czech Republic was prepared on the basis of the Regulation of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action and it contains the main targets and policies in all five dimensions of the Energy Union for the period 2021–2030 with a view to 2050. The main part of the Draft National Plan is the setting of the Czech Republic's contribution to the European climate and energy targets concerning the reduction of greenhouse-gas emissions, the increase in the share of renewable energy sources and increase in energy efficiency. The Draft National Plan is based on two main strategic documents, namely the Czech Republic's State Energy Policy, which was approved in 2015, and the Climate Policy of the Czech Republic, which was approved in 2017. The structure and the elements of the Draft National Plan comply with the above-mentioned Regulation.

As regards reducing greenhouse-gas emissions, the pan-European target is for a 43 % reduction by comparison with 2005 in EU ETS sectors, and 30 % in non-ETS sectors. The Czech Republic's main target is to reduce total greenhouse-gas emissions by 30 % by 2030 by comparison with 2005, equivalent to a reduction in emissions of 44 million tonnes CO_2 eq. The Draft National Plan also includes long-term indicative targets by 2050 based on the agreed Climate Policy. According to the emission projections, a 34 % reduction in greenhouse-gas emissions (by comparison with 2005) will be achieved through the implementation of the policies and measures contained in the Draft National Plan. Emission projections have been updated for the purpose of preparing the Draft National Plan and are consistent with these energy projections. These projections are prepared on a two-year basis.

Decarbonisation also includes renewable energy sources. An EU-wide target by 2030 of 32 %, expressed as a share of renewable sources in gross final energy consumption, was agreed. The recast of the Renewable Energy Directive furthermore includes requirements for sub-targets in heating and cooling and in transport. The Czech Republic proposes a 20.8 % contribution to the European target by 2030 – an increase of 7.8 percentage points by comparison with the Czech national target of 13.0 % for 2020. The average year-on-year growth of RES share in heating and cooling is proposed at 0.8 %. In transport, the target is set as binding on all Member States at 14 %. The main policies for fulfilling the proposed contribution include those laid down in the draft amendment to Act No 165/2012 on supported energy sources, which sets out a new support scheme after 2020. However, this proposal has not yet passed through the entire legislative process. Other policies beyond the scope of the proposed amendment to the law will also be important to meet the proposed RES contribution.

In energy efficiency, there are three targets for the period 2021–2030: (i) an indicative target for the size of primary energy sources, final consumption and energy intensity; (ii) a binding energy-savings target for public-sector buildings; (iii) a binding year-on-year rate of final consumption savings. These targets correspond to Articles 3, 5 and 7 of the Energy Efficiency Directive. The aim of the Czech Republic is to reach primary energy sources at the level of 1 727 PJ in 2030, final consumption at the level of 990 PJ and energy intensity of GDP at the level of 0.157 MJ/CZK. On the basis of the projected energy performance of central institution buildings in 2020, the Czech Republic set its commitment to energy savings in the low energy performance buildings of these institutions at 124 TJ, in accordance with the rules of the Energy Efficiency Directive. Furthermore, in accordance with Article 7, a commitment of cumulated energy savings of 462 PJ was set on the basis of the available EUROSTAT data and the consumption forecast in 2018 and 2019. The commitment in Articles 5 and 7 is preliminary and will be recalculated on the basis of current data available in 2020. In order to meet its energy-efficiency targets and commitments, the Czech Republic will continue to use economic measures including state aid, legislative measures and measures in the field of education and consultancy.

In the field of energy security, the Draft National Plan is based mainly on the targets and policies contained in the approved Czech Republic's State Energy Policy. As regards the dimension energy security, there are no EU-level targets, although there are a number of requirements arising from European legislation, for example from the Regulation concerning measures to safeguard the security of gas supply. The main objectives can be described as increasing the diversification of the energy mix, maintaining self-sufficiency in electricity consumption, ensuring sufficient development of energy infrastructure and no significant increase in import dependence. However, import dependence is very likely to gradually increase owing to a decrease in the use of domestic brown and black coal and the related increase in imported energy commodities.

With regard to the dimension internal energy market, the achievement of 15% electricity interconnection by 2030 is crucial. The Czech Republic aims to maintain the import and export capacity of the transmission system for 2030 in proportion to the maximum load of at least 30 % and 35 %, respectively, which corresponds to the 15 % target in terms of installed capacity. The Czech Republic’s interconnection is already almost 30 %, so the Czech Republic does not consider it necessary to introduce further specific policies in this area. Energy market integration and infrastructure development are already significantly harmonised at EU level. Further harmonisation is clearly provided by European legislation, which also includes most of the information and planning obligations, such as the obligation to prepare ten-year network development plans for transmission systems. The Draft National Plan describes the current situation and the expected development of market integration and energy infrastructure. Therefore, the Draft National Plan does not introduce any other specific policies or obligations beyond the ones already approved.

The fifth dimension of the Energy Union is research, innovation and competitiveness. In this regard, the Czech Republic has not set any specific quantifiable targets in public research, development and innovation that are specifically related to the Energy Union. However, research, development and innovation in sustainable energy is one of the priority areas of key strategic documents such as the National R&D Strategy for Smart Specialisation and the National Priorities for Research, Experimental Development and Innovation. In the development of priorities in this area, the Czech Republic also seeks to take into account the priorities at EU level, especially the priorities of the European Strategic Energy Technology Plan. It is not possible to precisely determine the exact level of public funding of research, development and innovation for low-carbon technologies. However, the Draft National Plan shows the estimate of public finances allocated to the energy sector.

The Draft National Plan was discussed with other ministries and other key stakeholders in the period from 21 December 2018 to 10 January 2019. The Draft was also published for public comment. A fairly large number of comments were made in the public consultation. Owing to the deadline laid down in the Regulation for the submission of the Draft National Plan, it was not possible to properly address all the comments submitted. Thus, the material had to be submitted to the Government at its meeting without incorporating all of the comments made. All of the comments will be duly addressed during the finalisation of the National Plan, and the Czech Republic asks the European Commission to take into account this national process of approval and discussion of this important strategic document.

Section A: National Plan

Contents

Introduction

The Draft National Energy and Climate Plan of the Czech Republic (hereinafter the 'National Plan') was prepared on the basis of the Regulation of the European Parliament and of the Council on the governance of the Energy Union and climate action[1], the proposal of which was presented in the legislative package entitled 'Clean Energy for All Europeans', which was published by the European Commission on 30 November 2016.

As regards the negotiation of the Regulation on the Governance of the Energy Union and Climate Action itself, on 29 June 2018 the text of the proposal by the EU Council, i.e. the Member States, adopted as part of 'trialogues', was approved. Furthermore, the draft Regulation was approved on 13 November 2018 by the plenary of the European Parliament. On 3 December 2018, the draft was formally approved by the Council for Transport, Telecommunications and Energy. The Regulation was published in the Official Journal of the European Union on 21 December 2018 and entered into force on 24 December 2018.

The obligation to prepare the National Energy and Climate Plan follows from Article 3 / Article 9 of the abovementioned Regulation. This document is a draft of the National Energy and Climate Plan of the Czech Republic pursuant to Article 9 of the Energy Union Governance Regulation. The structure of the National Plan is specifically prescribed by the annexes (namely Annex I) to this Regulation.[2]

The declared targets (purpose) of the National Energy and Climate Plan as well as the entire Energy Union governance system are: (i) to prepare and implement policies and measures designed to meet the targets of the Energy Union and the long-term Union greenhouse-gas emissions commitments, in particular the Union's 2030 targets for energy and climate; (ii) stimulate cooperation between Member States; (iii) greater regulatory and investor certainty based on covering all five basic dimensions of the Energy Union supported by planning documents and a robust and comprehensive analytical framework; (iv) effective opportunities for public participation; (v) a structured, transparent and iterative process between the Commission and the Member States; (vi) enhanced cooperation between energy and climate policy makers[3].

The submission of the draft National Plan will be followed by the so-called iterative process between the Czech Republic and the European Commission. Following this process, but also other requirements of the Energy Union Governance and Climate Action Regulation, such as regional consultations and public consultation, the draft National Plan will be finalised and submitted to the European Commission by the end of 2019.

The Draft National Plan has been consulted with other ministries and other key stakeholders in the period from 21 December 2018 to 10 January 2019. The Draft was also published for public comment. In the context of an external consultation process, approximately 220 major comments and 100

[1] The full title of the Regulation is as follows: REGULATION (EU) 2018/1999 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council

[2] The Annex to the Regulation prescribes level 1, 2, 3 (and, exceptionally, level 4) headings, but also subsections with Roman numerals. Save for exceptions, the level 4 headings are not based on the requirements of Annex I and have been added to improve the structure of the text.

[3] The above targets were formulated on the basis of information from the European Commission.

recommendations were received. About 500 comments were received in the public consultation within the given deadline. Owing to the deadline for the submission of the Draft National Plan given by the Regulation, it was not possible to properly address all the comments submitted. Thus, the material had to be submitted to the Government at its meeting without incorporating all of the comments made. All of the comments will be duly addressed during the finalisation of the National Plan, and the Czech Republic hereby asks the European Commission to take into account this national process of approval and discussion of this important strategic document.

Section A: National Plan

1 Overview and process for establishing the plan

1.1 Executive summary

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

1.1.1.1 Political context

The Czech Republic is a stable democratic State, a member of the UN, OECD, EU and NATO and other international organisations. The Czech Republic has a directly elected President and a bicameral Parliament, which consists of the Senate and the Chamber of Deputies.

As part of self-government, the Czech Republic is divided into 14 self-governing regions, 76 districts and more than 6 200 self-governing municipalities. Municipalities and regions are managed by elected assemblies. Regions are headed by governors, statutory cities by statutory mayors (*primátor*) and cities and municipalities by mayors (*starosta*). Prague has a special status, being simultaneously a region, statutory city and the capital.

1.1.1.2 Economic context[4]

Currently, the Czech Republic is undergoing a phase of economic growth, particularly owing to the growth of domestic demand, but also owing to net exports and increased private investment. Household consumption has been boosted by labour-market developments, rising disposable income and a high level of consumer confidence. From a sectoral point of view, industry contributed most to the growth of real gross value added, which reflects its higher volatility during the economic cycle and the structure of the Czech economy. However, other economic sectors also saw an increase in gross value added.

Over the next few years, real GDP is expected to grow at just under 2.5 %. Economic growth should be driven almost exclusively by domestic demand, including both consumption (particularly private) and investment by companies and the government. This growth structure can be considered healthy. Shortage of labour is becoming a constraint to faster economic growth owing to the tightness of the labour market.

Economic growth in the Czech Republic should be faster than in the euro area, which should lead to a continued increase in the Czech Republic's relative economic level. The expected medium-term trend towards increased wage dynamics and exchange-rate appreciation after the Czech National Bank (CNB) abandoned the exchange-rate floor should be reflected in an increase in the comparative GDP price level. In terms of the price competitiveness of the Czech economy, however, the expected increase should not be problematic.

Inflation is estimated to remain within the tolerance band of around 2 % of the CNB's inflation target for the period 2018–2021. An increase in unit labour costs and growth in domestic demand in the

[4] This information is based on documents from the Ministry of Finance prepared in May 2018. The figures below are then based on documents from the Ministry of Finance prepared in July 2018, which leads to partial inconsistency. The text and numeric values in this chapter will be aligned to match the July economic forecast.

context of a positive output gap should have inflationary pressure, while exchange rate appreciation will have the opposite effect on consumer prices. Higher inflation will result in slower growth of real wages and thus household consumption. In the labour market, the economic boom is reflected in the dynamic development of all important indicators, which confirms that the economy is at full employment.

In some professions and regions, the gap between job demand and supply is already significant. Shortage of labour may hinder production growth, forcing some businesses to reject new orders. On the other hand, it contributes to better use of labour, higher wages and hence household consumption. It can also motivate businesses to invest in machines and equipment that increase labour productivity.

In the short term, the labour shortage can be partly mitigated by the involvement of ‘discouraged persons’ (those economically inactive but willing to work), or by facilitating the employment of foreigners from non-EU countries. In the medium and long term, it will be important for economic growth to ensure that the education system better prepares graduates, allowing them to acquire the competencies and skills required to perform certain professions in the context of the digitisation and automation of the economy, including those that are yet to be created. On the demand side of the labour market, it will be necessary to modernise production and other procedures, thus reducing the labour intensity.

In terms of the external macroeconomic balance, the current account balance has been positive since 2014. Surplus balance of goods and services exceeds the deficit of primary income, which is most affected by the outflow of foreign direct investment in the form of dividends and reinvested profits. The current account balance should continue to show a slight surplus in the following years.

Although the expected economic developments are associated with positive expectations, they also involve risks. The economic prospects of our major business partners are further improving. Many ‘soft indicators’ in the euro area as a whole and in its major economies are close to historical or multi-year highs. Economic developments in the euro area could be even more favourable than expected, which could considerably benefit the highly export-oriented economy of the Czech Republic.

In this respect, the risks involve the tendency to increase protectionism – although the Czech Republic trades mostly with other EU states, although indirect exposure to some non-EU countries may be significant. Another risk is the form of the future relationship between the United Kingdom and the EU in relation to the free movement of goods and services.

In the longer term, significant risks include the loss of the EU budget revenues from the United Kingdom, as well as the new allocation linked to the higher relative economic development of the Czech regions and the possible redirection of funds in the EU budget to other priorities.

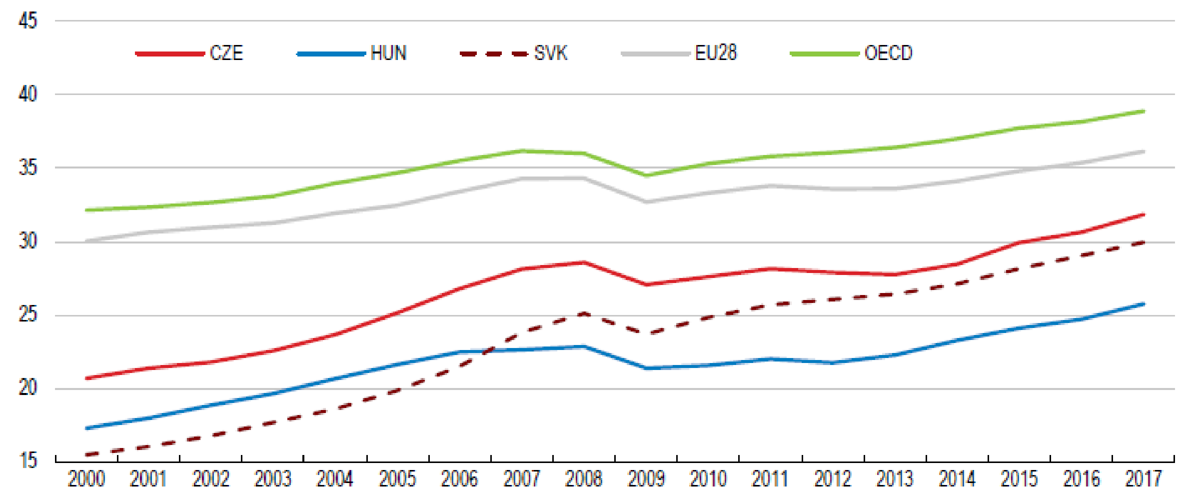
Table 1: *Economic context*

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
								Predikce	*Predikce*	*Výhled*	*Výhled*
Hrubý domácí produkt	*mld. Kč, b.c.*	4 060	4 098	4 314	4 596	4 773	5 055	5 320	5 596	5 840	6 094
Hrubý domácí produkt	*růst v %, s.c.*	-0,8	-0,5	2,7	5,3	2,6	4,4	3,6	3,3	2,6	2,4
Spotřeba domácností	*růst v %, s.c.*	-1,2	0,5	1,8	3,7	3,6	4,0	4,3	4,1	2,9	2,6
Spotřeba vlády	*růst v %, s.c.*	-2,0	2,5	1,1	1,9	2,0	1,5	1,9	2,0	1,8	1,8
Tvorba hrubého fixního kapitálu	*růst v %, s.c.*	-3,1	-2,5	3,9	10,2	-2,3	5,4	5,7	4,4	3,0	2,8
Příspěvek zahr. obchodu k růstu HDP	*proc. body, s.c.*	1,3	0,1	-0,5	-0,2	1,2	1,0	-0,2	-0,1	0,1	0,2
Příspěvek změny zásob k růstu HDP	*proc. body, s.c.*	-0,2	-0,7	1,1	0,8	0,0	-0,1	0,0	0,0	0,0	0,0
Deflátor HDP	*růst v %*	1,5	1,4	2,5	1,2	1,2	1,4	1,5	1,8	1,7	1,9
Průměrná míra inflace	*%*	3,3	1,4	0,4	0,3	0,7	2,5	2,1	1,9	1,8	1,8
Zaměstnanost *(VŠPS)*	*růst v %*	0,4	1,0	0,8	1,4	1,9	1,6	0,7	0,2	0,2	0,1
Míra nezaměstnanosti *(VŠPS)*	*průměr v %*	7,0	7,0	6,1	5,1	4,0	2,9	2,4	2,3	2,3	2,3
Objem mezd a platů *(domácí koncept*	*růst v %, b.c.*	2,6	0,5	3,6	4,8	5,8	8,3	7,7	6,5	5,5	5,4
Poměr salda BÚ k HDP	*%*	-1,6	-0,5	0,2	0,2	1,6	1,1	0,4	0,2	0,3	0,5
Předpoklady:											
Směnný kurz CZK/EUR		25,1	26,0	27,5	27,3	27,0	26,3	25,1	24,7	24,3	23,9
Dlouhodobé úrokové sazby (10 let)	*% p.a.*	2,7	2,2	1,4	0,6	0,4	1,0	1,9	2,2	2,6	2,9
Ropa Brent	*USD/barel*	112	109	99	52	44	54	65	61	59	57
HDP eurozóny (EA19)	*růst v %, s.c.*	-0,9	-0,2	1,3	2,1	1,8	2,3	2,3	1,8	1,8	1,7

Hrubý domácí produkt – Gross domestic product
mld Kč b.c.- CZK billion, current prices
růst v %, s.c. – growth in %, constant prices
Spotřeba domácností – household consumption
Spotřeba vlády – government consumption
Tvorba hrubého fixního kapitálu - Gross fixed capital formation
Proc. body, s.c. – percentage points, constant prices
příspěvek zahraničního obchodu k růstu HDP - contribution of foreign trade to GDP growth
příspěvek změny zásob k růstu HDP – contribution of inventory change to GDP growth
deflátor HDP – GDP deflator
Průměrná míra inflace - Average inflation rate
Zaměstnanost (všps) – Employment (LFS)
Míra nezaměstnanosti (všps) – unemployment rate (LFS)
Průměr v % - average in %
Objem mezd a platů (domací koncept) – Volume of wages and salaries (national approach)
poměr salda Bú k HDP - ratio of CA to GDP
Předpoklady – Assumptions
Směnný kurz CZK/EUR – CZK/EUR Exchange rate
Dlouhodobé úrokové sazby (10 let) - Long-term interest rates (10 years)
Ropa Brent – Crude oil Brent
USD/barrel
HDP eurozóny (EA19) – Euro area GDP (EA19)
Predikce – Prediction
Výhled - Outlook

Source: Ministry of Finance of the Czech Republic

Chart 1: *Comparison of the developments in GDP per capita (2010 prices, in USD thousand, PPP)*



Source: OECD Economic Survey of the Czech Republic (July 2018)

1.1.1.3 Environmental context

Over the past 20 years, the environment has significantly improved in terms of emissions of airborne dust and sulphur and nitrogen oxides in large and medium-sized combustion sources. However, it is still not satisfactory, particularly in terms of air pollution by substances posing health risks, and in affected areas it poses serious risks to human health and ecosystems and causes premature deaths and other economic damage. The situation is unsatisfactory in almost every municipality of the Czech Republic owing to emissions from domestic coal burners and in all cities owing to emissions from diesel and petrol engines. As a result, a significant majority of the population of the Czech Republic is affected.

The main risks to maintaining or further improving the environment are changes in the landscape related to the development of settlements (expansion of developed area, changes in the functional use of the area) and the developing road infrastructure, increased traffic intensity, intensive farming practices and finally consumption behaviour of households and individuals (heating, consumption of natural resources, etc.). The developments in environmental pressures will depend heavily on the performance of the economy in the next 10 years, with the specific load per unit of economic output to continue to gradually decline. An important aspect for improving the consumption behaviour of households is to promote increased consumer awareness of sustainable consumption and production and the impact of high consumption of people regardless of the limited supply of resources.

The development of anthropogenic loads and the state of the environmental elements can be influenced by the changing climate and the associated change in temperature and rainfall regime. It can be assumed that this mechanism will affect the total emissions from electricity and heat generation, distribution pattern of pollutants and air quality, the quality and quantity of surface water and groundwater, biodiversity and state of forest land, soil quality, the spread of harmful organisms in agriculture and the related consumption of agrochemicals. Overall, we are likely to see an increase in extreme nature of climate, consisting of more frequent occurrences of hazardous hydrological and weather phenomena such as floods, droughts, strong winds, temperature fluctuations, etc.

Model simulations expect a continuing gradual increase in average annual temperature by 0.3°C per decade. The total annual precipitation will not change significantly, but we will see increased fluctuations in total precipitation both on year-on-year basis and during the year, as well as the rainfall distribution in our territory to become more uneven. Changes in landscape use may lead to higher risk of water and wind erosion and reduced retention of the landscape, making it more vulnerable to floods owing to the expected more frequent torrential rainfall. Similarly, more frequent droughts are expected, owing to both lack of precipitation ('meteorological drought') and increased evaporation owing to high temperatures ('agricultural drought').

GHG emissions declined by 34.7 % between 1990 and 2016. However, in comparison with the EU, the Czech Republic has higher specific GHG emissions per capita (12.4 tons of CO_2 eq. per capita by comparison with 8.7 tons of CO_2 eq. per capita in the EU). On the other hand, the Czech Republic has a below-average share of transport in total European GHG emissions, currently at around 14 %, although it can be expected to increase. The emission intensity of GDP is higher in the Czech Republic by comparison with the EU average, owing to the higher share of industry in the GDP and the higher emission intensity of transport.

The above-the-threshold concentrations of PM10, which affect a large share of the population, continue to be a significant problem (the emission limit for the 24-hour average concentration of

PM10 was exceeded on 8.3 % of the territory in 2017, with the above-the-threshold concentrations affecting 23.1 % of the Czech population). As a result of PM10 air pollution, there may be an increase in the incidence of allergic diseases in children, as well as in an increase in respiratory and cardiovascular diseases or even premature deaths, especially in elderly and chronically ill people. Non-compliance with the target emission limits for benzo(a)pyrene and ground-level ozone also continues to be a problem. An important role in air quality is also played by poor dispersion conditions.

By 2020, particulate matter emissions of PM2.5, SO2, NOx, volatile organic compounds (VOC) and NH3 will decrease. The obligation of the Czech Republic to reduce the emissions of these pollutants is laid down in Directive 2016/2284 of the European Parliament and of the Council on the reduction of national emissions of certain atmospheric pollutants. It lays down the national commitments for 2020 and for 2030. According to Annex 2 of the Directive, the Czech Republic is obliged to reduce emissions of selected pollutants by comparison with the reference year 2005 as follows: for PM 2.5 by 17 % for 2020 and by 60 % for 2030; for SO_2 by 45 % for 2020 and by 66 % for 2030; for NOx by 35 % for 2020 and 64 % for 2030; for VOC by 18 % for 2020 and by 50 % for 2030; for NH3 by 7 % for 2020 and by 22 % for 2030. The quality of water in watercourses progressively improves, mainly owing to the decrease in the amount of discharged pollution from point sources. An important factor affecting water quality is the share of the population connected to water supply and sewerage systems which lead to a waste water treatment plant; their number has increased almost twice since 1990, with a particular increase in waste water treatment plants with tertiary treatment (removal of P and N). The requirements of Council Directive 91/271/EEC concerning urban waste-water treatment, which lays down an obligation to ensure that municipalities with more than 2 000 inhabitants are connected to waste water treatment plants, are not met only for a minor share of these municipalities. In 2017, 85.5 % of the Czech population was connected to the public sewer system and the share of connected population increased by 0.8 % year-on-year. By contrast, the Czech Republic is unsuccessful in limiting the extent of surface pollution, which mainly results from agricultural activity (the use of mineral fertilisers), which subsequently leads to the eutrophication of watercourses and reservoirs. An equally important aspect in assessing the state of water is its environmental value. In this respect, it is necessary to increase migration permeability and improve morphological conditions in watercourses, where appropriate and effective. Water quality problems do not only concern municipal water or pollution from agricultural sources, but also, for example, medicines that get through the sewerage into watercourses, where they negatively affect aquatic organisms and enter the food chains.

Owing to changes in landscape use and climate change, the resilience of ecosystems is diminishing, which results in the unfavourable state of a number of wild species of plants and wild animals (including the species of plants and animals of Community importance) and the reduced ability to eliminate or absorb external influences, including the spread of non-native species and harmful organisms. The decline in ecosystem resilience is mainly owing to the persisting consequences of intensified agriculture in the second half of the 20th century, accompanied by the unification of land affected by such agriculture, the persisting significant share of forests which are unbalanced in terms of species, age and spatial structure, persisting degradation of forest soils polluted by emissions, regulation and fragmentation of watercourses and the increasing fragmentation of the landscape (owing to transport and construction). These reasons result in the decline of rare species and the reduction of the abundance and vitality of populations of common species, migration routes are disrupted and plants and animals are exposed to increased stress, while undesirable (non-native and invasive) species spread.

1.1.1.4 Social context

Inequality and poverty have been low in the last decade by comparison with other OECD countries. There are large regional disparities in poverty; there is a high level of poverty in the Northwest and the Moravian-Silesian regions, while at the same time the level of poverty is generally relatively low, reflecting the high wage margins owing to differences in qualifications and productivity across sectors. The largest economic inequality is in Prague, while the low-income population in Prague is doing relatively 'better' by comparison with people from 'peripheral' regions. In the northwest, the higher level of poverty is owing to the low wage/income of most workers.

ii. Overarching strategy covering all five dimensions of the Energy Union

The Strategic Framework Czech Republic 2030 can be considered as the overarching strategy covering all five dimensions of the Energy Union. This document defines the top-level targets for the development of the Czech Republic. The strategic framework links two fundamental concepts: sustainable development and quality of life. The Czech Republic 2030 constitutes a long-term framework for strategic planning in the State administration and allows the long-term objectives of the State administration to be communicated transparently to professionals and the general public. The Strategic Framework Czech Republic 2030 builds on the 2010 Strategic Framework for Sustainable Development. The Report on Quality of Life and its Sustainability is prepared every two years. Specific measures are then further elaborated in the implementation plan.[5]

In this respect, it is necessary to point out that the Strategic Framework Czech Republic 2030 is the top-level strategic document, which can be described as an overarching document covering all five dimensions of the Energy Union. At the same time, however, it should be noted that the document has a significantly wider scope and deals in general with sustainable development and quality of life, where the definition of an energy union can only be seen as one of the parts of this overall definition. Table 2 then shows other significant top-level strategic documents, both overarching and sectoral (including the aforementioned Strategic Framework Czech Republic 2030). However, the list is not exhaustive; it only shows the most important documents. The key strategies in energy and climate protection are further outlined in subchapters **Error! Reference source not found.** and 1.2.1.2.

Table 2: *Top-level strategic documents*

Strategic document	Brief description
Strategic Framework Czech Republic 2030	Top-level document, which defines top-level targets for the development of the Czech Republic. The document supersedes the Strategic Framework for Sustainable Development of 2010.
Regional Development Strategy of the Czech Republic 2014–2020 (RDS)	The basic strategic document in regional development. The RDS is a tool for implementing regional policy and coordinating the impact of other public policies on regional development. The RDS interconnects sectoral aspects (themes and priorities) with territorial aspects. It is a medium-term document, which

[5] For more information and relevant materials, see www.cr2030.cz.

	contains a long-term view of the Czech Republic's regional development (long-term vision) as well as short-term implementation steps.
Transport Policy of the Czech Republic for 2014–2020 with the Prospect of 2050	Transport is one of the very important sectors of the national economy, which affects virtually all areas of public and private life and the business environment. This sector is necessary for increasing the competitiveness of the Czech Republic. The document identifies the key issues of the sector and proposes measures to address them.
International Competitiveness Strategy of the Czech Republic 2012–2020	The strategy defines measures that should put the Czech Republic among the 20 most competitive economies in the world. The tools to achieve this include maintaining a long-term balanced public budget, improve and improved quality and better efficiency of public administration, modernised transport, energy and ICT infrastructure, creating a financially sustainable public healthcare model, optimised education system and the entire national innovation system as the main pillars of the development of knowledge society and economy, increased flexibility of the labour market and creating favourable conditions for the development of business and commercial activities.
National Research, Development and Innovation Policy of the Czech Republic 2016–2020	The National Research, Development and Innovation Policy of the Czech Republic 2016–2020 is the key strategic document at national level, which sets out guidelines for research, development and innovation and forms the basis for other related strategic documents of the Czech Republic. The document puts more emphasis on supporting applied research for the needs of the economy and the State administration, and identifies the key areas and research topics on which applied research should focus. The National Policy also proposes changes in the management and funding of science to produce more top-level scientific results and to engage companies more in R&D. The document has superseded the National Research, Development and Innovation Policy of the Czech Republic 2009–2015.
National priorities for research, experimental development and innovation	By its Resolution No 552 of 19 July 2012, the Government approved the National Priorities of Oriented Research, Experimental Development and Innovation. RDI priorities are valid for the period until 2030 with gradual progress. Within

	the defined 6 priority areas, there are 24 sub-areas with a total of 170 specific targets. The document contains a description of each of the priority areas and sub-areas, indicating links between the areas and defining several system measures. The document also contains a statement on the expected allocation of RDI expenditures from the State budget to individual areas and defines the period during which the progress towards and the update of the priorities will be evaluated.
National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (RIS3 Strategy)	The purpose of the National RIS3 Strategy is to effectively focus European, national, regional and private funding on priority innovation specialisations in order to fully exploit the Czech Republic's knowledge potential.
National Initiative Industry 4.0	The document aims to mobilise key sectors and industry representatives to develop detailed action plans in areas of political, economic and social life. Reducing energy and raw material intensity of production, increasing productivity in production, optimising logistics routes, technology solutions for decentralised energy production and distribution systems and smart city infrastructure are the major benefits of Industry 4.0.
Raw material policy in the field of minerals and their sources	Raw material policy was updated in 2017. The document responds to the transformation of the raw material industry, especially as regards the range of raw materials required by modern industry. There has been a major shift towards modern high-tech raw materials which are used in electronics and other modern industries. The document reflects the principles of the EU Raw Materials Initiative, which was created in relation to the increase in the importance of raw materials security of EU Member States.
Czech Republic's State Energy Policy (SEP)	Top-level strategic document for the energy sector. It was approved in May 2015. The current SEP has an outlook until 2040.
State Environmental Policy of the Czech Republic 2012–2020	The State Environmental Policy of the Czech Republic 2012–2020 is an overarching strategic document, which defines the implementation of effective environmental protection in the Czech Republic. The main objective is to ensure a healthy and quality environment for people living in the Czech Republic, to contribute to the efficient use of all resources and to minimise the negative impacts of human activity on the environment, including cross-border impacts,

	thus contributing to better quality of life in Europe and in the world.

Source: Prepared by MIT using publicly available information

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

Table 3 provides an overview table on reducing GHG emissions. Table 4 sets out targets for renewable energy sources. Table 5 then sets out energy-efficiency targets. The main targets of the other dimensions of the Energy Union (i.e. energy security, internal energy market and research, innovation and competitiveness) and policies and measures in all dimensions of the Energy Union are clearly described in the various parts of this document, so it is not easy to create an overview table with a 'reasonable scope' with this information.

Table 3: *Overview table of GHG reduction targets (by comparison with 2005)*

	2020	2030
Absolute terms	32 Mt CO_2eq.	44 Mt CO_2eq.
Relative terms	20 %	30 %

Source: Prepared by MIT for the purposes of the National Plan

Table 4: *Overview table of RES targets (share of RES in gross final consumption)*

	2020	2030
RES share	13 %	20.8 %

Source: Prepared by MIT for the purposes of the National Plan

Table 5: *Overview table of energy-efficiency targets.*

	2020	2030
Article 3 (non-binding target)	Final energy consumption: 1 060 PJ Primary energy consumption: 1 855 PJ	Final energy consumption: 990 PJ Primary energy consumption: 1 727 PJ Energy intensity of GDP: 0.157 MJ/CZK
Article 5 (binding target)	148.6 TJ	124 TJ
Article 7 (binding target)	Annual energy savings: 51.1 PJ Cumulated savings: 204.39 PJ	Annual energy savings: 84 PJ Cumulated savings: 462 PJ

Source: Prepared by MIT for the purposes of the National Plan

1.2 Overview of current policy situation

i. The national and European energy system and the policy context of the national plan

The policy context of the national plan is described in Chapter 1.1.1.1. The description of the European energy system and the policy context at EU level goes beyond the scope of this document and is dealt with in other documents specifically focused on this area.

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

1.2.1.1 Czech Republic's State Energy Policy and other strategic documents in the field of energy

The key strategic document, which contains policies and measures in the field of energy and, therefore, across all five dimensions of the Energy Union, is the State Energy Policy (SEP). Furthermore, territorial energy policies, which must be in line with the State Energy Policy, are also being prepared. These strategic documents are laid down in Act No 406/2000, on energy management, as amended (hereinafter ‘Act No 406/2000’). The State Energy Policy is adopted for a period of 25 years and is binding for the performance of State administration in the field of energy management. It is prepared by the Ministry of Industry and Trade, which evaluates it at least once every 5 years and informs the Government of the evaluation. In addition, it submits to the Government, by 31 December of each year, an evaluation of the progress towards the targets and measures laid down in the SEP. The current Czech Republic's State Energy Policy was approved by the Government on 16 May 2015 and has an outlook until 2040.

The long-term vision of the Czech Republic’s energy sector is a reliable, affordable and sustainable energy supplies for households and the economy. This vision is summarised into three top-level objectives of the Czech Republic’s energy sector: security – competitiveness – sustainability.

The SEP contains the following strategic energy priorities: (i) a balanced energy mix / transformation of the energy industry; (ii) energy savings and energy efficiency improvements; (iii) infrastructure development; (iv) research in the field of energy and industry, human resources; (v) energy security.

Furthermore, it contains the strategy for the development of major energy sectors and related areas, namely: electricity sector; gas sector; oil processing; heating sector; transport; energy efficiency; research, development, innovation and education; power engineering; external energy policy.

Table 6: *Strategic objectives of the State Energy Policy*

Security	Competitiveness	Sustainability
Maintain or increase contingency reserves	Maintain transmission capacity for export and import at a level of at least 30 % of the electricity system load	Reduce energy intensity of gross value added to EU-28 average
Reduce and sustain the diversification of primary energy sources below 0.25	Optimise discounted energy costs	Permanently reduce the total environmental burden in all components

Reduce and sustain the diversification of gross electricity generation below 0.35	Keep the energy prices at no more than 120 % of the OECD level	Optimise the use of land for energy while maintaining full food security
Reduce and sustain the diversification of imports below 0.30	Achieve and maintain the levels of final electricity and gas prices below EU-28 level	Permanently reduce the share of fossil fuels in primary energy consumption
Sustain import dependence at or below EU-28 level	Achieve and maintain the share of energy expenditure in total household spending as low as possible below 10 %	Reduce the electricity intensity of GVA and keep it below EU-28 level
Ensure that the N-1 criterion is met in the operation of the electricity system	Optimise the share of the energy sector in gross value added	Achieve full use of the economically efficient potential of RES in the Czech Republic
Ensure permanent self-sufficiency in electricity supply at a minimum level of 90 %	Reduce the share of energy imports in gross value added below 2010 levels	Keep electricity consumption per capita permanently below the EU28 average
Ensure performance appropriateness within -5 % to +15 % of the maximum electricity system load	Maintain positive total economic value added of the energy sector	Achieve 60 % of heat supply from heat supply systems from cogeneration and 20 % from RES
	Stabilise the effect of energy imports on the balance of payments	

Source: Czech Republic's State Energy Policy (2015)

The Czech Republic's State Energy Policy provides the intended energy mix using relative corridors for primary energy sources and gross electricity generation.

Table 7: *Share of individual fuels in total primary energy sources (excluding electricity)*

	2016 level	2040 target level
Coal and other solid non-renewable fuels	40 %	11–17 %
Oil and petroleum products	20 %	14–17 %
Gaseous fuels	16 %	18-25 %
Nuclear energy	15 %	25-33 %
Renewable and secondary energy sources	10 %	17-22 %

Source: Czech Republic's State Energy Policy (2015)

Table 8: *Share of individual fuels in gross electricity generation*

	2016 level	2040 target level
Coal and other solid non-renewable fuels	50 %	11-21 %
Nuclear energy	29 %	46-58 %
Natural gas	8 %	5-15 %
Renewable and secondary energy sources	13 %	18-25 %

Source: Czech Republic's State Energy Policy (2015)

Table 9: *Basic strategic documents in the field of energy*

Strategic document	Brief description
Czech Republic's State Energy Policy (SEP)	Top-level strategic document for the energy sector. It was approved in May 2015. The current SEP has an outlook until 2040.
National Action Plan for Smart Grids (NAP SG)	It was approved by the Czech Government on 4 March 2015. It focuses mainly on the strategy of network infrastructure development to ensure reliable and safe operation with the required development of distributed production
National Action Plan for Clean Mobility (NAP CM)	It is based on Directive 2014/94/EC of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure. The document is aimed at creating a strategic framework for developing clean mobility and providing for the necessary infrastructure.
National Action Plan for the Development of Nuclear Energy in the Czech Republic (NAP NE)	Approved by the Czech government in June 2015. The document is aimed at meeting the objectives of the SEP in the area of further development of nuclear energy.
National Renewable Energy Action Plan of the Czech Republic (NAP RES)	The last NAP RES was approved by the government on 25 January 2016. This document specifies measures and tools concerning RES. For the period after 2021, the NAP RES will be superseded by the National Plan.
National Energy Efficiency Action Plan of the Czech Republic (NAP EE)	The National Energy Efficiency Action Plan describes the planned energy efficiency improvement measures and expected or achieved energy savings, including those in the supply, transmission and distribution of energy as well as energy end-use. For the period after 2021, the NAP EE will be superseded by the National Plan.
National Emission Reduction Programme of the Czech Republic	It is the basic strategic document on the air quality improvement and reduction of emissions from air pollution sources. The document was approved on 2 December 2015 by a resolution of the Government of the Czech Republic. This document is currently being updated.
Action Plan for Biomass in the Czech Republic 2012–2020	The aim of this document is primarily to define the measures and principles which will lead to the effective and efficient utilisation of the biomass energy potential and thus help to fulfil

	the obligations of the Czech Republic for the generation of energy from renewable sources by 2020. The document was approved by the government on 12 September 2012.
Raw material policy in the field of minerals and their sources	On 14 June 2017, by Resolution No 441 of 14 June 2017, the Government of the Czech Republic discussed and approved the document entitled ‘Raw Materials Policy of the Czech Republic in the Field of Minerals and their Sources’. This has completed the process of updating the Czech State raw materials policy, which has been running continuously since 2012, with the actual approval process lasting almost a year and a half.

Source: Prepared by MIT using publicly available information

1.2.1.2 Climate Policy and other strategic documents in the field of climate protection

The Climate Policy in the Czech Republic represents a strategy until 2030 as well as a low-emission economy development plan until 2050. It focuses on measures to reduce greenhouse-gas emissions and is thus complementary to the approved Strategy on Adaptation to Climate

Change in the Czech Republic, which focuses on the issue of adaptation to climate change. The Climate Policy follows on from the Czech Republic's State Energy Policy and takes up and develops a number of its measures in the field of energy. In doing so, it is based on the so-called optimised SEP scenario. However, it also contains a whole range of new policies and measures focused on sectors outside EU ETS.

The Climate Policy in the Czech Republic sets the main targets in reducing greenhouse-gas emissions and sets long-term indicative targets (see Table 10).

Table 10: *Summary of targets of the Climate Policy in Czech Republic*

Target horizon	Target description
Main target by 2020	By 2020, reduce emissions of the Czech Republic by at least **32 Mt CO_2 eq.** by comparison with 2005 (corresponding to a reduction of **20 % by comparison with 2005**).
Main target by 2030	By 2030, reduce emissions of the Czech Republic by at least **44 Mt CO_2 eq.** by comparison with 2005 (corresponding to a reduction of **30 % by comparison with 2005**).
Indicative target by 2040	Approach the indicative level of **70 Mt CO_2 eq.** of emissions in 2040.
Indicative target by 2050	Approach the indicative level **of 39 Mt CO_2 eq.** of emissions in 2050 (corresponding to a reduction of **80 % by comparison with 1990**).

Source: Climate Policy in Czech Republic

Table 11 contains a list of other important strategic documents in the field of climate protection and reduction of pollutants.

Table 11: *Basic strategic documents in the field of climate protection and reduction of pollutant emissions*

Strategic document	Brief description
Climate Policy in the Czech Republic (CP)	The Climate Policy in the Czech Republic represents a climate strategy until 2030 as well as a low-emission economy development plan until 2050.
Strategic Framework Czech Republic 2030	Top-level document, which defines top-level targets for the development of the Czech Republic. The document supersedes the Strategic Framework for Sustainable Development of 2010.
State Environmental Policy of the Czech Republic 2012–2020	It defines a plan to implement effective environmental protection in the Czech Republic by 2020.
Strategy on Adaptation to Climate Change in the Czech Republic	Approved in October 2015; it builds on the National Action Plan for Adaptation to Climate Change.
National Action Plan for Adaptation to Climate Change	It builds on the 2015 strategy; it contains specific implementation measures, including the responsibilities of individual ministries and the deadlines for the proposed tasks.
National Emission Reduction Programme of the Czech Republic	It is the basic strategic document on the air quality improvement and reduction of emissions from air pollution sources. The document was approved on 2 December 2015 by a resolution of the Government of the Czech Republic. This document is currently being updated.

Source: Prepared by MIT using publicly available information

iii. Key issues of cross-border relevance

Among the key issues of cross-border relevance are, in general, (i) major strategic documents that are subject to international strategic impact assessment (SEA); (ii) major infrastructure projects, in particular cross-border interconnection in the field of electricity transmission, transmission of gas and oil and petroleum products, as well as the construction of major production sources or sources located close to the border with the neighbouring state (these projects are predominantly subject to the international EIA); (iii) transnational cooperation in the field of science and research; (iv) other activities that may have an impact on another Member State.

iv. Administrative structure of implementing national energy and climate policies

As regards the administrative structure for implementing national energy and climate policies, an important role is played by the Ministry of Industry and Trade (which is the central State administrative body in the field of energy) and the Ministry of the Environment (which is the central State administration body in the field of climate policy). These ministries are responsible for preparing legislation in the above-mentioned areas and also non-legislative strategic materials. Legislative and non-legislative measures are specified within the Czech Government's 'legislative' or 'non-legislative' plan. Measures and policies pass through a standard legislative process, with gradual involvement of the Czech Government, the Chamber of Deputies, the Senate and the Czech President. Non-legislative documents are approved by the Czech Government, which adopts the relevant resolutions specifying concrete tasks stemming from a given resolution. The preparation of top-level strategic documents, their content and their binding nature are in most cases laid down in legislation. The obligation to prepare, the mandatory elements and the binding nature of the State Energy Policy are, for example, laid down in Act No 406/2000 on energy management.

1.3 Consultations and involvement of national and EU entities and the outcome thereof

i. Involvement of a national parliament

Detailed information on the involvement of the Czech Parliament will be added to the final version of the National Plan.

According to the standard procedure, all strategic materials must be approved (or acknowledged in the case of proposals) by the government of the Czech Republic before they are sent to the European Commission. The Government meeting is in this case preceded by a consultation process in which the relevant stakeholders may comment on the document and all the comments received are generally addressed before the Government meeting. Owing to the timeframe for the preparing the Draft National Plan, it was not possible when the Regulation came into force on 24 December 2018 for this process to be carried out in the standard way. The Czech Government acknowledged the document on 28 January 2019 and decided that it had to be submitted to the European Commission's representatives. However, not all of the comments received could be properly addressed. Hence the comments will be duly addressed during the finalisation of the National Plan, and the Czech Republic asks the European Commission to take into account this national process of approval and national discussion of this important strategic document.

The direct involvement of the Czech Parliament is not common in the case of non-legislative documents. When the document is finalised, the potential involvement of the Czech Parliament will be clarified.

ii. Involvement of local and regional authorities

Detailed information on the involvement of local and regional authorities will be added to the final version of the National Plan.

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

The draft National Energy and Climate Plan was prepared with the participation of relevant professional bodies. During December 2018, specifically on Friday 21 December 2018, a formal external consultation process was launched with ministries and other bodies with the status of a commenting body. Also, on Friday 21 December 2018, the Draft National Plan was posted on the website of the Ministry of Industry and Trade[6] for public consultation, which goes beyond the requirement of Article 10 of the Energy Union Governance and Climate Action Regulation, which calls for a public consultation only when finalising the National Plan. Ten working days were assigned for the consultation of the document (the deadline for comments was therefore 10 January 2019 / 11 January 2019 for the public consultation), which is the standard deadline for comments for non-legislative documents. However, some commenting bodies and the public (notably non-profit organisations) stressed that the deadline for comments on such an extensive material should be longer than ten days.

In the context of an external consultation process, approximately 220 major comments and 100 recommendations were received. About 500 comments were received in the public consultation within the given deadline. In both cases, however, some comments are duplicated (especially in the case of the public consultation).

The most important comments include (without limitation): the ambition level, especially in the area of RES and the electricity sector; a comment on determining the contribution to the European RES target; transition to a different scheme concerning compliance with Article 7 of the Energy Efficiency Directive – the requirement for detailed discussion; the requirement to process additional analyses; the requirement to fill in some missing parts such as impact analyses; impacts on final customers and minimisation of State aid; insufficient public/private resources to meet the contributions in the plan; insufficient time to discuss and revise the document; inadequacy of measures and policies to achieve targets and their lack of specificity in some cases; statistical irregularities and inconsistencies; excessive scope of some parts and also the excessive briefness of some other areas; contradicting the development of some underlying trends and quantities; a requirement to emphasise the role of nuclear power to meet decarbonisation targets.

With regard to the public consultation, it was not possible to incorporate or explain the comments received within the given time. This consultation was seen as preliminary and the public will be consulted further during the finalisation of the National Plan in accordance with Article 10 of the Energy Union Governance and Climate Action Regulation. In this respect, account will also be taken of Act No 100/2001, on environmental impact assessment and primarily of the requirement to conduct a screening procedure. If a strategic impact assessment (SEA) is initiated, public engagement will take place under this Act.

Owing to the time limit, it was not possible to address all the comments from the external consultation process. These comments will be addressed when finalising the plan.

All comments received, both from the external and the public consultation process, are available upon request (in Czech) if requested by the European Commission.

iv. Consultations of other Member States

Consultations of other Member States can take place once the draft National Plan is finalised. The Czech Republic therefore assumes that consultations with neighbouring states and, if applicable, other countries will take place in parallel with the iterative process in the first half of 2019.

However, there were partial consultations of other Member States already during the preparation of the proposal in accordance with Article 12 of the Energy Union Governance and Climate Action

[6] The reference to the document for the purposes of public consultation: https://www.mpo.cz/cz/energetika/strategicke-a-koncepcni-dokumenty/navrh-vnitrostatniho-planu-v-oblasti-energetiky-a-klimatu-ceske-republiky--242761/

Regulation. In this respect, it is possible to mention especially the expert meeting of the representatives of the Visegrad Group countries (Czech Republic, Slovakia, Hungary, Poland), including the representatives of Austria, which was convened by Slovakia on 20 November 2018. This meeting was attended by representatives of the public administration, namely those responsible for the energy sector and climate protection. Both the practical aspects concerning the preparation of the National Plan and the preparation process were discussed. Subsequently, they discussed individual issues corresponding to the individual dimensions of the Energy Union, namely: (i) renewable energy sources; (ii) climate protection; (iii) energy efficiency; (iv) the internal energy market; and (v) energy security. Although it was not possible to exchange the National Plans during this expert meeting, the main aspects of the preparation, the positions on the main targets and the most important policies to meet these targets were discussed. The experts also discussed further steps and specific elements of the National Plan where there is space for further regional cooperation.

v. Iterative process with the Commission

The iterative process with the Commission will take place in accordance with the Energy Union Governance and Climate Action Regulation only after the Member State has submitted the draft National Plan. The Commission will examine the draft integrated national energy and climate plans and may issue recommendations to each Member State no later than six months before the deadline for submitting the integrated national energy and climate plans. The iterative process will thus take place in the first half of 2019. The summary and the results of the iterative process will therefore be added only to the final version of the National Plan.

1.4 Regional cooperation in preparing the plan

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

Elements subject to joint or coordinated planning with other Member States will be added to the final version of the National Plan.

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

The Czech Republic prefers ‘bottom-up’ approach to regional cooperation. The Czech Republic actively works with other Member States within different multilateral or bilateral platforms on the relevant issues – electricity, gas, research, development and innovation, etc.

The Czech Republic does not consider it effective to initiate a specific regional cooperation platform aimed at discussing the National Plan as a whole, also in view of the fact that the regional dimension is different for different issues. For example, in the electricity sector, a different cooperation platform is important for the Czech Republic than, for example, in the gas sector.

Nevertheless, after finishing the draft National Plan, the Czech Republic plans to approach the neighbouring states and, possibly, other Member States, share this draft and discuss the issue with them. In this respect, the Czech Republic plans to use the existing bilateral or multilateral platforms. The outputs from these consultations will then be briefly summarised in the final version of this plan.

2 National objectives and targets

2.1 Dimension decarbonisation

2.1.1 GHG emissions and removals [7]

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

The EU's climate and energy policy framework for 2030 sets the EU-wide target of achieving a GHG reduction of at least 40 % by 2030 by comparison with 1990. This target is further broken down to emission reduction in EU ETS and non-ETS sectors by 43 % and 30 %, respectively, by comparison with 2005.

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 established binding national targets for individual Member States for non-ETS sectors. The targets for individual Member States range from 0 to 40 % by comparison with 2005. The regulation sets for the Czech Republic a binding emission reduction target of 14 % by comparison with 2005 and a binding linear trajectory of its achievement starting on the average of its greenhouse-gas emissions for 2016, 2017 and 2018 and ending in 2030. The start of the linear trajectory of a Member State is either at five-twelfths of the distance from 2019 to 2020 or in 2020, whichever results in a lower allocation for that Member State The Regulation also sets out flexibilities that a Member State may use.

Annual emission allocations for each year between 2021 and 2030 will be set out in implementing acts in accordance with the Regulation. For the purposes of these implementing acts, the Commission will carry out a comprehensive review of the most recent national inventory data for the years 2005 and 2016 to 2018 submitted by Member States pursuant to Article 7 of Regulation (EU) No 525/2013.

The progress towards the EU's 2030 climate and energy policy framework now also includes emissions and sinks related to land use, land-use change and forestry (LULUCF). Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse-gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU sets out Member States' commitments and accounting rules applicable to emissions and sinks from the LULUCF sector. For the periods from 2021 to 2025 and from 2026 to 2030, taking into account the flexibilities, each Member State shall ensure that its emissions from all of the land use categories do not exceed GHG sinks.

For managed forest land, a special accounting category is set on the basis of a forest reference level. By 31 December 2018, Member States should submit to the Commission their national forestry accounting plans, including these reference levels. The Czech Republic has submitted to the European Commission the draft national plan including the forest reference level for the period 2021–2025 of 7 685.13 kt CO_2eq. Based on a comparison of this reference level with the LULUCF emission projection mentioned in Chapter 4.2.1, it is clear that the Czech Republic is unlikely to be able to use

[7] It is necessary to ensure consistency with long-term strategies under Article 15.

flexibility in accordance with Article 7 of Regulation (EU) 2018/842 of the European Parliament and of the Council to achieve its target for non-ETS sectors by 2030. Further information on the LULUCF sector in the Czech Republic, including information on existing and planned policies and measures, is provided in a report submitted by the Czech Republic to the European Commission in 2017 on the basis of Article 10 of Decision No 529/2013/EU of the European Parliament and of the Council. [8]

ii. Alternatively, other national objectives and targets consistent with the Paris Agreement and existing long-term strategies. If it is important in terms of contributing to the overall commitment of the Union to reduce greenhouse-gas emissions, or, where relevant, other targets, including any sectoral and adaptation targets

In March 2017, the Government of the Czech Republic adopted the Climate Policy in the Czech Republic, which represents a long-term strategy for the transition to a low-carbon economy and the contribution of the Czech Republic to achieving the targets of the Paris Agreement. As a long-term strategy of low-emission development, in line with Article 4 of the Paris Agreement, it was sent to the Secretariat of the United Nations Framework Convention on Climate Change on 15 January 2018.

It is a climate protection strategy by 2030, with a long-term outlook for the transition to a sustainable low-emission economy by 2050. It defines the main national climate protection targets and measures to ensure that the greenhouse gas emission reduction targets are met in response to the obligations under international treaties (the UN Framework Convention on Climate Change and its Kyoto Protocol, the Paris Agreement and the obligations under EU legislation).

Table 12: *Main targets and long-term indicative targets of Climate Policy in the Czech Republic*

Target horizon	Target description
Main target by 2020	By 2020, reduce emissions of the Czech Republic by at least **32 Mt CO_2 eq.** by comparison with 2005 (corresponding to a reduction of **20 % by comparison with 2005**).
Main target by 2030	By 2030, reduce emissions of the Czech Republic by at least **44 Mt CO_2 eq.** by comparison with 2005 (corresponding to a reduction of **30 % by comparison with 2005**).
Indicative target by 2040	Approach the indicative level of **70 Mt CO_2 eq.** of emissions in 2040.
Indicative target by 2050	Approach the indicative level **of 39 Mt CO_2 eq.** of emissions in 2050 (corresponding to a reduction of **80 % by comparison with 1990**).

Source: Climate Policy in Czech Republic

The Implementation of the Climate Policy in the Czech Republic will be evaluated by the end of 2021 and the first update is scheduled by the end of 2023 following the review of commitments under the Paris Agreement.

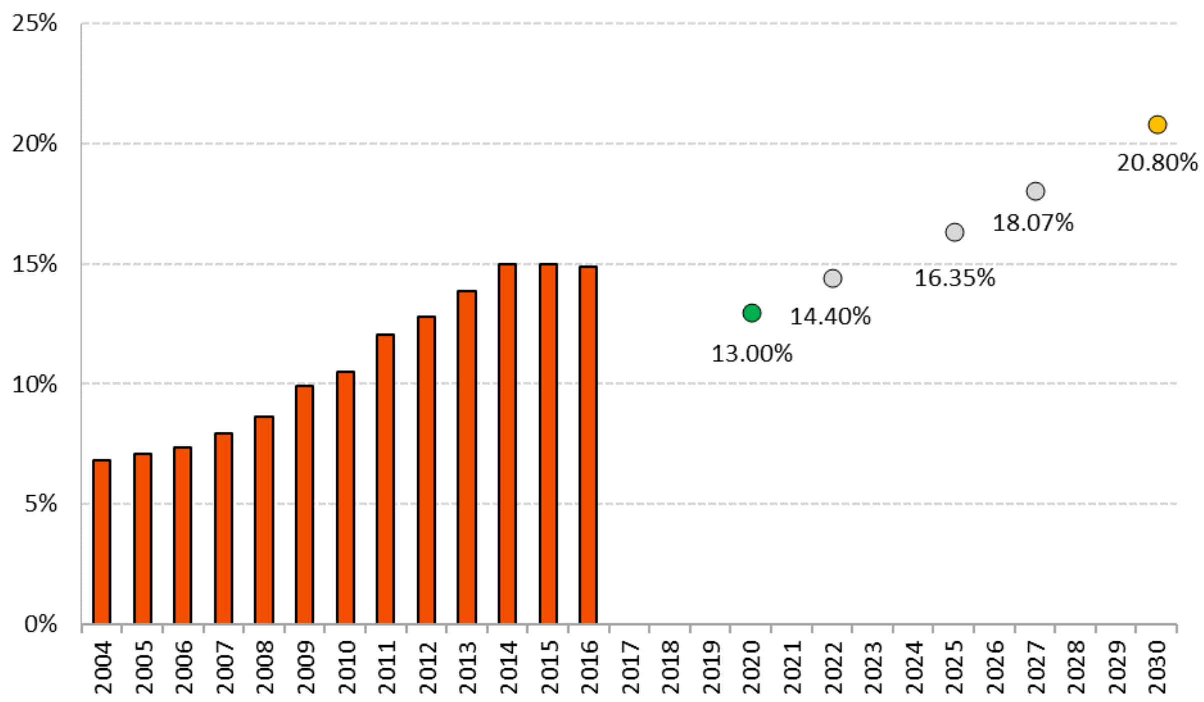
[8] The measures are available at: http://mzp.cz/cz/opatreni_v_ramci_lulucf

2.1.2 Renewable energy (2030 Framework target)

i. Elements under Article 4(2)(a)

The Czech Republic plans to achieve the RES share in gross final consumption at 20.8 % by 2030, which is an increase of 7.8 percentage points by comparison with the national target of 13.0 % for 2020. Thus, the 20.8 % share corresponds to the national contribution to achieving the binding EU target of 32.0 % by 2030, in line with Article 3 of the revised text of Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Pursuant to Article 4(2) of the Energy Union Governance and Climate Action Regulation, the Czech Republic pledges to achieve a share of 14.40 % by 2022, then 16.35 % by 2025 and 18.07 % by 2027.

Chart 2: *Proportional 2030 target by comparison with historical development (%)*



Source: Prepared by MIT for the purposes of the National Plan

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[9]

Table 13: *Developments in gross final consumption from RES by sectors for the purposes of determining the overall target (in TJ)*[10]

Final RES consumption	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity	33,247.7	35,065.1	35,869.6	36,460.1	36,998.0	37,103.7	37,350.6	37,430.8	37,163.1	36,977.8	36,869.5	37,177.9
Transport	14,197.3	20,398.5	20,612.3	21,123.0	21,927.6	22,635.4	23,472.2	24,544.1	26,086.1	27,513.1	29,036.9	30,511.0
Heating and cooling	117,220.8	127,351.1	131,818.6	135,814.6	140,697.1	143,593.0	146,854.9	150,327.5	153,579.2	157,035.0	160,072.1	164,483.4
Total	164,665.8	182,814.7	188,300.5	193,397.7	199,622.7	203,332.1	207,677.7	212,302.4	216,828.4	221,525.9	225,978.5	232,172.4

Source: Prepared by MIT for the purposes of the National Plan

Table 14: *Development of RES share in gross final consumption by sector (%)*[11]

RES share in consumption	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Electricity	13.6 %	14.0 %	13.9 %	14.1 %	14.3 %	14.4 %	14.5 %	14.5 %	14.3 %	14.2 %	14.2 %	14.2 %
Transport	6.4 %	8.8 %	7.8 %	8.1 %	8.6 %	9.0 %	9.5 %	10.3 %	11.3 %	12.1 %	13.1 %	14.0 %
Heating and cooling	19.9 %	22.0 %	22.8 %	23.7 %	24.6 %	25.3 %	26.0 %	26.8 %	27.5 %	28.3 %	29.0 %	30.0 %
Total	14.9 %	16.3 %	16.8 %	17.3 %	17.9 %	18.2 %	18.6 %	19.0 %	19.4 %	19.8 %	20.2 %	20.8 %

[9] The shares are calculated on the basis of the EUROSTAT methodology, which is currently used for expressing the RES targets. Unfortunately, the RES Directive has introduced a number of relatively fundamental changes in the calculation of the RES share and in this methodology. At the time of the preparation of the National Plan, neither the revised EUROSTAT methodology nor the calculation file was available to be able to verify how the changes in the Directive would be reflected in the calculation; this is also very problematic with regard to the comparability of individual values between Member States. The Czech Republic therefore made all the changes so that the calculation complies as closely as possible with the requirements of the Directive.

[10] The RES consumption for the calculation of the sectoral targets, which is shown below in the tables, and the RES consumption in the sector for the calculation of the overall target differ in accordance with the methodology.

[11] The methodology for determining RES share in gross final consumption is not entirely trivial. Other values are used to determine the sectoral shares and the total share in some cases; for example, values including and excluding multipliers were used for transport. There are also partial modifications to avoid double counting, for example with regard to the consumption of electricity in the transport sector. The overall denominator, i.e. 'gross final consumption', does not correspond to 'final consumption' within the energy balance, and there are some differences.

Source: Prepared by MIT for the purposes of the National Plan

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

Table 15: *Expected development of RES in the electricity production sector (in TJ)*

RES Consumption – electricity	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Non-household biomass	7,443.9	8,431.2	7,710.5	8,045.4	8,525.1	8,532.0	8,607.8	8,607.0	8,635.3	8,639.7	8,637.2	8,988.4
Hydropower plants	8,205.5	7,944.5	7,766.6	7,705.8	7,664.7	7,524.3	7,299.8	7,285.4	7,236.9	7,046.3	7,060.3	7,106.7
Biodegradable component of MSW	354.8	432.8	991.4	1,104.8	1,241.0	1,354.4	1,354.4	1,354.4	1,354.4	1,479.1	1,479.1	1,479.1
Biogas stations	9,320.5	9,469.5	9,411.0	9,393.9	9,109.6	8,937.2	8,970.0	8,542.8	7,831.2	7,161.0	6,423.6	5,683.0
Geothermal energy	0.0	152.1	152.1	152.1	152.1	152.1	152.1	278.1	309.6	341.1	372.6	404.1
Wind power plants	1,867.1	2,424.8	2,631.4	2,834.6	3,041.8	3,290.3	3,572.3	3,846.3	4,119.8	4,434.6	4,775.4	5,115.7
Photovoltaic power plants	7,673.2	8,050.8	8,076.0	8,112.0	8,169.6	8,256.0	8,374.8	8,526.0	8,713.2	8,936.4	9,195.6	9,490.8
Total	34,865.0	36,905.7	36,738.9	37,348.6	37,903.9	38,046.3	38,331.2	38,440.0	38,200.4	38,038.2	37,943.8	38,267.8

Source: Prepared by MIT for the purposes of the National Plan

Table 16: *Expected development of RES in the transport sector (in TJ)*[12]

RES consumption – transport	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1st generation biofuels	12,580.0	18,557.9	19,354.7	19,456.5	19,572.7	19,707.4	19,825.5	19,902.5	20,011.3	20,137.5	20,280.4	20,390.9
2nd generation biofuels (Part A)	0.0	0.0	276.5	555.9	1,398.1	1,970.7	2,832.2	4,264.8	6,575.1	8,630.4	10,864.5	13,108.5
2nd generation biofuels (Part B)	0.0	0.0	500.0	1,000.0	1,500.0	2,000.0	2,500.0	3,000.0	3,500.0	4,000.0	4,500.0	4,952.1
RES electricity	4,167.8	4,818.4	1,480.4	1,564.9	1,645.4	1,761.8	1,881.9	1,985.3	2,087.7	2,180.5	2,254.0	2,330.3
Total	16,747.8	23,376.3	21,611.6	22,577.3	24,116.2	25,439.9	27,039.7	29,152.5	32,174.1	34,948.4	37,898.9	40,781.9

[12] These values take account of multipliers, which are allowed by the RES Directive. For the period 2021–2030, multipliers were revised in line with the Directive.

Source: Prepared by MIT for the purposes of the National Plan

Table 17: *Expected development of RES in the heating and cooling sector (in TJ)*

RES consumption – H&C	2016	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Household biomass	75,545.0	79,669.9	80,968.4	82,258.9	83,542.1	84,818.5	86,088.9	87,354.2	88,615.5	89,879.4	91,150.0	92,434.1
Non-household biomass	26,631.0	29,415.5	30,052.6	31,519.8	33,614.4	33,900.9	34,836.0	35,097.3	35,220.6	35,269.5	35,318.5	36,723.2
Biodegradable component of MSW	2,418.0	2,690.9	4,701.7	5,110.2	5,600.2	6,008.7	6,008.7	6,008.7	6,008.7	6,457.7	6,457.7	6,457.7
Biogas stations	7,489.0	7,595.0	7,510.1	7,735.5	8,147.3	8,470.2	8,926.5	9,623.9	10,731.0	11,665.0	12,621.8	13,582.8
Heat pumps	4,441.8	6,621.2	7,166.0	7,710.8	8,255.6	8,800.5	9,345.3	9,890.1	10,435.0	10,979.8	11,524.6	12,069.5
Geothermal energy	0.0	310.0	310.0	310.0	310.0	310.0	310.0	960.0	1,122.5	1,285.0	1,447.5	1,610.0
Solar thermal collectors	787.0	1,048.6	1,109.8	1,169.4	1,227.5	1,284.2	1,339.5	1,393.3	1,445.9	1,498.6	1,552.0	1,606.1
Total	117,221.0	127,351.1	131,818.6	135,814.6	140,697.1	143,593.0	146,854.9	150,327.5	153,579.2	157,035.0	160,072.1	164,483.4

Source: Prepared by MIT for the purposes of the National Plan

Furthermore, the RES Directive sets an indicative target of the annual growth rate of RES share in the heating and cooling sector at 1.1 % as the average value in the period 2021–2030[13]. It is problematic for the Czech Republic to meet this indicative target, partly owing to the relatively high current RES share in the heating and cooling sector (almost 20 % in 2016). The above-mentioned trends correspond to the average annual growth rate of RES share in the heating and cooling sector of approximately 0.8 %. Achieving higher growth in this sector in the period until 2030 can be described as problematic, also owing to the potential for further development of individual RES sources, which has been carefully analysed within the preparation of the Draft National Plan.

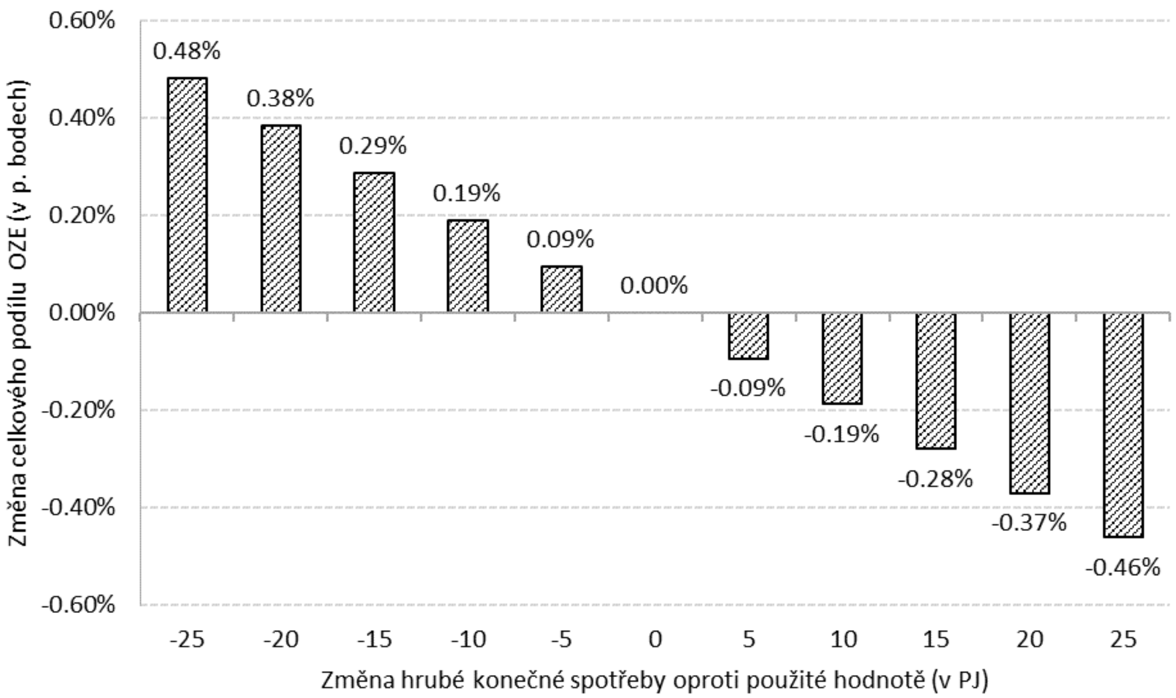
The values in the above tables are given in TJ, the values in ktoe are given in the analytical annexes to this document (specifically in Annex 2). The total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW will be added to the final version if possible (the divisions to modernisation may be problematic).

[13] I.e. it is the difference in the share in the heating and cooling sector in 2030 and in 2020 divided by the number of years of the reference period (10 years in this case).

The Czech Republic considers it very important to point out the inherent uncertainties of the outlook for the RES share in gross final consumption. It is a ratio indicator, the amount of which is therefore influenced not only by the development of the numerator but also by the development of the denominator. Developments in t final consumption/gross final consumption are affected by a number of significant uncertainties, from temperature conditions to economic growth (industrial production in a given year). Chart 3 presents the basic sensitivity analysis of the dependence of the total RES share on a change in gross final consumption. This also reflects the mutual interaction between RES and energy-efficiency targets. By way of background to these values, it is worth mentioning that in 2016 the contribution to the total share was 0.66 % for photovoltaic energy (with installed capacity of approximately 2 GW) and 0.16 % for wind energy (with installed capacity of 0.28 GW). It can be seen from the above that if we consider a possible deviation of final energy consumption (i.e. the denominator for the calculation of the RES share) of about -2.5 % to +2.5 % (which, in absolute value, is equivalent to a deviation of -25 to +25 PJ); the resulting deviation of the RES share would be -0.5 pp and +0.5 pp (by comparison with the reference value). The change in final energy consumption (denominator) by 5 PJ is therefore associated with a change in the RES share of approximately 0.1 pp and this relationship is basically linear.

The Czech Republic prefers to express the target as an interval, which allows partial uncertainties to be covered. However, this approach was not considered appropriate by the European Commission, particularly owing to the simplicity of assessing the contributions by individual Member States. Nevertheless, the Czech Republic considers it appropriate and important that this should be mentioned.

Chart 3: *Sensitivity analysis of the total RES share depending on a change in gross final consumption*



Změna celkového podílu OZE (v p. bodech) – Change in the total RES share (in percentage points)
Změna hrubé konečné spotřeby oproti použité hodnotě (v PJ) – Change in the gross final consumption by comparison with the value used (in PJ)

Source: Prepared by MIT for the purposes of the National Plan

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

Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport

Estimated trajectories on bioenergy demand are provided clearly in section iii of this Chapter (Chapter 2.1.2). In the electricity sector, bioenergy corresponds to the following items: biomass, biogas and municipal waste. It corresponds to biomass, biogas and municipal waste in the heating and cooling sector and biofuels and bio-methane in the transport sector. Below is information about biomass sources. The Czech Republic is currently a net exporter of solid biomass. Imports of solid biomass currently account for only a relatively small amount of total consumption. The trajectories shown in section iii do not account for the need for significant imports of solid biomass (for more information, see the analytical parts of this document). For more detailed information on the LULUCF sector, see Chapter 4.2.1.

Supply of biomass according to initial raw materials and origin

Agriculture

The area of arable land used for the cultivation of agricultural crops, including straw production, decreased by almost 260,000 ha in the Czech Republic between 2000 and 2017. By contrast, the area of permanent grasslands used for livestock grazing and hay production increased by about 140,000 ha in the same period. However, the total area of farmed agricultural land in the Czech Republic declined by more than 120 000 ha in the period 2000–2017 owing to the occupation of the agricultural land fund. That said, soil occupation has accelerated considerably in recent years, particularly for construction and other purposes (warehouses, shopping and entertainment centres, car parks, roads, civil engineering and industrial construction, mining of raw materials, especially sandy gravel, etc.). At present, about 15 ha of agricultural land is occupied daily, and given the continuing interest in infrastructure construction and construction plots, there is no indication that this trend of declining agricultural (and in particular arable) land has declined substantially.

Table 18: *State of farmed agricultural land in the Czech Republic, 2000–2017*

Rok	Zemědělská půda obhospo-dařovaná celkem	v tom									
		orná půda	z toho neosetá a úhor	chmelnice	z toho plodící	vinice	z toho plodící	zahrady	ovocné sady	trvalé travní porosty	ostatní trvalé kultury
Agrocenzus 2000	3 643 168	2 757 259	36 444	6 974	4 695	11 260	9 162	7 914	22 547	837 215	-
2002	3 652 028	2 767 052	83 149	8 203	6 148	11 869	9 985	5 068	20 990	838 846	-
2003	3 668 380	2 746 993	176 990	8 019	5 962	12 844	10 794	4 663	20 826	875 035	-
2004	3 631 423	2 718 879	54 539	7 720	5 873	17 394	13 029	4 331	24 984	858 115	-
2005	3 605 493	2 702 568	45 286	7 468	5 659	17 892	14 341	2 877	21 948	852 740	-
2006	3 565 982	2 628 763	43 743	7 176	5 460	17 649	15 627	2 326	20 678	889 389	-
2007	3 596 716	2 618 109	30 323	6 962	5 408	17 327	16 999	1 813	20 368	932 138	-
2008	3 571 594	2 592 152	23 377	6 672	5 345	16 799	16 403	1 779	21 140	933 052	-
2009	3 545 840	2 573 790	28 513	6 661	5 305	16 708	16 136	1 769	21 738	925 173	-
2010	3 523 857	2 540 471	45 047	6 479	5 238	16 686	16 033	1 351	22 776	936 095	-
2011	3 504 032	2 515 980	28 283	6 288	4 786	16 693	15 883	998	22 339	941 733	-
2012	3 525 889	2 513 380	32 847	5 985	4 435	16 648	15 696	1 371	20 769	967 736	-
2013	3 521 000	2 500 796	23 784	5 823	4 339	16 787	15 699	1 196	22 687	973 711	-
2014	3 515 555	2 488 740	22 002	5 748	4 472	16 946	15 810	666	22 949	980 506	-
2015	3 493 717	2 492 498	35 091	5 595	4 617	17 065	15 916	1 365	19 402	957 793	-
2016	3 488 788	2 494 021	30 167	5 603	4 783	17 088	15 896	748	20 802	948 566	1 958
2017	3 521 329	2 497 792	26 247	5 704	4 945	17 210	15 834	666	17 111	978 161	4 685

Rok – year
Agrocenzus – Agricultural census
Zemědělská půda obhospodařovaná celkem – Total farmed agricultural land
Orná půda – arable land
Z toho neosetá a úhor – of which non-sown and fallow
Chmelnice – hop gardens
Z toho plodící – of which those in production
Vinice – Vineyards
Zahrady – gardens
Ovocné sady – fruit plantations
Trvalé travní porosity – permanent grassland
Ostatní trvalé kultury – other permanent crops

Source: Czech Statistical Office

The current problem is also soil degradation, in particular erosion (water and wind), soil compaction, loss of humus, reduced water absorption capacity, etc. The total damage related to soil degradation is estimated at CZK 4 to 10 billion annually (loss of topsoil, reduction of yields, clogging of watercourses, damage to private and municipal property, etc.). In the Czech Republic, over 50 % of agricultural land is potentially threatened by water erosion and about 25 % by wind erosion. On some plots, farming methods to prevent soil erosion may involve, for example, the cultivation of certain crops only with the use of soil protection technologies, no cultivation of selected erosive crops, the obligation to grow multi-annual fodder crops such as clover and alfalfa or even the conversion of the respective soil blocks or their parts to permanent grassland.

Another issue is also the impact of climate change, which has recently been manifested, for example, by more frequent periods of agricultural drought, which reduce the yields of some commodities, thereby increasing the necessary crop area to ensure sufficient harvest of food commodities, feeds and bedding. Part of the land (especially of permanent grassland) is cultivated under the agri-environment-climate measures or falls within NATURA 2000, protected landscape areas, national parks or other types of specially protected areas where, owing to the protection of biodiversity or other specific requirements, intensive farming is impossible and lower production is to be expected.

Table 19: *Balance of sugar beet and selected cereals for the production of bioethanol fuel, 2011–2017*

	Unit	2011	2012	2013	2014	2015	2016	2017
Production of fuel bioethanol from[1])	t	54 412	102 195	104 488	104 112	104 715	115 575	**102 346**
– industrial sugar beet		54 412	69 920	80 852	66 000	56 819	69 763	**50 000**
– wheat		–	–	–	2 875	–	–	–
– grains of maize		–	32 275	23 636	35 234	47 896	45 812	52 346
Consumption of initial raw materials for bioethanol: – industrial sugar beet	t	636 620	818 064	945 968	772 200	664 782	816 227	**585 000**
– wheat		–	–	–	9 497	–	–	**–**
– grains of maize		–	103 603	75 872	113 101	153 746	147 057	168 031
Harvest areas of:[2]) – industrial sugar beet	ha	58 300	61 161	62 401	62 959	57 612	60 736	66 101
– wheat		863 100	815 381	829 393	835 941	829 820	839 710	832 062
– grain maize		109 700	119 333	96 902	98 749	79 972	86 407	85 995
Yield of:[2]) – industrial sugar beet	t/ha	66,84	63,26	60,00	70,28	59,38	67,81	66,56
– wheat		5,79	4,32	5,67	6,51	6,36	6,50	5,67
– grains of maize		8,12	7,78	6,97	8,43	5,54	9,79	6,84
Production of:[2]) – industrial sugar beet	t	3 899 000	3 868 829	3 743 772	4 424 619	3 421 035	4 118 356	4 399 521
– wheat		4 993 400	3 518 896	4 700 696	5 442 349	5 274 272	5 454 663	4 718 205
– grains of maize		890 500	928 147	675 380	832 235	442 709	845 765	588 105
Area of: – industrial sugar beet	ha	9 525	12 932	15 766	10 987	11 195	12 037	8 789
– wheat		–	–	–	1 459	–	–	–
– grain maize used for the production of bioethanol at a given yield		–	13 317	10 886	13 416	27 752	15 021	24 566
Share of areas of – industrial sugar beet	%	16,3	21,1	25,3	17,5	19,4	19,8	13,3
– wheat		–	–	–	0,2	–	–	–
– grain maize processed into bioethanol from the total area of these crops		–	11,2	11,2	13,6	34,7	17,4	28,6

[1]) Source: MIT - Eng (MIT) 6-12
[2]) Source: CZSO
Yield: Sugar beet - 11.70 kg per 1 kg of bioethanol. i.e. 9.1 kg per 1L of bioethanol
wheat (soft): 3.3 kg per 1 kg of bioethanol, i.e. 2.6 kg per 1L of bioethanol
grain of maize: 3.21 kg per 1 kg of bioethanol. i.e. 2.5 kg per 1L of bioethanol
...lu, tj. 9,1 kg na 1 l bioethanolu
pšenice (měkká): 3,3 kg na 1 kg bioethanolu, tj. 2,6 kg na 1 l bioethanolu
zrno kukuřice: 3,21 kg na 1 kg bioethanolu, tj. 2,5 kg na 1 l bioethanolu

Source: Ministry of Agriculture

This table shows the relatively variable yield of crops in individual years. For example, for grain maize there was a significant drop in harvest in 2017, when the production decreased by about 258 thousand tonnes by comparison with 2016, reaching 588 thousand tonnes. Compared with the 2016 harvest of 845.8 thousand tonnes, this is a significant drop in the production of this commodity. The reasons can be found primarily in unfavourable climatic conditions during June 2017, when maize suffered from severe drought, which resulted in a significant reduction in the yield per hectare. The table also shows a relatively low share of areas for sugar beet and grain maize processed for the production of bioethanol in transport to the total cultivated area of these crops.

Table 20: *Balance of crop areas and production of oilseed rape and the utilisation of rape for FAME production, 2011–2017*

	unit	2011	2012	2013	2014	2015	2016	2017
FAME production:[1])	t	210 092 197 492	172 729 159 979	181 694 181 694	219 316 217 315	167 646 167 646	148 832 148 432	157 429 152 291
Consumption of oilseed rape for FAME production[2])	t	487 805	395 148	448 784	536 768	414 086	366 627	376 159
Harvest area of oilseed rape[3])	ha	373 386	401 319	418 808	389 298	366 180	392 991	394 262
Oilseed rape yield[3])	t/ha	2,80	2,76	3,45	3,95	3,43	3,46	2,91
Oilseed rape production[3])	t	1 046 071	1 109 137	1 443 210	1 537 320	1 256 212	1 359 125	1 146 224
Oilseed rape area, at a given yield, intended for the production of FAME	ha	174 216	143 170	130 082	135 891	120 725	105 962	129 264
Share of areas of oilseed rape processed into FAME out of the total area	%	46,7	35,7	31,1	34,9	33,0	27,0	32,9

1) Source: MIT - Eng (MIT) 6-12
2) Source: VÚZT & SVB with regard to efficiency of rapeseed oil extraction and its reesterification, oilseed rape 2.55 kg per 1 kg of FAME
3) Source: CZSO

Source: Ministry of Agriculture

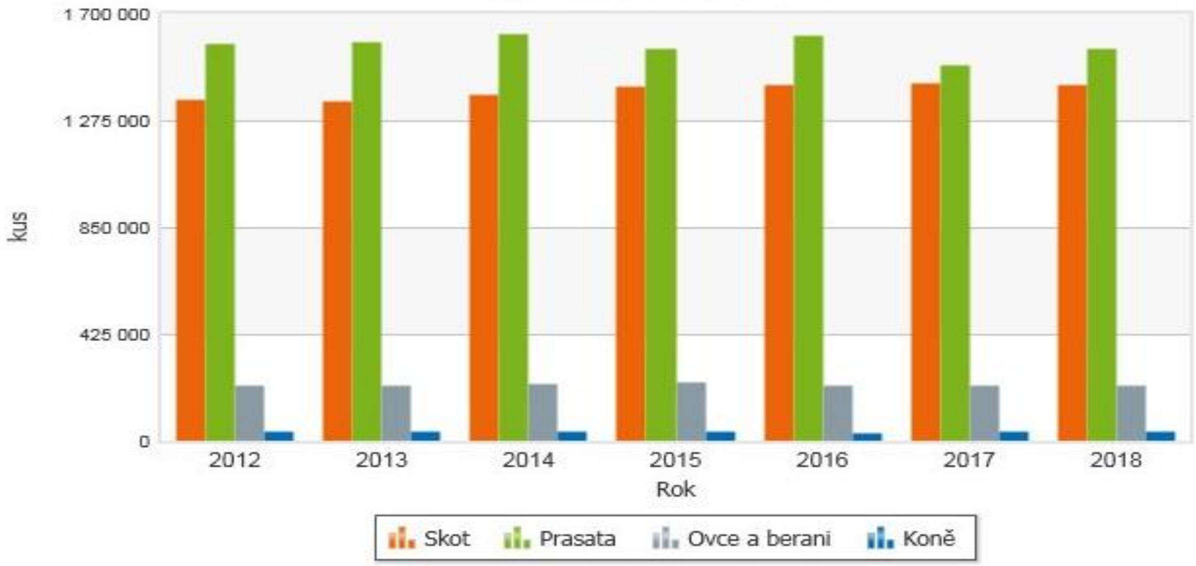
The above table shows relatively variable annual yields of oilseed rape. For example, the yield of crop sown in the last week of August 2016 was very poor owing to the high temperatures and the extreme infestation by aphids. In the spring of 2017, some 31,000 ha of rape were ploughed, the highest in the past 13 years. Further droughts in May and June 2017 resulted in a total drop in production of up to 2.9 t per ha. It can also be seen from the table that the share of areas of oilseed rape processed into FAME accounts for only about 30 % of total oilseed rape area in recent years.

Table 21: *Selected indicative indicators of strategic objectives according to the Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030*

Indicator	Unit	Current situation	Indicative value 2020	Indicative value 2025	Indicative value 2030	Performance and measures
Area of cereals	ha thousands	1,411	1,400	1,300	1,300	Reduction in areas in favour of areas for growing fruit, vegetables, hops, grapes and reallocation of livestock support.
Area of oil seed crops	ha thousands	464	430	400	400	Reduction in areas in favour of areas for growing fruit, vegetables, hops, grapes and reallocation of livestock support.
Area of perennial fodder crops	ha thousands	168	min. 180	min. 200	min. 250	Extensions of perennial fodder crop areas, at least in connection with the greening of direct payments.

Source: Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030

Chart 4: *Livestock in the Czech Republic, 2012–2018*



Kus – piece
Skot – cattle
Prasata – pigs
Ovce a berani – sheep and rams
Koně - horses

Source: Czech Statistical Office

The table above shows some stagnation in the current evolution of the number of selected livestock species. The Ministry of Agriculture, however, expects a revival in livestock production, in particular in the slaughter cattle sector and in the pig and poultry sectors, in line with its Strategy with a view to 2030. This development would be desirable in terms of the structural development of agriculture, positive impacts on the quality of soil, its water regime, biodiversity and ensuring cultural landscape. In terms of raw materials for energy production, this development would entail increased demands for the production of bulk plant feed and bedding, but also a partial increase in some livestock waste for subsequent use in the RES sector.

Forestry

The area of forest land in the Czech Republic is slowly growing, which is because the area of newly forested land which was previously not forested is larger than the area of land which is deforested for various reasons. In 2016, the area of forest land was almost 34 % of the area of the Czech Republic. The most important owner of forests in the Czech Republic is the State. Lesy ČR, a state-owned enterprise, manages an area of 1.25 million hectares, Vojenské lesy a statky manage about 123 thousand hectares, and other State-owned forests (national parks, regional forests, etc.) manage about 121 thousand hectares. Of the total area of forests, about 60 % are managed by the State[14], 19 % by natural persons, 17 % by municipalities, 3 % by legal persons, 2 % by the church and 1 % by cooperatives. The total timber stock was estimated at 696 million m^3 in 2016. The timber stock in the Czech Republic is given without bark.

Table 22: *Development of the total area of forest (ha)*

Year	2010	2012	2014	2015	2016
Forest land area in ha	2 657 376	2 661 889	2 666 376	2 668 392	2 669 850

[14] According to the 2017 Forest and Forest Management Report, State forests account for 56.04 % of the forest area.

Source: Forest Management Institute (FMI)

Table 23: *Total timber stock (m^3 million)*

Year	1980	1990	2000	2010	2016
Total timber stock (m^3 million)	536	564	630.5	680.6	695.8

Source: Forest Management Institute (FMI)

Available wood for energy purposes depends mainly on the amount of logging for which there are two basic sources of information, namely the statistics of the Czech Statistical Office (CZSO) and National Forest Inventory (NFI). According to the CZSO, the average total logging for 2005–2014 is 15.8 million m^3. On the basis of the results of the second NFI cycle 2011–2015, annual logging is 19.13 million m^3 (+/- 0.7 million m^3) on land designated for the fulfilment of forest functions (LDFFF) and 0.49 m^3 (+/- 0.9 million m^3) on non-LDFFF.

In recent years, however, the volume of logged timber has increased, given the extraordinary logging due, in particular, to catastrophic windthrow and bark beetle infestation. A total of 16.163 million m^3 were logged in 2015, a total of 17.617 million m^3 in 2016 and 19.387 million m^3 in 2017. In 2018, the total amount of logging is estimated at 20 million m^3. In 2019, the volume of raw timber infested by bark beetles is expected to potentially reach up to 50 million m^3. It depends on how much of this timber will be logged and then placed on the market, depending on the logging and sales capacities. Part of the affected trees will be left in forests and will have to be logged in the following years. Therefore, it cannot be expected that the total volume of raw timber deliveries would significantly exceed 20 million m^3. Nevertheless, it is significantly more than the roughly 15.5 million m^3 before the catastrophic windthrow and bark beetle infestation. This situation is likely to remain unchanged in the following years. This also creates an opportunity to use raw logs as energy.

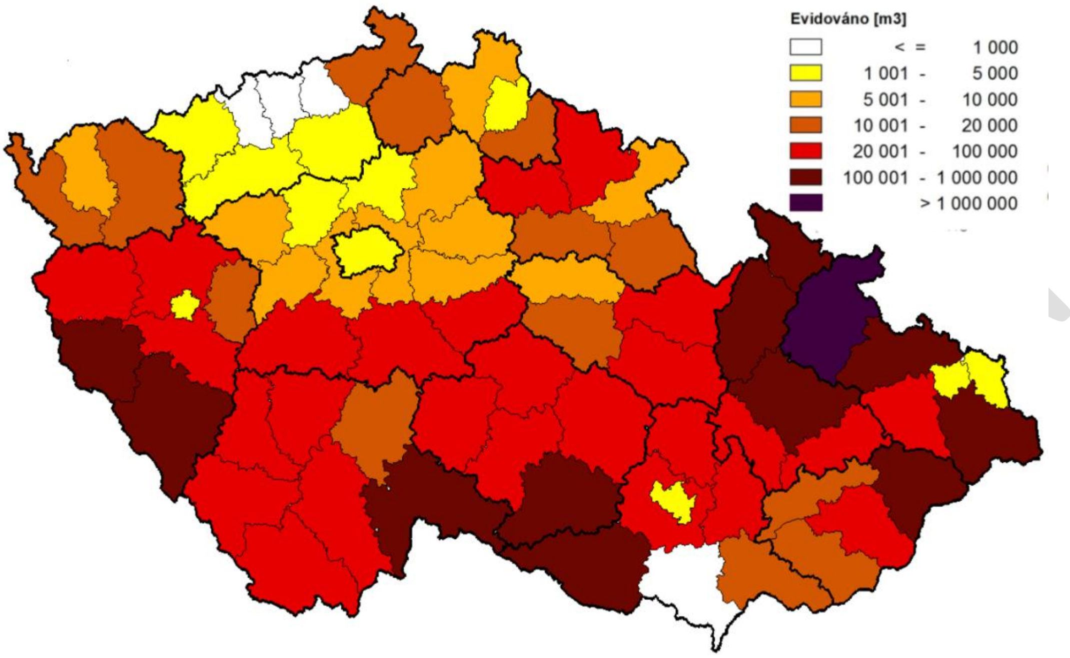
Table 24: *Timber logging in the Czech Republic by type of wood in thous. m^3, without bark*

Wood	1990	1995	2000	2005	2010	2012	2013	2014	2015	2016	2017
Total	**13,332**	**12,365**	**14,441**	**15,511**	**16,736**	**15,061**	**15,331**	**15,476**	**16,163**	**17,617**	**19,387**
of which:											
Coniferous, total	**12,175**	**11,308**	**12,851**	**13,883**	**15,066**	**13,056**	**13,229**	**13,472**	**14,385**	**15,924**	**17,735**
of which:											
spruce, fir, douglas fir	10,640	9,926	10,525	11,793	12,397	10,620	10,817	11,143	12,365	14,131	15,915
pine, all kinds	1,333	1,207	1,871	1,658	2,083	1,899	1,879	1,805	1,558	1,368	1,363
larch	201	169	455	430	585	537	532	523	462	424	457
coniferous, other	0	6	0	1	1	0	0	0	0	0	0
Deciduous, total	**1,157**	**1,057**	**1,590**	**1,627**	**1,670**	**2,005**	**2,102**	**2,004**	**1,778**	**1,693**	**1,652**
of which:											
oak	314	296	395	375	386	477	485	448	410	391	353
beech	484	381	663	801	812	887	949	897	763	747	721
ash	55	45	73	70	69	88	103	106	120	124	152
maple	16	20	28	28	30	45	54	47	43	38	42
linden	36	37	63	53	62	82	74	73	66	54	52
alder	34	31	36	30	30	46	48	47	42	35	40
birch	108	153	170	129	140	180	192	200	174	162	151
poplar, willow, aspen	47	48	83	62	59	90	94	97	83	65	69

deciduous, other	64	47	78	80	82	111	103	88	76	77	74

Source: Czech Statistical Office

Figure 1: *Volume of spruce bark wood recorded by district in 2017 (in m^3)*



Evidováno - recorded

Source: Ministry of Agriculture

A significant increase in the processed volume of logging residues (which are the main source of wood chips for energy purposes) is unlikely without financial support for their use for energy purposes (incineration and co-incineration), because, although there was an increase in total logging of 3.2 million m^3 in 2015–2017, a CZSO qualified estimate shows that the use of logging residues increased by only 0.1 m^3. The theoretical potential of unused logging residues is evident from the results of the land survey of National Forest Inventory of the Czech Republic (NFI2), where in the period 2011–2015 the volume of small wood (max. diameter of 7 cm) lying in the forests was found to be 13.3 million m^3 (lower limit of 12.5 m^3 and upper limit of 14 million m^3). For their possible use, however, account must be taken of the terrain conditions, the site conditions and the requirements of the individual certification systems. In the case of Forest Stewardship Council (FSC) certification, it is only possible to extract logging residues from defined forest type groups, which make up about 35 % of the forest land in the Czech Republic. The Programme for the Endorsement of Forest Certification (PEFC) limits the extraction of logging residues to sites where the site conditions permit after the assessment of the indicator of leaving part of the biomass after educational and logging interventions.

There is potential for increasing the available raw timber for energy purposes in connection with sawmill processing of logs, primarily in connection with the continued logging of bark-beetle-infested timber. According to a 2015 LČR study, the capacity of sawmill plants in the Czech Republic was 7 200 000 m^3 per year with the possibility of increasing it to almost 12 000 000 m^3 per year. The share of sawdust in the total volume of processed coniferous round timber is about 11 % and the share of slab cuts and wood chips is about 25 %. In the case of sawdust, it is likely that it will be used either directly for energy purposes or for the production of pellets and briquettes. In addition to the energy sector, slab cuts and chips will also be used partly for the production of pulp or chipboard and wood fibre boards. If the new sawmill in Štětí with a planned sawing capacity of one million m^3 per year is constructed, it will further increase biomass suitable for energy purposes, but probably involving only sawdust for the production of pellets or briquettes, because wood chips will be used mainly for the production of pulp.

The basic wood chips balance on the market is available at the CZSO website and includes the volume of wood waste and wood chips reported by heat and energy producers. This volume also includes wood chips which originate from non-forest sources, which mainly include fast-growing trees on agricultural land (about 2 800 ha) and maintenance of non-forest greenery. This volume probably also includes bark, which is most commonly used for the production of heat and electricity at large sawmills, but is not recorded when purchasing round timber. Based on CZSO statistics, the estimated annual supplies are 1.9–2.1 million m^3 for 2015–2017; converted to tonnes of dry matter, it is 0.80–0.88 million tonnes. These are wood chips mostly produced right in the woods from lop and top and include bark, leaves (in the growing season) and needles.

Pulp production is another source of renewable wood-based fuel – cellulose extracts. The statistics of the Ministry of Industry and Trade show that in recent years (2014–2016), their production and use for electricity and heat generation is around 1.4 million tonnes per year. In the pulp production sector, only the reconstruction of the Mondi paper mill in Štětí is currently planned, with the annual production of pulp to increase by about 290 000 tonnes, which will also increase the production of cellulose extracts by approximately 696 000 tonnes per year. However, extracts are mostly used to produce electricity and heat to be consumed directly in pulp mills.

According to the CZSO statistics, the higher logging has not led to any significant increase in firewood production in the last three years. In 2015–2017, total logging increased by 3.2 million m^3, but only 40 000 m^3 for firewood. With the continued growth of extraordinary logging, coupled with the saturation of the domestic and foreign markets by sawmill logs and the decline in log prices, it is likely that greater use will be made of bark beetle-infested logs as a fuel or raw material for the direct production of firewood and pellets. ENERGO 2015 statistical survey found that over 1 million Czech households use firewood and its total annual consumption was almost 5 000 000 tonnes.

Conclusions

Today's area of agricultural land which is annually used on a consistent basis for the production of raw materials used in the energy sector, is around 350–400 thousand ha. Forestry produces about 2 million m^3 of wood chips, 1.5 million tonnes of cellulose extracts and almost 5 million tonnes of firewood which are further used every year for energy purposes. In this respect, agricultural and forestry management plays an important role in the production of biomass further used as RES, thus contributing significantly to increasing energy self-sufficiency and meeting national climate commitments.

The strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030 permits an increase in the energy use of agricultural biomass by 2030 by 20 %, but only on condition of maintaining the strategic level of agricultural production for food use. The strategy thus confirms that the main role of agricultural land is to ensure sufficient food for human nutrition and livestock feed and bedding. This basic function can be affected by a number of negative factors, such as the loss of agricultural land, limits for erosive crops (e.g. maize, potatoes, beets, broad beans, soya, sunflower and sorghum) or the overall increase in instability of agricultural production caused by climate change (long-term drought, new pests, increased freezing of winter and spring crops, damage caused by torrential rain, hailstorms, etc.).

Therefore, additional area of land available for an increase in the production of energy biomass may in fact be very limited. Moreover, by 2030 both the area of agricultural land (especially arable land) and the stability of production will decrease, which means that the land used to produce energy biomass will rather stagnate or grow only slightly. Another uncertainty resulting from yield fluctuations is the developments in prices of not only the targeted biomass, but also of post-harvest residues (especially grain straw). Increasing demand for livestock feed and bedding may cause a rise in prices, which will also affect those interested in its use as energy. In general, therefore, it is necessary to anticipate an increase in the price of energy biomass above the inflation rate in 2020–2030.

In view of the above, it would not be responsible to continue to intensively increase the use of agricultural land for energy purposes; we should rather focus on its more efficient use in terms of the unit amount of energy from RES in final consumption per hectare. This could be facilitated, for example, by the development of biomethane production or partial replacement of the targeted biomass cultivation in biogas installations using biodegradable waste / biodegradable municipal waste. This could free up a certain amount of agricultural land fund for more efficient energy use methods. In the reference period until 2030, forest soil and wood biomass production is expected to increase for energy and technical use, depending on the capacities for the processing of increased extraordinary logging and the processing capacity of wood in the sawmill and paper industries. Already in 2017 and 2018, the total wood logging increased by more than 4 million m^3 per year by comparison with the period before the catastrophic windthrow and bark beetle infestation. The Central European market for raw wood is saturated, and use will have to be found for surplus wood. One of the options is its energy use.

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, renewable energy communities and renewables self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

The Czech Republic's State Energy Policy, approved in 2015, sets the target of at least 20 % of heat supply from heat supply systems to be covered by renewable energy sources by 2040.

2.2 Dimension energy efficiency

i. The elements set out in point (b) of Article 4

2.2.1.1 Compliance with obligation under Article 3 of Directive 2012/27/EU

Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC, as amended by its 2018 revision (hereinafter 'Directive 2012/27/EU'), establishes a framework for measures to promote energy efficiency improvements across the EU in order to ensure the EU energy efficiency target by 2020 / 2030. Article 3 of Directive 2012/27/EU allows each Member State to set an indicative national energy efficiency target, based on either primary or final energy consumption, primary or final energy savings, or energy intensity. At the same time, however, Member States should respect the EU energy efficiency target by 2020 and 2030, which is set at 20 % and 32.5 %, respectively. Achieving this target should lead in 2020 to EU primary energy consumption of no more than 1 474 Mtoe or final energy consumption of more than 1 078 Mtoe.

For the year 2030, the revised EU Energy Efficiency Directive sets a target of at least 32.5 %; when converted to absolute values, the primary energy consumption should not exceed 1 273 Mtoe and final energy consumption should not exceed 956 Mtoe for the EU (excluding the United Kingdom, it is 1 128 Mtoe of primary energy consumption and 846 Mtoe of final energy consumption).

The Czech Republic considers the indicative national target defined in Article 3 of Directive 2012/27/EU as a non-binding framework target, which does not create a specific and legally enforceable obligation for both the Czech Republic and other entities. Achieving the 2020/2030 target for final and primary energy consumption is influenced by a number of factors and assumptions, which may evolve over time. For this reason, the contribution of the Czech Republic is supplemented to include a specification of 'boundary conditions'. A significant change in these input parameters may in the future trigger the need for the Czech Republic to reassess the indicative national targets.

Contribution of the Czech Republic to the non-binding EU target by 2030

For the period until 2030, the Czech Republic considers it most appropriate to set a national target for the energy performance of the economy which better reflects the influence of external factors on final energy consumption, such as the economic growth. However, given that the Directive itself lays down the obligation to express the final consumption target, the Czech Republic will set its contribution by its final energy consumption in 2030, which should not exceed 990 PJ of final energy consumption and 1 727 PJ in primary energy consumption. This assumption corresponds to a reduction in the energy intensity of GDP and GVA to 0.157 and 0.174 MJ/CZK, respectively.

The national target is determined as the maximum potential for reducing energy consumption in individual sectors of the economy, i.e. at the limit of final energy consumption that the Czech Republic can realistically achieve. This potential reflects the effect of both the approved and planned strategies, policies and measures to be implemented in the period up to 2030, under the following assumptions:

- considering the climatic conditions, an increase in the number of tropical days in the summer and significant changes and intensities of the heating season by comparison with 2016 are not envisaged;
- GDP growth in line with the assumptions in Chapter 4.1;
- annual increase in residential area, taking into account the demographic developments in the Czech Republic in accordance with the assumptions in Chapter 4.1;
- growth in transport performance in the transport sector;
- a change in the structure of the economy (growth of the services sector and a decrease of heavy industry);
- increase/decrease of production in industry.

For a detailed description of the developments in and the setting of the final energy consumption target / primary energy consumption target, see Chapter 4.3.

Strategies and policies affecting the level of final energy consumption include, without limitation:

- Long-term strategy for the renovation of buildings pursuant to Article 2a of the Energy Performance of Buildings Directive;
- obligation under Article 5 of the Energy Efficiency Directive;
- obligation under Article 7 of the Energy Efficiency Directive;
- legislative and regulatory measures resulting from the transposition and implementation of national and EU legislation;
- strategies and policies in other areas including, *inter alia*, the transport sector and specified in the following strategic materials:
    - Czech Republic's State Energy Policy
    - National Reform Programme of the Czech Republic (NRP)

- State Environmental Policy
- Climate Policy in Czech Republic
- Strategic Framework for Sustainable Development of the Czech Republic
- Transport Policy of the Czech Republic for 2014–2020 with the prospect of 2050.

2.2.1.2 Cumulative energy-savings target under Article 7 of Directive 2012/27/EU for the period 2021–2030

The revision of Directive 2012/27/EU of 11 December 2018 extends the obligation to achieve new energy savings for the period 2021–2030.

In line with the text of the revision of Directive 2012/27/EU and the rules for setting the commitment, the Czech Republic's target under Article 7 for 2021–2030 was set at 84 PJ of new energy savings, i.e. 462 PJ of cumulated energy savings by 2030[15]. The commitment respects the requirement to meet the minimum annual energy savings of 0.8 % of annual final energy consumption in accordance with Article 7(1)(b).

The target calculation baseline is the final energy consumption according to Eurostat data. In the period 2021–2030, the Czech Republic does not exercise the option of deducting or counting additional savings under the 'exemption system' in accordance with Article 7(3).

The cumulated energy savings commitment is based on the assumption of a proportional reduction in energy consumption over the entire commitment period.

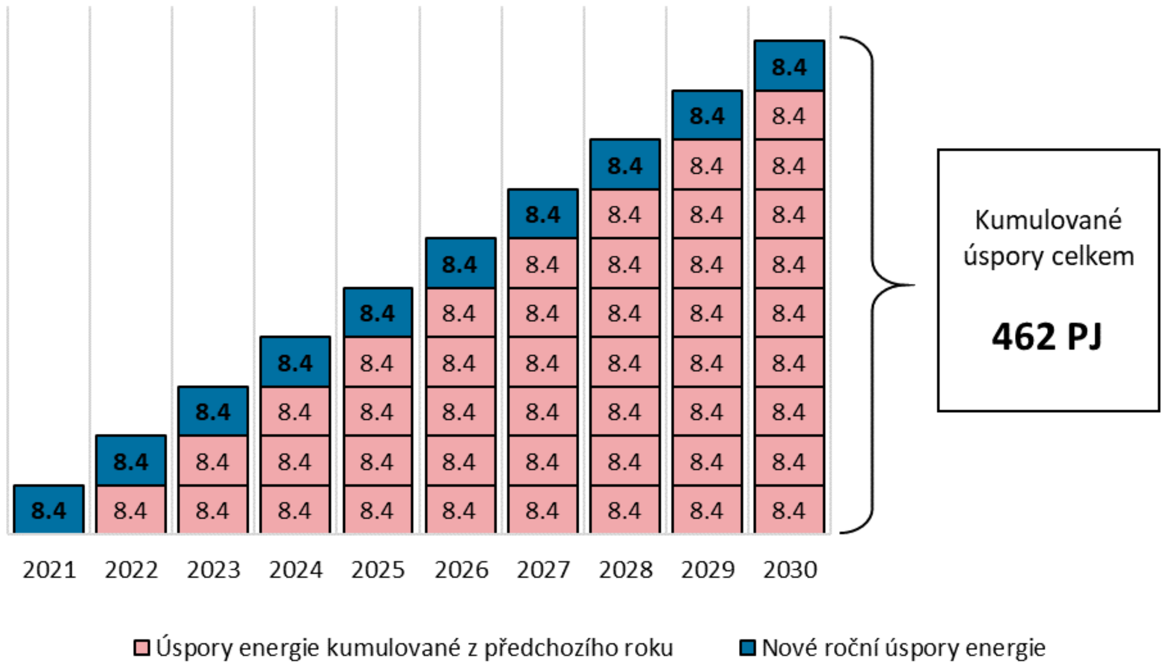
Table 25: *Calculation of savings in accordance with Article 7 (% and PJ)*

Commitment	Value
Averaged final consumption (2016–2018)	1 050 PJ
Relative amount of the commitment	0.8 %
Annual commitment	8.4 PJ
Total commitment	84 PJ
Cumulative commitment	462 PJ

Source: Prepared by MIT for the purposes of the National Plan

[15] The commitment is determined on the basis of the predicted development of final energy consumption in 2018. The commitment will be revised in 2020 on the basis of an EUROSTAT data update – in accordance with the Directive, the reference value will be averaged over the most recent three-year period prior to 1 January 2019. This approach is chosen in view of the time inconsistence between the submission of the National Plan and the deadline for transposition and implementation of the approved revision of Directive 2012/27/EU.

Chart 5: *Determining the cumulative commitment of the Czech Republic pursuant to Article 7 for 2021–2030 (PJ)*



Kumulované úspory celkem – Total cumulated savings
Úspory energie kumulované z předchozího roku – Cumulated energy savings from previous year
Nové roční úspory energie – New annual energy savings

Source: Prepared by MIT for the purposes of the National Plan

2.2.1.3 Exemplary role of public bodies' buildings under Article 5 of Directive 2012/27/EU

Article 5 of the Directive provides that each Member State shall ensure, as from 1 January 2014, the renovation of at least 3 % of the total floor area of buildings with a total useful floor area over 250 m^2, where the buildings are owned and occupied by central government and which simultaneously do not meet the minimum requirements for the energy performance of buildings of Class C - Efficient. These minimum requirements are set by individual Member States on the basis of Article 4 of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings.

On the basis of the projected energy performance class of a partially renovated building stock of central government because there was progress towards this obligation already in the current 2014–2020 period according to the 'Update of the Reconstruction Plan within the scope of Article 5 of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency'[16] approved by the Government, falling under the renovation obligation under Article 5 of Directive 2012/27/EU in 2021, the minimum energy savings were set for buildings not meeting the minimum energy performance class such that the savings would be achieved at the annual renovation rate of 3 % of the total useful floor area of non-compliant buildings. This approach is in line with the requirements of Article 5 of the Energy Efficiency Directive.

[16] Link to the document: https://www.mpo.cz/cz/energetika/energeticka-ucinnost/strategicke-dokumenty/plan-renovace-budov-ustrednich-vladnich-instituci-dle-cl--5-smernice-2012-27-eu-o-energeticke-ucinnosti--236718/

The determination of the annual energy saving commitment of 12.4 TJ assumes the implementation of all planned projects approved under the document 'Update of the Reconstruction Plan within the scope of Article 5 of Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency'[17].

ii. The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators, an evidence-based estimate of expected energy savings and wider benefits, and their contributions to the Union's energy-efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU

Indicative milestones of the long-term building renovation strategy

In accordance with Article 4 of Directive 2012/27/EU, an Update of the Building Renovation Strategy as part of the fifth Update of the National Energy Efficiency Action Plan[18] was prepared in 2017. The elaborated strategy analyses the different scenarios of the renovation of building stock, their costs and benefits, and proposes political, legislative and economic tools for their implementation[19]. The energy and economic impacts of individual scenarios were evaluated on the basis of outputs of individual parts (building stock overview, savings options in the building stock, renovation costs, defining individual renovation scenarios).

For the current period up to 2020, it can be assumed that the building stock renovation trend is follows the scenario below.

Table 26: *BAU 2017 Scenario – Building renovation strategy*

BAU 2017	2020	2030	2050
final energy consumption in the given year [PJ]	343	318	270
family houses	*141*	*131*	*110*
residential buildings	*78*	*73*	*62*
public and commercial buildings	*123*	*115*	*99*
energy saving by comparison with baseline 349 PJ [PJ]	6	31	79
investment costs in the given year [EUR million]	984	932	973
cumulative investment costs [EUR million]	3,925	13,512	31,769
family houses	*1,836*	*6,326*	*14,512*
residential buildings	*880*	*3,049*	*7,142*
public and commercial buildings	*1,209*	*4,137*	*10,115*
total induced GDP [EUR million]	5,180	14,405	32,074
average induced employment	18,947	18,672	18,136
total revenues of the State budget [EUR million]	1,318	4,547	10,731
total social security insurance premiums [EUR million]	151	520	1,227

However, this scenario (its milestones) cannot be taken as a benchmark for the period 2021–2030, as it is based on a strategy, which does not meet all the requirements of the revised Energy Performance of

[17] The value is an estimate based on the current renovation plan of the buildings of the central institutions. The commitment will be revised on the basis of the current data in 2020 following the planned renovations.

[18] Link to the document: https://www.mpo.cz/cz/energetika/energeticka-ucinnost/strategicke-dokumenty/narodni-akcni-plan-energeticke-ucinnosti-cr--150542/

[19] The strategy works with the quality of buildings without any significant reflection on the purpose of their use, i.e. assesses buildings in particular in terms of their energy performance in accordance with Directive 2010/31/EU.

Buildings Directive of 30 May 2018 and whose transposition deadline is set for March 2020. In response to the revised requirements for the Long-term Building Renovation Strategy under Article 2 of Directive 844/2018 of 30 May 2018, the current building renovation strategy will be revised in 2019 in order to meet all new requirements[20]. From this, the choice of the compliance scenario is to be understood as a framework scenario. In 2020, after the update, the chosen scenario, which assumes an increase in the percentage of comprehensive renovations, will be refined in line with the new requirements of Directive 844/2018 by an in-depth revision of the input data and in the light of the newly adopted and deployed tools for its implementation.

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

In this regard, it is possible to mention the target in relation to the heating and cooling sector, which follows from the approved State Energy Policy. This target states that 60 % of supplies in heat supply systems should be covered by cogeneration by 2040. This target is currently being met, but its future progress depends, *inter alia*, on the promotion of cogeneration. For more information on the support for CHP after 2020, see the Chapter 3.1.2.

2.3 Dimension energy security

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

2.3.1.1 Cross-cutting targets

Diversification targets are summarised in the target corridors of the Czech Republic's State Energy Policy.

Table 27: *Share of individual fuels in total primary energy sources (excluding electricity)*

	2016 level	2040 target level
Coal and other solid non-renewable fuels	40 %	11–17 %
Oil and petroleum products	20 %	14–17 %
Gaseous fuels	16 %	18-25 %
Nuclear energy	15 %	25-33 %
Renewable and secondary energy sources	10 %	17-22 %

Source: Czech Republic's State Energy Policy (2015)

Table 28: *Share of individual fuels in gross electricity generation*

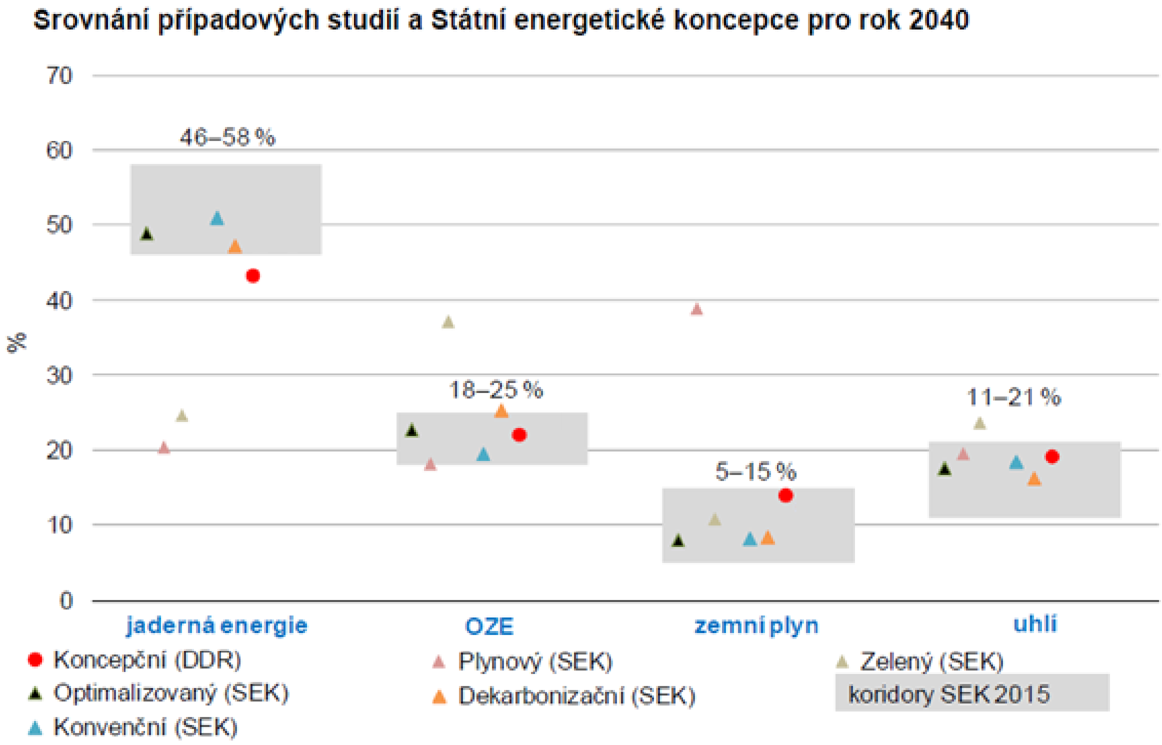
	2016 level	2040 target level
Coal and other solid non-renewable fuels	50 %	11-21 %
Nuclear energy	29 %	46-58 %
Natural gas	8 %	5-15 %
Renewable and secondary energy sources	13 %	18-25 %

[20] Already in 2018, activities were started on a project called ‘Preparing Tools for Implementing the Optimal Scenario of Building Renovation and Adaptation by 2050’, which will review the current building renovation strategy under Article 4 of the Energy Efficiency Directive.

Source: Czech Republic's State Energy Policy (2015)

The development of the energy sector towards the target corridors is evaluated on an annual basis under the so-called ‘Expected Balance’, which further analyses the marginal development scenarios on a periodic basis.

Chart 6: *Comparison of the case studies of the Czech Republic's State Energy Policy for 2040*



Srovnání případových studií a Státní energetické koncepce pro rok 2040 - Comparison of Case Studies and State Energy Policy for 2040

Jaderná energie – Nuclear power
OZE – RES
Zemní plyn – natural gas
Uhlí – coal
DDR – DDR
SEK - SEP
Koncepční - Strategic

Optimalizovaný – Optimised
Konvenční – Conventional
Plynový - gas
Dekarbonizační – Decarbonisation
Zelený – Green
Koridory SEK – SEP Corridors

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

The import dependence target is not to exceed 65 % of import dependence by 2030 and 70 % of import dependence by 2040[21].

2.3.1.2 Electricity sector

In the electricity sector, the Czech Republic has the following main targets:

– Maintaining the high quality of energy supply and meeting the parameters of the adequacy of production capacities.

[21] Under this target, nuclear fuel is considered as an imported resource. For this reason, this value is not directly comparable to the value given in the analytical annexes to this document, because according to the energy balance, it includes nuclear reaction heat, which is not imported by definition.

- Ensuring self-sufficiency in electricity generation, based in particular on advanced conventional technologies with high efficiency of conversion and increasing share of renewable and secondary sources.
- Gradual decline in electricity exports and maintaining the balance between +/- 10 % of domestic consumption in line with the conditions of the internal market.
- Maintaining a positive power balance and ensuring the adequacy of the power reserves and control outputs (providing for the necessary support services) and permanently ensuring the power adequacy of -5 % to +15 % of the maximum load of the electricity system (free available capacity according to the ENTSO-E methodology).
- Ensure a systematic solution to the loop electricity flows and transit from a safety and cost compensation perspective.
- Ensure diversification of primary energy sources in accordance with the target corridors of the Czech Republic's State Energy Policy, which, *inter alia*, means the continued development of nuclear energy in the Czech Republic.

2.3.1.3 Gas sector

In the gas sector, the Czech Republic has the following main targets:

- Ensure the diversification of gas sources and transport routes as well as the efficient functioning of domestic gas-storage facilities.
- Ensure effective access to transit capacities for natural-gas supplies to Czech consumers.
- Permanently ensure the ability of reverse flow and the renewal and development of the gas-transmission system. Ensure capacities for an increase in natural gas supply (increase necessary for heat supply, electricity generation and transport).
- Maintain and potentially further strengthen the transit role of the Czech Republic in gas transmission.
- Support projects ensuring the capacity of gas-storage facilities in the Czech Republic at 35–40 % of annual gas consumption and deliverability guaranteed over a two-month period for at least 70 % of peak daily consumption in the winter. Create conditions for the reverse flow of the transmission system and the capacity to deliver gas from the North or the West of at least 40 million m^3 per day.
- Support financially and institutionally both the transformation of existing biogas stations to biomethane production, and new biomethane stations including their connection to the gas system.
- Provide for the connection and potential gas transmission and distribution capacities for potential replacement of coal with gas for large customers (heat plants).
- In connection with the decarbonisation targets, prepare the gas transmission and distribution system for a higher share of new gas types and sector coupling.

2.3.1.4 Oil sector

In the oil sector, the Czech Republic has the following main targets:

- Support other projects increasing the diversification of oil- and petroleum-product supplies to the Czech Republic, e.g. increasing the capacity of the TAL oil pipeline, construction of an oil pipeline connection between the Litvínov and Leuna (Spergau) refineries.
- Support the development and strengthening of the existing system for oil transport to the Czech Republic in order to provide for and maintain sufficient transport capacity for the needs of refineries in the Czech Republic and, in cooperation with other countries (Slovakia, Ukraine, Russia), maintain the operability of the entire transmission system built in the past at high costs.

- Preserve two functional supply routes for the transport of oil to the Czech Republic from two different directions as the basis of the Czech Republic’s oil security.
- Maintain emergency stocks of oil and petroleum products in accordance with the new calculation methodology under Council Directive 2009/119/EC of at least 90 days of net imports and verify their availability for crisis use.
- Ensure that oil processing capacities in the Czech Republic are permanently operational at least at 50 % of usual domestic consumption.

2.3.1.5 Heating sector

In the heating sector, the Czech Republic has the following main targets:

- As a priority, maintain economically efficient and energy-efficient heat supply systems.
- Cover at least 60 % of heat supply from heat supply systems by high-efficiency cogeneration.
- Renewal, transformation and stabilisation of heat supply systems, based primarily on national sources (nuclear, coal, RES, secondary sources) supplemented with natural gas.
- Promote the transition of especially medium and small heat supply systems, multi-fuel systems using locally available biomass, natural gas, or, if applicable, other fuels, where especially natural gas will play the role of a stabilising and supplementary fuel.
- Create conditions in heat supply systems for the efficient use of heat from renewable and secondary energy sources available at regional and local levels.
- Provide for the necessary long-term supply of coal for the heat sector in a situation of decreasing exploitable reserves using legislative and regulatory measures, while respecting competition rules, giving priority to increasing efficiency and savings.
- Significant increase in the recovery of waste in waste energy recovery facilities in order to achieve a high recovery rate of the incinerable component of waste after sorting by 2024.
- Support the use of primarily larger heat plants for the supply regulatory services for the transmission system.
- Create conditions for heating plants in island operations of individual areas to play their role in emergency situations.
- Ensure the integration of smaller heat plants into smart grids and decentralised management.
- Support and develop the energy supply capability in local (island) subsystems in the event of a system breakdown owing to large-scale failures caused by natural events or terrorist or cyber-attacks to the extent necessary to ensure the minimum supply to the population and maintain the functioning of critical infrastructure.
- In connection with the ongoing decentralisation of electricity sources, it will be necessary to ensure the overall flexibility of the energy system. From this perspective, heating sources should be more involved in the provision of support services at the distribution and transmission system level. At the same time, thanks to the possibility of using cogeneration, production sources contribute to flexible electricity supplies; on the other hand, technology such as electric boilers and heat pumps have the potential to increase the ability to control electricity generation/consumption.

ii. National objectives with regard to increasing: the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems

The Czech Republic has a relatively well diversified energy mix. The targets for the diversification of energy sources are mainly incorporated in the target corridors of the Czech Republic's State Energy Policy (see Chapter 2.3.1.1). For more details on targets concerning the supply of energy commodities from third countries, see point (iii) of this Chapter (see also Table 6).

iii. Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

Table 6 shows strategic targets of the State Energy Policy. In relation to reducing the dependence on energy imports / increasing the diversification of consumed (imported) resources, the following targets (or, more precisely, quantifiable indicators) can be emphasised.

– ensure permanent self-sufficiency in electricity supply at a minimum level of 90 %;
– reduce and sustain the diversification of primary energy sources below 0.25;
– reduce and sustain the diversification of gross electricity generation below 0.35;
– reduce and sustain the diversification of imports below 0.30;
– reduce the share of energy imports in gross value added below 2010 levels;
– stabilise the effect of energy imports on the balance of payments.

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

Possible measures in this area will depend on the implementation of new national legislation, especially the legislation that will implement the 'Clean Energy for All European' package currently under discussion, specifically the revised texts of the draft regulations and the Internal Electricity Market Directive.

2.4 Dimension internal energy market

2.4.1 Electricity interconnectivity (2030 Framework target)

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 differential in the wholesale market exceeding an indicative threshold of EUR 2/MWh between Member States, regions or bidding zones;

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

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

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

2030 interconnectivity target

The 2030 framework transmission system interconnectivity target corresponds to maintaining the transmission system import and export capacity relative to the maximum load at a level of at least 30 % and 35 %, respectively[22]. However, this target is not directly comparable to the 2030 EU target of 15 %, as this target is expressed in relation to installed capacity. In general, it can be stated that the target under the Czech Republic's State Energy Policy corresponds to the 15 % target, because the

[22] Target state, or PIII.1. strategy under Priority III – Infrastructure and International Cooperation.

share of the maximum load in relation to the installed capacity corresponds to approximately 50 % (53 % in 2017)[23]. The Czech Republic therefore commits itself primarily to fulfilling the target under the Czech Republic's State Energy Policy, which is already achieved and way above the target, but the achievement of this target should correspond to the implementation of the Barcelona Agreement (2030 target of 15 %), even though the developments of the maximum load and the installed capacity may be somewhat different.

The level of the Czech transmission system interconnectivity is an area which is monitored and evaluated on an ongoing basis, in particular by ČEPS, a.s., the transmission system operator, both on the national level in accordance with the Czech Republic's State Energy Policy, which directly requires to maintain import and export capacity of the Czech transmission system in relation to the maximum load at least at 30 % and 35 %, respectively, and at European level within the European Ten-Year Network Development Plan, which assesses the progress towards the 2012 Barcelona criterion of 10 % of the transmission systems interconnectivity and the 2030 connectivity target at 15 %. Table 29 specifies the projected 2030 interconnectivity level (both for export and import) relative to the maximum load in two scenarios. In both cases, the 30 % and 35 % targets should be achieved with a relatively significant margin. Table 30 then shows the assumed interconnectivity level relative to the installed capacity. Both Scenario A and Scenario B assume the same installed capacity in this respect, so there are no differences between these scenarios. The current interconnectivity level is described in Chapter 4.5.1.

Table 29: *Assumed interconnectivity in 2030 (relative to maximum load)*

	Scenario A	Scenario B
Interconnectivity (export)	58.0 %	60.2 %
Interconnectivity (import)	50.0 %	51.8 %

Source: ČEPS, a.s.

Table 30: *Assumed interconnectivity in 2030 according to the Barcelona Agreement (relative to installed capacity)*

	Scenario A	Scenario B
Interconnectivity (export)	44.1 %	44.1 %
Interconnectivity (import)	38.0 %	38.0 %

Source: ČEPS, a.s.

Calculation methodology

The current model of international transmission systems is used to calculate the export and import capacity of the Czech transmission system; in the case of the Czech Republic, the model is supplemented to include parts of the transmission system with investment plans to be implemented by the reference year. Cross-border capacities are calculated using the ENTSO-E NTC methodology, modified for the needs of transit systems such as the Czech transmission system (strong link between individual boundaries and their interaction). The procedure for determining cross-border capacities is laid down in ČEPS's internal workflow, which is in line with the procedure for determining the free tradable capacities for auctions, which is available on ČEPS website. The calculation of the percentage

[23] In 2017, the maximum load (according to the Energy Regulatory Office) was 11 768 MW and the installed capacity (according to ČEPS, a.s.) was 22 216 MW.

of export and import capacity of the Czech transmission system is then given by the share of the determined summary export/import capacity in MW for the year and the net load outlook for the year.[24]

Formula for calculating interconnectivity (export):

$$P_{ex\%} = \frac{P_{sumEXPORT}}{P_{\max LOAD}} * 100$$

Formula for calculating interconnectivity (import):

$$P_{im\%} = \frac{P_{sumIMPORT}}{P_{\max LOAD}} * 100$$

2.4.2 Energy transmission infrastructure

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

Electricity sector

In accordance with the Energy Act, ČEPS a.s. (the transmission system operator) prepares every two years the 'Ten-Year Plan for the Development of the Czech Republic's Transmission System', which is approved by the ERO following a binding opinion of the Ministry of Industry and Trade. The Ten-Year Development Plan is published on the ČEPS website[25]. The Czech Development Plan complies with the obligations imposed on its subject matter in the Energy Act, the subject matter being the measures taken to ensure appropriate capacity of the transmission system so that it meets the requirements necessary to ensure the security of electricity supply. For more information on expected developments in the electricity system, see the Chapter 4.5.2.3.

Gas sector

In accordance with the Energy Act, NET4GAS (a transmission-system operator) prepares each year the Ten-Year Plan for the Development of the Czech Republic's Transmission System, which aims to analyse the development of maximum daily and annual consumption and the adequacy of input and output capacity for the Czech Republic. The plan includes completed and forthcoming investment projects which increase the capacity of the transmission system, and also a supply-security analysis. The Ten-Year Plan is approved by the ERO following a binding opinion of the MIT, and is published on the NET4GAS website.[26] For more information on expected developments in the transmission system, see the Chapter 4.5.2.4.

ii. Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)[27]

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[24] The outlooks for load and installed capacity are not fully consistent with the outlooks for the purpose of this document, which is also due to the different detail and purpose of these outlooks. However, there should be no significant disproportion/inconsistency in this respect.

[25] The Ten-Year Plan for the Development of the Transmission System of the Czech Republic is available at: https://www.ceps.cz/en/rozvoj-ps

[26] The Ten-Year Plan for the Development of the Transmission System of the Czech Republic is available at: https://www.net4gas.cz/cz/projekty/rozvojove-plany/

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

Electricity sector

The above-mentioned Czech Development Plan is also reflected in the content of the Central and Eastern Europe regional investment plan and the Ten-Year EU Network Transmission Plan, which are adopted by ENTSO-E at a two-year interval. The Czech Development Plan contains not only PCI projects but also projects that ensure appropriate capacity of the Czech Republic's transmission system so that it meets the requirements necessary to ensure electricity supply security.

Gas sector

The development of the gas infrastructure will be in line with the approved Ten-Year Plan for the Development of the Transport System in the Czech Republic. The projects are aimed both at maintaining the capacity of the transmission system and its modernisation, and at its development. As of 2018, the most important such project is C4G, which is implemented in accordance with the priorities of the Czech Republic's State Energy Policy, and is supported by binding contracts for the transmission of natural gas. Implementing the Capacity4Gas project will significantly increase the transit role of the Czech Republic in the field of natural gas and strengthen the Czech Republic's energy security in the gas sector.

In the period of the Ten-Year Development Plan, the development of gas infrastructure in line with future trends can be expected. Gradual decarbonisation of the European economy could build on a 'hybrid system', which will benefit from the synergies between the electricity and gas networks.

According to the Czech Republic's State Energy Policy, the objective is to maintain the transition role of the Czech Republic, diversify gas sources, deepen the integration of European gas markets, and increase the resilience and use of the Czech transmission system. Operating conditions for North or West flows should reach capacity levels of at least 40 million m^3/day. This criterion is currently met. At the same time, the system will have to be able to supply the energy source base (power stations and heat plants) – expanding sources firing natural gas to 15 % of installed capacity (currently over 8 %) and with BAT (Best Available Technology) parameters, expansion of micro-cogeneration sources and the use of gas in transport. This will mean the potential connection of new direct customers consuming gas from the transmission system (power plants, heat plants), as well as an increase in output capacities from transmission to distribution systems. If the SEP targets are to be achieved in a liberalised gas sector, consultation of all stakeholders is necessary.

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 timeframe for when the objectives shall be met

2.4.3.1 Electricity sector

The integration of day-ahead and intraday markets in Europe, on the basis of the implicit cross-border capacity allocation, has more than a 15-year history when this coupling initially involved only neighbouring States[28] on the basis of bilateral or multilateral agreements. Consequently, these already coupled markets were further integrated into larger regions.

[28] For example, 2009 saw the Czech and Slovak day-ahead electricity coupling.

The main benefits of market integration include access to a larger – single electricity market. The energy market segmented into individual national markets (although physically coupled) is inefficient and the trading on it is more risky and, therefore, expensive. In coupled markets, participants can better respond to changes in production and consumption. This way, the system opens up space for other players, the market becomes stabilised and more transparent. As a result, competition increases, leading to downward pressure on prices. Savings from coupled markets can then be reflected by traders in their pricing policy.

Other benefits resulting from the integration of short-term electricity markets can be summarised as follows:

- optimal use of cross-border transmission capacities;
- integration helps to balance the electricity systems of individual countries;
- price indices become stabilised and the volatility of the difference in spot electricity prices across EU markets decreases;
- purchases of often unused capacities of cross-border profiles in explicit auctions are limited;
- there is a decrease in risks associated with the purchase of cross-border capacity without the ownership of electricity in export/import and vice versa.

An important step, which was not only to promote the creation of a single EU electricity market but which also showed the attention the European Commission pays to the issue of integration, was the adoption of Commission Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management (CACM Regulation).

In accordance with the requirements of the CACM Regulation, on 7 October 2015 OTE, a.s. was appointed by the Energy Regulatory Office as the Nominated Electricity Market Organiser (NEMO), which will ensure a single day-ahead or intraday coupling in the Czech Republic[29]. The appointment of the market operator as the Nominated Electricity Market Organiser is not only a clear confirmation and a positive evaluation of the market operator's activities so far, but also a commitment by the market operator to actively participate in EU integration activities. Together with other European exchanges appointed as NEMO and transmission system operators in Europe, OTE a.s. cooperates towards the obligation to complete and further develop and, finally, operate the single day-ahead and intraday coupling in the EU, as required by the CACM Regulation.

Electricity forward market

The aim is to offer all the products of long-term capacity rights relevant to the bidding zone border of the Czech Republic through the Central Auction Office already for 2019.

Day-ahead coupling

The Czech Republic has day-ahead coupling with the Slovak, Hungarian and Romanian markets within the 4M MC[30]. Work is underway to couple this region with the coupled region of Western Europe (MRC) using a flow-based approach to cross-border capacity allocation. The aim is to ensure the full coupling of the EU single electricity market, which is also the main objective of the CACM Regulation, which is currently being prepared. The Czech Republic will be involved in the single day-ahead coupling (SDAC) in the EU after the finalisation of the flow-based CORE CCR project, which is expected by the end of 2021. With the consent of all stakeholders and with the support of the relevant national regulatory authorities, the single electricity market in the EU (4M MC and MRC) can

[29] For more information see: http://www.ote-cr.cz/kratkodobe-trhy/integrace-trhu/all-nemo-cooperation
[30] For more information see: http://www.ote-cr.cz/kratkodobe-trhy/integrace-trhu/mc-cz-sk-hu-ro

be created earlier, provisionally, until flow-based cross-border capacity allocation is implemented in this region on the basis of NTC capacities.[31]

Intraday coupling

ČEPS, a.s., as the transmission system operator in the Czech Republic and OTE, a.s. as the nominated electricity market operator in the Czech Republic, together with similar entities in Bulgaria, Austria, Germany, Hungary, Poland, Romania, Slovenia and Croatia, form the LIP 15 project. All the parties to the project expressed their interest in implementing continuous cross-border trading and introducing implicit intraday cross-border transmission capacity allocation on the Czech–German, Czech–Austrian, Austrian–Hungarian, Austrian–Slovenian, Hungarian–Romanian, Hungarian–Croatian and Croatian–Slovenian border. The inclusion of the Czech-Polish, and the Bulgarian-Romanian border is under discussion. According to the schedule of the XBID project, which may be subject to additional modifications, the operating involvement of the second wave is expected in mid-2019[32]. This will achieve the integration of the Czech Republic into the single intraday coupling (SIDC) in the EU in accordance with the CACM Regulation. The integration of the Czech-Slovak border is not included in the project owing to the absence of Slovak representatives.

Balancing services market

The Czech Republic, through ČEPS, a.s. as the national transmission system operator, is already involved in regional projects IGCC[33], TERRE[34] and PICASSO[35] and the pan-European MARI[36] project. All projects are implemented by transnational Platforms for automatic Frequency Restoration Reserves. Since 2012, ČEPS has been a member of the IGCC platform for operating the imbalance netting process. The Czech Republic is planning to become a member of TERRE at the end of 2019, and of the remaining two platforms by the end of 2021. The membership of ČEPS in the platforms will lead to pricing of balancing energy from standard products being harmonised with the rest of Europe. Furthermore, thanks to the applicability of the EBGL Regulation, the 15-minute imbalance settlement period will be introduced in the Czech Republic by the beginning of 2025.

2.4.3.2 Gas sector

The integration of gas markets within the creation of a single gas market in the EU lags far behind the integration of electricity markets. In addition to infrastructure projects that are geared towards facilitating the reservation of capacities for gas traders or making areas that are not directly coupled accessible for trading (e.g. between the Czech Republic and Austria through TRU[37]), no integration projects are currently under discussion with the aim of coupling organised gas markets in our region.

The Czech Republic intends to help complete the internal energy market, in particular the internal gas market, by removing infrastructure bottlenecks and market barriers between the Czech Republic and its neighbours, namely Poland and Austria. This should be facilitated by the fact that the national gas market legislation has been adapted to two regulations designed to ensure uniform principles for the creation of a single internal gas market in the EU – Regulation (EU) No 2017/460 establishing a network code on harmonised transmission tariff structures for gas, Regulation (EU) No 2017/459

[31] For more information see: http://www.ote-cr.cz/kratkodobe-trhy/integrace-trhu/pcr-price-coupling
[32] For more information see: http://www.ote-cr.cz/kratkodobe-trhy/integrace-trhu/xbid
[33] International Grid Control Cooperation
[34] Trans-European Replacement Reserves Exchange
[35] Platform for the International Coordination of the Automatic frequency restoration process and Stable System Operation
[36] Manually Activated Reserves Initiative
[37] For more information, see NET4GAS website at: https://www.net4gas.cz/cz/media/tiskove-zpravy/zpravy/cesky-rakousky-trh-plynem-se-propojuji-diky-nove-sluzbe-trading-region-upgrade-tru.html

establishing a network code on capacity allocation mechanisms in gas-transmission systems and repealing Regulation (EU) No 984/2013.

It should also be facilitated by the support for PCI projects (Projects of Common Interest), enabling direct coupling with the gas systems of Poland (the Czech-Polish gas corridor project) and Austria (the BACI project). This would significantly contribute to the integration of national markets in the region and the creation of a Central European gas market. The Czech Republic and Austria have made most progress towards this integration, where, in order to accelerate the process, the TRU (Trading Region Upgrade) project was launched on 1 October 2018, which uses existing Slovak gas infrastructure to couple the national markets of both countries.

The national gas market in the Czech Republic has been fully liberalised since 2007; the ERO regulates only those prices which, for technical or organisational reasons, cannot be formed by market mechanisms within a competitive environment. There are several dozen gas traders on the Czech gas market, which offer their services to customers. The Czech gas market operates on the principle of non-discrimination, where each trader may reach out to any customer, and any customer may enter into a contract with any trader. Supply prices and other supply terms depend only on a mutual agreement. The developed competitive environment on the gas market has enabled a wide range of trader offers, both in terms of price, and the related business terms. The market dynamics thus depends more on the ability and willingness of customers to change suppliers to get more favourable conditions. The Energy Act and its implementing legislation guarantee all customers the right to change their gas supplier. This change is free. If the customer meets the existing business conditions, he may thus choose his gas supplier.

Trading in the internal gas market then takes place either through bilateral trading or an organised short-term market. For more information, see Chapter 4.5.3.

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 timeframe for when the objectives are to be met

The preparation and resulting form of national legislation on demand response and energy storage will depend on:

- the outcome of the debate on the ‘Clean Energy for All Europeans’ package in relation to the internal electricity market. It is necessary to anticipate an 18-month implementation timeframe for the Directive;
- and also on the proposals of European gas legislation (the ‘gas package’) to be introduced by the European Commission in 2020.

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

Within the National Action Plan for Smart Grids (NAP SG), the preparation of the conditions for introducing smart metering in the Czech Republic is underway. The resulting form will, however, depend on the final legislative text of the ‘Clean Energy for All Europeans’ package in the area of the internal electricity market. It is necessary to anticipate an 18-month implementation timeframe.

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 timeframe for when the objectives are to be met

The Czech Republic aims to ensure the maximum possible adequacy with an acceptable level of risk. Ensuring system adequacy is in the competence of the transmission system operator, i.e. ČEPS, a.s. in the Czech Republic. Ensuring production adequacy is also in the competence of ČEPS, a.s., but it must be carefully monitored by the State, which creates the conditions for ensuring this adequacy. The safe operation of the electricity system and the required quality of the electricity supply depends, in addition to the reliability parameters of the transmission and distribution system, also on a balanced production mix that cannot be directly influenced by the transmission and distribution system operators. The current Czech Republic's State Energy Policy anticipates the balance for the Czech Republic to be equal over the medium term and does not expect a significant import dependence.

In accordance with Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) No 1228/2003, the transmission system operator carries out an annual outlook for the adequacy of production capacities, including the proposal of measures to address any problems with ensuring the adequacy of production capacities. The document prepared by the transmission system operator is then based on an analysis of systemic risks concerning the ES power balance reliability using probabilistic approach for different periods and consumption scenarios, levels of construction and recovery / lifespan of conventional sources, the throughput of international couplings, and the share of renewable energy sources and decentralised energy sources in different scenarios. The evaluation also includes the preparation of critical scenarios and the evaluation of potential risks requiring measures in production and system adequacy. When preparing the critical scenarios, we draw on the experience of other transmission system operators, relying on the ‘low probability–high impact’ principle, which allows the evaluation of risks even in extreme operational situations.

The Czech Republic currently has no established and legislatively or non-legislatively prescribed supply reliability standard, expressed by relevant indicators such as the Loss of Load Expectation (LOLE) or Value of Loss Load (VoLL), which would allow a target to be expressed in terms of production adequacy exactly through these values. Without these parameters, it is not possible to easily justify measures to ensure the necessary reliability and adequacy of production capacities of the Czech electricity system. The proposed EU legislation foresees the obligation to determine LOLE at Member State level (together with other parameters – VoLL).[38]

The assessment of the adequacy of the Czech electricity system production capacities up to 2030, prepared by the transmission system operator in August 2017, works with an indicative reliability standard at LOLE level of 3 hours for P50 % and 6 hours for P95 %.

Higher flexibility of the electricity system can also be facilitated by a higher degree of integration with other sectors such as heating, gas or transport. In the case of heating, it mainly involves the power2heat technology, which has been deployed for a long time in the Czech Republic; however, it is appropriate to consider the support of their development. In the case of the gas sector, it involves the production of hydrogen by electrolysis (power2Gas technology) and possibly its methanisation into the form of synthetic methane. Specific measures on financial support for energy stored in gaseous form in the gas system may depend on the EU legislative framework, which will be introduced in the European Commission’s ‘2020 gas package’. In transport, this may involve the use of electricity storage in electric cars and the coordination of their charging in the surplus electricity period.

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

[38] Currently, there is an ongoing research project entitled: ‘Transposition of reliability indicators according to the MAF methodology into the national reliability standards, which can be used in the planning of corrective measures in case of indication of resource inadequacy within the Czech electricity system’. The project aims, *inter alia*, to propose a methodology for setting production adequacy targets.

For more detailed information, see Chapter 3.4.3, specifically point (iv), which addresses policies and measures to protect consumers, especially vulnerable and, where relevant, energy-poor consumers, and to enhance the competitiveness and competitiveness of the retail energy market.

2.4.4 Energy poverty

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

2.4.4.1 National energy poverty objectives

The definition of energy poverty is yet to be laid down in Czech legislation. In research projects, energy poverty is generally defined as a situation where a household does not have the socially and materially necessary level of energy services. Energy poverty is caused by a combination of three basic factors at household level: energy prices, energy efficiency and household income.

In the Czech Republic, a working group was set up in 2015 to deal with energy poverty within the National Action Plan for Smart Grids. The aim of the group's activities is to set up a methodology for identifying 'vulnerable customers' and households affected by energy poverty. In line with the outcomes of previous projects, the following factors for identifying 'energy poverty' in the Czech Republic were defined: the quality and energy performance of a building, the price of energy at the given place, the income of the household, the conditions and the quality of the indoor environment. The adequacy of living area is an additional indicator.

Because finding the links between these factors and assessing the impacts of their combinations on households is difficult, an energy poverty project was awarded in a public tender. The output of the project is to set up a certified methodology for evaluating energy poverty and vulnerable customer in the Czech Republic and to propose measures to prevent and address these phenomena. Project outputs can be expected by 30 November 2020, but partial outputs will be available throughout the project according to its schedule.

At the same time, to meet its obligation under Article 7 of Directive 2012/27/EU, the Czech Republic will set up the instruments so as to ensure increase in energy efficiency also for low-income groups, see Chapter 3.2.

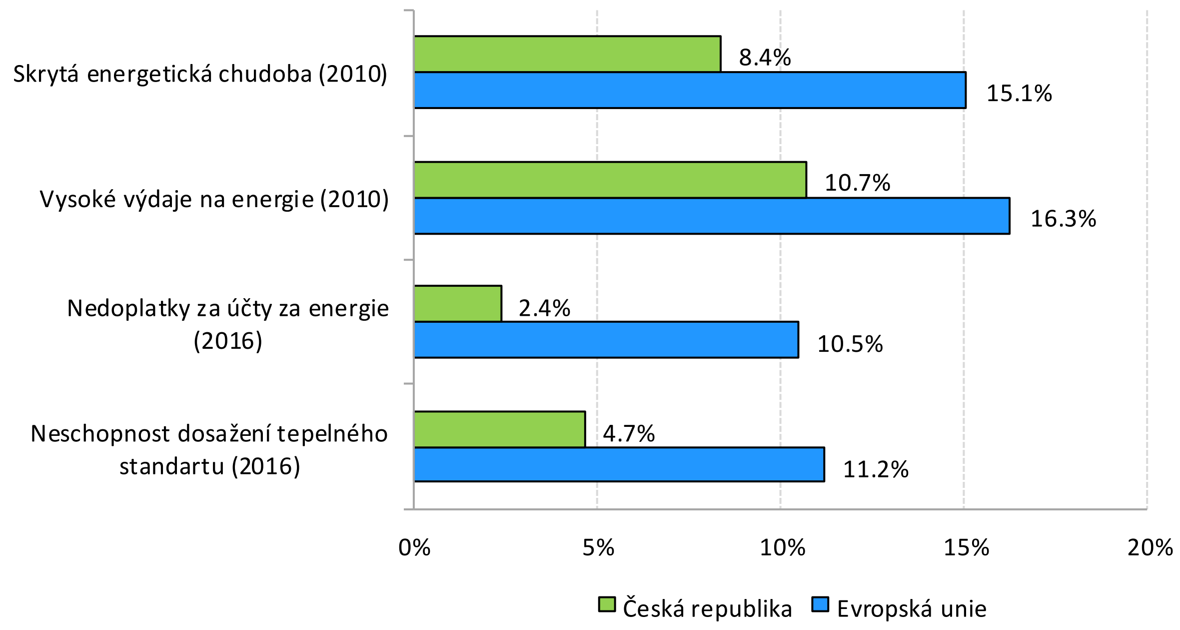
2.4.4.2 Context information for energy poverty[39]

The Czech Republic considers the project output deadline to be sufficient given that the Czech Republic achieves better household sector indicators than the EU average. Approximately 4.7 % of households were unable to maintain sufficient heating comfort in 2016 and only 2.4 % had problems paying energy bills.

The Czech Republic is slightly better than the EU average in expenditure-based indicators. Approximately 10.7 % of households spend more than double the median on energy and 8.4 % spend so little on energy that they probably live in hidden energy poverty.

[39] This information is taken from 'Energy Poverty Observatory' materials on the Czech Republic. However, these data (their information value for the Czech Republic) will need to be verified, also on the basis of the established methodology.

Chart 7: *Comparison of indicators with respect to the EU average*



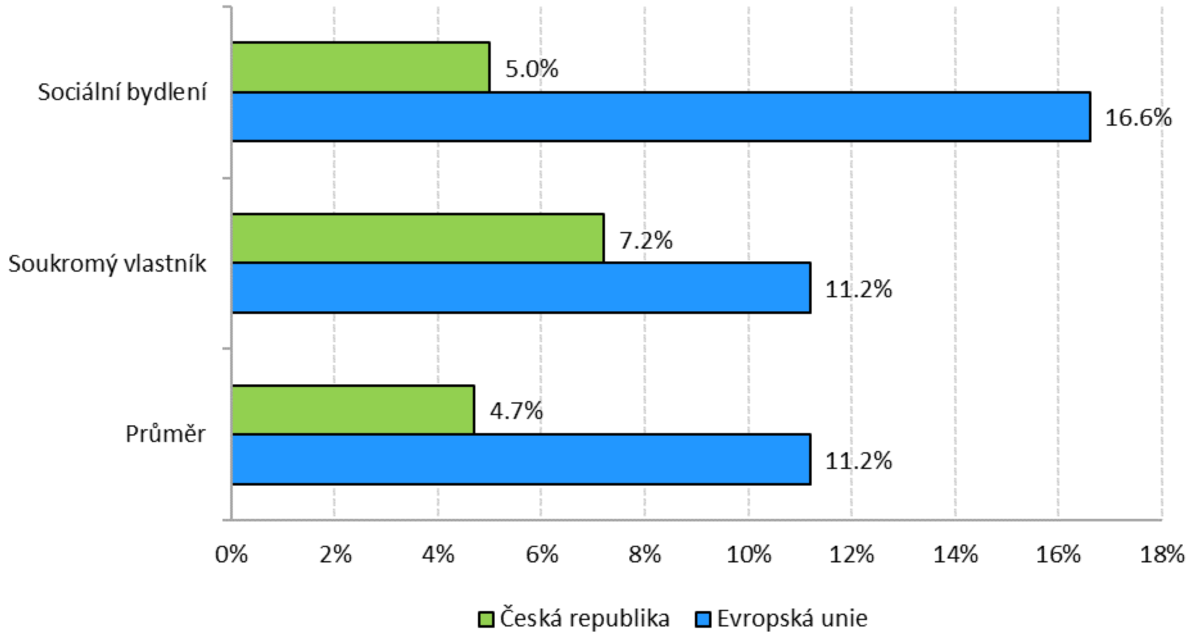
Skrytá energetická chudoba – hidden energy poverty
Vysoké výdaje na energii – High energy expenditures
Nedoplatky za účty na energie – Arrears on energy bills
Neschopnost dosažení tepelného standard – Inability to achieve heat standard
Česká republika – Czech Republic
Evropská unie – European Union

Source: Energy Observatory

Energy poverty (its indicators or indicators expressing it) in the Czech Republic has been gradually decreasing since 2005. The share of households that could not maintain sufficient thermal comfort decreased from 11 % in 2005 to 5 % in 2016 and the number of households with energy bill arrears fell from 5 % in 2005 to 2 % in 2016.

The indicators in the household sector indicate that energy poverty in the Czech Republic mostly affects private tenants. However, there are no clear groups by the type of dwelling or urbanisation density where energy poverty is most significant. There seems to be no clear socio-economic group that is particularly vulnerable to energy poverty in the Czech Republic.

Chart 8: *Inability to provide for sufficient heating (comparison between the Czech Republic and the European average)*



Sociální bydlení – social housing
Soukromý vlastník – private owner
Průměr – average

Česká republika – Czech Republic
Evropská unie – European Union

Source: Energy Observatory

2.5 Dimension 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 timeframe for when the objectives are to be met

The Czech Republic has not set any specific quantifiable targets in public research, development and innovation specifically related to the Energy Union. The difficulty of setting energy and climate targets is due, *inter alia*, to the structure of public funding for research, development and innovation, which is not sector-focused but is provided under national and ministerial support programmes. The strategic objectives are then described in more detail in the relevant strategy papers. These documents include in particular the National Research and Innovation Strategy for Smart Specialisation[40] and National Priorities for Research, Experimental Development and Innovation[41].

The document entitled National Priorities for Research, Experimental Development and Innovation identifies a total of six main priority areas, of which the priority area Sustainability of Energy and Material Resources best corresponds to the focus of the Energy Union. This area is further divided into three sub-areas: (i) sustainable energy; (ii) reducing the economy's energy demands; and (iii) material base. For more information, see Chapter 3.5.

[40] The document is available at: https://www.mpo.cz/cz/podnikani/ris3-strategie/
[41] The document is available at: https://www.vyzkum.cz/FrontClanek.aspx?idsekce=653383

National priorities for research, experimental development and innovation include indicative share of funds by priority area, which should be allocated for implementation within the overall R&D&I budget. On the basis of this strategic document, approximately 18 % of the total research, development and innovation budget should be allocated to the priority Sustainable Energy and Material Resources (see Table 31).

Table 31: *Indicative distribution of funds among the different priority areas*

Priority area title	Share of funds
Competitive knowledge-based economy	20 %
Sustainability of energy and material resources	18 %
Environment for quality life	18 %
Social and cultural challenges	10 %
Healthy population	20 %
Secure society	14 %

Source: National priorities for oriented research, experimental development and innovation

The area of research, development and innovation is also addressed specifically in the Czech Republic's State Energy Policy. Table 32 identifies priority areas of research, development and innovation on the basis of this strategic document. The research, development and innovation areas are also partially addressed by other strategic energy documents such as the National Action Plan for the Development of Nuclear Energy in the Czech Republic, the National Action Plan for Smart Grids, or the National Action Plan for Clean Mobility.

Table 32: *Priority areas of research, development and innovation under the State Energy Policy*

Priority area	Detailed description
Renewable (alternative) energy sources	More efficient use of biomass, development of advanced biofuels made from non-food biomass and waste, development of new photovoltaic systems including control elements, geothermal sources in geological conditions of the Czech Republic, energy use of hydrogen including fuel cells, heat pumps of all categories with high efficiency.
Nuclear technologies	Research of promising 3rd and 4th generation nuclear technologies, enhancing the efficiency, durability and safety of nuclear sources, solution for radioactive waste and spent nuclear fuel, solution for the end of the fuel cycle, developments in the field and also in engineering / special construction technologies for nuclear power in relation to material engineering.
More efficient use of fossil energy sources	Research into more efficient and new combustion technologies for traditional fossil fuels such as clean coal technology with BAT or better parameters and with parameters complying with future economic and environmental requirements, development of high temperature materials, applied research and innovation of gas and steam turbines, heat exchangers, cogeneration systems, geological storage of carbon dioxide.
Increasing efficiency and reliability of energy systems and distribution networks	Increasing the efficiency and reliability of energy systems and distribution networks for energy media, integration of decentralised energy sources and their back-up in case of risk situations, development of control systems at the level of transmission and distribution networks; the development of smart grids and the use of decentralised network, production and consumption management, including the possibility of managing storage in central and local systems (in particular at the distribution system level); system reliability management systems and their regional integration, network maintenance and operation systems based on element monitoring and risk management,

	and emergency mechanisms of island subsystem management (especially at the transmission network level); the development of protection against cyber-attacks and the protection of telecommunication systems, pilot projects in the field of electricity storage.
Energy recovery of waste	Research and development of new technologies for the energy recovery of secondary raw materials and wastes, which cannot be used for material recovery.
Transport systems	Increasing the efficiency of systems and means of public transport including electric traction vehicles and their drives; fuel cell development and battery development for the development of electric cars; the development of infrastructure for electric cars and hydrogen economy; the development of telematic traffic control systems aimed at automating and optimising individual transport; projects to reduce losses in supply systems and electrical traction equipment in transport.

Source: Czech Republic's State Energy Policy (2015)

On the basis of the measures in the Czech Republic's State Energy Policy, the sectoral programme of public support for research, development and innovations in the field of energy was also approved, which is administered by the Technology Agency of the Czech Republic. The programme is called THÉTA. The programme is approved for the period 2018–2025. It was effective to 'renew' this programme, if possible, also after 2025[42] and possibly to further strengthen the sectoral definition of support for research, development and innovation in the field of energy / climate protection. For more information on THÉTA, see Chapter 3.5.1.4.

ii. Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives, including long-term targets (2050) for deployment of low-carbon technologies, including for decarbonising energy and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

The Czech Republic has no specific national 2050 objectives for deployment of low-carbon technologies beyond those set out in other parts of this document. Also, the introduction of specific technologies should be primarily market-driven. The State may create conditions in research, development and innovation, possibly to partially support specific technologies in accordance with the State aid rules, but it is arguable whether the State should specify targets for the introduction of certain technologies and thereby distort the market environment.

iii. Where applicable, national objectives with regard to competitiveness

Of course, competitiveness is closely linked to the idea of the Energy Union. However, competitiveness is a relatively broad issue for the Czech Republic and in this sense it goes beyond the National Energy and Climate Plan.

The national objectives / the strategy of the Czech Republic in this area are contained in specific strategy documents. These include in particular the Strategy of International Competitiveness of the Czech Republic 2012–2020, approved in 2011, as well as the National Research and Innovation Strategy for Smart Specialisation of the Czech Republic, whose aim is to effectively target European, national, regional and private funds on priority innovation specialisations, thereby making full use of the knowledge potential of the Czech Republic. This way, the strategy also significantly contributes to increased competitiveness of the economy. Finally, the National Industry 4.0 initiative can be mentioned.

[42] In this respect, it should be noted that the potential 'renewal' of this programme must be preceded by interim evaluation of the current programme.

In this respect, the Czech Republic also acknowledges the importance of the EU Competitiveness Council, in which it is actively involved.

3 Policies and measures

3.1 Dimension decarbonisation

The Czech Republic has long been struggling with combustion process emissions of substances posing health risks (PM2.5, PM10, polycyclic aromatic hydrocarbons, benzo(a)pyrene, NOx, VOC, ground-level ozone, CO, dioxins, toxic metals and others), which are generated by the combustion of coal in household furnaces in almost every municipality in the Czech Republic. Also, emissions from old diesel and petrol engines in transport pose a health risk. Health risks, sickness rate among the population, premature deaths and the reduced life expectancy caused by these emissions are unsustainable, and external health and property damage is economically significant and stand at tens of billions of *koruna* per year. Because of the seriousness and the national scale of the problem, it is desirable to reduce, as a priority, emissions of CO_2 from combustion processes in these major areas of household furnaces and old diesel and petrol engines, even as a major multiplier effect, which also justifies State subsidies to protect public health, because at present the damage to health and property is far from internalised into fuel and energy prices.

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

3.1.1.1 Transport sector

The strategic and policy objectives and the main principles of development in the field of transport and transport networks are laid down by the Transport Policy of the Czech Republic 2014–2020, with a view to 2050. These are being gradually elaborated further in follow-up strategies. The main objective is to create conditions for the development of a quality transport system, which makes use of the characteristics of the various modes of transport and relies on the principles of competition with regard to its economic and social impacts and its impacts on the environment and public health. The State Environmental Policy of the Czech Republic 2012–2020 also includes requirements for the support of the use of alternative fuels, development of environmentally-friendly transport or economic instruments to include externalities from all modes of transport.

Transport policy envisages the gradual replacement of conventional fuels (i.e. oil-based fuels) for alternative energy in road transport and the further electrification of railways and urban public transport, with the gradual shift in freight transport from road to rail or water. A similar 2030 sub-target is set by the Czech Republic's State Energy Policy (2015) and the National Emission Reduction Programme of the Czech Republic (2015).

A number of measures are being implemented in the Czech Republic to promote the use of different types of alternative fuels. In accordance with Act No 16/1993, on road tax, vehicles for the transport of persons or freight vehicles with a maximum permissible weight of less than 12 tonnes using alternative fuel (hybrid drives, electric motors, CNG, LPG and bioethanol E85) are exempt from road tax; lower excise rate is applied to natural gas used in transport, even though the advantage is gradually decreasing. A certain (although lower) advantage in this area also applies to the use of LPG in transport.

In order to meet the targets laid down in Directive 2014/94/EC of the European Parliament and of the Council concerning the requirement to establish a national policy framework for the development of alternative fuels in transport and related infrastructure, on 20 November 2015 the Government of the Czech Republic adopted the National Action Plan for Clean Mobility. For more detailed information on this programme, see Chapter 3.1.3.1 of the National Action Plan for Clean Mobility.

In the 2014–2020 period, support for 'clean mobility' is provided by several current Operational Programmes. While the Operational Programme Transport (OPT) is aimed at supporting the public infrastructure of charging and filling stations (CNG/LNG/hydrogen), the Integrated Regional Operational Programme (IROP) supports the development of clean mobility in public transport and the Operational Programme Entrepreneurship and Innovation for Competitiveness (OP EIC) supports the introduction of electromobility in the business sector. Also, the Operational Programme Prague – Growth Pole of the Czech Republic has created a new specific target for the purchase of zero-emission electric buses, including the development of the related infrastructure. The operational programmes also include other measures that have an impact on greenhouse-gas emissions in all priority axes focusing on the development of railway infrastructure (TEN-T network completion) and infrastructure for other sustainable transport (e.g. modernisation of electric traction of urban public transport).

Act No 201/2012, on air protection, requires also a minimum share of biofuels in the total amount of vehicle gasoline and diesel for a calendar year to be put into free tax circulation. Fuel suppliers are obliged to gradually reduce greenhouse-gas emissions per unit of energy contained in the fuel over the life cycle of the fuel. By 31 December 2014, they had to reach a 2 % reduction in emissions, then by 31 December 2017 they had to reach a 3.5 % reduction and a 6 % reduction by the end of 2020. Only biofuels meeting the sustainability criteria under Government Decree No 189/2018, on sustainability criteria for biofuels and on the reduction of greenhouse-gas emissions from fuels can be counted towards the obligations. Act No 353/2003, on excise tax, then lays down the tax rate for individual fuels and the conditions under which pure and high-percentage biofuels are subject to a lower excise rate. The Multi-annual Programme for the Promotion of the Further Use of Sustainable Biofuels in Transport 2015–2020 (Government Resolution No 655/2014) aimed to maintain the existing system of promotion of the use of pure biofuels and high-percentage biofuel blends in transport. The Programme describes the use of liquid biofuels in transport both technically and legislatively and constitutes a framework that sets the optimum level of support for each biofuel type. However, its adjustments, which had to be made following the notification of the Programme to the European Commission, significantly reduced the interest of motorists in the use of high-percentage or pure biofuels in transport, whose current use is therefore only minimal.

An important tool for creating a sustainable urban transport system is the elaboration of a Strategic Sustainable Urban Mobility Plan. The aim is to comprehensively address the issue of mobility in bigger cities connected with suburban areas, not only in terms of transport issues, but also in terms of the possibilities of influencing mobility and how it is made possible. Strategic Sustainable Urban Mobility Plans should be developed and regularly updated in cities with a population of over 40 000.

Energy savings are based on increased use of public transport in passenger transport and on increasing the share of rail transport by comparison with road transport in freight transport. The public transport strategy, prepared as the initial strategic document of the Ministry of Transport for public transport in 2015–2020 with a view to 2030, therefore aims to improve the public transport system. Public transport operators and transport infrastructure managers can apply for support through the Integrated Regional Operational Programme for a range of activities related to the increase in sustainable forms of transport, such as fleet renewal. This will be necessary to comply with Government Decree No 49/2015, so that the average age of public transport vehicles is not more than 9 years.

In the area of freight transport, it is necessary to mention the Freight Transport Strategy 2017–2023 with a view to 2030, which, in view of the more difficult introduction of alternative energies in freight transport, highlights this especially in the area of urban freight transport and city logistics. According to this strategy, smaller, preferably alternative-drive lorries must be used for deliveries especially in historic city centres. The use of LNG (possibly even bioLNG) in the short term and electricity or hydrogen in the long term would have the greatest potential in this area. Road freight transport should be more broadly reflected in the forthcoming update of the National Action Plan for Clean Mobility.

Fuel savings are also facilitated by increased traffic safety and fluency in all modes of transport, which is the aim of the approved Action Plan for the Deployment of Intelligent Transport Systems 2020 with a view to 2050. Among other things, intelligent systems will allow the technical condition of transport routes to be monitored and serious traffic accidents to be prevented. Implementation of the National Cycling Development Strategy 2013–2020 aims to improve the coordination of the development and the conditions for the use of this environmentally-friendly non-motorised transport.

To support the use of environmentally-friendly vehicles, the National Emission Reduction Programme of the Czech Republic includes the measure ‘Renewal of the public transport vehicle fleet with alternative-drive vehicles’. Under this measure, public authorities should, as part of its fleet renewal, regularly purchase M1 and N1 alternative-drive vehicles in order to achieve at least a 25 % share of alternative-drive vehicles in the total public administration fleet by the end of 2020 and a 50 % share of alternative-drive vehicles by the end of 2030.

Low-emission zones are geographically defined areas that limit access of vehicles on the basis of their emissions in order to improve air quality in these areas. The rules for the classification of road motor vehicles into emission categories and emission labels were laid down in Government Decree No 56/2013. The introduction of low-emission zones is also supported under the National Programme Environment. The National Programme is also geared towards supporting alternative modes of transport (e.g. car sharing, bike sharing, alternative drives, or non-motorised modes of transport). In 2016–2018 within the National Programme Environment, the Ministry of the Environment announced three calls with a total allocation of CZK 300 million for municipalities, regions and their organisations to support the purchase of alternative-drive vehicles. This call is complementary to the OP EIC calls for legal persons.

3.1.1.2 Agriculture and forestry sector

An important way of using methane and preventing its spontaneous formation is the processing of residues of agricultural production in biogas stations. The main tool to promote biogas utilisation was the introduction of feed-in tariffs and green bonuses linked to the amount of electricity produced. The construction of biogas stations has been supported under operational programmes and is also supported in the current period. The Rural Development Programme supported the construction of agricultural biogas stations. The construction of biogas stations using bio-waste is supported by the Operational Programme Environment, while the Operational Programme Enterprise and Innovation for Competitiveness provides support to the output of heat from the existing biogas stations for its efficient use.

The Action Plan for Biomass in the Czech Republic 2012–2020 foresees the possibility to achieve annual energy production from agricultural land and agricultural by-products and processing of agricultural products in the range of 133.9 to 186.8 PJ by 2020. The use of by-products and biodegradable waste accounts for the largest share (44 %), targeted cultivation of biomass for energy use on arable land accounts for about 40 % and energy use of grassland harvest makes up the rest (about 16 %). Such energy can replace the corresponding amount of fossil fuels, thereby contributing to the reduction of greenhouse-gas emissions.

The Rural Development Programme of the Czech Republic 2014–2020 goes beyond the cross-compliance control measures and will address the achievement of climate targets by 2020, notably through the measures implemented under Priority 5 ‘Promoting efficient use of resources and supporting the transition to a climate-proof low-carbon economy in the agricultural, food and forestry sectors’, as well as measures under Priority 4 ‘Renewal, protection and improvement of agriculture- and forestry-dependent ecosystems”. These targets will also be partially facilitated by measures under Priority 2 ‘Enhancing the viability of agricultural holdings and the competitiveness of all types of farming in all regions and promoting innovative agricultural technologies and sustainable forest management’.

An important tool for reducing the consumption of mineral fertilisers is the development of organic farming, where the use of nitrogenous mineral fertilisers is completely prohibited. The organic farming regime is laid down in Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91 and Act No 242/2000, on organic farming. The support provided under the Rural Development Programme of the Czech Republic has a substantial impact on the expansion of the area of agricultural land managed according to organic farming principles.

Carbon sequestration in soil is facilitated by mandatory compliance with the standards on Good Agricultural and Environmental Condition and compliance with mandatory farming requirements, transposed by Government Decree No 48/2017, laying down requirements in accordance with acts and standards on good agricultural and environmental condition for controls of cross-compliance and consequences of their infringement for the granting of certain agricultural support. Paying support to farmers is conditional, *inter alia*, on meeting these standards and requirements. Important measures under the Rural Development Programme include the agri-environmental climate measures, namely owing to maintaining or enhancing the nitrogen retention capacity by setting appropriate land management or by the transition to a culture with higher retention potential. Another effect of this measure is the strengthening of anti-erosion measures with a high sequestration impact, especially in nitrate-endangered areas or along watercourses (grassing, grassland care).

One of the tools for addressing climate issues by expanding forest areas is local support for afforestation of agricultural land provided under the Rural Development Programme. Government Decree 185/2015, on the conditions for granting subsidies in the context of agricultural land afforestation measures and amending some related decrees, provides for subsidies for the establishment of and care for forests for a period of 5 years and for the termination of agricultural production on afforested land for a period of 10 years.

Another tool is the support for preventing forest damage by forest fires and natural disasters and catastrophic events, which also contributes to the reduction of forest fire emissions / the conservation of carbon in biomass and soil. Carbon sequestration in soil will also be facilitated by the support for sustainable management of permanent grassland.

2. The National Forest Programme includes ‘Key Action 6 – Reduce the impacts of the expected global climate change and extreme meteorological phenomena’, which is based on 12 specific measures. These measures are generally focused on creating more resilient forest ecosystems by supporting diversified forests with the greatest possible use of natural processes, varied tree species, natural renewal and cultivation process variability.

The Strategy of the Ministry of Agriculture with a view to 2030 under Objective D.2 ‘Competitiveness of the forest management-based value chain’ aims, *inter alia*, to: (i) create conditions for higher household use and consumption of wood and wood products; (ii) create conditions for investment in the forest management sector and the downstream value chain, which will lead to the production of higher added value wood products; (iii) reduce exports of wood mass from the Czech Republic; (iv) promote research and development towards better use of wood mass and explore new product opportunities with the use of wood.

All this should lead to increased use of wood as a renewable carbon-binding raw material and a substitute for other materials whose production is associated with high CO_2 emissions. Reducing exports of raw wood and its processing (especially to cut timber and timber boards) in the Czech Republic will positively contribute to the Czech Republic's emission balance.

3.1.1.3 Waste management sector

The basic Czech legal regulation in the area of waste management is Act No 185/2001, on waste. The Waste Act is in line with Directive 2008/98/EC of the European Parliament and of the Council, on waste, and therefore lays down the EU Waste Management Principles into Czech legislation.

Act No 477/2001, on packaging and amending certain acts, addresses the prevention of waste packaging. It defines the basic obligations for the handling of packaging and packaging waste, including the labelling of packaging, reusable packaging, returnable packaging, returnable deposit packaging and take-back.

New European regulations, together with new technological procedures for handling selected products, resulted in the need to adopt a special law on the handling of these products. The forthcoming draft End-of-Life Products Act lays down the rights and obligations of all those who handle electrical equipment, batteries and accumulators, tyres and vehicles from their placement on the market until their processing after they have become waste.

In addition, work is carried out on the preparation of the implementing legislation related to the amendment to the Waste Act, Act No 223/2015, as well as new implementing legislation defining the rules for solid alternative fuels produced from waste (SAF Decree), a list of wastes that will be banned from landfilling from 2024 (Landfill Ban Decree).

The basic strategic document and tool for waste management is the Waste Management Plan of the Czech Republic 2015–2024 (WMP), which also fulfils and further elaborates the State Environmental Policy of the Czech Republic 2012–2020. The WMP is designed in accordance with the waste management hierarchy in accordance with the above-mentioned Directive 2008/98/EC, on waste. The strategic objectives of the plan are to prevent waste generation and to reduce specific waste production, minimise the adverse effects of waste generation and its management on human health and the environment, ensure sustainable development of the society, and move towards a European 'recycling society', maximise waste utilisation as a substitute for primary sources and transition to a circular economy.

The Waste Prevention Programme, approved by Government Resolution No 569 of 27 October 2014, is a strategic document with specific targets and measures, thus creating the conditions for lower consumption of primary sources and gradual reduction of waste production. Reducing the amount of waste also reduces the demand for its processing and the associated greenhouse-gas emissions. This government programme introduces the following tools: education and training, elaboration of expert analyses for the possibility of setting new legislative requirements in the field of waste prevention, methodological and legislative measures, and support for research and development. The Waste Prevention Programme is part of the Waste Management Plan of the Czech Republic.

3.1.1.4 Household sector

Under the New Green Savings grant programme, funded from the revenues from auctioning of emission allowances, it is possible to combine the reduction of the energy performance of buildings with the greening of the heating source, where it is possible to obtain grants for biomass boilers, heat pumps or gas condensing boilers. Furthermore, it financially supports the construction of new buildings with very high energy performance (buildings approaching the passive energy standard) and installation of photovoltaic systems. The New Green Savings (NGS) supports energy savings and the replacement of heating sources in family houses throughout the Czech Republic, and in residential buildings only in Prague. The construction of new low-energy buildings is supported within the NGS throughout the Czech Republic. As part of the greening of heating, the installation of solar (photothermal) systems is also supported under the NGS. Reducing the energy performance of buildings outside of Prague Capital City is also supported within the Integrated Regional Operational Programme.

More efficient and cleaner heat production in households is also supported through the Boiler Replacement Scheme from the Operational Programme Environment 2014–2020, SO 2.1. The grants are intended to replace old environmentally damaging solid fuel boilers with modern low-emission boilers (e.g. gas condensing boilers), heat pump or solar system; the highest subsidy is provided for biomass-only boiler and heat pump.

3.1.1.5 Industry sector

In order to reduce greenhouse-gas emissions in the industry sector, it is crucial to implement cross-cutting measures based on EU legislation. In addition to the EU ETS, especially integrated pollution prevention and control, in accordance with Act No 76/2002, on integrated prevention, has a major contribution to reducing emissions. Emissions of fluorinated gases are regulated by Act No 73/2012, on ozone-depleting substances and on fluorinated greenhouse gases, and Implementing Decree No 257/2012, on the prevention of emissions of ozone-depleting substances and on fluorinated greenhouse gases, which transpose the relevant EU regulations.

3.1.1.6 Energy sector

The contribution of the energy sector to greenhouse-gas emissions (or their reduction) is described in detail in other parts of this document. However, it is useful to emphasise the role of individual energy sources within the energy mix in reducing greenhouse gases. In this respect, it is useful to briefly describe the role of nuclear energy as an emission-free energy source (the role and expected development of other emission-free sources, especially renewable sources, is described in other parts of this document).

A total of 6 nuclear power units in the Temelín power plant and the Dukovany power plant are currently in operation in the Czech Republic. The key national strategy documents clearly state that the maintenance of the current share of nuclear energy in the energy mix and its further development is crucial for achieving the long-term low-emission commitments of the Czech Republic. The current Czech Republic's State Energy Policy envisages increasing the share of nuclear energy in primary energy sources to 25–33 % (from the current level of about 15 %) and increasing its share in gross electricity production to 46–58 % (from the current level of about 29 %). Following the approval of the State Energy Policy in the Czech Republic in May 2015, the National Action Plan for the Development of Nuclear Energy in the Czech Republic was approved in June 2015, which specifically elaborates on the requirement of the Czech Republic's State Energy Policy to strengthen the role of nuclear energy. The strategic assignment is to ensure the continuity of operation of the Dukovany Nuclear Power Plant, which will have been in operation for 50 years in 2035. The process of obtaining key permits and preparation of both sites is currently under way. However, there has been no decision on the investment and financing model so far. The analytical parts of this document consider the further development of nuclear energy in accordance with the approved strategic documents. This development is relevant for the post-2030 period and will be updated together if necessary together with the update/preparation of the next National Plan (for the period 2030–2040).

ii. Where relevant, regional cooperation in this area

The Czech Republic does not consider this area relevant at the National Plan level. More precisely, regional cooperation is regulated in detail at EU level and at the level of international institutions such as the UNFCCC.

iii. Without prejudice to the applicability of State aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

Reducing emissions outside the EU ETS is significantly facilitated by the support from EU funds for the development of renewable energy sources and improving energy efficiency, as described in Chapters 3.1.2 and 3.2 below. Operational Programme Transport 2014–2020 contributes to the reduction of greenhouse-gas emissions in transport, mainly supporting the development of transport infrastructure, which leads to a reduction in fuel and energy consumption. The Rural Development Programme 2014–2020 contributes to reducing emissions and increasing declines in the agricultural and forestry sectors by supporting agri-environmental and climate measures and modernising agricultural and forestry operations. Key national programmes include the above-mentioned New Green Savings programme, funded from the revenues from the auctioning of emissions allowances, which reduces greenhouse-gas emissions, primarily in the household sector.

3.1.2 Renewable energy

i. Policies and measures to achieve the national contribution to the binding 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2 of this Annex, including sector- and technology-specific measures[43]

3.1.2.1 Existing policies for the promotion of renewable energy sources

The following table summarises existing policies on renewable energy sources. This is only a summary. Detailed information is provided in the Progress Report on the Promotion and Use of Renewable Energy in the Czech Republic[44].

Table 33: *Most important existing policies on renewable energy sources[45]*

Policy/measure	Characteristics
Indirect support (reduction of administrative requirements)	Reducing administrative requirements for connection and operation of small sources up to 10 kW
Indirect support (mandatory assessment of installation)	Mandatory assessment of the installation of alternative systems as part of compliance with the requirements on energy performance of buildings
Indirect support (guarantees of origin of energy)	Issue of guarantees of origin
Indirect support (overview of efficient heat supply	Overview of efficient heat supply systems pursuant to

[43] When planning these measures, Member States shall take into account the end of life of existing installations and the modernisation potential.

[44] Report on progress in the promotion and use of energy from renewable sources in the Czech Republic under Article 22 of Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources. The last submitted report is for 2015 and 2016.

[45] This is not an exhaustive list, but rather the most important policies / policies specifically focused on renewable energy sources.

systems)	Section 25(5) of Act No 165/2012, on supported energy sources and amending certain acts.
Indirect support (spatial planning)	Spatial planning
Operating support for electricity	Operating support for electricity in the Czech Republic is provided in Act No 165/2012, on supported energy sources, which implemented Directive 2009/28/EC on the promotion of the use of energy from renewable sources. Operating support is possible for the electricity sector by means of a feed-in tariff or green bonus.
Operating support for heat	Operating support for heat (biomass including biogas, biofuels, geothermal energy)
Investment support – electricity (State programmes)	State Programme for the Promotion of Energy Savings and the Use of Renewable Energy Sources (Ministry of Industry and Trade); Green Savings and New Green Savings (Ministry of the Environment); Boiler Replacement Scheme from the Operational Programme Environment 2014–2020, SO 2.1 (Ministry of the Environment and selected regions)
Investment support – electricity (operational programmes)	Operational Programme Enterprise and Innovation for Competitiveness (Ministry of Industry and Trade) 2014–2020; Investment support – electricity (operational programmes)
Investment support – electricity (European Agricultural Fund for Rural Development)	European Agricultural Fund for Rural Development – Rural Development Programme (Ministry of Agriculture) – this type of support has already been terminated.
Investment support – heat (State programmes)	Green Savings and New Green Savings (Ministry of the Environment); Boiler Replacement Scheme within the Operational Programme Environment 2014–2020, SO 2.1
Investment support – heat (operational programmes)	Operational Programme Enterprise and Innovation for Competitiveness (Ministry of Industry and Trade) 2014–2020; Operational Programme Environment (Ministry of the Environment)
Investment support – heat (European Agricultural Fund for Rural Development)	European Agricultural Fund for Rural Development – Rural Development Programme (Ministry of Agriculture) – this type of support has already been terminated.
Tax instrument (tax exemption, reduction or refund)	Exemption from electricity tax for electricity from renewable sources
Tax instrument (tax exemption, reduction or refund)	Exemption from immovable property tax
Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels	Promoting the use of biofuels through the mandatory reduction of greenhouse-gas emissions from fuels laid down in Section 20(1) of Act No 201/2012, on air protection, as amended
Aid for biofuels (mandatory blending)	Mandatory blending of biofuels into automotive petrol and diesel fuels

Aid for biofuels (high-percentage and pure biofuels)	Support for high-percentage and pure biofuels, support for advanced biofuels.

Source: Prepared by MIT for the purposes of the National Plan

3.1.2.2 Policies to ensure the achievement of renewable energy target by 2030

In order to meet its national contribution to the European RES target at 32 % by 2030, as set out in Chapter 2.1.2, the Czech Republic has amended Act No 165/2012, on supported energy sources. The policies proposed in this amendment can be seen as the main policies for ensuring the achievement of the transport target by 2030. Under Act No 165/2012, a new RES support scheme after 2020 is proposed, which should ensure progress towards the national contribution in this area. In this respect, however, it must be emphasised that this is only a draft amendment to the act, which still has to go through the legislative process of the Czech Republic, which usually lasts between one and two years.

At present, the overall 2020 EU target for the share of energy from RES to total final energy consumption of is 20 %, as well as binding targets for individual Member States where the target for the Czech Republic is set at 13 %. This national target of the Czech Republic was already achieved in 2013 and in 2016 the Czech Republic reached the share of energy from RES to total final energy consumption of 14.89 %. Between 2021 and 2030, at least a 6 % increase in the share of energy from RES to final energy consumption will have to be achieved. However, this increase does not take into account the fact that the Czech Republic will also have to 'cope' with the potential decrease in energy from RES after around 2028 in the case of electricity plants that are claiming and receiving operating support today, where the production of energy from renewable energy sources may terminate after the end of the current operating support for these plants, because without any operating support there is a risk that these plants will shut down. The risk of plant shutdowns and termination may mean that without any further measures to maintain and motivate these plants to stay in operation, the current share of energy from RES may lose up to 8.09 %. The most high-risk plants are fuel sources using biomass and biogas. These sources currently account for 6.3 % of the share of energy from RES to total final energy consumption of the current share of energy from RES of 14.89 %. The 6.3 % does not include the production of heat in households, which accounts for another 5.04 % of the share of energy from RES out of 14.89 % of the current share of energy from RES, or the use of biofuels in transport. It is therefore essential to keep these plants in operation if their production is still sufficiently efficient; any further support to maintain production in these plants will be more effective in achieving the targets. If current plants are not kept in operation, it would be necessary from the present perspective (2016) to have new generating plants and facilities to provide by 2030 not only 6 % but up to 12.21 % of additional share of energy from RES.

The setting and structure of the support system to ensure the achievement of energy targets from supported energy sources by 2030 in the draft amendment to the Supported Energy Act

In order for the Czech Republic to be prepared for this situation, Act No 165/2012 proposes the preparation of tools and measures with appropriate forms of support for all supported energy sources. The selected approach is conceived as a comprehensive solution for the new support setting in the period 2021–2030 for the development of new RES sources as well as for the maintenance of energy-efficient plants that are currently in operation. In simple terms, this principle can be summarised as follows:

a) modification of the current form of support for small sources up to 1 MW, where the support will no longer be used in the form of feed-in tariffs, but only in the form of an hourly green bonus. This is the most 'pro-market' approach and financially most effective form of support for small sources.

b) introduction of support through competitive tenders (auctions) for sources above 1 MW. This is a ‘pro-market’ principle, which, moreover, also follows for these sources as an obligation from EU legislation.
c) introducing a new form of support so that some existing sources can be maintained in operation and some other new sources can develop, and introducing new forms of support to ensure the required sectoral RES targets in heating and cooling.
d) This involves the introduction of new forms of support in order to ensure the achievement of sectoral RES targets in transport required by the revised RES Directive. This involves the promotion of biomethane.

1. <u>Adjustment of operating support for the construction of new plants in individual sectors</u>

Support for electricity from renewable energy sources

The scope of support will only be for non-fuel sources (except PVPP) and landfill or sludge gas. Fuel sources were redirected to heat support to ensure the achievement of the RES target in the heating and cooling sector. The form of support for new electricity plants will be applied by an hourly green bonus, with a division into electricity plants, which will compete for the support in an auction. For sources up to 1 MW support will be provided in the form of an annual green bonus officially laid down in an ERO price decision and for sources above 1 MW, the support will be provided by means of auctions in the form of the ‘auction bonus’. The duration of the support will remain unchanged – over the lifetime (20 or 30 years).

Support for electricity from secondary energy sources

The scope of the support will be limited to mining gases. Waste heat will be supported through investment support and municipal waste incineration plants will be supported through heat generation. The form of support for new electricity plants will be applied by a yearly green bonus, with a division into electricity plants, which will compete for the support in an auction. For sources up to 1 MW support will be provided in the form of an annual green bonus officially laid down in an ERO price decision and for sources above 1 MW, support will be provided by means of auctions in the form of the ‘auction bonus’. New support period will be set for electricity plants from secondary sources – over the lifetime (15 years).

Support for electricity from high-efficiency combined heat and power

The scope of the support will continue to be determined for all cogeneration plants as ‘fuel-neutral’. Support for CHP electricity will not be announced if other operating support is announced for the given type of supported energy source – for example, if operating support for RES electricity and operating support for DES electricity is announced, the support for CHP electricity will be announced only for non-renewables. The generating facility will only be able to use one type of operating support. The form of support for new electricity plants will be applied by a yearly green bonus, with a division into electricity plants, which will compete for the support in an auction. For sources up to 1 MW support will be provided in the form of an annual green bonus officially laid down in an ERO price decision and for sources above 1 MW, the support will be provided by means of auctions in the form of the ‘auction bonus’. New support period will be set for electricity plants from high-efficiency cogeneration – over the lifetime (15 years).

Aid for heat from renewable energy sources

The scope of the support will be used to build new biogas, biomass and geothermal power plants and to compensate for fuel costs for RES by comparison with fuel costs for non-RES in the case of biomass and geothermal energy (as ‘heat support for maintaining the heat plant in operation’). The form of the support will be determined by an annual green bonus. The duration of support for the construction of new biogas, biomass and geothermal energy plants will be set over the lifetime (20 years). The duration of 'maintenance support' will be set at least 3 years after the announcement of the support in a government decree.

2. <u>New types and forms of support</u>

In order to maintain energy-efficient power and heat plants in operation, support will be put in place to maintain the plants in operation. The above-mentioned forms of support will be applied if the government so decides in its decree, specifying the types of supported sources and forms of support for 3 years ahead.

Support for electricity to maintain the operation of a power-generating facility

The support is intended to offset the difference between the price of biomass and the price of solid fossil non-RES fuels in biomass-fired power-generating facilities or operating costs and the market price of electricity and heat in a high-efficiency CHP power-generating facility, a secondary source power-generating facility or a power-generating facility using biomass, biogas or geothermal energy. The form of the support will be determined by an hourly or annual green bonus. The duration of the support will be set at least 3 years after the announcement of the support in a government decree, and if the market situation is the same – i.e. the operating costs and the biomass price are higher than the market price of solid fossil non-RES fuels or the market price of electricity and heat.

Support for heat to maintain the operation of a heat-generating facility

Heat-generating facilities are subject to the same principle and rules as the above-mentioned electricity support to maintain the operation of a power-generating facility. In the case of heat support to maintain the operation of a heat-generating facility, this support will also apply to the co-incineration of RES and non-RES, it is the transition from electricity support to heat support. The form of the support will be determined in this case by an annual green bonus.

Support for electricity to modernise a power-generating facility

The support is intended for electricity produced in a power-generating facility in which modernisation was carried out under the conditions laid down in the Implementing Decree. By using electricity support on the modernised power-generating facility, the right of electricity support which was created prior to the modernisation of the power plant terminates. The support applies to electricity produced in the power-generating facility meeting the conditions imposed on new plants. The support will be in the form of an hourly or yearly green bonus or auction bonus. The duration of the support will be for the lifetime of the power-generating facility; support may also be set for a shorter period of time.

Modification of a power-generating facility equipment without affecting the entitlement to support

The submitted amendment to the Act also clearly defines the conditions for the modification of a power-generating facility equipment which does not affect the existing right to operating support and the conditions for granting the support. It is a modification which does not change the installed capacity of the power-generating facility. If the modification of the power-generating facility equipment increases the installed capacity of the power-generating facility, the existing right to electricity support of a non-fuel source shall apply to the amount of electricity in proportion to the installed capacity of the power-generating facility before and after the modification of the equipment. In the case of a fuel source, it applies to the amount of electricity corresponding to electricity production before the modification of the equipment. The method of determining the amount of electricity which maintains the existing right to electricity support shall be determined by implementing legislation. If the installed capacity of the power-generating facility is exceeded and the installed capacity is decisive for determining the different amount of support according to the price decision, the installed capacity after the modification of the equipment is decisive for the amount of support granted. If the installed capacity of the power-generating facility is exceeded and the installed capacity was decisive for the creation of the right to support at the time of commissioning of this power-generating facility, the right to support terminates.

3. New type of support to ensure the fulfilment of the RES target in the transport sector – support for biomethane

In order to ensure the achievement of the RES target in the transport sector and the sub-target in this sector for advanced biofuels, it is necessary to introduce new support, which will initiate the production of 'advanced' biomethane and its supply to the transport sector. The form of the support will be set as an annual green bonus over the lifetime (20 years). Operating support financing is proposed from the State budget, mainly from the savings for the support of RES electricity for biogas power-generating facilities which will be converted to biomethane plants. The conditions of this support will be similar to those that have been introduced earlier in this Act for the support of biomethane, i.e. support for generating plants in the Czech Republic connected to the distribution or transmission system operated by a gas production licence holder in accordance with the quality requirements for biomethane, odourisation and measurement. At the same time, there will be requirements similar to those which currently apply to the support for electricity and heat – this involves the registration of the generating facility and support in the OTE system or the requirements for measuring and reporting the amount of biomethane etc. The amendment to the act also introduces guarantees of origin of electricity from RES and electricity from CHP.

4. New forms of support – support by means of auction bonus

The amendment to the Act introduces an adjustment in the provision of operating support for electricity from RES according to the Environmental and Energy State Aid Guidelines 2014–2020, which are very likely to be set for 2021–2030 and at the same time responds to the revised RES Directive. In both EU regulations, larger sources must tender the amount of operating support. A mandatory auction bonus is therefore introduced to support electricity from RES for generating facilities with a capacity exceeding 1 MW (with a capacity exceeding 6 MW or 6 units for wind power plants) and for CHP plants and secondary energy source plants with a capacity exceeding 1 MW. In the case of electricity generation from renewable energy sources, 'reference price' needs to be tendered, in the case of CHP and DES plants, the auction bonus is tendered. In the case of the CHP and DES power-generating facilities, the generating facility is supported by the directly tendered annual auction bonus, in the case of a RES power-generating facility the producer is supported by an hourly auction bonus, which is determined as the difference between the reference price and the hourly market price of electricity. The support in the form of the auction bonus will be paid to the generating facility by OTE, a.s. The amendment to the Act contains provisions concerning the announcement of the auction, the evaluation of the tenders received, auction support contracts, the exercise and termination of the right under financial guarantee, the extinction of the right to support from the auction and the publication auction result. An auction may be cancelled, but it must be duly substantiated, including an indication on whether the auction will be repeated or whether the support will be determined officially. The act also provides details of the auction support contract. The MIT undertakes to ensure the provision of support in the amount and manner specified in the contract, and the producer undertakes to commission the power-generating facility or modernise it, keep it in operation and produce electricity under the conditions laid down by the contract and the law. An amendment to the contract may only be made in writing; it is not possible to change the tendered reference price or auction bonus.

5. New form of regulation of supported energy sources

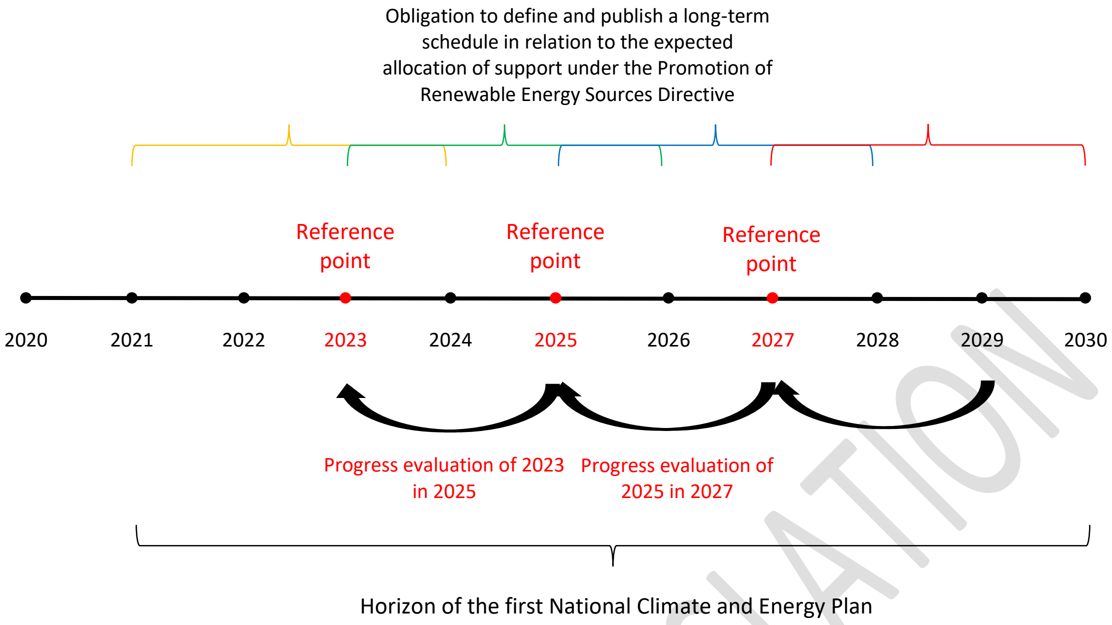
A new form of regulation in the law is set in several steps. The first step is to create the actual Integrated Plan with a forecast for 2021–2030. The Integrated Plan is implemented in accordance with a government decree, which will cover at least 3 subsequent years. The government decree (GD) is issued 12 months before the first year of the period defined in the government decree, and for the next period the government adds the values for the following period (year) by a decree. The right to the above forms of support for power-generating facilities, heat-generating facilities or biomethane-generating facilities commissioned from 1 January 2021 or for modernised generating facilities and generating facilities receiving 'maintenance' support applies to the supported sources specified in this decree – there will no longer be an automatic statutory entitlement to support. The act also stipulates the content of the government decree, which will at least specify the types of supported sources, the types and forms of support, the types of facilities and the amount of installed capacity of power-, heat- and biomethane-generating facilities to be supported, the maximum amount of financial security and its form in the case of an auction, the definition of the types of supported energy sources (SES) which, in the case of auctions, cannot participate without a building permit or the determination of whether there will be a joint auction for new and modernised power-generating facilities, and the duration of the electricity support and heat support to maintain the operation of a power-generating facility and heat-generating facility. Effective regulation and control of the achievement of predicted and target values of energy from RES will be carried out every month by entering the data in OTE register. If the values are exceeded, the support for other generating facilities will no longer be provided. The amendment to the Act sets out the procedure and the process for the completion of generating facilities under construction.

Relation between the new support scheme and the National Plans

Any support for sources beyond 2020 will be linked to the implementation of the National Energy and Climate Plan (for 2021–2030). State support will be granted in such a way as to achieve the trajectory / the target point and control points specified in this document.

The initiator for the use of appropriate tools to support RES (including SES) is the MIT, after identifying the possibility of non-compliance with the National Action Plans, which will always choose which form of support is most appropriate at the moment to ensure the achievement of the national RES target. In order to ensure predictability of the planned support for investors, in 2021, 2023, 2025 and 2027 the MIT will determine the expected timetable in relation to the expected allocation of total State aid (investment support + operating support, both in the form of officially determined support and in the form of auctions), covering the following three years. This timetable and the estimate of all the support provided for RES (and other SES) for the following 3 years will be set out in a government decree. The government decree will be updated every two years, thereby 'activating' the different forms of support for new sources, depending on the need for development and the achievement of targets.

Figure 2: *Relation between support scheme under amendment to Act No 165/2012 and National Plans*



Source: Prepared by MIT for the purposes of the National Plan

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

The Czech Republic does not currently plan on using a voluntary statistical transfer of production from domestic renewable sources to another Member State. Nevertheless, such a potential transfer should not be ruled out. However, the Czech Republic will primarily try to meet the contribution to the European target specified in Chapter2.1.2. However, the development of renewable sources can of course exceed this target. In this case, statistical transfer of the Czech Republic (as a provider of RES share) to another Member State could be considered. The Czech Republic also does not plan on using the transfer to achieve the Czech Republic's target (as a recipient of RES share); the target is designed so that the Czech Republic is able to achieve it using national sources.

The Czech Republic would also welcome its potential involvement in RES-related projects of common interest (PCI) or projects supported by the Connecting Europe Facility (CEF). At this point, however, it is not possible to provide more specific information. Projects of common interest also depend to a large extent on the interest of investors and the availability of suitable sites. The Czech Republic also does not rule out its involvement in the European RES Fund. However, the exact functioning of this fund is not yet fully defined; therefore, it is not possible to provide more specific information in this respect.

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

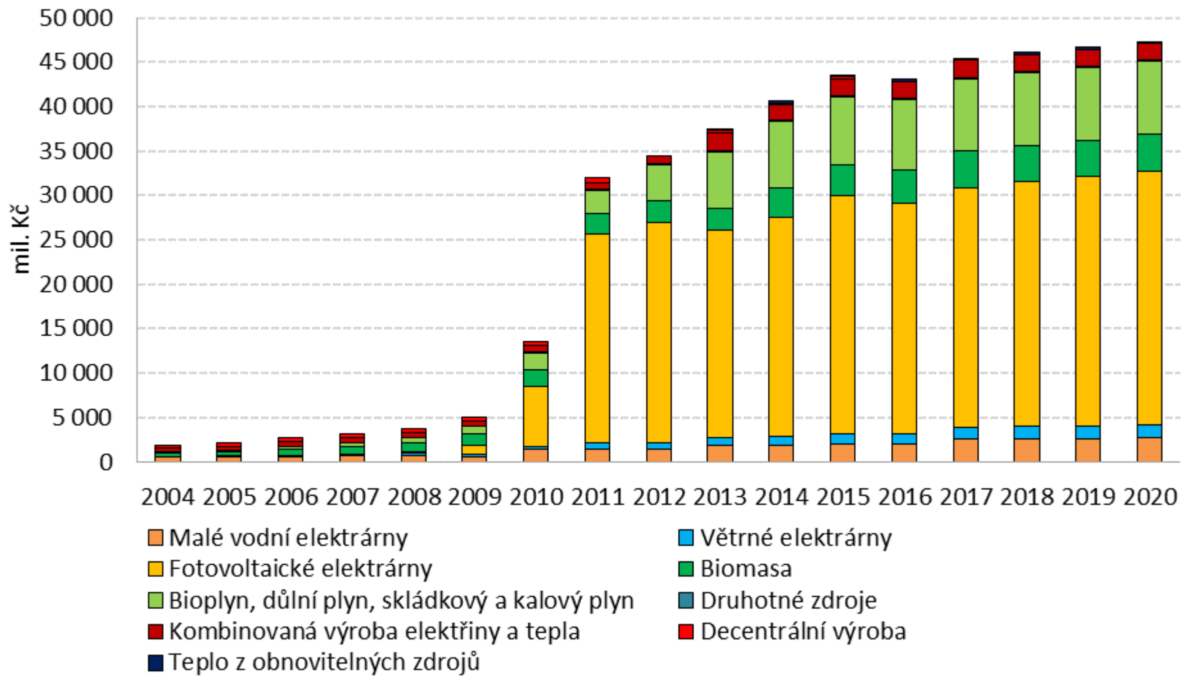
Financial support for the development of renewable sources can be divided into three basic groups:

– **Measures paid by the owners and constructors of buildings without support –** measures and instruments based on the option of 'mandatory' or 'forced' installation of renewable energy generating facilities by owners and constructors of building as part of meeting the requirements for energy performance of buildings, and gradual tightening of these requirements up to nearly zero-energy buildings.

– **Investment support –** maximum use if the Czech Republic has sufficient funding from EU funds or, if available, earmarked funding (for more information, see Chapter 3.2). In addition, the 'Modernisation Fund' consisting of the revenues from the sale of emission allowances and other EU ETS-related instruments will be used to support RES investments. (for more detailed information on the revenues from the auctioning of emission allowances and their potential use, see Chapter 3.2, part viii.).

– **Operating support** – support will be provided for certain types of RES whose production cost is currently higher than the market price and investment support alone will not ensure their further development. For biomass and biogas sources, support will be provided to the maximum possible energy efficiency of using this primary fuel, i.e. power generation in a high-efficiency CHP facility. This support will also be used to cover the fuel cost difference, as the amount of support will be determined so as to offset the increased cost of purchasing RES fuel by comparison with fossil fuel or to offset the increased cost of producing RES energy by comparison with the market price of energy. Chart 9 illustrates historical cost of operating support for existing sources (with extrapolation for 2020). Chart 10 development of funds for operating support from the State budget.

Chart 9: *Historical cost of existing operating support for SES (2004–2020)*[46]

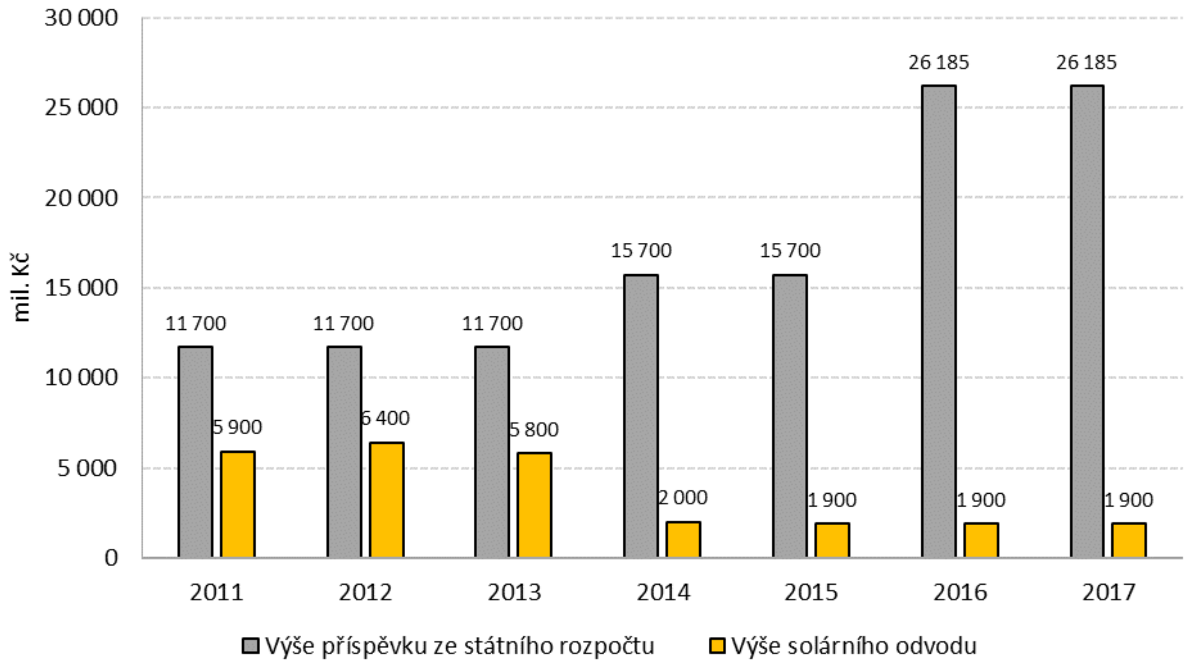


Mil. Kč – CZK million
Malé vodní elektrárny – Small hydropower plants
Větrné elektrárny – Wind power plants
Fotovoltaické elektrárny – Photovoltaic power plants
Biomasa - Biomass
Bioplyn, důlní plyn, skládkový a kalový plyn - Biogas, mining gas, landfill and sludge gas
Druhotné zdroje – Secondary sources
Kombinovaná výroba elektřiny a tepla – Combined production of electricity and heat

[46] An extrapolation for 2019 and 2020.

Source: 2004–2012 – ERO; 2013–2017 – OTE, a.s., 2018–2020 forecast

Chart 10: *Developments in the amount of the State budget contribution and solar tax in 2011–2017*[47]



Výše příspěvku ze státního rozpočtu – State budget contribution
Výše solárního odvodu – Solar tax
Mil. Kč – CZK million

Source: Ministry of Industry and Trade; Ministry of Finance

iv. Where applicable, the assessment of the support for electricity from renewable sources that Member States are to carry out pursuant to Article 6(4) of Directive (EU) 2018/2001

In accordance with the requirements of the Promotion of Renewable Energy Sources Directive, the Czech Republic shall, at least every five years, assess the effectiveness of its national support schemes for electricity from renewable sources and their effects on different consumer groups and on investments. The results of this assessment will be taken into account in the long-term planning (as may be indicated in the update of the National Plan) and the results may be reported and commented on in the progress reports in accordance with the requirements of the Energy Union Governance and Climate Action Regulation.

v. Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements

Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Article 21(6) and Article 22(5) of Directive (EU) 2018/2001 to

[47] The State budget contribution for RES support is partly financed using the revenues from the sale of emission allowances.

promote and facilitate the development of self-consumption and renewable energy communities

The newly set-up building law processes should aim to simplify, accelerate and streamline administrative processes related to issuing building permits. Priority should therefore be given to the reduction of any administrative procedures leading to the permitting of buildings, focusing on having a single administrative procedure. Such a procedure should result in a single permitting decision replacing all the partial decisions of building authorities (land-use permit and building permit), and the decisions of other administrative bodies and authorities concerned issued in accordance with the applicable legislation. The purpose should be to remove the chain of administrative procedures and, subsequently, administrative decisions, and thus reduce the possibility of appealing against individual decisions and subsequent actions brought before administrative courts. One permitting decision will include all the existing aspects of the land-use permit and will be extended to include some aspects that are currently part of the building permit (construction and technical aspects); it will be issued on the basis of new building documentation with newly defined content and scope (simpler documentation). Subsequently, the building will be constructed on the basis of the 'detail design' notified to the building authority upon the commencement of construction. After completing the construction, the builder submits the as-built documentation with the announcement of the building's entry into use or with an application for use permit. Throughout the process, public interests would be monitored by authorised persons (designer, building manager, technical supervisor of the builder). The entire management process will focus on concentration, with the obligation of the parties, the authorities concerned and the public concerned to put forward their comments on the project as soon as possible, with penalties for non-compliance with that obligation, i.e. disregarding later objections or comments. The assumption is that this single permitting decision, which includes all the permits required to implement a project, will be issued by a single building authority, which will conduct the permitting procedure and issue a decision. The basic 'merging' of the procedure into a single procedure will be carried out in accordance with the Building Act. However, it will be necessary to find a way to incorporate other 'partial' procedures, on the basis of which decisions are issued under special laws.

Regarding the issue of computerisation, building authorities will be able to use an entirely new IT system to handle a significant part of their activities electronically, including electronic submission of forms and documentation and other documents relevant to the procedure. Unifying all document formats and creating an information system for electronic procedures before building authorities will reduce administrative burden and streamline activities, both financially and in terms of time. At the same time, it would increase the efficiency of public administration, thus increasing the international competitiveness of the Czech Republic. It would also increase the transparency of all the agenda processes in the entire Czech Republic, as well as the mutual coordination of the individual authorities concerned, persons concerned or the possibility of monitoring statistical data. By standardisation and building a unified information system, building authorities will be able to provide higher quality services. A draft of the new Building Act should be submitted in 2020; the law should be published in the Collection of Laws in 2022 with effect in 2023.[48]

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

Heat supply systems represent energy infrastructure that is necessary for the efficient use of heat from renewable and secondary energy sources which are impossible or inefficient to be acquired and used

[48] The information in this subchapter is taken from the document of the Ministry for Regional Development 'Recodification of Public Building Law'; the document was submitted to the Czech Government in September 2018.

separately in individual buildings (less valuable biomass, biogas from biowaste, geothermal energy, waste heat from industrial processes, etc.). The use of locally available heat sources contributes to the decentralisation of the energy sector, reduces dependence on fossil fuel imports and strengthens the local economy.

The Czech Republic has a developed heating sector that needs to be gradually transformed for the use of low-carbon energy sources, including energy from secondary sources and waste heat, and their transport to consumers, especially in urban agglomerations.

In view of achieving the Czech Republic's 2030 target, the development of the use of renewable energy sources in existing heat supply systems will be crucial. The Czech Republic therefore plans to support mainly the modernisation of existing heat supply systems in order to meet the requirements for efficient energy supply systems under the Energy Efficiency Directive. However, there is also room for the creation of new (especially smaller) renewable heat supply systems, for example through the use of heat from biogas stations, which today are mostly used only for electricity generation and potentially have a large amount of heat produced from renewable sources.

vii. Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account: (i) biomass availability, including sustainable biomass: both domestic potential and imports from third countries; (ii) other biomass uses by other sectors (agriculture and forest-based sectors); as well as measures for the sustainability of biomass production and use

The following measures can be considered as measures on the promotion of the use of energy from biomass:

- Investment support – operational programmes and State programmes
  - New Green Savings (Ministry of the Environment)
  - Boiler Replacement Scheme within the Operational Programme Environment 2014–2020, SO 2.1 (Ministry of the Environment and selected regions)
- Operational programmes
  - Operational programme Enterprise and Innovation for Competitiveness (Ministry of Industry and Trade)
  - Operational Programme Environment (Ministry of the Environment)
- Exemption from real estate tax (pursuant to Act No 338/1992) for selected groups of sources (geothermal energy sources including heat pumps, solar collectors and biomass energy sources)
- Indirect support by promoting cogeneration from renewable energy sources
- Direct operating support of renewable heat in accordance with Act No 165/2012.
- Higher charges for landfilled municipal waste, prohibition of landfilling of recoverable waste

The implementation of appropriate measures leading to an efficient and effective use of the biomass energy potential in the Czech Republic is described in the Action Plan for Biomass in the Czech Republic[49].

For more detailed information regarding the availability of biomass, see Chapter 2.1.2.

[49] The document is available at: http://eagri.cz/public/web/mze/zivotni-prostredi/obnovitelne-zdroje-energie/biomasa/akcni-plan-pro-biomasu/akcni-plan-pro-biomasu-v-cr-na-obdobi.html

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

The EU ETS is partly affected by the promotion of the production of electricity from renewable sources and energy savings in final consumption, leading to a reduction in the demand for emission allowances in installations within the EU ETS.

Energy savings programmes (such as New Green Savings) are gradually influencing the EU ETS in terms of the number of installations included in the system. About 30 % of the approximately 300 installations are just above the thermal input threshold for inclusion in the EU ETS (20 MW). Energy consumption, including heat off-take from central heat supply systems within the EU ETS, is decreasing owing to the programmes, and these installations are gradually forced to shut down oversized low-efficiency fossil fuel boilers and replace them with a new appropriate source such as natural gas. This reduces the applicable heat input below the 20 MW threshold and the facility ceases to fall within the EU ETS. Since 2013, this has annually eliminated an average of five installations from the EU ETS, and this trend is gradually accelerating.

ii. Policies and measures to achieve other national targets, where applicable

Policies and measures to achieve national targets are detailed in other parts of this document. The Czech Republic considers it relevant to mention in this section the plans and measures to adapt to climate change.

The Strategy for Adaptation to Climate Change in the Czech Republic (hereinafter the ‘Adaptation Strategy of the Czech Republic’) was approved by Government Resolution No 861 of 26 October 2015. The document has been prepared for 2015–2020 with the view to 2030. It is the result of inter-ministerial cooperation, with the Ministry of the Environment being responsible for the overall coordination. The aim of the Adaptation Strategy of the Czech Republic is to adapt to the impacts of climate change as much as possible, to maintain good living conditions and to preserve and potentially improve the economic potential for future generations.

The Adaptation Strategy of the Czech Republic identifies the following priority areas (sectors), which are expected to be most affected by climate change. These sectors are forestry, agriculture, water regime in the landscape and water management, urbanised landscape, biodiversity and ecosystem services, health and hygiene, tourism, transport, industry and energy, emergencies and the protection of the population and the environment.

Continuous implementation of the Adaptation Strategy of the Czech Republic will be evaluated in 2019 and then every 4 years.

The Adaptation Strategy of the Czech Republic is implemented by the National Action Plan for Adaptation to Climate Change (hereinafter the ‘Action Plan’), which was approved by Government Resolution No 34 of 16 January 2017. The Action Plan elaborates the measures outlined in the Adaptation Strategy of the Czech Republic into specific tasks, assigning responsibilities, implementation deadlines, relevance of measures concerning individual climate change manifestations and sources of funding.

The Action Plan is structured on the basis of climate change manifestations such as long-term drought, rising temperatures, extreme meteorological phenomena and natural fires. Given that these phenomena cut across sectors, inter-ministerial cooperation is needed to prevent and address negative impacts, in order to ensure coordination of the implementation of adaptation measures across sectors. The Action

Plan contains 33 specific targets and 1 cross-cutting target on education, training and awareness-raising. The individual targets are pursued by 52 priority measures and 160 tasks. The 34 specific targets include a total of 350 tasks, of which 160 are priority 1 tasks, 150 are priority 2 tasks and 40 tasks fall under the cross-cutting education and training target.

As an EU Member State, the Czech Republic is committed to common EU targets and is actively involved in negotiating the adaptation policy within the EU. The Adaptation Strategy of the Czech Republic is in line with the EU Adaptation Strategy.

iii. Policies and measures to achieve low emission mobility (including electrification of transport)

3.1.3.1 National Action Plan for Clean Mobility[50]

Policies and measures to achieve low emission mobility are contained, in particular, in the National Action Plan for Clean Mobility 2015–2018 with a view to 2030 (NAP CM). The NAP CM is based on the requirement of Directive 2014/94/EU on the deployment of alternative fuels infrastructure to adopt the relevant national policy framework for the development of alternative fuels markets in the transport sector and related infrastructure. The NAP deals with electromobility, CNG, LNG and, to a limited extent, with hydrogen technology (or fuel cell technology). Owing to the direct link to Directive 2014/94/EU, this document applies primarily to those alternative fuels for which that Directive requires the Member States to define national targets for the development of the relevant charging and filling station infrastructure within the above national framework, where this is considered desirable (see area of hydrogen filling stations). This focus of the NAP CM is also in line with the effort to support primarily technologies that are currently on the brink of full commercial use.

The NAP CM contains a total of 49 specific measures, including the determination of the deadline and responsibilities, which are divided into the following thematic areas: (i) legal/legislative measures; (ii) direct incentives to purchase alternative fuel vehicles; (iii) tax incentives; (iv) non-financial incentives on the demand side (including related administrative measures); (v) research, technological development and demonstration; (vi) other measures.

The implementation of the NAP CM is continuously monitored and evaluated; the outputs from this evaluation are included in the annual reports, which are submitted to the Government of the Czech Republic for approval/information by 30 June of each year. Table 34 shows a comprehensive summary of the development of clean mobility based on the document Information on the implementation of the measures under the National Action Plan for Clean Mobility (NAP CM) for 2017.

Table 34: *Indicators of clean mobility development*

Indicator	Year	Estimated number according to NAP CM for the year	Actual number for the year
Number of electric vehicles (battery-only electric vehicle / plug-in hybrid)	2017	1 200/3 800	1 472/600[51]
Number of charging points	2017	270[52]	280
Number of CNG vehicles	2017	22,830[53]	18,900

[50] The document is available at: https://www.mpo.cz/cz/prumysl/zpracovatelsky-prumysl/automobilovy-prumysl/narodni-akcni-plan-ciste-mobility--167456/

[51] Plug-in hybrids were not independently monitored before 2018. According to 2018 statistics, it can be estimated that plug-in hybrids account for less than 10 % of total hybrid registrations.

[52] Electrical engineering Industry Association (270 stations and 631 available charging points)

[53] This is a moderately optimistic scenario (Option 1)

Number of public CNG filling stations	2017	135	164
Number of LNG filling stations	2017	0	1[54]
CNG consumption in transport (m^3 million)	2017	64.5[55]	67.5
LNG consumption in transport (m^3)	2017	0	0

Source: Information on the progress towards the National Action Plan for Clean Mobility (NAP CM) for 2017

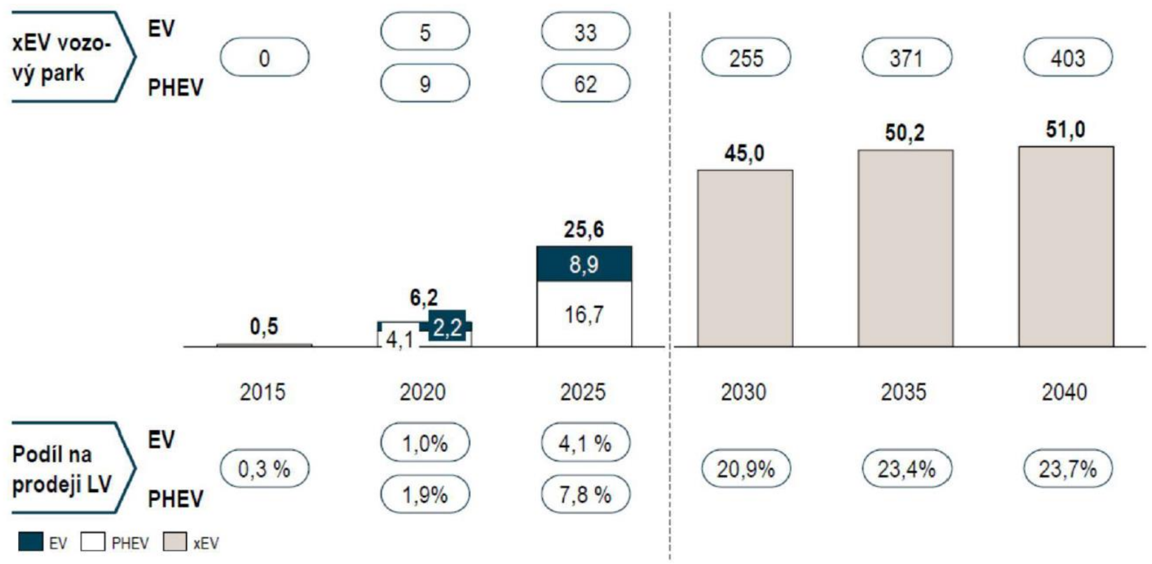
By the end of 2019, a document to address the development of clean mobility after 2021 should be presented. This document will be in the form of an update to the National Clean Mobility Plan or, alternatively, in the form of a wider strategic framework for clean mobility.

Beyond the NAP CM there are also some other strategic materials that contain measures and policies aimed at achieving more extensive development of low emission mobility. These include, for example, the Action Plan for the Future of the Automotive Industry in the Czech Republic[56], or the Memorandum on Long-Term Cooperation in the Development of Natural Gas Vehicles 2025[57].

3.1.3.2 Electromobility

The NAP CM formulated a baseline scenario for the development of electromobility until 2040 with a detailed focus on the period until 2025. The conditions for this development are detailed in the NAP CM.

Chart 11: *Baseline scenario of electromobility development in the Czech Republic according to NAP CM (thousands of vehicles)*



xEV vozový park – xEV fleet
Podíl na prodeji LV – share in LV sales

Source: National Action Plan for Clean Mobility

[54] The filling station was in trial mode.
[55] This is a moderately optimistic scenario (Option 1)
[56] The document is available at: https://www.vlada.cz/assets/media-centrum/aktualne/Akcni-plan-o-budoucnosti-automobiloveho-prumyslu-v-CR.pdf
[57] The document is available at: https://www.mpo.cz/assets/cz/prumysl/2018/5/Memorandum-CNG.pdf

The NAP CM then identifies the need for recharging stations at 1 300 public charging points. The desirable number of public charging stations will be primarily based on the expected number of electric-drive vehicles that can be recharged from this infrastructure (i.e. BEV and PHEV) at the end of 2020. In this respect, the NAP CM assumes 17 000 electric vehicles, of which 6 000 BEV and 11 000 PHEV.

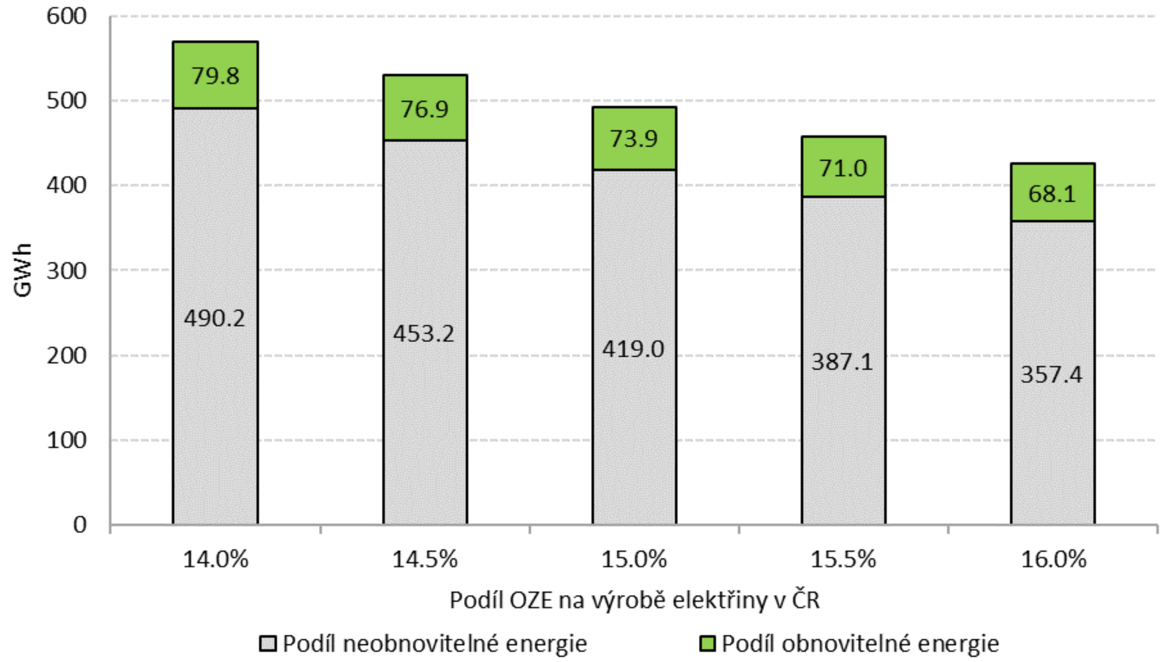
The developments in electromobility and future electricity consumption in the transport sector are also very important in terms of contributing to the 14 % target of share of renewable energy in transport. In 2016, total electricity consumption in transport amounted to 1 636 GWh, with the rail transport accounting for the vast majority (94 %). In line with the possibility to use the European renewable energy mix in dividing electricity production into renewable and non-renewable components in line with the current text of the Directive, the total electricity consumption of RES in transport totalled 449 GWh in 2016. In 2016, electricity from RES in transport accounted for 1.6 % of the total of 6.42 %.

The new RES directive then brought a number of partial changes. These include, in particular, the change in the rail transport multiplier from 2.5 times to 1.5 times, the change in the road transport multiplier from 5 times to 4 times, the implicit limitation of the possibility to use the European mix[58] and the addition of other fuels to be included in the denominator. Based on the analyses carried out by the Czech Republic, the contribution of electricity consumption in transport in 2030 is expected at 0.8 %[59]. This corresponds to the total electricity consumption in road transport at approximately 550 GWh (including trolleybus transport), where approximately 80 GWh corresponds to the share of renewable electricity, assuming an approximate 14.2 % share of RES in electricity by 2030 (this share is still based on methodology for the period 'n-2'). This is an increase of about 481 GWh by comparison with the current situation (in 2016 the electricity consumption in road transport was 69 GWh the vast majority of which was attributed to trolleybus transport). Chart 12 It shows the target consumption of electricity in road transport depending on the share of RES in the national electricity mix. Chart 13 then shows the dependence of the electricity consumption in road transport on the development of consumption in rail transport, which amounted to 1 536 GWh in 2016 (assuming a share of RES in the electricity mix of 15 %). In the case of development also in the area of electric buses and electric utility vehicles corresponding to the middle scenario, a lower number of passenger cars would be sufficient to meet the target.

[58] In the opinion of the Czech Republic, this unfairly discriminates against countries which meet their RES targets primarily in the heating and cooling sector compared to countries with a higher RES share in the electricity sector, which may also lead to a lower motivation for the development of electromobility if this development is seen strictly as an instrument for meeting renewable energy targets. Also, the Czech Republic believes that the prohibition to use the European mix was not sufficiently discussed and the impact of this change was not sufficiently considered.

[59] The conservative value compared to the current contribution to the 1.6 % share is mainly due to changes in the parameters of the Directive, which relatively reduce the share of electricity from RES.

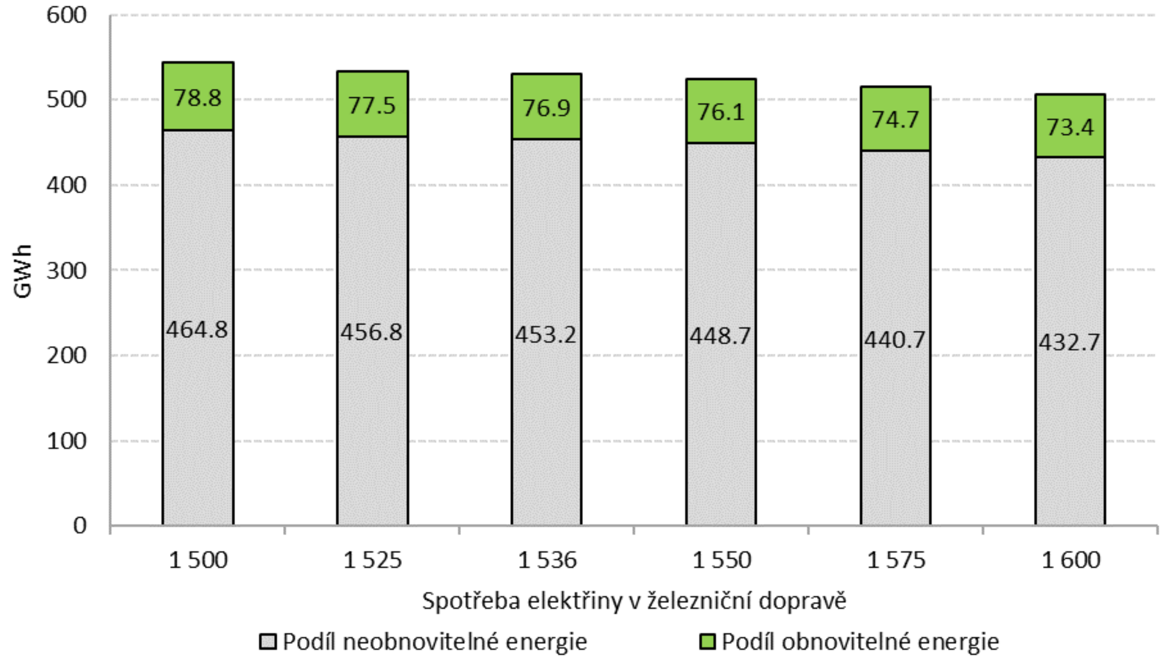
Chart 12: *Contribution of road transport necessary for progress towards the RES target depending on the share of electricity from RES*



Podíl OZE na výrobě elektřiny v ČR – RES share in electricity production in the Czech Republic
Podíl neobnovitelné energie – Non-renewable energy share
Podíl obnovitelné energie – Renewable energy share

Source: Prepared by MIT for the purposes of the National Plan

Chart 13: *Necessary contribution of road transport for the progress towards the RES target depending on consumption in rail transport*



Spotřeba elektřiny v železniční dopravě – Electricity consumption in rail transport
Podíl neobnovitelné energie – Non-renewable energy share
Podíl obnovitelné energie – Renewable energy share

Source: Prepared by MIT for the purposes of the National Plan

The currently relevant document on the future development of electromobility is a study for the purposes of the National Action Plan for Smart Grids, which is, among other things, focused in detail on the analysis of the necessary measures to ensure the preparedness of the distribution systems. These values then also constitute the default data for the respective network models. The medium development scenario reflects the NAP CM baseline scenario and roughly matches it. In order to meet the RES target in the transport sector, it is necessary to achieve electromobility development at approximately the medium scenario level in the case of passenger cars. In the case of development in the area of electric buses and electric utility vehicles, a lower number of passenger cars would be sufficient to meet the target. Nevertheless, the Czech Republic will aim its policies at meeting the medium scenario or the NAP CM baseline scenario, which should lead to a contribution higher than 0.7 %.

Table 35: *Low scenario of electromobility development according to NAP SG (for 2030)*

Vehicle category	**Number of vehicles**	**Share**	**Consumption in GWh**
Passenger cars (cat. M1)	74,331	1.33 %	109.85
Buses (cat. M2, M3)	286	1.34 %	25.43
Utility vehicles (cat. N1, N2, N3)	6,679	0.95 %	91.11

Source: Prediction of electromobility development in the Czech Republic for NAP SG purposes (April 2018)

Table 36: *Medium scenario of electromobility development according to NAP SG (for 2030)*

Vehicle category	**Number of vehicles**	**Share**	**Consumption in GWh**
Passenger cars (cat. M1)	200,647	3.59 %	296.52
Buses (cat. M2, M3)	583	2.72 %	51.80
Utility vehicles (cat. N1, N2, N3)	15,949	2.17 %	217.55

Source: Prediction of electromobility development in the Czech Republic for NAP SG purposes (April 2018)

Table 37: *High scenario of electromobility development according to NAP SG (for 2030)*

Vehicle category	**Number of vehicles**	**Share**	**Consumption in GWh**
Passenger cars (cat. M1)	785,788	14.04 %	1,161.23
Buses (cat. M2, M3)	978	4.56 %	86.88

Utility vehicles (cat. N1, N2, N3)	45,497	5.94 %	620.61

Source: Prediction of electromobility development in the Czech Republic for NAP SG purposes (April 2018)

In this respect, it is also necessary to mention a number of uncertainties that affect the future development of the electromobility sector. These include, for example, future targets for the automotive industry to reduce greenhouse-gas emissions. These targets are still being negotiated at EU level and at the time of preparation of this document their final form was still uncertain.

3.1.3.3 Natural gas

Table 38 shows the number of filling stations, vehicles and CNG sales. The number of natural gas (CNG) passenger cars exceeded 17 thousand in 2017 thousand cars. There were more than 160 public filling stations were in operation. CNG sales have steadily seen two-digit growth, although 2017 saw a partial year-on-year slowdown in this growth.

Table 38: *Number of filling stations, vehicles and CNG sales.*

	2010	2011	2012	2013	2014	2015	2016	2017
Public filling stations	32	34	45	50	75	108	143	164
Vehicles total	2,500	3,250	4,300	6,300	8,055	12,000	15,500	18,900
Passenger cars	2,112	2,807	3,818	5,747	7,205	10,750	13,970	17,160
Buses	300	336	362	404	518	820	1,020	1,120
CNG sales (m^3)	10.058	12.089	15.242	21.952	29.912	43.589	59.346	67.603
CNG sales growth (%)	24.4	20.2	26.0	44.0	36.3	45.7	36.1	13.9

Source: CNG4you

The expected development of clean natural gas mobility by 2030 can be simplified into periods, namely the period until 2020, period 2021–2025 and period 2026–2030. Below is a brief description based on the approved NAP CM, which, however, has been partly modified to reflect the current developments (or developments since NAP CM approval).

Period until 2020

- The existing excise tax on natural gas in transport will be maintained until 2020 (in line with the existing Excise Tax Act).
- The development of the use of different types of natural gas vehicles and the development of infrastructure will be supported by the State.
- The number of vehicles will approach about 30 to 35 thousand[60].
- In connection with Directive 2014/94/EU on the implementation of alternative fuels infrastructure, the number of filling stations at the end of the period will reach about 300 CNG stations (200 public and 100 non-public).
- According to the NAP CM, the volume of natural gas consumption in transport was to reach about 200 million m^3 CNG[61], but this volume is unlikely to be achieved. The volume of LNG consumption will be approximately 12 million m^3.

[60] The original estimated development of the NAP SG was up to 50 000 of vehicles and of about 180 LNG vehicles, but this has shown to have been too optimistic.

2021–2025

- During this period, the excise tax will remain at a level guaranteeing a stable investment environment until a 10 % share in the fuel market is reached.
- The support for the development of natural gas in transport and infrastructure development by the State remains unchanged, which contributes to maintaining the current growth rate.
- Concerning LNG, there is a 25 % annual increase in the number of vehicles, filling stations and LNG consumption.
- The number of vehicles will be around 88 000 CNG vehicles and 490 LNG vehicles[62].
- The number of CNG filling stations will reach 450 at the end of the year[63] (300 public and 150 non-public).
- In connection with Directive 2014/94/EU of the European Parliament and of the Council on the implementation of alternative fuels infrastructure, at the end of the period there will be about 5 LNG filling stations.
- The volume of natural gas consumed in the transport sector will reach about 284 million m^3 with a 50 % biofuel share[64] / 192 million m^3 with a 74 % biofuel share.

2026–2030

- In this period, a 10 % market share will be reached.
- The CNG infrastructure is becoming sufficiently developed, the growth of CNG sales remains practically the same.
- The overall LNG growth continues at 20 % per year.
- The number of vehicles will reach about 100–160 thousand CNG vehicles and 500–1 000 LNG V1 vehicles.
- The number of CNG filling stations will exceed 500 at the end of the year[65] (340 public and 160 non-public) and 14 LNG stations.
- The volume of natural gas consumed in the transport sector will reach up to 474 million m^3 of CNG with a 60 % biofuel share and 35 million m^3 of LNG.[66]

In this respect, it is necessary to note that the development of the consumption of gaseous fuels in the transport sector is also important in view of the intended development of biomethane in this sector. Calculations show that in 2030 the consumption of gaseous fuels in transport should be approximately 15 PJ, with about 40 % of this value being biomethane. This is consistent with achieving the target of advanced biofuels in transport.

Possible restriction:

The predicted number of vehicles in 2020–2030 is prepared on the assumption that the existing tax remains unchanged, or that the rate of taxation of natural gas used in transport relative to other available classical or alternative fuels remains unchanged, because the increase in this rate would result in less demand for the purchase of CNG/LNG vehicles. This would reduce the biomethane fleet and could endanger the achievement of the RES target in transport by 2030, where the use of biomethane plays a pivotal role.

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[61] In relation to the number of vehicles, due to the lower number of cars this is unlikely to be achieved.

[62] In a more conservative scenario, the numbers are 60 000 CNG vehicles and 490 LNG vehicles.

[63] The number of filling stations will correspond to the development of CNG/LNG fleet – these numbers are rather based on the optimistic developments; in conservative scenario we can expect the pace of infrastructure construction to slow down.

[64] 192 million m^3 with a 74 % biofuel share in the alternative scenario.

[65] The infrastructure development will depend on the profitability and return on investment in existing infrastructure – it can be considered as rather optimistic; more conservatively, a slower increase in the number of stations can be expected.

[66] 307 million m^3 with a 90 % biofuel share and 17 million m^3 in the alternative scenario.

3.1.3.4 Hydrogen mobility

As mentioned above, the original NAP CM focuses on the use of hydrogen in transport rather marginally. The reason is that in 2015, when this document was being prepared, there was no hydrogen vehicle registered in the Czech Republic, and that the only hydrogen station in the Czech Republic is not publicly accessible and is used primarily for a single hydrogen bus operated under the project TRIHYBUS of Nuclear Research Institute Řež in 2009–2015.

Nevertheless, the NAP CM declares the interest of the Czech Republic to include hydrogen in the national policy framework for alternative fuels in transport under Directive 2014/94/EU on the implementation of alternative fuels infrastructure. This is evidenced by the target set by the Czech Republic for the development of hydrogen filling stations. According to this document, 3–5 stations should be built in the Czech Republic by 2025. This is the initial target, with the NAP CM expecting it to increase in the future, based on a study that would more fully assess the potential of hydrogen mobility in the Czech Republic. The NAP CM also notes that hydrogen mobility should be supported by the same measures as electromobility, because it constitutes ‘hydrogen electromobility’. Therefore, the development of infrastructure for hydrogen filling stations should be stimulated, for example by investment support. Similarly, it is assumed that hydrogen vehicles will enjoy from the same benefits as electric vehicles, whether in terms of parking in cities or the use of preferential lanes. These vehicles are also assumed to be exempt from paying the motorway toll charges. In order to realise these benefits, hydrogen vehicles will be classified as ‘electric vehicles”’, which will be issued free special registration plates (beginning with ‘EL’). The issue of these special registration plates (including for hydrogen vehicles) will begin in April 2019.

The task of the NAP CM regarding the study of hydrogen mobility opportunities in the Czech Republic was fulfilled in 2017, when the study was prepared for the Ministry of Transport by Grant Thornton Advisory[67]. This study contains 4 scenarios of possible long-term development in the area of hydrogen mobility in the Czech Republic, with the baseline scenario considered the most realistic. This scenario envisages that there should be 115 886 hydrogen passenger cars and 1 091 hydrogen buses in 2030.

The study also states that one of the main requirements for the development of hydrogen mobility is the existence of a functioning and safe filling station infrastructure. However, its costs cannot be expected, at least in the initial phase, to be borne exclusively by private operators. It is therefore desirable for the State to actively support the construction of both public filling stations for ordinary citizens and the non-public part of the hydrogen infrastructure for public transport or municipal services. In view of this, within the forthcoming grant programme ‘Supporting the Development of Alternative Fuel Infrastructure’, the study recommends that the planned allocation for the sub-programme to support hydrogen stations be doubled by comparison with the original plan (CZK 100 million).

On the basis of the simulation of possible future scenarios for hydrogen vehicle market development, the study includes the prediction of the number of vehicles and hydrogen filling stations for the years 2025, 2030 and 2050. The model outputs of this study clearly show that if at least the baseline development scenario is to be achieved, at least 12 hydrogen filling stations should be built in the Czech Republic by 2025. For this reason, in the future update of the NAP CM, the Ministry of Transport should adjust the national target of the number of hydrogen filling stations from the current 3–5 to 12 stations.

[67] The study Use of Hydrogen Powered Vehicles in Transport in the Czech Republic is available at: https://www.mdcr.cz/Dokumenty?lang=en-GB&mssfd=Strategie

In June 2017, this study was approved at the Minister of Transport's Meeting, which stated that this should form the basis for the Ministry of Transport to update the NAP CM. It was subsequently submitted for information to the Government of the Czech Republic. In 2018, some parts of the study (including prediction in the baseline scenario) were further updated. Future update of the NAP CM can see further refinement of developments in this area.

Table 39: *Main conclusions of the updated Study of Hydrogen Mobility Development in the Czech Republic – basic scenario of development of hydrogen mobility in the Czech Republic (September 2018)*

	2020	**2025**	**2030**
Number of hydrogen cars	**53**	**12,782**	**117,169**
Number of hydrogen buses	**2**	**119**	**1,091**
Additional costs per car (CZK thousands)	686	417	84
Additional costs per bus (CZK thousands)	6,037	3,617	2,053
Differential costs by comparison with conventional fuels, in aggregate – hydrogen cars (CZK thousands)	37	6,006	25,853
Differential costs by comparison with conventional fuels, in aggregate – hydrogen buses (CZK thousands)	12	470	2,999
Avoided CO_2 emissions (thousands of tonnes)	**1**	**35**	**308**
Number of filling stations	3	12	117
Aggregate costs of infrastructure support (CZK thousands)	86	386	3,936

Source: Use of hydrogen drive in transport in the Czech Republic

3.1.3.5 LPG / bio LPG

Fossil LPG

With regard to the way in which LPG is obtained (it is produced as a 'residue' in oil refining or extracted as a 'secondary gas' in the natural gas extraction, in both cases its volume being about 3 to 4 % of the product produced), LPG is considered as a product whose consistent availability on the market will last for as long as other fossil fuels are available. The decline in its availability can be expected only after a reduction in the supply of fossil fuels to the European market.

BioLPG

A gradual increase in the supply of bioLPG is expected after 2020. BioLPG is created as a by-product in the production of HVO (i.e. essentially waste, as in the case of conventional LPG). New technologies are also being tested for the direct production of bioLPG from waste cellulose, and it can be assumed that other production methods will follow.

Specifics of LPG / bioLPG utilisation on the Czech market

The advantage of LPG on the Czech market is a fully developed distribution infrastructure (about 900 petrol stations) and a high popularity of this fuel (about 170 000 vehicles).

The main potential of this fuel is in the conversions of older vehicles with worse emissions parameters. LPG can thus partially address the emissions of the older fleet for a large part of drivers who do not have enough money to buy a 'cleaner' vehicle and who constantly use cars of an above-average age.

At present, LPG is used almost exclusively in passenger cars and small municipal vehicles. Some development projects (e.g. in Spain, USA) test the further use of LPG in heavy vehicles (e.g. buses). These can be expected to appear very quickly in the Czech Republic as well, because unlike in other alternative technologies there is no need to develop the supply infrastructure.

Future of bioLPG 2050+

BioLPG development projects focus on waste recovery. In terms of GHG, it is an emission-neutral source. Current LPG RDE tests also show very low pollutant emissions, so it is a source that is suitable for long-term use also in inhabited areas. The ease of use is also facilitated by the good fuel storability, the long range of the vehicle and minimal technical constraints in production / conversion (a relatively lightweight and well-placeable tanks by comparison with CNG)

Possible restriction

Like any other alternative fuels, LPG is accepted by the market thanks to tax relief (the current tax rate in the Czech Republic copies the minimum requirements of the EU). The consumption forecast has been prepared on the assumption of keeping the existing tax burden / the LPG tax ratio relative to other available classical or alternative fuels unchanged. Any unilateral increase in the tax on LPG would result in a reduction in the consumption of this fuel.

iv. Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

Currently, there are no national policies, a schedule and measures planned to gradually phase out energy grants, especially for fossil fuels, beyond the measures outlined in the strategy documents, in particular the NAP CM.

3.2 Dimension 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 under Articles 7a and 7b and Article 20(6) of Directive 2012/27/EU and to be prepared in accordance with Annex III to this Regulation

In view of the effective date of the revision of the Energy Efficiency Directive and the date of its transposition, the Czech Republic does not submit a concrete proposal of a scheme to meet the obligation in accordance with Article 1(3) of the revised Energy Efficiency Directive. However, the scheme setting options are discussed by politicians and professionals.

When setting up the energy efficiency obligation scheme In accordance with Article 7 of the Energy Efficiency Directive, the Czech Republic draws on experience from the current period. The 2014–2020 period shows the limits for the application of certain measures, and at the same time identifies the potential of using the measures that the Czech Republic has not yet implemented.

On the basis of an input analysis, the Czech Republic considers and discusses the possibility to use a combination of the obligation scheme and alternative policy measures in accordance with Article 7 of and Annex V to the Energy Efficiency Directive.

Previous analyses show that this combination should optimise existing State measures and extend them to include measures that are not currently being used.

The setting of the scheme and the choice of the measures to fulfil the obligation under Article 7 of the Energy Efficiency Directive and how it is implemented will be further discussed within the working group of the Coordinating Committee of the Minister of Industry and Trade for the implementation of the NAP EE. Taking into account the current state of debate, the Czech Republic expects the transposition deadline for the implementation of Article 7 of the Energy Performance Directive to be met. Subsequently, policies and tools will be updated in this Plan.

ii. Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, [68] including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building stock, in accordance with Article 2a of Directive 2010/31/EU

General information on the long-term renovation strategy for the residential buildings fund

Owing to the deadline for the implementing of the revision of Directive 2018/844 amending Directive 2010/31/EU, the milestones under the current Building Renovation Strategy cannot be considered as decisive and applicable for defining policies for their implementation. For this reason, the draft National Plan does not contain specific tools for implementing the Long-Term Building Renovation Strategy under the revised Energy Performance of Buildings Directive. However, the Czech Republic considers the following measures to be the possible measures to decarbonise the building fund by 2030. However, their implementation requires discussion across the political spectrum and an assessment of its feasibility.

Economic measures

The high initial investment costs of energy-efficient renovations of buildings are among the main barriers to their implementation. The Czech Republic has more than ten years of experience in offering support programmes that help different groups of property owners to achieve energy savings in the operation of their properties. After 2020, the Czech Republic therefore plans to introduce a financial support scheme for the renovation of buildings. Currently, a suitable combination of grants and an extension of the financial instruments portfolio is being addressed.

In this area, ongoing discussions focus on the setting of support under national programmes as well as under European Structural and Investment Funds. An analysis is being conducted of the extent to which Union programmes and financial instruments can be used. In addition to grants, the discussions focus on extending the portfolio of financial instruments according to the needs of individual actors. An analysis of possible energy savings and investment assets shows that a total renovation of a building is an investment with a long return (typically around 20 years), but at the same time this means that the return on this investment is roughly 4–6 % per annum or higher. This is an attractive value given comparable investment opportunities (not for the business sector, but for institutions and households, and also for investment funds or banks). In this respect, an analysis of which barriers to massive investment in building renovation are key and which can be removed is being conducted. It is necessary to analyse these market failures based, *inter alia*, on the ownership structure of buildings, the necessary co-financing by the owners, the expected benefits of renovation, the great diversity and the relatively small (financial) size of the projects and the high transaction costs of implementation. It will then serve as a basis to discuss the possible use of innovative financial instruments to realise energy savings in buildings.

Legislative and administrative measures

Measures already implemented include the updated amendment to Act No 406/2000, on energy management, owing to the transposition of Energy Performance of Buildings Directive (amendments:

[68] In accordance with Article 2a of Directive 2010/31/EU [as amended by the draft of COM(2016) 765].

Act No 318/2012, Act No 103/2015). In accordance with the Directive, this act defines the minimum energy performance requirements for new buildings, larger changes to completed buildings and non-large (i.e. smaller) changes to completed buildings. These requirements are defined at the 'cost-optimal' level. For the purposes of publicly funded support programmes, the criteria should be more progressive, but still set at a cost-effective level.

In the second step, the Energy Management Act requires the construction of buildings with 'near-zero' consumption (gradually for new buildings with application for building permit submitted after 1 January 2016 until 1 January 2020). However, this standard is defined very softly and inadequately in the Implementing Decree on the energy performance of buildings. For this reason, this definition is being revised and the second step of near-zero-energy buildings is being introduced; this obligation will take effect for example from 2022.

Education and consultation measures

The ignorance of concrete appropriate measures to reduce the energy performance of a building, their cost and savings potential increases transaction costs for building renovation. This barrier can be somewhat reduced by strengthening the role of State-guaranteed consultation in the 'Energy Consultation and Information Centres'. In addition, preparation of model projects for common types of buildings, with a calculation of investment costs and savings achieved, is being considered.

The above is to be understood rather as an overview of the areas in which the Czech Republic will focus on the setting of specific measures. These measures will be complemented in relation to the transposition and implementation of the revision of the Energy Performance of Buildings Directive.

iii. Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models[69]

For the period 2021–2030, continued support for the use of the EPC method is expected, particularly in the public sector, in order to maximise the efficiency of public funds invested and energy savings achieved. To this end, plans are being made to remove barriers to the use of the EPC method by public bodies, especially through education related to public procurement for comprehensive services, support for energy provider information centres and support for regional offices focusing on the support for the use of energy services.

iv. Other 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 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote energy audits and energy management systems[70], consumer information and training measures[71], and other measures to promote energy efficiency[72])

All relevant policies, measures and programmes are described in the other sections of this chapter or other parts of this document.

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

[69] In accordance with Article 18 of Directive 2012/27/EU.
[70] In accordance with Article 8 of Directive 2012/27/EU.
[71] In accordance with Article 12 and 17 of Directive 2012/27/EU.
[72] In accordance with Article 19 of Directive 2012/27/EU.

As stated in the previous sections summarising policies to meet the energy-efficiency targets and commitments, the Czech Republic will make efforts to create local information centres for the general public. With regard to public opinion, it is necessary that these services are affordable for the public, especially at a minimum price. Furthermore, we consider it important to strengthen the self-government capacities in relation to energy and energy efficiency, increase the professional education of employees and strengthen their powers in the implementation of instruments and measures at both national and local levels. To implement such a scheme, the Czech Republic is considering the use of the Union's LIFE programme.

vi. Description of measures to develop measures to utilise energy efficiency potentials of gas and electricity infrastructure[73]

Electricity sector[74]

Losses in the transmission system are mainly determined by the amount of transformation power transmitted with the distribution system operator, the output from power plants connected to the transmission system, and the flow through the transmission system, which is determined by the transactions between the individual trading zones in the interconnected European system.

In an area which can be influenced by the transmission system operator and which does not reduce the security of operation and reliability of electricity supplies, two loss reduction areas can generally be considered. These areas are investment in infrastructure and system management resources.

Investments in infrastructure

Increasing network throughput and thereby achieving greater interconnection, which, if applied specifically, ultimately results in a reduction in system losses. An increase in the throughput of the system resulting in loss reduction is largely motivated by the need to increase the possibilities of transferring active power from sources to consumption and within the interconnected European electricity system which, in the long run, secondarily leads to meeting the loss reduction requirements. Examples of implementation include the assessment of the needs in individual corridors where, when necessary, lines with higher parameters (higher current carrying capacity, line doubling) are built, resulting in a lower unit loss factor.

Within the standard renewal of installations at the end of their service life, a predetermined number of transformers between transmission and distribution systems are replaced annually. These transformers are replaced by completely new ones with higher unit output, with gradual replacement of 220/110 kV transformation for 400/110kV transformation.

Regarding the reduction of losses in lines and in the transmission system, the fully modernised lines use cables with a larger cross-section, which leads to reduced losses of this line. For example, the difference when using the 434-AL1/56-ST1A cable instead of 350AlFe4 means a drop in unit active losses of about 30 % with the same active power transmission. At present, 490-AL1/64-ST1A cables are being introduced, which will further contribute to the reduction of active power transmission losses in key lines, which are modernised or duplicated with an estimated rated transmission capacity of around 2 500 A. Significant investments in the transmission system involving the use of cables with lower resistivity.

System management resources

[73] In accordance with Article 15(2) of Directive 2012/27/EU.

[74] There is a more detailed document in this area, which was created with the contribution of ČEPS a.s., ČEZ Distribuce, a.s. and PREdistribuce, a.s., which deals with this issue in more detail. Only a certain summary of this more detailed document is given in this material.

Loss reduction in the transmission system through a change in network operation is very limited. A deviation from the basic connection generally results in increased losses in the transmission system. The parameter in the form of the place and amount of the supply/consumption of active power, which significantly affects the magnitude of losses, cannot be influenced by the transmission system operator and, if so, at significant costs. From this perspective, only the production of reactive power, which partly contributes to losses in the transmission system, can be influenced. In this area, there are possibilities to implement source management and offset resources, in order not only to ensure the security and reliability of operation, but also to reduce losses. Approaches or tools applied in this area specifically include automatic voltage regulators in conjunction with an optimisation tool.

In general, measures taken to reduce losses should always be applied with regard to the given site and always with the aim of reducing overall losses and not with respect to losses of one type of equipment. The choice of system management tools is limited by the possibility to use the available control resources, which are already fully utilised in the transmission system, but the choice is wider in pilot project allowing greater integration and coordination.

Approaches to reducing energy performance in the distribution system

A distributor's options to influence the reduction of electricity consumption are greatly limited by legislation and the obligation to supply the contractual volume of electricity to end customers. It should also be noted that, despite the distributor's efforts to implement procedures and technologies to help reduce losses, there are a number of trends related to the development of renewable sources which lead to increased losses. For example, wider deployment of renewable sources usually increases the amount of reactive energy in the network, leading to increased losses. In addition, small intermittent sources are connected to the network asymetrically, which can lead to disproportionate loading of some outlets, and thereby increase losses. In addition, the development of decentralised energy production and some appliances (e.g. pulse-controlled sources) may also involve the propagation of higher harmonic frequencies into the network, which may also result in higher losses.

The power consumption reductions that the distributor can influence is mainly possible in the area of technical and non-technical losses. These include, for example, the introduction of new technologies, voltage unification, the renewal of existing installations and the replacement of existing elements of the distribution system with new elements with higher efficiency and better parameters, as well as inspections of off-take points with the aim of detecting unauthorised electricity off-take.

Data on electricity consumption and losses for individual voltage levels show that the largest space for reducing consumption / technical losses is at low voltage (lv) level and partly at high voltage (hv) level.

Thus, measures to reduce losses can be generally divided into two groups:

– network renewal through the replacement of key network elements for elements with higher efficiency and better parameters. Within distribution, this mainly includes the replacement of transformers and the enlargement of cable cross-sections. In terms of cost-effectiveness, this includes the scenario, which needs to be assessed with regard to the specific conditions of its application, because the financial costs may not always justify the results – mainly in terms of local load and network topology.
– The second set of measures represents an alternative to the general application of elements with higher efficiency and better parameters. It involves the deployment of such elements that enable, for example, advanced methods of network management and monitoring. Within the synergies, these elements are deployed both for reasons of better load distribution (and thus loss reduction), but also because of the need for better network monitoring at lower voltage levels, which, given the changing patterns of consumption/production, is one of main challenges for distribution.

Gas sector

With a gradual phasing out of coal sources, the use of natural gas, biogas and, prospectively, synthetic methane and hydrogen will increase in the Czech Republic. The gas system has the potential to contribute to achieving the energy efficiency target, for example by the installation of more efficient equipment, which will increase the energy performance of the system's operation. This can be done in the context of continuous maintenance and modernisation of the system. For example, more efficient compressor stations could be installed with the help of the EU Structural Funds.

vii. Regional cooperation in this area, where applicable

Regional cooperation (at the level of cooperation with other Member States) in this dimension will be described in the final version of the National Plan, if necessary.

Below is basic information on the regional dimension at the Czech Republic level.

Act No 406/2000 obliges the regions and the Prague Capital City to prepare the regional energy strategy and to regularly assess it. Beyond the scope of this obligation, regions and municipalities above a certain size carry out energy audits, or introduce an energy management system. The above documents allow the energy efficiency to be assessed by region. These assessments are important for setting up appropriate measures that are acceptable across the public administration.

The Ministry of Industry and Trade and the regions are in negotiations to create a platform where it is possible to address the implementation issues of the above-mentioned documents. There are intensive discussions with the representatives of these units in order to promote the interest in the issue of improving energy efficiency, identifying potential in a given area and looking for possibilities to realise this potential. Self-governing units are the bodies concerned for the approval of legal acts as well as strategic documents. Therefore, they are indirectly involved in the making of State energy efficiency policy.

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

In terms of financing, instruments and measures to increase energy efficiency, in addition to State budget funds there are two major sources of funding for promoting the implementation of energy-saving measures – the European Structural and Investment Funds, and revenues from the auctioning of emission allowances.

European Structural and Investment Funds

For the period 2014–2020, this is an important source of funding to ensure the development of the energy sector and the achievement of European and national targets in this area. As for the period 2021–2027, on 2 May 2018 the EC published the draft Multiannual Financial Framework 2021–2027. The budget is designed to address the main priorities and policies that deliver the highest European added value. Overall, the Commission proposes a long-term budget of EUR 1 279 billion in commitment appropriations (in current prices) for 2021–2027, which corresponds to 1.11 % of the EU-27 gross national income (GNI). Taking into account inflation, the budget has slightly increased by comparison with the current 2014–2020 budget (including the European Development Fund). The Commission has proposed a similar cohesion policy budget to the one in the current period (without the UK, however, there is a slight increase of 3 %). In its first draft, the Commission allocated EUR 226 billion for the European Regional Development Fund (ERDF), approximately EUR 47 billion for the Cohesion Fund (CF) and about EUR 100 billion for the European Social Fund (ESF). In addition, the Commission has also published information on where the funds will go and how they will be linked to those directly managed by the European Commission. The allocation for the Czech Republic amounted to EUR 18 billion in constant prices, representing a decline of about 24 % by comparison with the current period (EUR 20.1 billion in current prices). The decision on the future long-term EU budget will then be left to the Council, which will decide unanimously after obtaining the consent of the European Parliament.

Table 40: *Multiannual Financial Framework for the period 2021–2027*[75]

	07–13 (EUR billion)		14–20 (EUR billion)		2021+ (EUR billion)	
	EU	**CR**	**EU**	**CR**	**EU**	**CR**
ERDF	201	13.66	212	11.94	226	10.524
CF	70	8.82	75.4 (including transfer to CEF)	6.14	47 (including transfer to CEF)	6.44
ESF	76	3.77	84	3.43	100	2.737
Total	347	26.12 (7.52 %)	371	21.51 (5.8 %)	373	ca 20.02[76]

Source: Ministry for Regional Development (National Coordination Authority)

Although the Czech Republic's allocation within the EU's financial framework for the period 2021+ is about 25 % lower by comparison with this period, it is still a significant source of funding, part of which will be allocated to the support of the transition to a low-carbon economy and circular economy and adaptation to climate change, which is one of the five basic policy objectives (namely PO 2)[77].

Table 41: *Five basic policy objectives of the Multiannual Financial Framework*

Objective	Target description
PO 1	A smarter Europe by promoting innovative and smart economic transformation
PO 2	A greener, low-carbon Europe by promoting clean and fair energy transition, green and blue investment, the circular economy, climate adaptation and risk prevention and management
PO 3	A more connected Europe by enhancing mobility and regional ICT connectivity
PO 4	A more social Europe implementing the European Pillar of Social Rights
PO 5	A Europe closer to citizens by fostering the sustainable and integrated development of urban, rural and coastal areas and local initiatives

Source: Ministry for Regional Development (National Coordination Authority)

On the basis of the analytical part of the National Cohesion Strategy (NCS) and taking into account the umbrella document of the Czech Republic 2030, five development priorities were formulated,

[75] In this respect, it should be noted that the proposed post-2020 allocation may vary depending on the negotiations on the Multiannual Financial Framework, cohesion policy legislation and related financial aspects.
[76] Of the total amount, there is another EUR 314 million allocated to European Territorial Cooperation.
[77] Compared to the 11 thematic objectives in 2014–2020, the number of these thematic objectives has been reduced.

which can be most efficiently achieved by ESIF funding. These priorities are: (i) low-carbon economy and environmental responsibility; (ii) development based on research, innovation and the use of technology; (iii) well-being and human capital; (iv) accessibility and mobility; (v) sustainable development of the territory.

In order to roughly determine the expected volume of energy efficiency funds as one of the foundations of the Energy Union, we rely on the gradual development of debates at both European and national level. Only 30 % of the European Cohesion Fund and the Regional Development Fund could be allocated to PO 2, which can roughly be estimated at CZK 123 billion, including the State contribution. However, national level, there are 5 prioritised sub-areas in low-carbon economy transition alone. The allocation of European funding to this priority therefore depends to a certain extent on the State's decision. It can range from several billion to tens of billions of *koruna*.

It is therefore important to note in this respect that at the time of the preparation of the Draft National Plan it was not possible to precisely quantify the funds for the individual Energy Union dimensions owing to the ongoing preparation of the National Cohesion Strategy in the Czech Republic after 2020, which forms the basis for the Partnership Agreement 2021–2027. Late 2018 saw the first theme prioritisation phase in this respect; the second prioritisation phase is expected in Q1 2019. In June 2019, the National Cohesion Strategy in the Czech Republic after 2020 should be submitted to the Czech Government for approval. Therefore, more detailed information is likely to be reflected in the final version of the National Plan.

Revenues from the auctioning of emission allowances

The revenues from the sale of emission allowances are distributed equally between the Ministry of the Environment and the Ministry of Industry and Trade, in accordance with the current text of Section 7(7) of Act No 383/2012, on the conditions for trading in greenhouse gas emission allowances. The Ministry of the Environment is responsible for the Act on the Conditions for Trading in Greenhouse Gas Emission Allowances, which must also ensure the collection of data and calculation of the free allocation. In accordance with the requirements of the relevant directive, these funds are assigned in particular to reducing greenhouse-gas emissions, promoting innovation in industry and to measures to increase energy efficiency, including the construction and renovation of heat supply systems, increase in the energy performance of buildings and increase in the efficiency of energy use in industry and the energy sector.

Table 42: *Revenues from emission trading until now (CZK billion) thousands)*

	2013	2014	2015	2016	2017
Revenues from emission trading	3.80	0.96	3.03	3.17	5.22
New Green Savings sources	1.90	0.48	1.51	1.59	2.61
MoE share of emission trading revenues	1.90	0.48	1.51	1.59	2.61

Source: Prepared by MIT for the purposes of the National Plan

The Ministry of the Environment uses its 50 % share as the main source of funding for the New Green Savings (co-financed from the State budget).

Since 2015, the part that belongs to the Ministry of Industry and Trade has been wholly used to cover part of the support for electricity and heat from supported sources. The explanatory memorandum to the government decree on the determination of State budget funds in accordance with Section 28(3) of the Supported Energy Sources Act for 2019 shows the following State grant requirement between 2015 and 2018 (see Table 43).

Table 43: *State budget support for supported RES (CZK billion) thousands)*

	2015	2016	2017	2018
State budget support for supported RES	17.700	21.965	26.185	26.185

Source: Prepared by MIT for the purposes of the National Plan

The use of the proceeds from the sale of emission allowances in the fourth trading period (2021–2030) under the new EU legislation will depend on how the new legislation is transposed and implemented. The Ministry of the Environment is responsible for the Act on the Conditions for Trading in Emission Allowances.

The legislative process for the adoption of the amendment to Act No 383/2012, on the conditions for trading in greenhouse gas emission allowances, was launched in late 2018 (the consultation process on this amendment took place in December 2018). It is this amendment that should clarify the key points for predicting the use and the amount of funds available for energy efficiency policy and the supported energy sources policy after 2020.

Table 44 Table 44 shows the prediction of revenues from the auctioned emission allowances for the period 2021–2030. The following factors are important within the distribution of revenues from the auctioning of emission allowances: (i) the use of the 'Modernisation Fund'; (ii) the use of the free allocation under Article 10c ('derogation'); (iii) the introduction of the compensation of indirect costs[78]. The exact setting of these parameters is yet to be decided at the time of preparation of this document. However, it is necessary to maximise the targeted use of these funds to meet the RES and energy-efficiency targets. This use should be at 60–70 % of total revenues. Table 44 It is based on the prediction of the emission allowance price, indicated and briefly commented on below (see Chart 14).

Table 44: *Predicted revenues from auctioned emission allowances for the Czech Republic (CZK million)*

	Revenues without the allocation of free allowances for the modernisation of the electricity production sector	Revenues under the free allocation scenario for the modernisation of the electricity production sector up to 10 million EUA per year	Revenues under the free allocation scenario for the modernisation of the electricity production sector up to 40 % of EUA per year	Revenues from the auctioning of allowances in the aviation sector
2021	14,018	9,642	8,910	23
2022	17,214	12,438	11,638	24
2023	21,372	16,196	15,330	26
2024	22,358	16,782	15,848	27
2025	23,248	17,272	16,271	28
2026	24,739	18,177	17,079	30
2027	24,988	17,842	16,646	32
2028	23,617	15,886	14,592	34
2029	25,665	17,350	15,958	35
2030	29,303	20,403	18,913	37

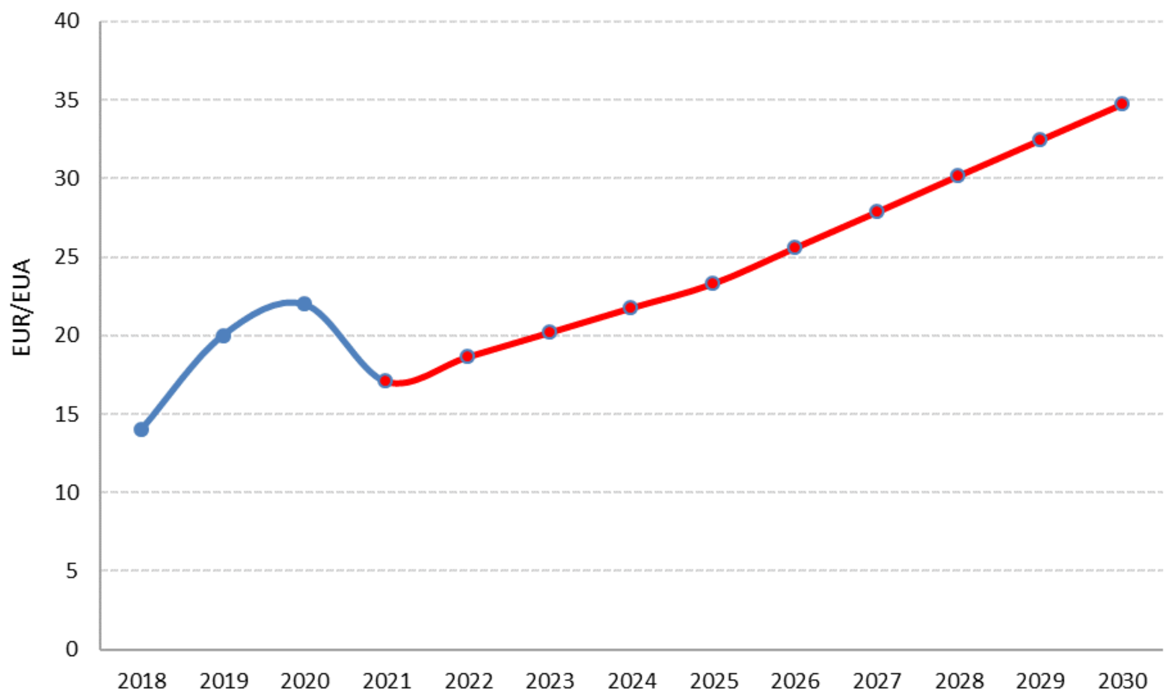
[78] The amendment to the Act also deals with other transposition aspects following from the approved European legislation.

Total	**226,523**	**161,987**	**151,184**	**295**

Source: Final report on Regulatory Impact Assessment (RIA) on the draft act amending Act No 383/2012, on the conditions for trading in greenhouse gas emission allowances (version for comments, December 2018)

Chart 14 shows the predicted allowance price. According to the estimated emission allowance price[79], which is based on the European Commission's documents, the 3rd trading period in 2019 and 2020 will conclude with an increase in the allowance price to EUR 20–22 per allowance. In the 4th trading period, a price drop to EUR 17 and its gradual increase to EUR 30 by 2030 is expected.[80]

Chart 14: *Predicted emission allowance prices 2018–2030 (EUR/EUA)*



Source: Final report on Regulatory Impact Assessment (RIA) on the draft act amending Act No 383/2012, on the conditions for trading in greenhouse gas emission allowances (version for comments, December 2018)

3.3 Dimension energy security [81]

i. Policies and measures related to the elements set out in point 2.3[82]

[79] EUA – for stationary sources

[80] The predicted emission allowance price is not absolutely comparable to the allowance price given in the analytical parts of this document and is also based on EC recommendations, which are not fully consistent with the recommendations for the preparation of this document. However, the trends in both outlooks are comparable and there should not be a significant disproportion / inconsistency.

[81] Policies and measures reflect the first energy efficiency principle.

[82] Consistency with preventive action plans and emergency plans under Regulation [proposed through COM(2016) 52] concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010, and risk-preparedness plans under Regulation [proposed through COM(2016) 862] on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC.

3.3.1.1 Energy sector

The main policies and measures to ensure the security of energy supplies in the electricity sector are:

- Development of the transmission system (distribution systems) in order to ensure system and production adequacy and security of electricity supply ensuring long-term fulfilment of the N-1 criterion;
- measures to ensure the adequacy of production capacities;
- development of an integrated electricity market;
- measures following from European legislation;
- diversification of the electricity mix;
- emergency system management and emergency prevention.

Transmission system development

The development of the electricity system is crucial to ensuring the security of electricity supply. In the Czech Republic, the transmission system operator has the primary responsibility for the development of the transmission system. The development of the transmission system is also significantly coordinated at EU level. Detailed information on the current state and the expected development of the electricity infrastructure is given in Chapter 4.5.2.

Measures to ensure the adequacy of production capacities

In relation to ensuring the adequacy of generation capacities, the generation adequacy outlook, including the draft measures to resolve potential problems with ensuring the adequacy of generation capacities, is prepared annually as needed in accordance with the requirements of Regulation No 714/2009 of the European Parliament and the Council.[83] Currently, work is underway on the preparation of a detailed analysis and methodology for determining the reliability standard with the use of commonly used reliability indicators, which should subsequently form the basis of legislative (non-legislative) provision of the security standard in the area of generation adequacy. A summary of the generation adequacy outlook is given in Chapter 4.4.1.4.

Development of an integrated electricity market

One of the important elements for enhancing energy security is the further development of the internal electricity market / its continued integration. The internal energy market is a separate dimension of the Energy Union and is described in more detail in the other parts of this document, specifically in Chapters 2.4, 3.4 and 4.5.

Measures following from European legislation

The security of electricity supply is already very well regulated by specific European legislation. It specifically includes the regulation on risk-preparedness in the electricity sector, which was published as part of the legislative package ‘Clean Energy for All Europeans’.

Diversification of the electricity mix

The Czech Republic will strive for the highest possible diversification of the energy/electricity mix and the minimisation of sources using large quantities of input fuel which must be imported from abroad. The strategically optimal electricity mix for 2040 is specified in the approved Czech Republic's State Energy Policy and is referred to in Chapter 1.2.1.1. In this respect, it is important to emphasise the role of nuclear power, which should gradually replace coal in the electricity mix. An increase in the share of nuclear energy and renewable sources at the expense of fossil fuels is also a

[83] The latest Assessment of the Czech Electricity System Production Adequacy is from 2018 and is available at: https://www.mpo.cz/cz/energetika/elektroenergetika/hodnoceni-vyrobni-primerenosti-es-cr-do-roku-2030--233193/

key prerequisite for achieving long-term commitments to reduce greenhouse-gas emissions, as set out in Chapter 3.1.1.6. The Czech Republic no longer has its own uranium ore, so the fuel for nuclear power plants is imported from abroad. However, in comparison especially with natural gas, the quantity of nuclear fuel that can be stored allows consumption for several years ahead. Therefore, although it is not a domestic source, in terms of energy security or import dependence this energy source is a better alternative than, for example, natural gas.

Emergency system management and emergency prevention

The issue of managing crisis situations is mainly regulated in Act No 240/2000, on crisis management (the Crisis Act), as amended, which establishes the scope of competence and powers of State bodies and bodies of territorial self-governing units and the rights and obligations of legal and natural persons in the preparation for crisis situations not related to the defence of the Czech Republic against external attack and in their resolution and protection of critical infrastructure, and the responsibility for violation of these obligations.

On the other hand, emergency situations are regulated by Act No 458/2000, on the conditions for business and on the performance of State administration in the energy sectors and amending certain acts (the Energy Act), as amended, which transposes the relevant European Union regulations and, in relation to the directly applicable European Union regulations, regulates the conditions for business and the performance of State administration in the energy, electricity, gas and heating sectors as well as the rights and obligations of natural and legal persons associated with them.

Emergency in the energy sector

According to the Energy Act, emergency means a state in the electricity, gas or heat supply system as a result of natural events, measures of State authorities under a state of emergency, threats to the State or the state of war, accidents or accumulation of failures on facilities for the production, transmission and distribution of electricity, accidents on facilities for the production, transmission, distribution and storage of gas, accidents on heat supply system facilities, smog alerts pursuant to special regulations, terrorist acts, unequal balance of the electricity system or its part, unequal balance of the gas system or its part, unequal balance in the heat supply system, transmission of a fault from a foreign electricity system, threat to physical security or protection of persons causing a significant and sudden shortage of electricity, gas or heat or threat to the integrity of the electricity system, gas system or heat supply system, its security and operational reliability, in the case of the electricity system or gas system on the entire the territory of the State, on a defined territory or its part.

The Act further defines the term ‘emergency prevention’ as a set of measures and activities carried out in a situation where there is a real risk of an emergency. In the case of the gas system, it consists of two phases: early warning, where there is information of a possible emergency, and alert, where there is an actual deterioration in the supply to customers, but it is not yet necessary to introduce a general reduction in consumption.

The transmission system operator announces the exact time of start or termination of an emergency for the entire territory of the State in mass media and by means of dispatching management and immediately notifies the Ministry of Industry and Trade, the Energy Regulatory Office, the Ministry of the Interior, the market operator, the regional authorities and the Prague City Hall. Similarly, the transmission system operator notifies emergency prevention without delay to the Ministry of Industry and Trade, the Energy Regulatory Office, the Ministry of the Interior, the market operator, the regional authorities and the Prague City Hall within one hour after the commencement of the respective activities. For the defined area or its part, these obligations lie with the distribution system operators. In the heating sector, emergency and its termination is declared through the media or by another appropriate manner by the Ministry of Industry and Trade for the entire territory of the State and by a regional authority or the Prague City Hall for its part. The body which has declared the emergency is obliged to immediately inform the Ministry of the Interior and the competent regional fire rescue service of the expected duration of the heat supply restrictions.

Pursuant to the enabling provisions of Act No 458/2000, on the conditions for business and the performance of State administration in the energy sector and amending certain acts (the Energy Act), the Ministry of Industry and Trade shall issue an Implementing Decree laying down the measures and procedures to be applied to preventing emergencies, during emergencies and the removal of the consequences of emergencies, the methods to declare emergencies and notify the prevention of emergencies and the procedures in restricting the generation of electricity, the consumption of electricity, gas and heat including the balancing, cut-off and frequency plans, the method to ensure gas security standards, the requirements for the content of emergency plans, the method to ensure gas security standards, requirements for the content of documents for the preparation of preventive action plans in accordance with a directly applicable EU regulation and the deadlines for their submission to the Ministry. In the electricity sector, such enabling provisions are laid down in Implementing Decree No 80/2010, on the state of emergency in the electricity sector and on the content of the emergency plan; in the gas sector, such enabling provisions are laid down in Implementing Decree No 344/2012, as amended by Implementing Decree No 215/2015; and in the heating sector, such enabling provisions are laid down in Implementing Decree No 225/2001, establishing the procedure for the occurrence and elimination of a state of emergency in the heating sector.

Critical infrastructure protection

In accordance with Act No 240/2000, on crisis management and amending certain acts (the Crisis Act), critical infrastructure means a critical infrastructure element or a system of critical infrastructure elements, the disruption of whose function would have a serious impact on the security of the State, securing of the basic living needs of the population, human health or the economy of the State. A critical infrastructure element means, in particular, a structure, equipment, resource or public infrastructure, determined according to the cross-cutting and sectoral criteria set out in Government Decree No 432/2010, on the criteria for the identification of critical infrastructure elements. These elements are determined by assessing their criticality, the impact of the loss of their function and their irreplaceability or, where relevant, the possibility to provide an alternative to their function.

According to law, critical infrastructure protection means a measure aimed at reducing the risk of the critical infrastructure element's function becoming disrupted. A critical infrastructure entity means the critical infrastructure element operator; a European critical infrastructure element operator is considered to be a European critical infrastructure entity.

Type crisis management plans

Type plans set out recommended type procedures and principles for a particular type of crisis situation and measures to address such a situation. According to Government Decree No 462/2000, type plans are part of the Ministry's crisis plan. Within the scope of MIT's competence, these include: (i) the type plan for addressing crisis situations concerning a large-scale electricity supply disruption; (ii) the type plan for addressing crisis situations of a large-scale gas supply disruption.

Emergency plans

Emergency preparedness is a prerequisite for the successful resolution of extraordinary events (from calamities, floods, system failures to declaration of emergency in accordance with Act No 458/2000). Emergency preparedness consists in the ability to respond, correctly and in due time, to the occurrence of an emergency or crisis situation and to eliminate the risk to life, health, property or the environment to the maximum extent possible.

In accordance with Act No 458/2000, the Energy Act, it is necessary to prepare emergency plans, which represent a set of planned measures for the prevention of emergencies and for the effective and rapid elimination of these situations.

The procedure for restoring electricity supply within the distribution network

The procedure for the reduction of electricity consumption and the restoration of electricity supply within the distribution system is laid down primarily in Implementing Decree No 80/2010, on emergency in the electricity sector and on the requirements for the content of emergency plans.

In accordance with Section 1 of this Implementing Decree, the reduction of electricity consumption in areas where there is a risk of emergency or where an emergency has been declared is determined by the application of the appropriate level of the control plan, cut-off plan, operative shutdown of a part of facility or automatic operation of frequency relays in accordance with the frequency plan, to the extent necessary to equalise the power balance of the relevant part of the electricity system.

In accordance with Section 3(2), regional distribution system operators submit to the transmission system operator by 30 September of each year the updated capacity values for the individual control levels and the cut-off plan and frequency plan levels.

The use and the requirements for the content of the control plan, the cut-off plan, the frequency plan and the emergency plan are set out in the relevant annexes to the Implementing Decree.

3.3.1.2 Gas sector

The main policies and measures to ensure the security of energy supplies in the gas sector are:

- diversification of gas sources and gas transit routes (closely linked to the development of the transmission system);
- measures following from European legislation;
- development of the transmission system (distribution systems) in order to ensure system adequacy and security of gas supply ensuring long-term fulfilment of the N-1 criterion;
- development of an integrated gas market;
- a rigorous monitoring of compliance by the gas traders with the security standard of supply for protected customers;
- measures to ensure sufficient storage capacity and the efficient use of gas-storage facilities;
- emergency gas system management and emergency prevention.

Diversification of sources and gas transit routes

The Czech Republic is almost exclusively dependent on the import of natural gas. Domestic gas production covers only a negligible share of domestic consumption (approximately 2–3 %). For this reason, it is very important to ensure diversification of natural gas sources and routes. Concerning the diversification of natural gas transit routes, the Czech Republic uses a very good connection to the gas infrastructure of neighbouring countries, especially Germany and Slovakia, thanks to transit pipelines which lead east-west, west-east and partly north-south. In this respect, it is possible to mention the possibility of reverse flows following the limitation of gas supply in 2009 and the commissioning of the new Gazela transit pipeline in 2013, which resulted in a relatively significant increase in the capacity of inputs into the Czech system. For more information, see Chapter 4.5.2.2.

The security of supply with respect to the diversification of natural gas sources and transmission routes and the robustness of the transmission system is expressed within the N-1 criterion, in accordance with the requirements of Regulation No 1938/2017. N-1 is quantified by the transmission system operator within the Ten-Year Network Transmission Development Plan. The recommended value of this criterion is 100 %. According to the Ten-Year Development Plan 2019–2028, the values for 2019 and 2028 are at 320.7 % and 454.2 %, respectively, and the recommended infrastructure security standard is therefore exceeded by 350 % for the end interval.

The vast majority of imported natural gas comes from the Russian Federation. Business diversification is also important in this respect. The Czech Republic has taken the first major step towards securing greater business diversification already in 1997, with the validity of a 20-year gas supply contract concluded with Norway, which expired in 2017. Currently more than one third of natural gas is sourced at European gas exchanges. This, of course, is closely linked to the development of the internal market in natural gas, which is described in separate chapters of this document.

Measures following from European legislation

The security of natural gas supply is already very well regulated by specific European legislation. In accordance with Regulation No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC, preparation is underway of the Preventive Action Plan to ensure gas supply in the Czech Republic and of the Emergency Plan, which could affect the security of gas supply in the Czech Republic.[84]

In October 2017, Regulation (EC) No 2017/1938 of the European Parliament and of the Council concerning measures to safeguard the security of gas supply and repealing Regulation 994/2010 came into force. As part of the coordination of emergency planning at national, regional and EU level, the obligation to prepare preventive action plans and emergency plans is maintained. At the same time, other specific measures are introduced, such as the principle of solidarity. The Regulation also lays down an obligation to comply with the infrastructure standard at N-1 level or an obligation to establish and maintain a security standard of gas supply.

Development of the transmission system to ensure system adequacy and gas supply security

The transmission system development aims to ensure system adequacy and gas supply security in order to, *inter alia*: (i) strengthen the Czech Republic's transit role on a European scale; (ii) increase interconnection of the transmission systems of the individual EU Member States; (iii) remove bottlenecks at national level.

The expected development of the transmission system is described in the ten-year network development plan, which is prepared by the transmission system operator. Under this plan, measures are taken to ensure system adequacy and gas supply security. The ten-year network development plan: (i) indicates which parts of the transmission system are to be built or extended over the next ten years; (ii) identifies all the investments in the transmission system that the transmission system operator has decided on and the new investments to be made in the next three years.

When making the Development Plan, the transmission system operator shall base its current and foreseeable future gas supply and demand on it. To that end, the transmission system operator shall analyse the development of gas production, supply, import and export, taking into account the planned development of the distribution systems connected to the transmission system, the planned development of gas-storage facilities and the EU-wide transmission system development plan prepared pursuant to Regulation (EC) 715/2009.

The purpose of the ten-year network development plan is to provide an overview of anticipated investments increasing the capacity of the Czech transmission system and to assess the compliance of

84 The Preventive Action Plan and the Emergency Plan (or their update) are available at: https://www.mpo.cz/cz/energetika/energeticka-legislativa/plany-dle-narizeni-ep-a-rady-c--994-2010--119187/

the transmission system with the requirements: (i) of the State Energy Policy (or other relevant strategic documents); (ii) for ensuring the supply security standard and ensuring compliance with the N-1 criterion.

Development of an integrated gas market

One of the important elements for enhancing energy security is the further development of the internal natural gas market / its continued integration. The internal energy market is a separate dimension of the Energy Union and is described in more detail in the other parts of this document, specifically in Chapters 2.4, 3.4 and 4.5.

Security supply standard

The key policy for ensuring the security of natural gas supply is to provide for the ‘supply standard’. The obligation to ensure the security supply standard is laid down by 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 security supply standard is further regulated by Act No 458/2000, as amended. The manner to ensure the security standard, its determination and other related requirements are regulated by Implementing Decree No 344/2012, on the state of emergency in the gas sector and on the manner to ensure the security gas supply standard, as amended (as amended by Implementing Decree No 215/2015).

Within its competences, the Market Operator is entrusted with monitoring and evaluating the compliance with the security supply standard. In addition, as part of the monitoring of gas sector statistics, the Energy Regulatory Office publishes regularly during the heating season a monthly report on the assessment of the security standard of gas supply in the Czech Republic. This report contains aggregated information on compliance with the security standard, in particular with regard to the obligation to store at least 30 % in gas-storage facilities, the structure and the manner of demonstration of the protected customers’ shares and other relevant indicators.

Measures to ensure sufficient storage capacity and the efficient use of gas-storage facilities

On the basis of the measure laid down in the State Energy Policy (2015), the overall capacity of gas-storage facilities should be maintained at 35 to 40 % of annual gas consumption. In 2016, where natural gas consumption stood at 88.2 TWh, the value of this criterion was 37 %. Taking into account the expected consumption of natural gas and the development of storage capacity, this criterion should be met by 2030 (2028[85]). However, it should be emphasised that this is not an enforceable obligation (this obligation is not laid down in legislation). In the Czech Republic, natural gas-storage facilities are operated on a commercial basis and investments in further storage capacities may be affected, *inter alia*, by the following factors: (i) the difference between summer and winter gas prices; (ii) greater market integration and gas systems coupling (i.e. greater market flexibility) leading to greater competition in the services offered by gas storage facility operators; (iii) the decision to build storage facilities is often made conditional on binding interest of a particular trader; (iv) the security supply standard has no direct effect on the extension of storage capacities connected to the Czech system; this is because it is possible to use foreign gas-storage facilities provided there is sufficient agreed transmission capacity to the Czech Republic, which the storage facility operator can ensure and offer to the market within the standard product; (v) the setting of the gas market, including the level of transmission tariffs to and from the gas storage facility creates the essential conditions for storage and should be set up to ensure the efficient use of gas-storage facilities and maintain optimal storage capacity as required by the State Energy Policy (2015).

[85] Based on the Ten-Year Network Development Plan of the Czech Republic 2019–2028

Also, the deliverability from the storage facilities should be guaranteed for 2 months at 70 % of the peak daily consumption in winter. The highest daily consumption was reached on 23 January 2006, namely 68 million m^3; the corresponding required deliverability is 47.6 million m^3. The maximum deliverability of all the tanks connected to the Czech system is 69.7 million m^3 – however, this value is usually reached if the storage facilities are at maximum capacity and, therefore, it can be reasonably assumed that at the end of the winter season the required deliverability may no longer be guaranteed. However, it should be emphasised that this criterion is only aggregate and, as such, it does not completely reflect the relevant features of Czech storage facilities, especially their geographical distribution, which cannot be described as optimal, because almost all of them are located in Moravia (in Bohemia, there is only the Háje storage facility), which is owing to the suitable conditions for their location.

For more detailed information on the existing capacity and location of gas-storage facilities, as well as the anticipated development of capacity and deliverability, see Chapter 4.5.2.2 / 4.5.2.4.

Emergency gas system management and emergency prevention.

Emergency system management

The operation of the system is supervised by the gas dispatching of the transmission operator, which is informed of the network state by means of measuring devices and dispatching centres of other operators (distributors and storage facilities), while the expected operational values for the given state can be obtained by simulating the operation. A significant difference between expected and actual values may indicate an accident on a facility. For reliable and safe operation, the dispatching centres of the transmission operator, storage facility operators and distributors are capable of cooperating, even in the event of an accident on the system. The NET4Gas-transmission system Emergency Plan is the key document dealing with emergency situations. In case of emergency prevention and emergency situations, the Gas System Emergency Plan of the Czech Republic is also prepared. The Emergency Plan is revised and refined every year. Furthermore, Implementing Decree 344/2012 lays down the procedure to declare an emergency. Article 13 of 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 introduces a solidarity process in which a Member State is obliged to offer the requesting Member State natural gas for its solidarity-protected customers. The Central Crisis Team and the Ministry of Industry and Trade as the competent authorities are responsible for providing and requesting solidarity in the Czech Republic.

Preventing emergency

When preventing emergency in the early warning phase (stage 1), use is made of the storage capacity of the transmission and distribution systems, storage facility operators examine the possibility of maximum off-take from the storage facilities, and the extraction operators examine the possibility of extraction and traders examine the possibility of increased gas imports to the Czech Republic. All of them immediately inform the transmission operator of the supply possibilities. Emergency in the early warning phase is reported by the transmission operator or distribution company without delay to the storage facility operators, gas producers, traders and customers in the area concerned and, within one hour after the declaration, to the Ministry of Industry and Trade, Energy Regulatory Office, the Ministry of the Interior and regional authorities. Emergency committees and crisis teams are activated. The market operator shall notify all market participants that imbalances will be settled in the emergency prevention regime.

The transmission operator may also declare the state of emergency prevention (stage 2) for the entire territory of the Czech Republic. This involves reduction in the agreed transmission, distribution and gas supply to all Group A customers' off-take points (customers with gas consumption above 630 MWh per year) to the extent that they can switch to substitute fuel. If the measure is not effective, the gas supply to the defined customer off-take points can be interrupted. The operator shall notify these points to the transmission operator or to the distribution companies and traders to which these off-take points belong. In addition to the entities above, the declaration of emergency in the warning phase will also involve the Czech Radio. Also, in the case of settlement, no compensation for lost profits may be claimed.

3.3.1.3 Oil and petroleum products

The main policies and measures to ensure the security of energy supplies in the oil and petroleum products sector are:

- Diversification of sources and transport routes for oil transport;
- providing for emergency oil reserves.

Security in the oil and petroleum products sector is, of course, wider than the above. A detailed analysis within this document is not effective and is dealt with in more detail in other documents. Some more detailed information on the current situation is available, for example, in the Report on the Development of the Energy Sector in the Oil and Petroleum Products Sector[86].

Ensuring emergency oil reserves can be considered as one of the main measures to provide for energy security. The Czech law lays down the obligation to create and maintain emergency reserves of oil and petroleum products in Act No 189/1999, on emergency oil reserves, on dealing with oil emergency situations and amending certain related acts (Emergency Oil Reserves Act) of 29 July 1999, as amended. Section 2 of this Act provides for the creation and maintenance of emergency reserves, and Section 2(2) provides the following: 'Emergency reserves are created and maintained by the Administration of State Material Reserves from oil and selected petroleum products in an amount equivalent to at least 90 days of average daily net imports of the reference year.' In this respect, an important legal regulation is the Implementing Decree No 165/2013 on the types of oil and the composition of petroleum products for storage in emergency oil reserves, on the calculation of the level of emergency oil reserves, on storage facilities and on the reporting of emergency oil reserves.

3.3.1.4 Heat sector

Energy security can be viewed from several perspectives. The primary objective of the heating sector users (customers) is primarily to have stable heat supply. In terms of heat source and heat supply system operators, the primary objective is ensuring such entry conditions that their business in the sector is predictable and, ultimately, profitable.

In line with the strategic national documents, the following areas were identified as the primary objectives (trends) in the heating sector:

- diversification and decentralisation of sources;
- flexibility of the supply of heat and other products and services.

Diversification and decentralisation of sources

On the basis of the national strategic documents, a higher degree of diversification of heat sources is expected in the future owing to the gradual replacement of coal (as one of the primary fuels in the heating sector used by larger sources) by alternative fuels. Namely, the increase concerns the share of:

[86] This document is available in electronic form at: https://www.mpo.cz/cz/energetika/statni-energeticka-politika/zprava-o-vyvoji-energetickeho-sektoru-v-oblasti-ropy-a-ropnych-produktu-za-rok-2016--235988/

- waste for energy purposes;
- biomass;
- natural gas;

In individual strategic documents (such as the Action Plan for Biomass in the Czech Republic 2012–2020), the heating sector is mentioned as one of the sectors with a high potential to use biomass, which should at least partially help to replace coal. Primarily, local biomass sources should be used, especially:

- residual biomass types;
- biomass grown for the particular purpose;
- biodegradable municipal waste.

The potential of biomass can be seen in individual heat production / its use in the case of central heat sources in relation to high-efficiency CHP.

In terms of decentralisation, the probable decentralisation of larger sources and the emergence of smaller power plants, in particular in the form of cogeneration units, can be expected in the future.

At the same time, the strategic documents mention the effort of most heating plants to switch to high-efficiency cogeneration where this is technically feasible and economically advantageous.

Flexibility of the supply of heat and other products and services

In connection with the ongoing decentralisation of electricity sources, it will be necessary to ensure the overall flexibility of the energy system. From this perspective, heating sources should be more involved in the provision of support services at the distribution and transmission system level.

At the same time, thanks to the possibility of using cogeneration, production sources contribute to flexible electricity supplies; on the other hand, technology such as electric boilers and heat pumps have the potential to increase the ability to control electricity generation/consumption.

Finally, it is necessary to mention the development of not only the market with heat and electricity, but also with cold.

ii. Regional cooperation in this area

Regional cooperation in the gas sector takes place, *inter alia*, on the platform to prepare the Gas Regional Investment Plan for Central and Eastern Europe (CEE GRIP). It is also possible to mention the Gas Coordination Group meetings. Regional cooperation also stems from the Security of Gas Supply Regulation, which lays down the solidarity principle and the elaboration of regional chapters on risk analysis, preventive action plans and emergency plans. In the electricity sector, the issue is addressed within a number of already existing structures, for example within ENTSO-E cooperation. Regional energy security cooperation is likely to be further strengthened on the basis of the Security of Electricity Supply Regulation, which was part of the 'Clean Energy for All Europeans' legislative package.

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

Financial measures related to energy security at national level, including EU support and the use of EU funds, mainly concern the development of electricity and gas infrastructure. For more details, see Chapter 3.4.

3.4 Dimension internal energy market [87]

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

The framework target for Czech transmission system interconnectivity corresponds to maintaining the transmission system import and export capacity relative to the maximum load at a level of at least 30 % and 35 %, respectively. This is in line with the 15 % 2030 interconnectivity target (relative to installed capacity). The Czech Republic is currently meeting this target with a relatively significant reserve and can be expected to do so in the future (see Chapter 2.4.1 and Chapter 4.5.1). Therefore, the Czech Republic does not consider it necessary to have specific policies and measures to achieve this target.

The expected export and import capacity of the Czech Republic and its adequacy for trade exchanges and especially for the secure operation of the transmission system is periodically assessed both within the preparation of the ten-year network development plan of the Czech Republic and within the cooperation on the ten-year development plan at ENSTO-E level.

With regard to the strengthening of export and import capacity, pre-project preparation (elaboration of the spatial-technical study) of a new line between the Czech Republic and Slovakia was started in coordination with the Slovak partners. Another aspect affecting the capacity of the cross-border transmission system, which should be mentioned in this context, is the strategy of ČEPS, the transmission system operator, which aims to replace the 220 kV system with a 400 kV system. For more information, see also Chapter 4.5.2.

ii. Regional cooperation in this area[88]

In accordance with Regulation (EU) No 714/2009 of the European Parliament and of the Council on conditions for access to the network for cross-border exchanges in electricity, the development plan is also reflected in the content of the regional investment plan for the Central and Eastern Europe on a two-yearly basis. Therefore, many of ČEPS's upcoming development investment projects are part of the regional investment plan of continental Central and Eastern Europe 2015 and are included in the TYNDP 2016, which is subject to assessment in accordance with established criteria.

One of the cooperative initiatives is 'Electricity Neighbours'. Electricity Neighbours is an initiative set up in 2015 on the basis of a joint declaration prepared by the German Federal Ministry of Economy and Energy in cooperation with the European Commission and the countries of the Pentalateral Energy Forum. The group consists of Germany, France, the Benelux countries, Denmark, Italy, Norway, Sweden, Poland and the Czech Republic. The declaration highlights the importance of the internal market as the most advantageous economic means of ensuring supply security.

The real development of operational security in individual regions and blackout response in Western Europe in 2006 led to the establishment of ad-hoc coordination platforms (Coreso, TSC, SSC) aiming to ensure operational coordination between the dispatching centres of the participating transmission system operators.

Over the years, and with increasing need for coordination, *inter alia* owing to the growing share of intermittent electricity sources in the interconnected European system, cooperation among the TSOs has become much more interlinked and more detailed. Without exaggeration, this voluntary

[87] Policies and measures reflect the first energy efficiency principle.
[88] Non-regional PCI groups established under Regulation (EU) No 347/2013.

cooperation has allowed the functioning of an interconnected European electricity system with sufficient reliability of electricity supply.

In June 2017, TSCNet and Coreso, as two future RSCs (Regional Security Coordinators), in accordance with the SO GL (System Operation Guidelines, laying down the guidelines for the operation of electricity transmission systems), signed a framework cooperation agreement. This means sharing resources, methodologies and tools, joint or alternating provision of services and development of new services and resources. The adopted SO GL, together with the CACM (Capacitive Allocation and Congestion Management, establishing a guideline on capacity allocation and congestion management) and the Emergency Restoration Network Code (NC ER, establishing a network code on electricity emergency and restoration), sufficiently define the mandatory cooperation between the TSOs and the regional security coordinators.

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

Investment in the electricity system can be considered as very important, also in relation to the use of EU funds. The reason for the need for these investments is that the age of a significant part of the production sources and electricity system is 35 years or more and requires corresponding investment in maintenance, renewal and modernisation. Furthermore, it is necessary to adapt to new technologies and further technological development both in terms of sources and consumption. Electricity networks should be modernised on an ongoing basis to allow for the further development of new electricity generation sources (increase of free connection capacity). In addition to the European and Investment Structural Funds (ESIF), after 2020 the Czech Republic plans to continue using funds from the CEF as well.

The current use of the structural funds can be summarised as follows. Eight projects for modernising and improving the capacity of the transmission system with a total value of CZK 1 609 million have been approved so far, the EU contribution is CZK 643 million; as of 21 March 2018 CZK 23 million was reimbursed to three projects. In the area of modernisation and capacity increase of distribution systems, seven projects with total project expenditure of CZK 289 million are currently being administered, the EU contribution being CZK 116 million. In 2014–2020, the sub-area of transmission, distribution and storage of electricity and the modernisation of energy infrastructure is supported under the OP EIC, namely under Priority Axis 3, Investment Priority 3, Development and deployment of low and high voltage smart distribution systems, SO 3.3 ‘Increase the application of smart network elements in distribution systems’.

According to the OP EIC programming document, the total allocation for investment grants under this investment priority was EUR 37 million. As of 21 March 2018, a total of three applications with a total investment grant of CZK 152.641 million were approved. There was also less interest in grants for the construction of smart electricity networks, which should cover the expected significant increase in the number of decentralised sources connected into the system and the introduction of new consumption management services. However, the interest of the regulated entities is closely related to the setting of the fifth regulatory period.

In 2017, the European Commission approved the request for change / removal of the share for large enterprises in SO 3.2, 3.3 and 3.5. This should ensure a higher absorption capacity. OP EIC provides support to an increase in the applications of elements of Smart Grids I – distribution networks and Smart Grids II – transmission networks.

3.4.2 Natural gas transmission infrastructure

i. Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

The process to determine the incremental capacity of commercial infrastructure projects is governed by Commission Regulation (EU) 2017/459 of 16 March 2017 establishing a network code on capacity allocation mechanisms in gas-transmission systems and repealing Regulation (EU) No 984/2013. In addition, it also specifies non-commercial projects which can be put on the 'Union list of projects of common interest under Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013[89] 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. These projects can then enjoy certain benefits provided for in this regulation. The last type of projects is national projects, which are governed by Act No 458/2000, on the conditions for business and the performance of State administration in the energy sectors and amending certain acts (the Energy Act).

ii. Regional cooperation in this area[90]

Context of regional cooperation

The Czech Republic produces only 2 % of its natural gas consumption and is therefore dependent on imports from third countries. Sufficient diversification of transport routes (the Gazela pipeline and reverse gas flows at border transfer points) together with market liberalisation have led to the currently very good security of gas supply for domestic customers. The transmission system operator in the Czech Republic is at the same time an important natural gas transit operator for markets in Western, Central and Southern Europe. It is currently not possible to precisely determine the impact of decarbonisation in the European and Czech context on the Czech gas network and the concrete information on how this network will be used with a view to minimising the transmission system operator's sunk costs. At present, technological solutions for the gas sector decarbonisation are not developed to a large extent in both the EU and the Czech Republic, and it is therefore appropriate to keep this infrastructure for future use for both natural gas and new types of gases. A combination of natural gas with CCS or CCU may be considered for the storage or utilisation of carbon produced from natural gas splitting. Another European trend is the future use of synthetic methane, biomethane and hydrogen as a partial substitute for natural gas. The specific decision on the use of the technologies for new types of gases can be expected in 2020 to 2030, largely depending on the research and development of these technologies and the economies of scale to be achieved after they are deployed.

Regional cooperation in the area of natural gas

In the area of natural gas, micro- and macro-regional cooperation takes place on several levels. Within the Gas Coordination Group, which meets regularly about once a year, the EU Member States discuss security, legislative and economic issues related to the EU gas sector.

Regional infrastructure cooperation is strengthened at the operational level through the implementation of PCI projects, which are regularly discussed in smaller groups set up on a geographic basis.

[89] Projects of Common Interest are updated as needed and the provision of these specific projects in the National Plan does not mean that these projects can be considered binding.

[90] Non-regional PCI groups established under Regulation (EU) No 347/2013.

On the basis of the revised Security of Gas Supply Regulation (2017/1938), the so-called Risk Groups have been set up through which carry out regional risk management. States are discussing factors that could threaten the stability of gas supply in the future and look for ways to mitigate the risks. The Czech Republic is an active member of three regional groups, namely the Ukrainian, Baltic and Belarusian groups. Furthermore, the 'Solidarity mechanism' has been established, which obliges States to work more closely with their neighbours on crisis management and to codify the mechanism to provide cross-border assistance in case of threatened gas supply outages to protected customers.

The V4 Gas Forum is regularly held by the presiding country of the Visegrad Group. The focus of the meetings is always fully up to the presiding State, but typically the central theme is the debate on the possibilities for regional cooperation in the area of gas infrastructure development and the search for a common position on the legislative proposals being discussed by the EU Council. The V4 Gas Forum newly discusses the legal and operational aspects of Solidarity implementation.

The 'Budapest Process' is a platform for V4+B4+ meetings. This platform is relatively new, and it is currently difficult to predict how the initiative develops, or what its specific focus will be.

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

For gas infrastructure projects, it is currently possible to obtain EU financial support through the Connecting Europe Facility (CEF). CEF is part of the EU Financial Framework 2014–2020. In the past, projects also received support from the EU Trans-European Energy Network (TEN-E) programme, which provided support to long-term energy investments.

In 2012, the BACI project received financial support from the TEN-E funds. The financial support was 50 % of the eligible costs incurred in updating the documentation for the land-use permit and the study of the future possibilities of interconnecting the Czech and Austrian gas-transmission systems. The study was completed in 2013 and the land-use permit application was filed in May 2015. At the end of 2014, the project received a CEF grant covering 50 % of the eligible costs of the preparatory study on the preparation of documents for the investment application. These documents were completed in late 2015.

In 2014, the CPI project received financial support from the CEF programme covering 50 % of the eligible costs for the development of land-use permit documentation and documentation for contractor and material selection for the Stork II project. In the context of the CEF's second call in the energy sector, a grant for construction work on the Stork II project was obtained, but it was cancelled because the project was postponed until the end of 2022 by the Polish partner. In 2017 a CEF grant was obtained for design work as part of the project to modernise the Břeclav compressor station. Its aim is primarily to prepare a feasibility study and to create an introductory project and the Detail Design.

3.4.3 Market integration

i. Policies and measures related to the elements set out in point 2.4.3

With regard to international aspects, the policies and measures of the Czech Republic in this area are primarily aimed at EU legislation, namely Regulation 2015/1222 (CACM) and the conditions and methodologies that follow therefrom. This is especially includes the MCO plan, see Chapter 2.4.3, which is binding on all NEMOs within the EU.

In cooperation with all NEMOs in the EU, in June 2017 first a plan was created to jointly establish and perform the functions of a market coupling operator – the 'MCO plan'. It established rules for the management and cooperation between NEMOs, defines the relationship with third parties, and also describes the transition of existing initiatives of interconnected day and intraday markets into a single interconnected day and intraday market.

In relation to the CACM Regulation, the following methodologies were developed in 2017: (i) the methodology of products that NEMOs can incorporate into single day-ahead or single intraday coupling; (ii) back-up methodology; (iii) the methodology for harmonised maximum and minimum clearing prices.

The single price coupling algorithm and the continuous trading matching algorithm is the last methodology which had to be prepared by the MCOs under CACM.

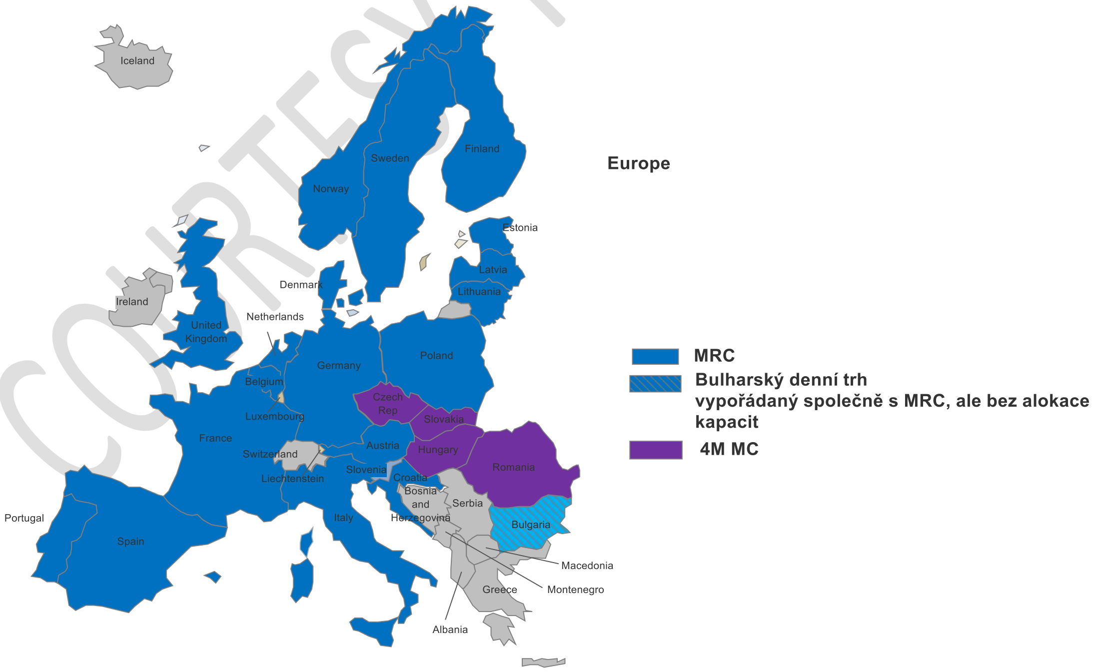
Electricity forward market

In late 2018, the Czech Republic will sign a contract through ČEPS to establish a single EU platform for the allocation of long-term capacity rights under harmonised rules. Once signed, the allocation will be assigned through this platform.

Integration of day-ahead electricity market

As part of the MCO Plan, the Price Coupling of Regions (PCR) project, based on the cooperation of energy exchanges, has been established as a technical solution to enable the integration of day-ahead markets. OTE, a.s. has been a full member of this project since 2013 and has been thus involved in the development of this solution. The PCR system provides a unified algorithm, known as EUPHEMIA, and unified operational procedures for effective electricity pricing and the use of cross-border transmission capacity. The PCR solution is already being used in price-coupled markets (see Figure 5.4) in Europe and its further use, as a basis for a future pan-European solution, can therefore be seen as a logical step.

Figure 3: *Current state of day-ahead market coupling in electricity in Europe*



Bulharský denní trh vypořádaný společně s MRC, ale bez alokace kapacit – Bulgarian day-ahead market together with MRC, but without capacity allocation

Source: OTE, a.s.

The Multi-Regional Coupling (MRC) includes the markets of Germany/Austria, France, Belgium, Netherlands, Luxembourg, Denmark, Finland, Croatia, Sweden, Norway, United Kingdom, Spain, Portugal, Latvia, Lithuania, Estonia, Slovenia, Italy and Poland. This coupling area accounts for approximately 2 800 TWh of annual electricity consumption. The Bulgarian day-ahead market is settled together with the MRC, but without the allocation of cross-border capacities.

Thanks to the long-term integration activities of the Market Operator, the Czech Republic is part of the day-ahead market coupling covering the Czech, Slovak, Hungarian and Romanian electricity market (4M MC). The 4M MC uses the PCR solution, which ensures the technical and procedural compatibility between 4M MC and the MRC and the target European solutions. Market participants in the Czech Republic are offered products and solutions also used in Western Europe.

Over the last few years, there were ongoing preparations for the coupling of this regional project to MRC on the basis of the implicit flow-based allocation of cross-border capacities within CORE established by the CACM Regulation and consisting of 12 EU Member States[91]. OTE aims to provide its market participants, as soon as possible, with the possibility of implicit allocation of cross-border capacity at the largest possible number of cross-border profiles of the Czech Republic.

Integration of intraday electricity market

A logical step towards creating a single European market is also the individual coupling at regional / pan-European level in intraday trading. The integration of intraday trading is largely different from day-ahead coupling, because it is a continuous 24/7 trading, with significant demands not only on the harmonisation of procedures between marketplaces and providers of cross-border profiles but also on the technical solution used, which must achieve very high availability while maintaining stable performance.

2018 saw the conclusion of the implementation of a platform for the single intraday continuous trading with the implicit allocation of cross-border capacities within the Cross-Border Intraday Coupling (XBID) project, which was established as the technical solution for the single intraday coupling in Europe under the MCO Plan. The XBID project responds to market needs by creating a more transparent and efficient continuous trading environment that enables market participants to easily trade their intraday positions across EU markets without the need for explicit allocation of transmission capacity.

The solution is based on a single central IT system linking bids from local trading systems operated by nominated electricity market organisers, as well as available transmission capacities between trading zones provided by transmission system operators. As part of the central solution, orders placed by market participants in one country may be matched with orders placed by market participants in any other participating country if there is an available cross-border transmission capacity between the zones concerned.

[91] France, Germany, Belgium, the Netherlands, Austria, Czech Republic, Slovakia, Poland, Hungary, Slovenia, Croatia and Romania.

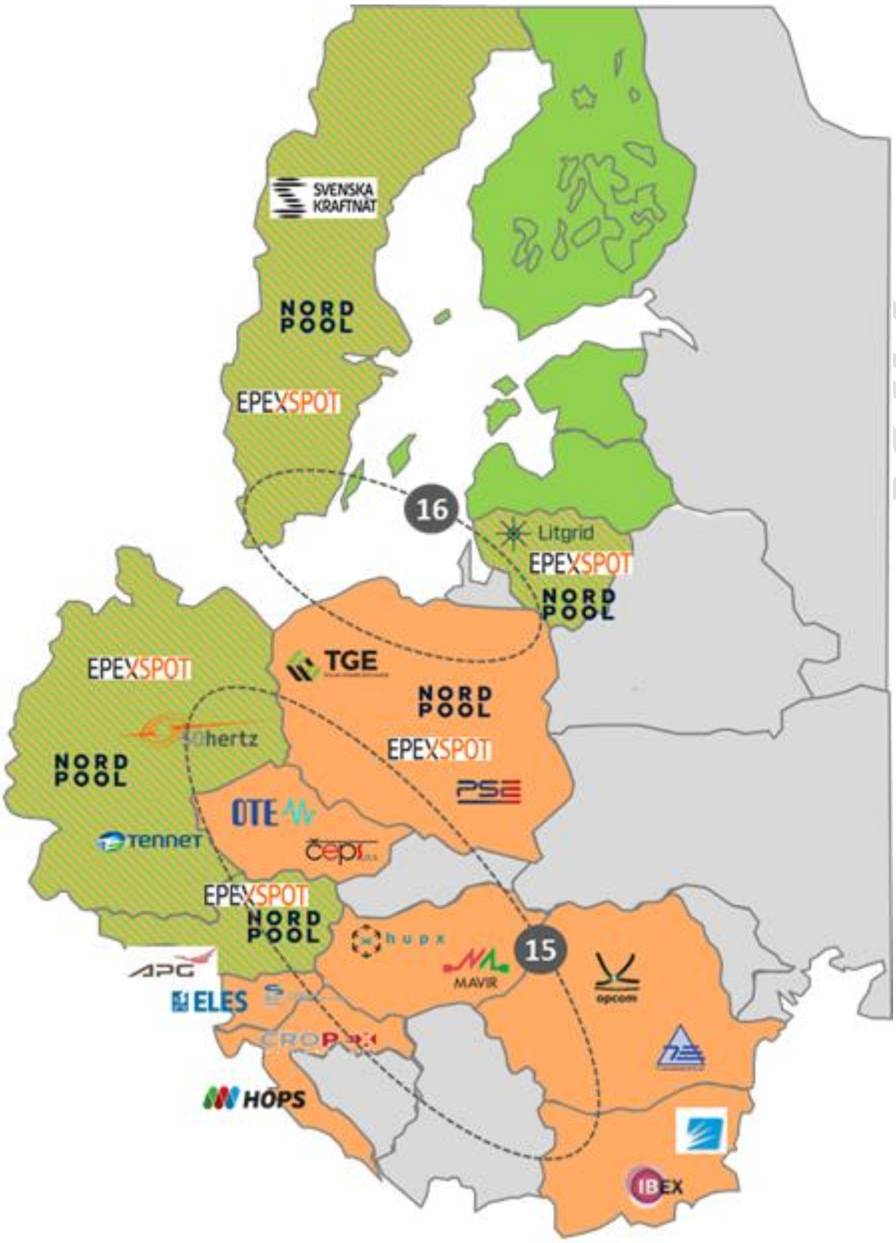
Figure 4: *Expected state of day-ahead coupling in electricity in Europe after 2019*

Source: OTE, a.s.

The national intraday coupling is realised through 'local implementation projects', which bring together nominated electricity market operators and transmission system operators in a given area or region. On 12 June 2018, the first wave of local implementation projects was successfully launched, covering the following countries: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Lithuania, Latvia, Norway, the Netherlands, Portugal, Spain and Sweden.

ČEPS, a.s. as the transmission system operator in the Czech Republic and OTE, a.s. as the nominated electricity market operator in the Czech Republic together with similar entities in Austria, Germany, Hungary, Romania, Croatia and Slovenia, forms a local implementation project (LIP 15) in Central and Eastern Europe, which is aimed at launching the second wave. The second wave launch date now under discussion is roughly in mid-2019.

Figure 5: *Cross-border profiles under LIP 15*



Source: OTE, a.s.

Balancing services market

Through ČEPS, the Czech Republic is represented in the TERRE[92], MARI[93] and PICASSO[94] platform projects implementing transnational platforms for sharing and activating balancing energy bids from standard products. The common objective of all platforms is the introduction of a single market with standardised balancing energy bids and thereby also the achievement of the key EBGL[95] objectives. ČEPS is also a member of other working groups which prepare or implement other EBGL

92 Trans European Replacement Reserves Exchange

93 Manually Activated Reserves Initiative

94 Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation

95 Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing

requirements; together with the implementation of the platforms, these represent an instrument for the Czech Republic to achieve commitments in this area of the market.

Specific national policies and measures are then based on this European legislation, such as designating the Nominated Energy Market Operator, see Chapter 2.4.3, approval by the competent authorities of individual methodologies and conditions at national level (ERO in most cases).

Table 45: *Integration projects in the gas sector*

Policy/project	**Policy/project description**
Market integration (BACI project)	The BACI project would allow closer access to CEGH Hub in Baumgarten through direct coupling of the Austrian and Czech gas markets, which would facilitate better market integration, promote competition and have a positive impact on gas prices in the relevant gas markets. Expected launch: 2024.
Trading Region Upgrade (TRU)	The TRU project was initiated in August 2017 on the basis of a Memorandum of Understanding between the Czech Republic and Slovakia. The pilot project was launched following successful capacity tests on 1 October 2018.
Czech-Polish Interconnection Gas Pipeline (CPI)	Market integration through increased cross-border capacity between CZ and PL markets supporting gas-gas competition with a positive impact on wholesale and retail gas prices; expected launch: 2022.

Source: Prepared by MIT for the purposes of the National Plan

ii. Measures to increase the flexibility of the energy system with regard to renewable energy production such as 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

The change of market setting to increase its flexibility is implemented as part of the implementation of the Commission Regulation (EU) 2016/1719 of 26 September 2016 establishing a guideline on forward capacity allocation ('FCA Regulation'), Regulation (EU) 2015/1222 of 24 July 2015 establishing a guideline on capacity allocation and congestion management ('CACM Regulation') and finally Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing ('EB Regulation').

The FCA Regulation lays down detailed rules on cross-zonal capacity allocation in the forward markets, on the establishment of a common methodology to determine long-term cross-zonal capacity, on the establishment of a single allocation platform at European level offering long-term transmission rights, and on the possibility to return long-term transmission rights for subsequent forward capacity allocation or transfer long-term transmission rights between market participants.

The CACM Regulation lays down detailed guidelines on cross-zonal capacity allocation and congestion management in the day-ahead and intraday markets, including the requirements for the establishment of common methodologies for determining the volumes of capacity simultaneously available between bidding zones, criteria to assess efficiency and a review process for defining bidding zones.

The EB Regulation lays down a detailed guideline on electricity balancing including the establishment of common principles for the procurement and the settlement of frequency containment reserves, frequency restoration reserves and replacement reserves and a common methodology for the activation of frequency restoration reserves and replacement reserves.

iii. Where applicable, measures to ensure the non-discriminatory participation of renewable energy, demand response and storage, including via aggregation, in all energy markets

Pursuant to Act No 165/2012, on supported energy sources, the transmission system operator or distribution system operator is obliged, in its licensed territory, to preferentially connect to the transmission system or to the distribution system a facility generating electricity from a supported source in order to transfer or distribute electricity, if the manufacturer so requests and meets the conditions of connection, except for the demonstrable lack of capacity of the transmission and distribution facility or in the case of the risk to safe and reliable operation of the electricity system. At the same time, the transmission system operator or distribution system operator shall, at the request of the producer whose facility generating electricity from a supported source is to be connected to the distribution system or the transmission system, provide the necessary information for the connection, information on estimated connection costs, the time limit for connection, handling the connection application and an estimate of the time needed to make the connection.

Following the adoption of the proposal for a recast Directive on common rules for the internal market in electricity, the flexibility and aggregation measures required by the Directive will be implemented to support the development of the demand side.

iii. 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

Policies and measures to protect the legitimate interests of customers and consumers in the energy sector to meet all reasonable energy supply requirements:

– ensuring the supply of energy to consumers at the most competitive prices;
– ensuring appropriate measures to promote a more efficient use of energy for consumers;
– increased level of customer protection in the position of the consumer, i.e. especially household customers;
– ensuring that consumers are informed about their energy consumption and energy costs in sufficient time intervals; non-discriminatory payment systems;
– ensuring that consumers are informed of their rights in the energy sector;
– ensuring the enforcement of consumer rights – establishing swift and effective complaints procedures and out-of-court settlement mechanisms;
– ensuring the availability of effective means of settling disputes for all customers;
– issuing binding decisions on the protection of consumers' rights in disputes with energy companies;
– issuing binding decisions regarding energy companies; imposing effective, proportionate and dissuasive sanctions on energy companies;
– promoting fair competition, enabling consumers to make full use of the opportunities in energy markets.

Energy poverty is a multidimensional phenomenon, which can be characterised from many different perspectives. Still, the basic model criteria may reflect a situation where households have insufficient level of basic energy services as a result of a combination of high energy expenditure, low household income, low energy efficiency of buildings and facilities, possibly in combination with the specific energy needs of these households. Therefore, energy poverty itself can be seen as a problem at the interface between social, economic and environmental agendas. For this reason, the solution may be an integrated approach, which can include both social policy measures and measures to improve energy efficiency in households, as well as measures to increase consumer awareness of the ways to save energy (improving the position of consumers, especially of vulnerable consumers).

The terms ‘vulnerable customer’ or ‘energy poverty’ are commonly used in EU documents and EU legislation, without this term being defined in them. Rather than focusing on the definition of vulnerable customers, the EU places a strong emphasis on the existence of support systems and the definition of which categories of customers this support applies to. In connection with vulnerable customers, regardless of how this term is defined in individual Member States with regard to national conditions, Member States should ensure the enforcement of rights and obligations aimed at protecting and supporting this category of customers.

Therefore, criteria must be determined at national level to define the term ‘energy poverty’, thus allowing regular monitoring of the state of energy poverty in the Czech Republic. The term ‘vulnerable customer’ can be understood and defined in the Czech environment only once the priorities allowing to develop and implement interventions and assess their effectiveness are determined on the basis of research and market analysis.

Regardless of the fact that energy poverty or vulnerable customer is not currently defined in the Czech Republic, customer support systems are now in place that partially meet the requirements of the directives, because they allow economic support and protection against disconnection of poor customers. It is a combination of economic support within social systems, together with tools to protect customers in emergency situations (supplier of last resort, obligation going beyond the licence). However, the Czech Republic does not have a specific support system for the energy sector, which is not in direct contradiction with EU requirements, because the EU requires a high degree of caution when considering intervention in the internal electricity or gas market, even if the intention is to protect vulnerable customers.

Existing support systems:

– an economic support system specific to the energy sector (the Czech Republic does not have an economic support system specific to the energy sector). In most countries with an economic support system in the energy sector, the system covers customers with income below a defined level.);
– a system of economic support outside of the energy sector (a characteristic factor is that customers can get some financial support if needed) (part of social systems in the Czech Republic).
– a system of non-economic support specific to the energy sector (a non-financial support system, such as, in particular, disconnection protection, may work as a complement to the economic support system). In the Czech Republic, these measures include the institutes of supplier of last resort and obligations going beyond the licence regulated by the Energy Act).

A vulnerable customer, whose position may be derived from the state of ‘energy poverty’, must be appropriately defined in law to ensure his suitable protection. The underlying theoretical parameters of a vulnerable customer may in particular involve situations where:

– customers are significantly less capable of protecting or representing their interests in the energy market than typical consumers (for example, owing to age or health);
– in the event of a negative energy supply situation, customers, owing to their personal situation, will be more harmed by an event than other customers in the same situation.

The energy sector in the Czech Republic lacks systematic collection of information on the number of households suffering from energy poverty; therefore, there can be no binding parameters characterising a vulnerable customer. Ultimately, therefore, there can be no system of economic support for vulnerable customers personalised for the energy sector.

In this respect, there are the following principles on which new policies and measures should be based to protect vulnerable and energy poor consumers:

– in order to identify energy poverty among household customers in the Czech Republic, it will be necessary to publish the parameters and criteria used for its identification, measurement and monitoring – important factors in designing the indicators for measuring energy poverty are, *inter alia*, low income, high energy costs and low energy efficiency of homes;
– drawing up a national action plan or another appropriate framework to tackle this problem, which would aim to reduce the number of people facing the problem and ensure the necessary energy supplies to vulnerable customers and customers suffering from energy poverty;
– the application of an integrated approach, for example as part of energy and social policy – measures need to be adapted to the specific situation identified and may include social or energy policy measures relating to the payment of electricity bills, investment in energy efficiency of residential buildings or consumer protection, such as disconnection protection;
– in the fight against energy poverty, appropriate instruments may also include community energy principle, which may also bring about progress in energy efficiency of households and reduce consumption and lower supply rates – community energy may enable energy market participation to certain consumer groups in households which would otherwise not be able to do so;
– the protection of customers suffering from energy poverty or the protection of vulnerable customers should be ensured by means other than public interventions in the setting of electricity or gas supply prices, an exception being an intervention in the form of 'public service', but it must be consistent with transparent conditions and only in precisely defined cases.

For more information on energy poverty, see also Chapter 2.4.4 and 3.4.4.

iv. Description of measures to enable and develop demand response, including those addressing tariffs to support dynamic pricing[96]

Following the adoption of the proposal for a recast Directive on common rules for the internal market in electricity, the flexibility and aggregation measures required by the Directive will be implemented to support the development of the demand side.

This issue is also partially addressed by the National Action Plan for Smart Grids.[97]

3.4.4 Energy poverty

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

The Czech Republic does not currently have policies or measures specifically aimed at reducing energy poverty. This issue is primarily addressed by social policies or, where applicable, partially by consumer protection policies. However, the Czech Republic addresses this issue also with regard to the approved European legislation. Currently, work is underway on the methodology to identify vulnerable customers and consumers suffering from energy poverty and tools to address this problem (for more information, see Chapter 2.4.4). It will likely be possible to propose specific measures and policies in this area only following the preparation of this methodology. Of course, the Czech Republic is prepared to inform about the developments in this area by periodic progress reports.

[96] In accordance with Article 15(8) of Directive 2012/27/EU.

[97] The National Action Plan for Smart Grids is available at the following link (only abstract in English): https://www.mpo.cz/dokument156514.html

3.5 Dimension research, innovation and competitiveness

i. Policies and measures related to the elements set out in point 2.5

3.5.1.1 National research, development and innovation policy of the Czech Republic 2016–2020[98]

The National Research, Development and Innovation Policy of the Czech Republic 2016–2020 is the key strategic document at national level, which sets out guidelines for research, development and innovation and forms the basis for other related strategic documents of the Czech Republic. The document puts more emphasis on supporting applied research for the needs of the economy and the State administration, and identifies the key areas and research topics on which applied research should focus. The National Policy also proposes changes in the management and funding of science so that more top-level scientific results are produced and companies become more engaged in R&D.

3.5.1.2 National priorities for research, experimental development and innovation[99]

National Priorities of Oriented Research, Experimental Development and Innovation were approved by the Government of the Czech Republic on 19 July 2012. RDI priorities are valid for the period until 2030 with gradual progress. Within the defined 6 priority areas, there are 24 sub-areas with a total of 170 specific targets. The document contains a description of each of the priority areas and sub-areas, indicating links between the areas and defining several system measures. The document also contains a statement on the expected allocation of RDI expenditures from the State budget to individual areas and defines the period during which the progress towards and the update of the priorities will be evaluated.

Table 46: *Energy-related priority areas within the National Priorities*

Area:	Sub-area:
Renewable energy sources	Developing economically efficient solar energy
	Developing economically efficient use of geothermal energy
	Developing economically efficient use of biomass
Nuclear sources	Efficient long-term use of existing nuclear power plants
	Supporting the safety of nuclear installations
	Research to support the construction and operation of new economically efficient and secure units
	Research and development of the fuel cycle
	Storage of radioactive waste and spent fuel
	Research and development of 4th generation reactors, especially efficient and safe fast reactors
Fossil energy sources	Economically efficient and environmentally-friendly fossil power and heating
Electric networks including energy storage	Capacity, reliability and safety of backbone transmission networks
	Modifying networks for ‘demand-side management’
	Electricity storage, including the use of hydropower
	Security and resilience of distribution networks

[98] The document is available at: https://www.vyzkum.cz/FrontClanek.aspx?idsekce=682145
[99] The document is available at: https://www.vyzkum.cz/FrontClanek.aspx?idsekce=653383

Production and distribution of heat/cold, including cogeneration and trigeneration	Heat off-take from power plants in base load
	High-efficiency cogeneration (trigeneration) in district heating systems in partial load operations (system services)
	Distributed combined production of electricity, heat and cold from all types of sources
	Transmission and storage of heat
	Efficient management of treating indoor environment
	Alternative sources – waste recovery
Energy in transport	Increase the share of liquid biofuels to replace fossil sources
	Increase the share of electricity use for drives to replace fossil sources
	In the future, introduce hydrogen as a source of energy in transport
Systemic development of the Czech energy sector in the context of EU energy sector development	System analyses to support a balanced State Energy Policies (SEP), other related strategy documents of the State and regional development policies with regard to the EU framework
	Integral strategy of municipal and regional development with verification by demonstration projects (link to SET Plan – Smart Cities and Smart Regions)

Source: National priorities for oriented research, experimental development and innovation

3.5.1.3 National Research and Innovation Strategy for Smart Specialisation

EU Member States were obliged to prepare their National Research and Innovation Strategies for Smart Specialisation (National RIS3 Strategies) in order to identify appropriate prospective economic areas, which should be subsequently supported by the European Structural and Investment Funds (ESIF). To this end, the Czech Republic has prepared its National RIS3 Strategy, which reflects the priorities of our economy, which should be targeted by ESIF programmes and selected research and development support programmes of the Ministry of Industry and Trade and the Technology Agency of the Czech Republic. The approval of the National RIS3 Strategy by the Czech government and the European Commission was a necessary condition to receive funds from the relevant ESIF.

3.5.1.4 THÉTA

One of the major science and research policies is THÉTA, a public support programme specifically focused on the energy sector. It is managed by the Czech Technology Agency. The programme was created on the basis of measures from the State Energy Policy.

The focus of THÉTA is based on the updated Czech Republic's State Energy Policy, approved by the Czech Government in May 2015. The programme is aimed at supporting projects whose results have a high potential for application in a number of areas of the public life of the Czech Republic. The programme period is 2018–2025 (i.e. 8 years in total). The first public tender was announced in 2017; as of late 2018, the second public tender has been announced. The maximum project implementation period in this programme is 8 years.

In the medium and long term, the programme aims to contribute, through the outputs, results and impacts of the supported projects, to achieving the vision of transformation and modernisation of the energy sector in accordance with approved strategic documents. This will be achieved through the support for energy research, development and innovation with a focus on: (i) promoting public interest projects; (ii) new technologies and system elements with high potential for rapid deployment in practice; (iii) support for long-term technological perspectives. The programme is further divided into three sub-programmes: (i) public interest research; (ii) strategic energy technologies; (iii) long-term technological perspectives.

The State budget expenditures for THÉTA for 2018–2025 total CZK 4 000 million. Non-public funds should then amount to CZK 1 715 million. Thus, total expenditure amounts to CZK 5 715 million. The programme allocation is divided into sub-programmes as follows: sub-programme 1 – 15 %, sub-programme 2 – 50 % and sub-programme 3 – 35 %. Table 47 shows the approved THÉTA budget for 2018–2025.

Table 47: *THÉTA budget (rounded to CZK million) thousands)*

Year	2018	2019	2020	2021	2022	2023	2024	2025
Total expenditure	272	509	818	917	917	917	867	498
State budget expenditure	200	360	580	640	640	640	600	340
Non-public funds	72	149	238	277	277	277	267	158

Source: THÉTA, a programme to support applied research, experimental development and innovation

3.5.1.5 Research infrastructure of the Czech Republic

In 2009, Act No 130/2002, on the promotion of research, experimental development and innovation from public funds and amending certain related acts (Promotion of Research, Experimental Development and Innovation Act), as amended, laid down a new specific legislative instrument to support research infrastructure of the Czech Republic. The Ministry of Education, Youth and Sports became the central State administration authority of the Czech Republic responsible for financing the so-called 'large infrastructures for research, experimental development and innovation' from the public funds of the Czech Republic, with large infrastructure being defined as 'unique research facilities, including their purchase, related investment and activities, which is necessary for a comprehensive research and development activity with high financial costs and technological complexity and which is approved by the government and established by one research organisation for use also by other research organisations.'

In 2010, the Roadmap of Large Infrastructures for Research, Experimental Development and Innovation of the Czech Republic was prepared for the first time, whose structure corresponds to the ESFRI Roadmap and which was updated in 2011 and 2015, when a completely new Roadmap of Large Infrastructures for Research, Experimental Development and Innovation of the Czech Republic 2016–2022[100] was prepared. Since 2010, the Roadmap of Large Infrastructures for Research, Experimental Development and Innovation of the Czech Republic thus represents a strategic document of the Czech Republic which establishes the policy of support and further investment development of large research infrastructures and represents the Czech Republic's contribution to the European efforts for strategic approach to research infrastructures on national and macro-regional EU level.

In the energy sector, the following are considered large infrastructure: (i) catalytic processes for the efficient use of carbonaceous energy raw materials; (ii) COMPASS – tokamak for thermonuclear fusion research; (iii) CVVOZE PowerLab; (iv) Jules Horowitz Reactor – participation of the Czech Republic; (v) experimental nuclear reactors LVR-15 and LR-0; (vi) research infrastructure for geothermal energy; (vii) SUSEN – sustainable energy; (viii) VR-1 – a school reactor for research activities.

[100] The document is available at: http://www.msmt.cz/vyzkum-a-vyvoj-2/cestovni-mapa-cr-velkych-infrastruktur-pro-vyzkum

3.5.1.6 National competence centres

As part of ‘Competence Centres’, a programme of the Technology Agency of the Czech Republic, the following centres focusing on energy were established: Competence Centre for Energy Recovery of Waste, Centre for Advanced Nuclear Technology (CANUT), Advanced Technologies for Heat and Power Generation, Centre for Research and Experimental Development of Reliable Energy, and Centre for the Development of Technologies for Nuclear and Radiation Safety: RANUS – TD. As part of the National Competence Centre programme, the National Energy Centre is established.

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

In the area of science and research, the Czech Republic is relatively significantly involved in cooperation with other Member States, both at the level of the European Strategic Energy Technology Plan (SET Plan) and its other pillars (for example the European Energy Research Alliance). The Czech Republic is also relatively significantly involved in the EU Framework Programme for Research and Innovation (Horizon 2020). The Czech Republic is also involved in European but also international research within important scientific centres (see, for example, the research infrastructures in the energy sector referred to in Chapter 3.5.1.5). The Czech Republic is also involved in research cooperation programmes of the International Energy Agency. A detailed description of the science and research cooperation will be finalised in the final version of the National Plan, if necessary.

The priorities of the European Strategic Energy Technology Plan (see Table 48) are already largely taken into account in the State Energy Strategy in areas defining the main R&D priorities. The priorities of the SET Plan have also been taken into account in detail in the preparation of the THÉTA programme, which is specifically focused on the energy sector. The specific reflection / use of the SET Plan priorities and their modifications for the Czech Republic are specifically referred to in the text of the approved THETA programme or in the underlying analyses of this programme.

Table 48: *Priorities under the Integrated Roadmap, Energy Union priorities, 10 SET Plan projects*

SET Plan Integrated Roadmap (13 themes)	ENERGY UNION R&I & Competitiveness priorities	SET Plan (10 key actions)
T10: Development of renewables T8: System flexibility	N°1 in Renewables	1. Performant renewable technologies integrated in the system 2. Reduce costs of technologies
T1: Engaging consumers T2: Smart technologies for consumers	Smart EU Energy System with consumers at the centre	3. New technologies & services for consumers
T6: Modernising the electricity grid T7: Energy storage T8: System flexibility T9: Smart cities & communities		4. Resilience & security of energy system
T3: Energy efficiency in buildings T4: Energy efficiency in heating & cooling T5: Energy efficiency in industry & services	Efficient Energy Systems	5. New materials & technologies for buildings 6. Energy efficiency for industry
T7: Energy storage	Sustainable Transport	7. Competitive in global battery sector (e-mobility)
T13: Biofuels, fuel cells & hydrogen, alternative fuels		8. Renewable fuels
T11: Carbon capture storage/use		9. CCS/U
T12: Nuclear energy		10. Nuclear Safety

Source: Information systems SETIS

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

For more detailed information on the level of public funding for energy research and innovation, see Chapter 4.6. The sources of funding for energy research and innovation will be finalised in the final version of the National Plan, if necessary.

In general, (i.e. not in relation to energy), financial measures, including the intended EU support, are described in detail in the National RIS3 Strategy, which aims, *inter alia*, to identify appropriate prospective areas of the economy, which should be subsequently supported by European Structural and Investment Funds (ESIF). The National RIS3 Strategy then reflects the Czech economy's priorities to be targeted by ESIF programmes and selected research and development support programmes of the Ministry of Industry and Trade and the Technology Agency of the Czech Republic (see Chapter 3.5.1.3).

Section B: Analytical basis[101]

[101] See part 2 for a detailed list of parameters and variables to be reported in Section B of National Plans.

4 CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES[102][103]

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

i. Macroeconomic forecasts (GDP and population growth)

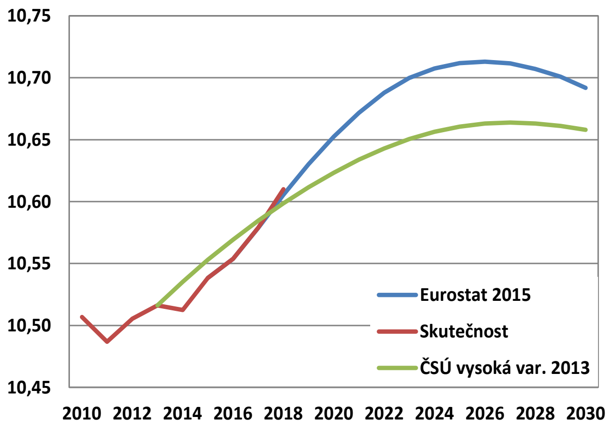
4.1.1.1 Expected population trends (demographic projections)

Demographic projection is one of the basic parameters for deriving long-term macroeconomic outlook. The future intensity of population ageing and the economic response to this process is a major factor affecting the long-term economic development.

[102] The current situation must reflect the date of submission of the National Plan (or last available date). The existing policies and measures include those which have been implemented and adopted. The adopted policies and measures are those which have been adopted by a formal government decision before the date of submission of the National Plan and for which there is a clear commitment to carry them out. Implemented policies and measures are those that are covered by one or more of the following statements as at the date of submission of the National Plan: national legislation is in force, one or more voluntary agreements have been concluded, financial resources have been allocated, human resources have been mobilised.

[103] The choice of external factors may be based on the assumptions made in the 2016 EU baseline scenario or another later policy scenarios for the same variables. Another useful source of data in creating national estimates using existing policies and measures and in impact assessments is also the specific results of Member States in relation to the EU 2016 benchmark scenario or other future policy scenarios.

Chart 15: *Population (millions of persons)*

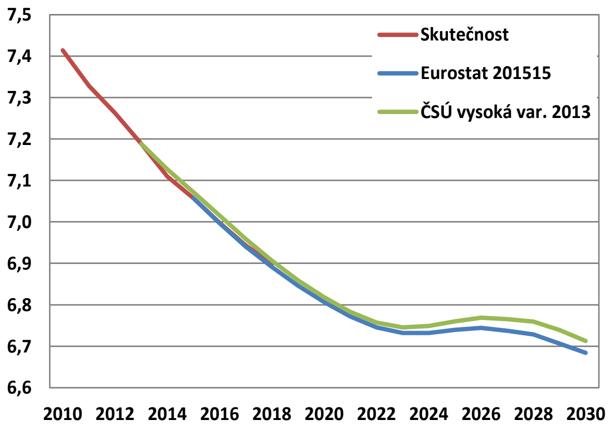


Skutečnost – Actual

Čsú – vysoká var. 2013 – CZSO high scenario 2013

Source: CZSO, Eurostat.

Chart 16: *Population aged 15–64 (millions of persons)*



Skutečnost – Actual

Čsú – vysoká var. 2013 – CZSO high scenario 2013

Source: CZSO, Eurostat.

The 2013 projection of the Czech Statistical Office[104], valid at the time the document was prepared, was prepared using the 2012 data. It does not (and cannot) reflect the changes in demographic trends in recent years. This involves a relatively dramatic increase in birth rates, when total fertility increased from 1.46[105] in 2013 to 1.67 in 2017, which in turn led to an increase in the number of live births by 7.1 %. In other parameters, such as mortality and international migration balance, the actual development was roughly in line with the projection's expectations.

That is why a newer 2015 Eurostat demographic projection was used[106] (published in 2017). According to the projection, the current population growth should continue in the next few years. It should peak probably in 2025 at about 10.7 million people. After that, the population should gradually shrink.

Since 2009, demographic ageing has resulted in a shrinkage of the working-age population aged 15–64. However, its intensity is decreasing over time and this process should temporarily stop after 2024. This is owing to the generation born in the first half of the 1960s, a period of low birth rates, which will reach the age of 65.

4.1.1.2 Expected economic growth

The prediction of economic development for 2018–2021 is based on the April Macroeconomic Forecast of the Czech Republic. In 2018–2021, economic growth should gradually slow down from 3.6 % in 2018 to 2.4 % in 2021. Domestic demand, both final consumption (households and general government sector) and investment, should be the main driver of growth over the entire period. In spite of the continued growth of exports, net exports should have more or less neutral effect on GDP growth owing to the high import intensity of exports and domestic demand (especially investments).

The outlook for the years 2022–2030 is based on the following assumptions.

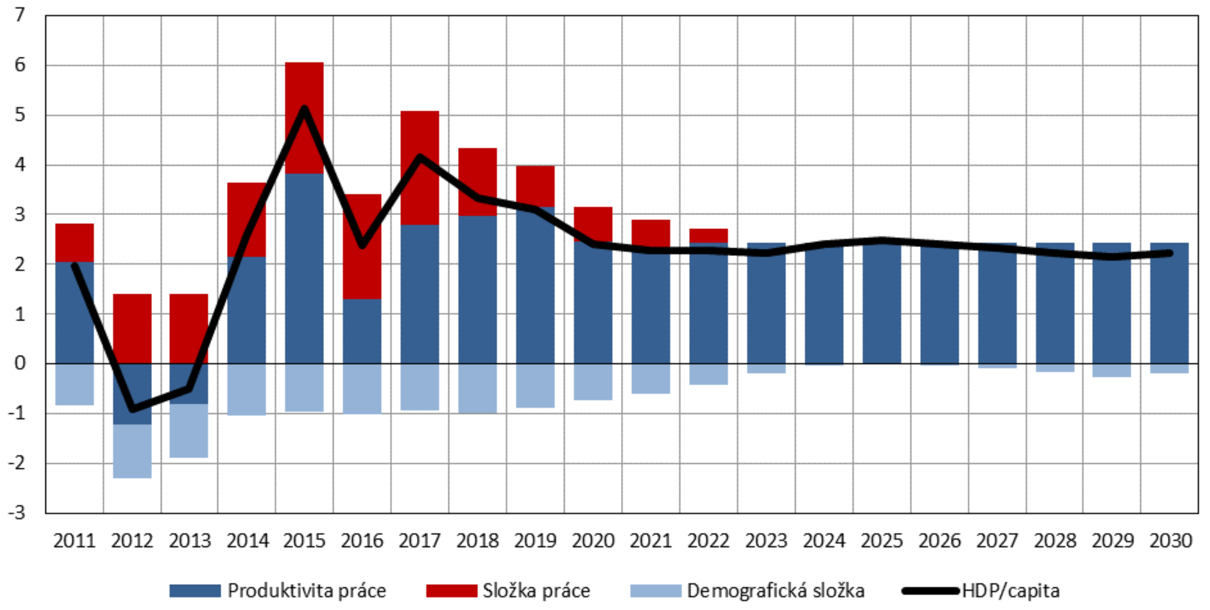
The labour productivity growth (relative to employment) should reach 2.4 % per year over the entire period. This growth corresponds to the long-term average of the period 1994–2017. Although productivity growth slowed down in this period, as in a number of other economies (in 1994–2007, labour productivity increased by an average of 3.4 % per year while in 2008–2017 the average growth was only 1.1 % per year), given the low level of productivity in the Czech Republic by comparison with the developed Western economies, we believe that there is still significant scope for further increase in labour productivity. The ratio of employment in the working age population (15–64 years) could reach 80 %. Given this assumption, the increase in labour productivity will be the dominant growth factor.

104 https://www.czso.cz/csu/czso/projekce-obyvatelstva-ceske-republiky-do-roku-2100-n-fu4s64b8h4. The new CZSO demographic projection was issued in November 2018.

105 It includes the number of live births per 1 woman if her fertility remained the same as in that year over her entire reproductive period.

106 http://ec.europa.eu/eurostat/web/population-demography-migration-projections/population-projections-/database

Chart 17: *Decomposition of the growth of real GDP per capita (annual growth in %, contribution to growth in percentage points)*[107]



Produktivita práce – labour productivity

Složka práce – labour component

Demografická složka – demographic component

Source: CZSO, Eurostat. Calculations of the Ministry of Finance of the Czech Republic

Together with the expected development of the working-age population (a total decline of 1.2 % by comparison with 2021), these assumptions thus determine real GDP growth, which should fluctuate around 2.3 % in 2022–2030. At the end of the period, the projected decline in the working-age population will be more pronounced, which could slow economic growth from 2.5 % in 2024–25 to 2.1 % in 2029 and 2030.

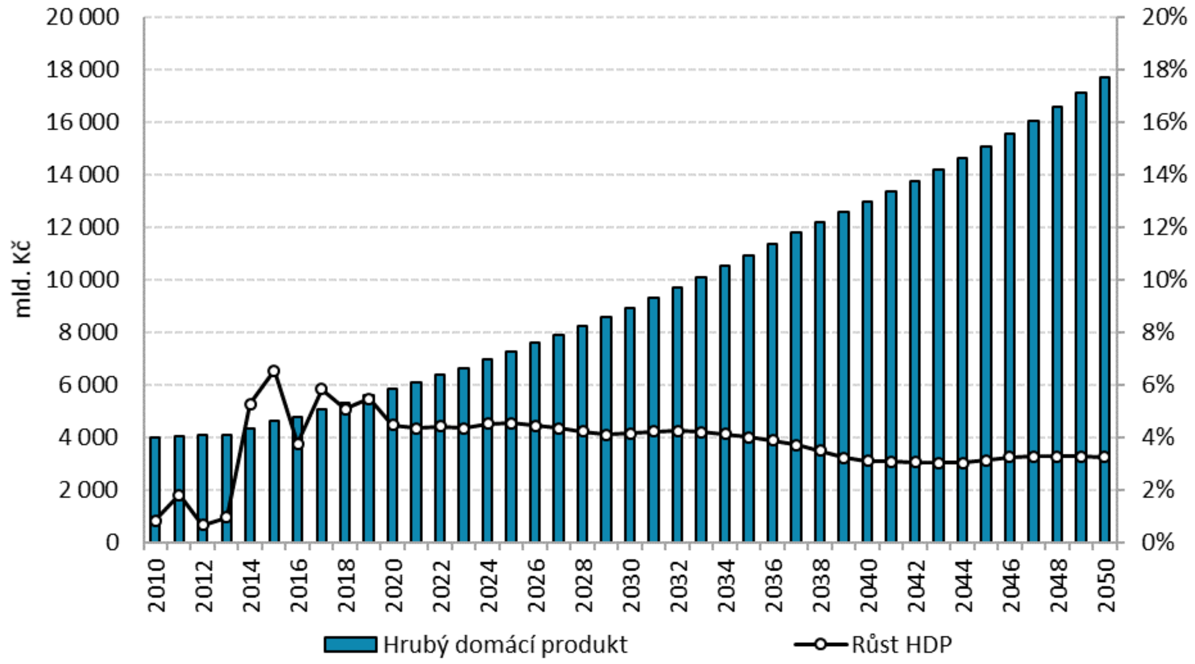
For the entire period of 2022–2030 we expect stable price developments. GDP deflators and gross added value should increase by 2 % per year. Nominal gross value added[108] could be 90 % of GDP in individual years of the 2018–2030 period. This corresponds to the mutual relationship between these aggregates, which were achieved in 2010–2017 on average.

For the development of the CZK/EUR exchange rate, the technical assumption of a gradual appreciation of 1 % per year was adopted. This is in line with the expected continued convergence of the economic level of the Czech Republic and the euro area.

[107] Note: Labour component is defined as the ratio of employment in the working age population (15–64), the demographic component is the share of the working-age population in the total population. Labour productivity is related to employment.

[108] The Ministry of Finance does not predict the development of the gross value added; therefore, the values for 2018–2021 are projected based on the assumptions in this document.

Chart 18: *GDP growth outlook*



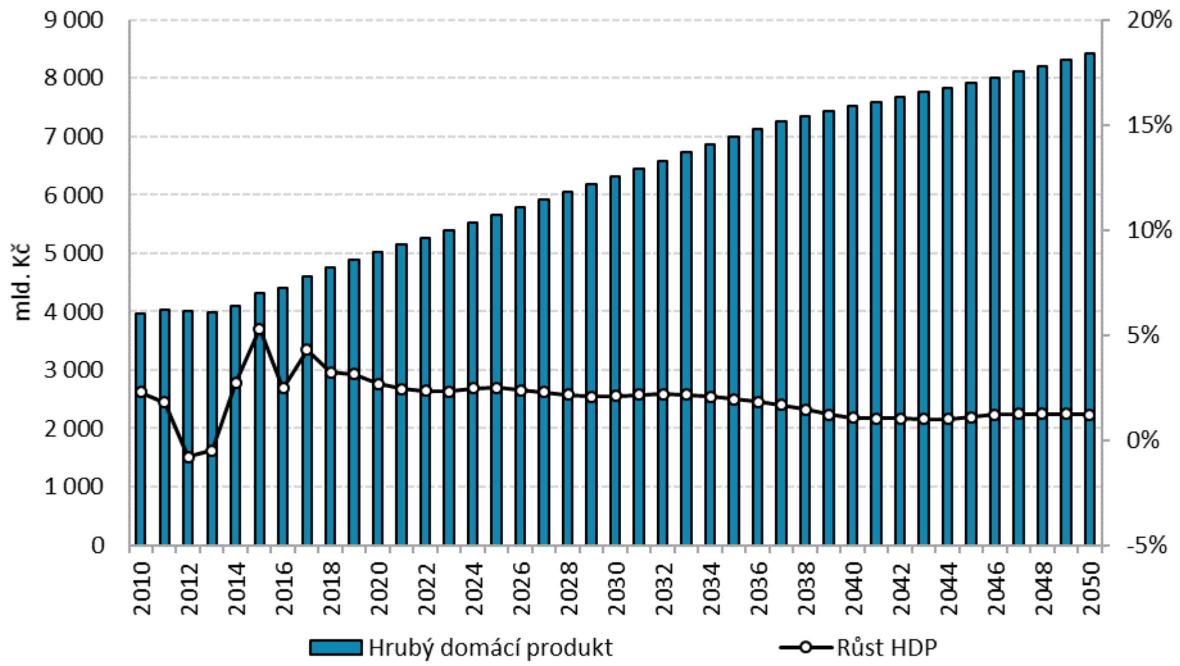
Hrubý domácí product – Gross domestic product

Růst HDP – GDP growth

Mld kč – CZK billion

Source: Ministry of Finance of the Czech Republic (August 2018)

Chart 19: *GDP growth outlook (2010 prices)*



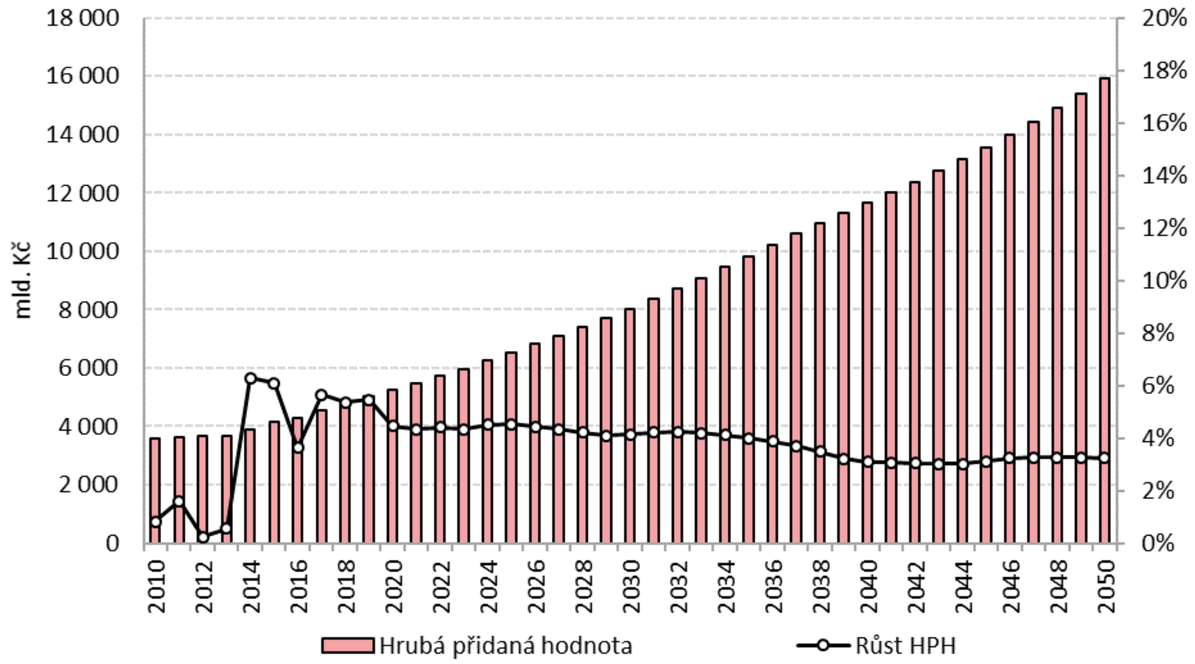
Hrubý domácí product – Gross domestic product

Růst HDP – GDP growth

Mld kč – CZK billion

Source: Ministry of Finance of the Czech Republic (August 2018)

Chart 20: *GVA growth outlook*



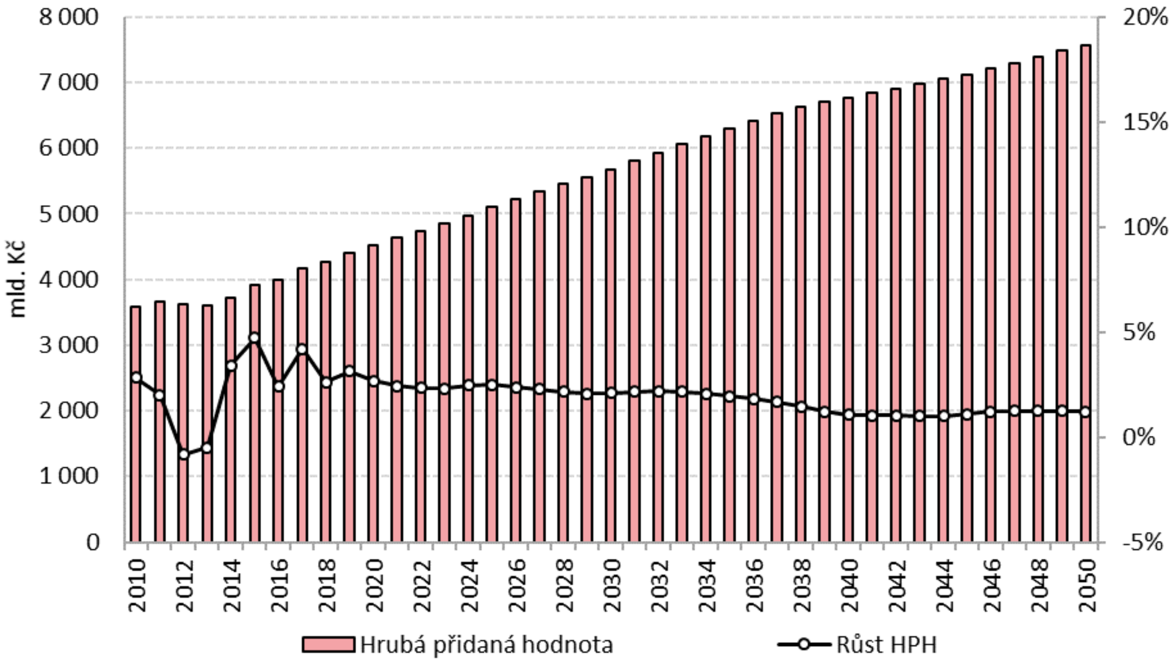
Hrubá přidaná hodnota – Gross value added

Růst HPH – GVA growth

Mld kč – CZK billion

Source: Ministry of Finance of the Czech Republic (August 2018)

Chart 21: *GVA growth outlook (2010 prices)*



Hrubá přidaná hodnota – Gross value added

Růst HPH – GVA growth

Mld kč – CZK billion

Source: Ministry of Finance of the Czech Republic (August 2018)

Table 49: *Outlook of basic macroeconomic parameters (Part 1)*

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
										Prediction	*Prediction*	*Prediction*	*Prediction*	*Outlook*	*Outlook*	*Outlook*	*Outlook*
Gross domestic product	*CZK billion*	3,962	4,034	4,060	4,098	4,314	4,596	4,768	5,045	5,300	5,589	5,838	6,091	6,359	6,635	6,934	7,249
	Growth (%)	**0.8**	**1.8**	**0.6**	**0.9**	**5.3**	**6.5**	**3.7**	**5.8**	**5.1**	**5.5**	**4.5**	**4.3**	**4.4**	**4.3**	**4.5**	**4.5**
	CZK billion 2010	3,962	4,033	4,001	3,981	4,089	4,307	4,412	4,601	4,750	4,898	5,029	5,150	5,271	5,392	5,525	5,662
	Growth (%)	**2.3**	**1.8**	**-0.8**	**-0.5**	**2.7**	**5.3**	**2.5**	**4.3**	**3.2**	**3.1**	**2.7**	**2.4**	**2.4**	**2.3**	**2.5**	**2.5**
Gross value added	*CZK billion*	3,583	3,640	3,649	3,668	3,899	4,136	4,286	4,528	4,771	5,031	5,255	5,482	5,723	5,972	6,241	6,524
	Growth (%)	**0.8**	**1.6**	**0.2**	**0.5**	**6.3**	**6.1**	**3.6**	**5.6**	**5.4**	**5.5**	**4.5**	**4.3**	**4.4**	**4.3**	**4.5**	**4.5**
	CZK billion 2010	3,583	3,655	3,624	3,606	3,729	3,905	3,999	4,166	4,275	4,409	4,526	4,636	4,745	4,853	4,973	5,096
	Growth (%)	**2.8**	**2.0**	**-0.8**	**-0.5**	**3.4**	**4.7**	**2.4**	**4.2**	**2.6**	**3.1**	**2.7**	**2.4**	**2.4**	**2.3**	**2.5**	**2.5**
GDP deflator	*2010=100*	100.0	100.0	101.5	102.9	105.5	106.7	108.1	109.7	111.6	114.1	116.1	118.3	120.6	123.0	125.5	128.0
	Growth (%)	**-1.4**	**0.0**	**1.5**	**1.4**	**2.5**	**1.2**	**1.3**	**1.5**	**1.8**	**2.3**	**1.7**	**1.9**	**2.0**	**2.0**	**2.0**	**2.0**
GVA deflator	*2010=100*	100.0	99.6	100.7	101.7	104.5	105.9	107.2	108.7	111.6	114.1	116.1	118.3	120.6	123.0	125.5	128.0
	Growth (%)	**-2.0**	**-0.4**	**1.1**	**1.0**	**2.8**	**1.3**	**1.2**	**1.4**	**2.7**	**2.3**	**1.7**	**1.9**	**2.0**	**2.0**	**2.0**	**2.0**
CZK/EUR (ECU)		25.3	24.6	25.1	26.0	27.5	27.3	27.0	26.3	25.6	25.2	24.6	24.0	23.8	23.5	23.3	23.1
	appreciation (%)	**4.6**	**2.9**	**-2.2**	**-3.2**	**-5.7**	**0.9**	**0.9**	**2.7**	**2.8**	**1.4**	**2.5**	**2.5**	**1.0**	**1.0**	**1.0**	**1.0**
Employment	*thous. persons*	5,057	5,043	5,065	5,081	5,109	5,182	5,264	5,346	5,419	5,430	5,439	5,444	5,442	5,436	5,439	5,444
	Growth (%)	**-1.0**	**-0.3**	**0.4**	**0.3**	**0.6**	**1.4**	**1.6**	**1.6**	**1.4**	**0.2**	**0.2**	**0.1**	**0.0**	**-0.1**	**0.1**	**0.1**
Population as of 1 January	*thous. persons*	10,462	10,487	10,505	10,516	10,512	10,538	10,554	10,579	10,610	10,630	10,652	10,672	10,688	10,700	10,707	10,712
	Growth (%)		**-0.2**	**0.2**	**0.1**	**0.0**	**0.2**	**0.1**	**0.2**	**0.3**	**0.2**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.0**
Population (year average)	*thous. persons*	10,517	10,497	10,509	10,511	10,525	10,543	10,565	10,590	10,620	10,641	10,662	10,680	10,694	10,704	10,710	10,712
	Growth (%)		**-0.2**	**0.1**	**0.0**	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.2**	**0.2**	**0.2**	**0.1**	**0.1**	**0.1**	**0.0**
Population 15–64	*thous. persons*	7,371	7,295	7,225	7,149	7,083	7,027	6,970	6,921	6,873	6,826	6,789	6,759	6,739	6,732	6,736	6,742
	Growth (%)		**-1.0**	**-1.0**	**-1.1**	**-0.9**	**-0.8**	**-0.8**	**-0.7**	**-0.7**	**-0.7**	**-0.5**	**-0.4**	**-0.3**	**-0.1**	**0.1**	**0.1**
Productivity	*CZK thousand 2010/empl.*	784	800	790	784	800	831	838	861	877	902	925	946	969	992	1,016	1,040
	Growth (%)	**3.3**	**2.1**	**-1.2**	**-0.8**	**2.2**	**3.8**	**0.8**	**2.7**	**1.9**	**2.9**	**2.5**	**2.3**	**2.4**	**2.4**	**2.4**	**2.4**
Average household size	*persons/household*	2.507	2.496	2.419	2.407	2.396	2.387	2.378	2.369	2.360	2.351	2.342	2.333	2.324	2.315	2.306	2.297
Number of households	*thousands*	4,195.3	4,205.5	4,344.3	4,367.2	4,391.9	4,416.3	4,442.7	4,469.7	4,499.7	4,525.9	4,552.1	4,577.2	4,600.9	4,623.0	4,643.6	4,662.9
Number of households, EU-SILC	*thousands*	4,149.7	4,180.6	4,254.9	4,282.5	4,304.5	4,324.7	4,347.8	4,372.3	4,401.6	4,427.2	4,452.8	4,477.4	4,500.6	4,522.2	4,542.3	4,561.3
Available household income	*CZK billion*	2,179	2,184	2,206	2,208	2,285	2,383	2,474	2,575	2,721.9	2,880.7	3,009.1	3,139.3	3,277.4	3,419.6	3,573.6	3,735.8
	Growth (%)	**0.8**	**0.2**	**1.0**	**0.1**	**3.5**	**4.3**	**3.8**	**4.1**	**5.7**	**5.8**	**4.5**	**4.3**	**4.4**	**4.3**	**4.5**	**4.5**
Available household income + NISD	*CZK billion*	2,207	2,212	2,234	2,237	2,315	2,412	2,506	2,612	2,760.6	2,921.7	3,051.9	3,183.9	3,324.0	3,468.3	3,624.4	3,789.0
	Growth (%)	**0.8**	**0.2**	**1.0**	**0.1**	**3.5**	**4.2**	**3.9**	**4.2**	**5.7**	**5.8**	**4.5**	**4.3**	**4.4**	**4.3**	**4.5**	**4.5**

Table 50: *Outlook of basic macroeconomic parameters (Part 2)*

		2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
		Outlook	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*
Gross domestic product	*CZK billion*	7,570	7,897	8,229	8,566	8,921	9,296	9,689	10,095	10,510	10,929	11,351	11,771	12,180	12,572	12,960
	Growth (%)	**4.4**	**4.3**	**4.2**	**4.1**	**4.1**	**4.2**	**4.2**	**4.2**	**4.1**	**4.0**	**3.9**	**3.7**	**3.5**	**3.2**	**3.1**
	CZK billion 2010	5,797	5,929	6,057	6,182	6,312	6,448	6,589	6,731	6,870	7,004	7,131	7,250	7,355	7,443	7,522
	Growth (%)	**2.4**	**2.3**	**2.2**	**2.1**	**2.1**	**2.2**	**2.2**	**2.2**	**2.1**	**1.9**	**1.8**	**1.7**	**1.4**	**1.2**	**1.1**
Gross value added	*CZK billion*	6,813	7,108	7,407	7,710	8,029	8,367	8,720	9,086	9,460	9,837	10,216	10,594	10,962	11,315	11,665
	Growth (%)	**4.4**	**4.3**	**4.2**	**4.1**	**4.1**	**4.2**	**4.2**	**4.2**	**4.1**	**4.0**	**3.9**	**3.7**	**3.5**	**3.2**	**3.1**
	CZK billion 2010	5,218	5,337	5,452	5,564	5,681	5,804	5,930	6,058	6,183	6,304	6,418	6,526	6,620	6,699	6,770
	Growth (%)	**2.4**	**2.3**	**2.2**	**2.1**	**2.1**	**2.2**	**2.2**	**2.2**	**2.1**	**1.9**	**1.8**	**1.7**	**1.4**	**1.2**	**1.1**
GDP deflator	*2010=100*	130.6	133.2	135.8	138.6	141.3	144.2	147.0	150.0	153.0	156.0	159.2	162.4	165.6	168.9	172.3
	Growth (%)	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
GVA deflator	*2010=100*	130.6	133.2	135.8	138.6	141.3	144.2	147.0	150.0	153.0	156.0	159.2	162.4	165.6	168.9	172.3
	Growth (%)	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
CZK/EUR (ECU)		22.9	22.6	22.4	22.2	22.0	21.9	21.7	21.6	21.5	21.4	21.3	21.2	21.1	21.0	20.9
	appreciation (%)	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**
Employment	*thous. persons*	5,443	5,437	5,424	5,406	5,390	5,379	5,371	5,362	5,350	5,332	5,310	5,281	5,243	5,192	5,137
	Growth (%)	**0.0**	**-0.1**	**-0.2**	**-0.3**	**-0.3**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**-0.3**	**-0.4**	**-0.5**	**-0.7**	**-1.0**	**-1.1**
Population as of 1 January	*thous. persons*	10,713	10,712	10,707	10,701	10,692	10,680	10,665	10,649	10,632	10,616	10,600	10,585	10,572	10,561	10,552
	Growth (%)	**0.0**	**0.0**	**0.0**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Population (year average)	*thous. persons*	10,712	10,709	10,704	10,696	10,686	10,673	10,657	10,641	10,624	10,608	10,592	10,578	10,566	10,557	10,549
	Growth (%)	**0.0**	**0.0**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.2**	**-0.2**	**-0.2**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Population 15–64	*thous. persons*	6,741	6,733	6,717	6,695	6,675	6,662	6,651	6,640	6,625	6,604	6,576	6,541	6,492	6,430	6,362
	Growth (%)	**0.0**	**-0.1**	**-0.2**	**-0.3**	**-0.3**	**-0.2**	**-0.2**	**-0.2**	**-0.2**	**-0.3**	**-0.4**	**-0.5**	**-0.7**	**-1.0**	**-1.1**
Productivity	*CZK thousand 2010/empl.*	1,065	1,091	1,117	1,144	1,171	1,199	1,227	1,255	1,284	1,313	1,343	1,373	1,403	1,433	1,464
	Growth (%)	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.4**	**2.3**	**2.3**	**2.3**	**2.3**	**2.2**	**2.2**	**2.2**	**2.2**	**2.1**
Average household size	*persons/household*	2.288	2.279	2.270	2.261	2.252	2.244	2.235	2.226	2.217	2.208	2.199	2.190	2.181	2.172	2.163
Number of households	*thousands*	4,681.2	4,698.3	4,714.5	4,729.9	4,744.1	4,757.1	4,769.4	4,781.2	4,793.0	4,805.2	4,817.7	4,831.0	4,845.4	4,861.0	4,877.4
Number of households, EU-SILC	*thousands*	4,579.1	4,595.9	4,611.7	4,626.7	4,640.6	4,653.4	4,665.4	4,677.0	4,688.5	4,700.4	4,712.7	4,725.7	4,739.8	4,755.0	4,771.1
Available household income	*CZK billion*	3,901.3	4,070.0	4,241.2	4,415.1	4,597.8	4,791.1	4,993.5	5,203.0	5,416.9	5,632.7	5,850.0	6,066.7	6,277.4	6,479.5	6,679.5
	Growth (%)	**4.4**	**4.3**	**4.2**	**4.1**	**4.1**	**4.2**	**4.2**	**4.2**	**4.1**	**4.0**	**3.9**	**3.7**	**3.5**	**3.2**	**3.1**
Available household income + NISD	*CZK billion*	3,956.8	4,127.8	4,301.5	4,477.9	4,663.2	4,859.2	5,064.5	5,277.0	5,494.0	5,712.8	5,933.2	6,152.9	6,366.6	6,571.6	6,774.4
	Growth (%)	**4.4**	**4.3**	**4.2**	**4.1**	**4.1**	**4.2**	**4.2**	**4.2**	**4.1**	**4.0**	**3.9**	**3.7**	**3.5**	**3.2**	**3.1**

Table 51: *Outlook of basic macroeconomic parameters (Part 3)*

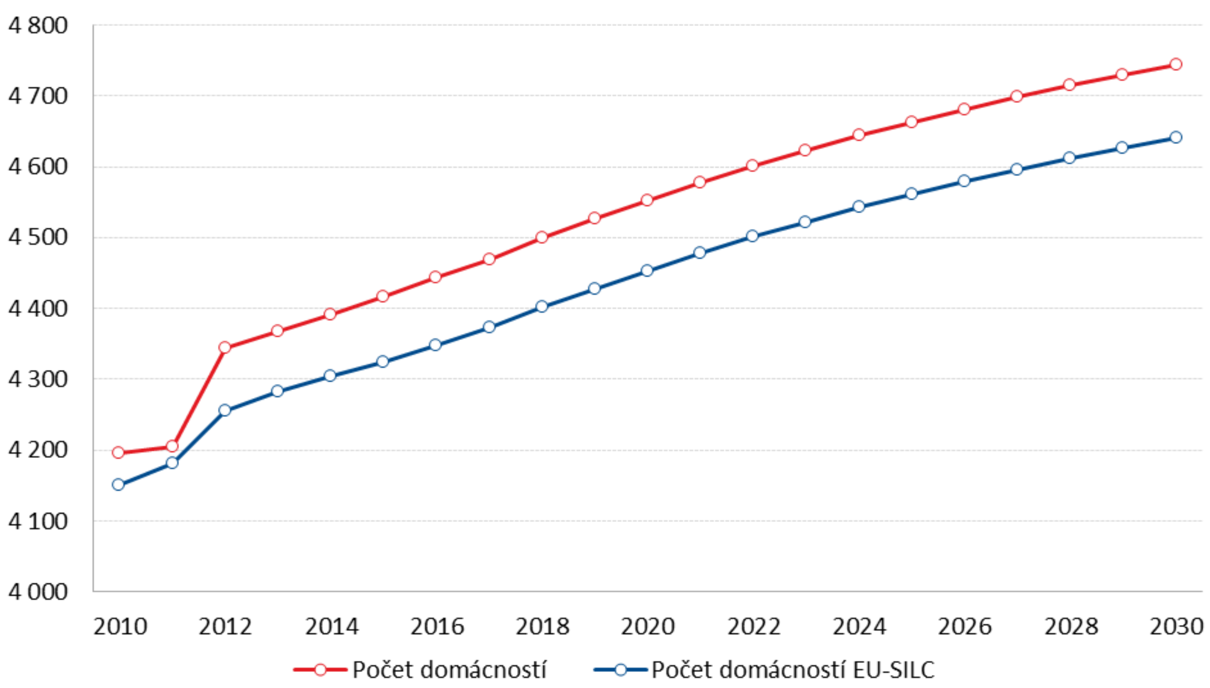
		2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
		Outlook	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*	*Outlook*
Gross domestic product	*CZK billion*	12,960	13,356	13,762	14,178	14,606	15,061	15,549	16,056	16,580	17,120	17,675
	Growth (%)	**3.1**	**3.1**	**3.0**	**3.0**	**3.0**	**3.1**	**3.2**	**3.3**	**3.3**	**3.3**	**3.2**
	CZK billion 2010	7,522	7,600	7,677	7,755	7,832	7,917	8,014	8,113	8,213	8,315	8,416
	Growth (%)	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
Gross value added	*CZK billion*	11,665	12,021	12,386	12,761	13,146	13,555	13,995	14,452	14,923	15,409	15,908
	Growth (%)	**3.1**	**3.1**	**3.0**	**3.0**	**3.0**	**3.1**	**3.2**	**3.3**	**3.3**	**3.3**	**3.2**
	CZK billion 2010	6,770	6,840	6,910	6,979	7,049	7,126	7,213	7,302	7,392	7,484	7,575
	Growth (%)	**1.1**	**1.0**	**1.0**	**1.0**	**1.0**	**1.1**	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
GDP deflator	*2010=100*	172.3	175.7	179.3	182.8	186.5	190.2	194.0	197.9	201.9	205.9	210.0
	Growth (%)	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
GVA deflator	*2010=100*	172.3	175.7	179.3	182.8	186.5	190.2	194.0	197.9	201.9	205.9	210.0
	Growth (%)	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
CZK/EUR (ECU)		20.9	20.8	20.8	20.7	20.7	20.6	20.6	20.5	20.5	20.4	20.4
	appreciation (%)	**0.5**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**	**0.3**
Employment	*thous. persons*	5,137	5,083	5,029	4,976	4,925	4,880	4,843	4,808	4,774	4,742	4,710
	Growth (%)	**-1.1**	**-1.1**	**-1.1**	**-1.0**	**-1.0**	**-0.9**	**-0.8**	**-0.7**	**-0.7**	**-0.7**	**-0.7**
Population as of 1 January	*thous. persons*	10,552	10,545	10,538	10,532	10,526	10,520	10,513	10,505	10,496	10,488	10,478
	Growth (%)	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Population (year average)	*thous. persons*	10,549	10,541	10,535	10,529	10,523	10,516	10,509	10,500	10,492	10,483	10,473
	Growth (%)	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**	**-0.1**
Population 15–64	*thous. persons*	6,362	6,294	6,228	6,163	6,099	6,044	5,997	5,954	5,913	5,873	5,833
	Growth (%)	**-1.1**	**-1.1**	**-1.1**	**-1.0**	**-1.0**	**-0.9**	**-0.8**	**-0.7**	**-0.7**	**-0.7**	**-0.7**
Productivity	*CZK thousand 2010/empl.*	1,464	1,495	1,527	1,558	1,590	1,622	1,655	1,687	1,720	1,753	1,787
	Growth (%)	**2.1**	**2.1**	**2.1**	**2.1**	**2.0**	**2.0**	**2.0**	**2.0**	**1.9**	**1.9**	**1.9**
Average household size	*persons/household*	2.163	2.154	2.145	2.136	2.127	2.118	2.109	2.100	2.091	2.082	2.073
Number of households	*thousands*	4,877.4	4,894.4	4,911.9	4,929.7	4,947.7	4,965.5	4,983.1	5,000.5	5,017.9	5,035.2	5,052.3
Number of households, EU-SILC	*thousands*	4,771.1	4,787.7	4,804.8	4,822.2	4,839.8	4,857.3	4,874.4	4,891.5	4,908.5	4,925.4	4,942.1
Available household income	*CZK billion*	6,679.5	6,883.4	7,092.7	7,307.3	7,527.9	7,762.3	8,013.7	8,275.4	8,545.2	8,823.5	9,109.5
	Growth (%)	**3.1**	**3.1**	**3.0**	**3.0**	**3.0**	**3.1**	**3.2**	**3.3**	**3.3**	**3.3**	**3.2**
Available household income + NISD	*CZK billion*	6,774.4	6,981.3	7,193.5	7,411.1	7,634.9	7,872.6	8,127.7	8,393.0	8,666.7	8,949.0	9,239.0
	Growth (%)	**3.1**	**3.1**	**3.0**	**3.0**	**3.0**	**3.1**	**3.2**	**3.3**	**3.3**	**3.3**	**3.2**

Source: Ministry of Finance of the Czech Republic (August 2018)

4.1.1.3 Outlook of the number of households

In the Czech Republic, as well as in other EU countries, the average household size has been slowly but consistently decreasing, largely owing to demographic trends (population ageing, increasing maternal age). In the following years, we expect it to linearly decline at the 2017 annual rate. The average number of household members could thus fall from 2.37 in 2017 to 2.25 in 2030. The expected total number of households is derived from population projection and average household size. The number of (private) households according to the EU-SILC survey[109] in 2017 was about 97.8 % of the total number of households; this share is maintained for the entire outlook period.

Chart 22: *Outlook of the number of households (thousands)*



Počet domácností – number of households

Počet domácností EU-SILC - number of households, EU-SILC

Source: Eurostat. Calculations of the Ministry of Finance of the Czech Republic

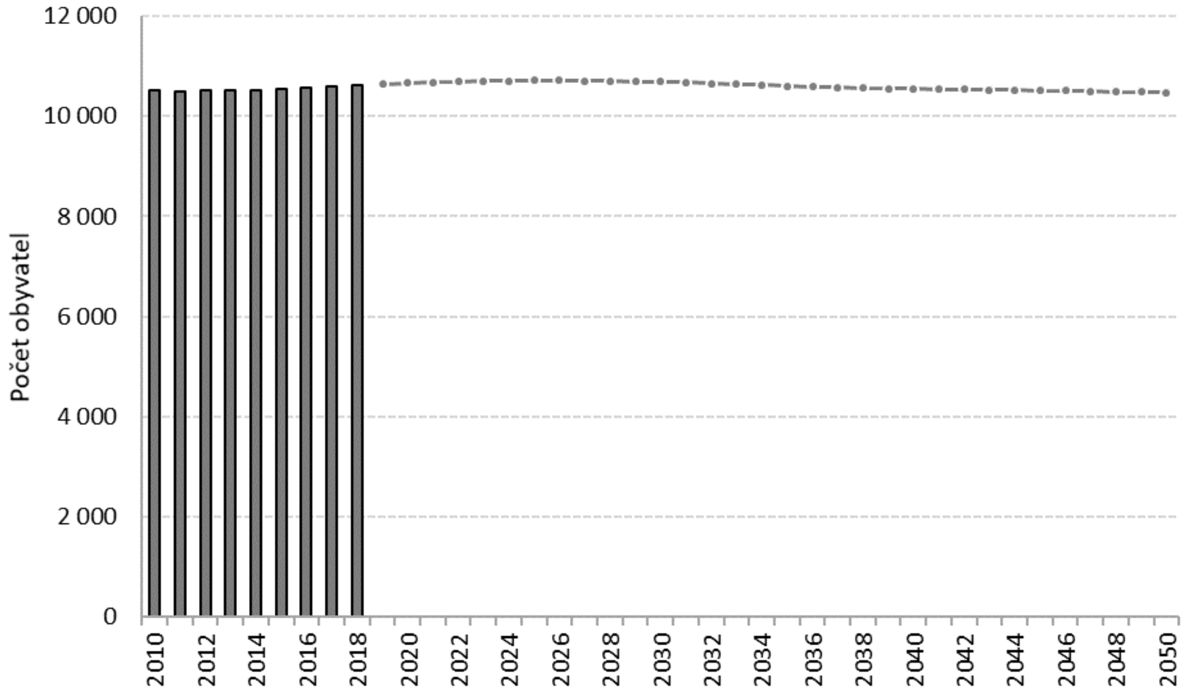
The available household income for 2018 and 2019 is based on the April Macroeconomic Forecast of the Czech Republic. Its year-on-year growth could reach 5.4 % and 5.3 % in these years, mainly owing to the predicted strong rise in wages and salaries. In 2020–2030, the nominal available household income could be 51.6 % of GDP, which corresponds to the prediction for 2019. Its growth in this period should average 4.4 % in *koruna* and 5.5 % in euro. The available household income and non-profit institutions serving households in 2017 exceeded the available household income by about 1.5 %. We expect the same percentage over the entire period.

[109] The EU-SILC survey is carried out only in permanently occupied private apartments and does not include collective and institutional households (prisons, elderly homes, hostels, etc.) and homeless people.

4.1.1.4 Population outlook

Below is the historical development of the population and population outlook. The historical development of the population is based on the data of the Czech Statistical Office. It is evident that the population of the Czech Republic is growing year-on-year, but relatively slowly at an average of around 18 thousand people, which corresponds to an average year-on-year growth of approximately 0.18 %. More detailed demographic analyses and evaluation of historical trends are available in this respect. The population outlook corresponds to the so-called baseline projection according to EUROSTAT. According to the projection, in the period up to 2050 it is possible to expect a relative stagnation or very slight decline of the population.

Chart 23: *Population outlook (average)*



Počet obyvatel - Population

Source: EUROSTAT

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

Sectoral changes expected to impact the energy sector and greenhouse-gas emissions are described in detail in the relevant chapters of this document and the analytical annexes.

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

4.1.1.5 Global energy trends

Current trends in the development of the global energy sector

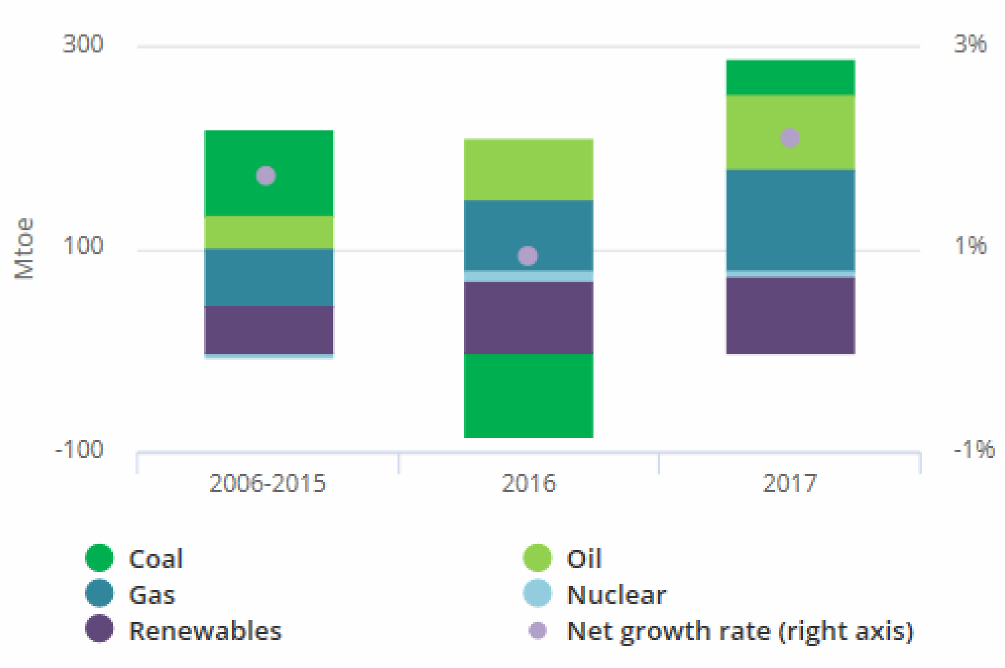
Global energy demand grew by 2.1 % in 2017, according to IEA preliminary estimates[110], more than twice the growth rate in 2016. Global energy demand in 2017 reached an estimated 14 050 million tonnes of oil equivalent (Mtoe), compared with 10 035 Mtoe in 2000.

Fossil fuels met over 70 % of the growth in energy demand around the world. Natural gas demand increased the most, reaching a record share of 22 % in total energy demand. Renewables also grew strongly, making up around a quarter of global energy demand growth, while nuclear use accounted for the remainder of the growth. The overall share of fossil fuels in global energy demand in 2017 remained at 81 %, a level that has remained stable for more than three decades despite strong growth in renewables.

Improvements in global energy efficiency slowed down. The rate of decline in global energy intensity, defined as the energy consumed per unit of economic output, slowed to only 1.7 % in 2017, much lower than the 2.0 % improvement seen in 2016.

The growth in global energy demand was concentrated especially in Asia, with China and India together accounting for more than 40 % of total demand growth. Energy demand in all developed economies contributed more than 20 % to global energy demand growth, although the share of these countries in total energy consumption continued to decline. Southeast Asian countries and Africa have seen remarkable growth (8 % and 6 % of global energy demand growth, respectively), although the per capita energy consumption in these regions is still below the global average.

Chart 24: *Average annual growth in global energy demand by fuel*



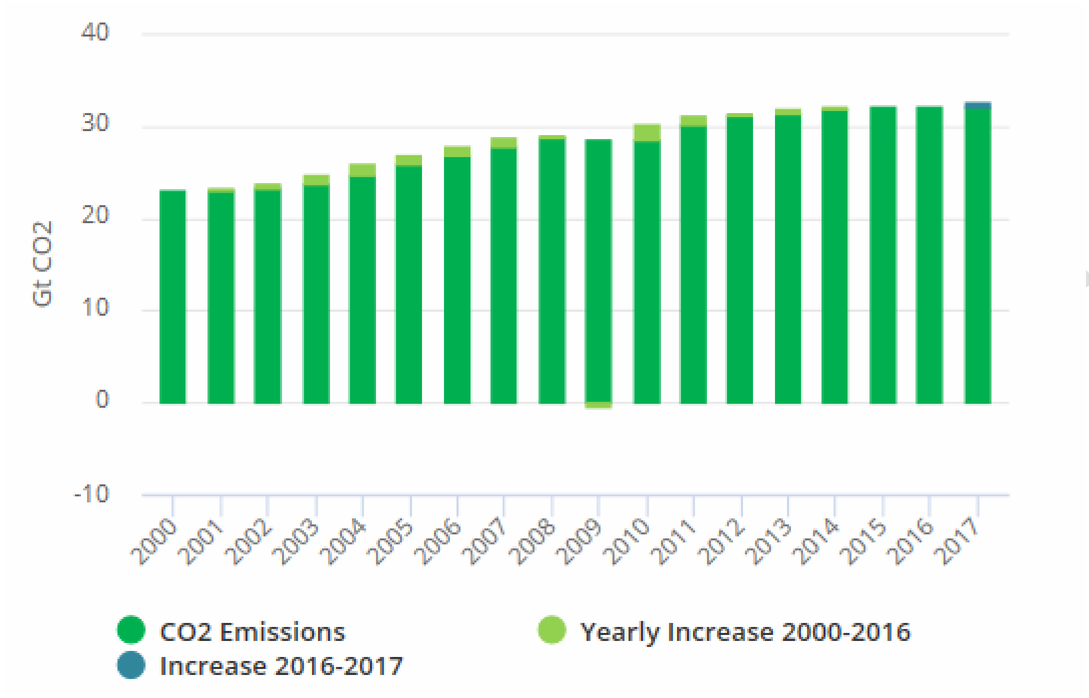
Source: International Energy Agency; Global Energy & CO2 Status Report (online)

Global energy- related CO_2 emissions increased by 1.4 % in 2017 and reached a historic maximum of 32.5 billion tonnes, i.e. a renewed growth after three years of relative stagnation. However, the

110 Current trends in the development of the global energy sector are based on the information from the International Energy Agency (IEA), specifically from the Global Energy & CO2 Status Report, available online at https://www.iea.org/geco/.

increase in CO_2 emissions was not universal. While most major economies saw an increase, some others declined, including the United States, the United Kingdom, Mexico and Japan. The United States saw the largest decline, mainly owing to higher use of renewable sources.

Chart 25: *Global energy-related CO2 emissions*

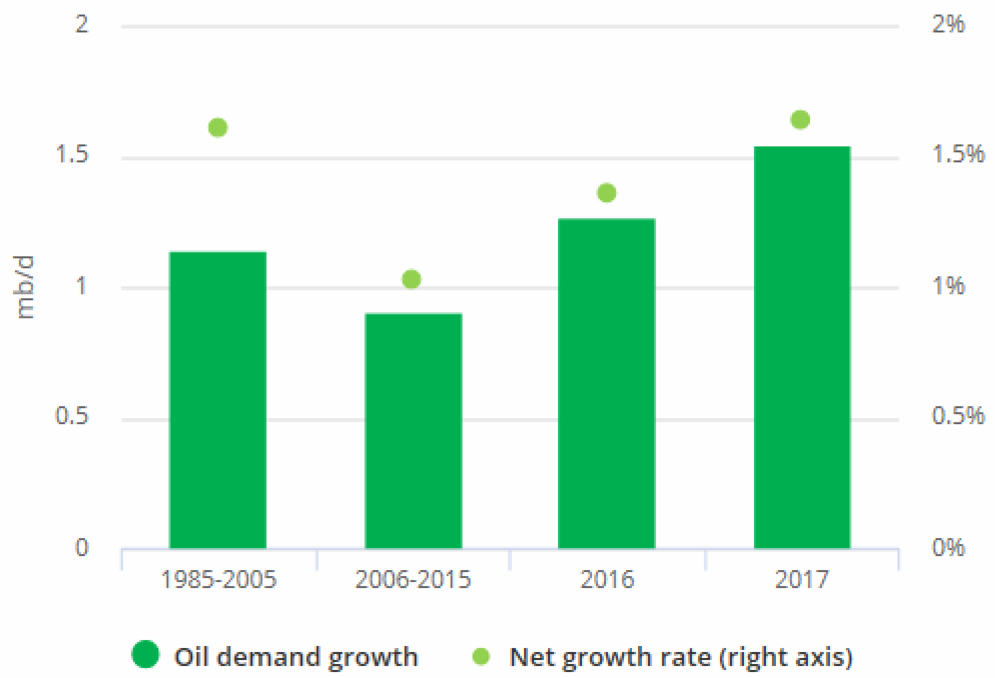


Source: International Energy Agency; Global Energy & CO2 Status Report (online)

The global demand for oil grew by 1.6 % (or 1.5 million barrels per day) in 2017, a much higher year-on-year growth than the average growth of 1 % over the last decade. An increasing share of SUVs and light trucks in large economies and the demand in the petrochemical sector were the main drivers of this growth.[111]

111 In this respect, it is appropriate to mention the trend of a gradual move away from plastics, which is linked to better knowledge about global negative impacts on the environment, which may have a potential impact on oil consumption in the petrochemical sector.

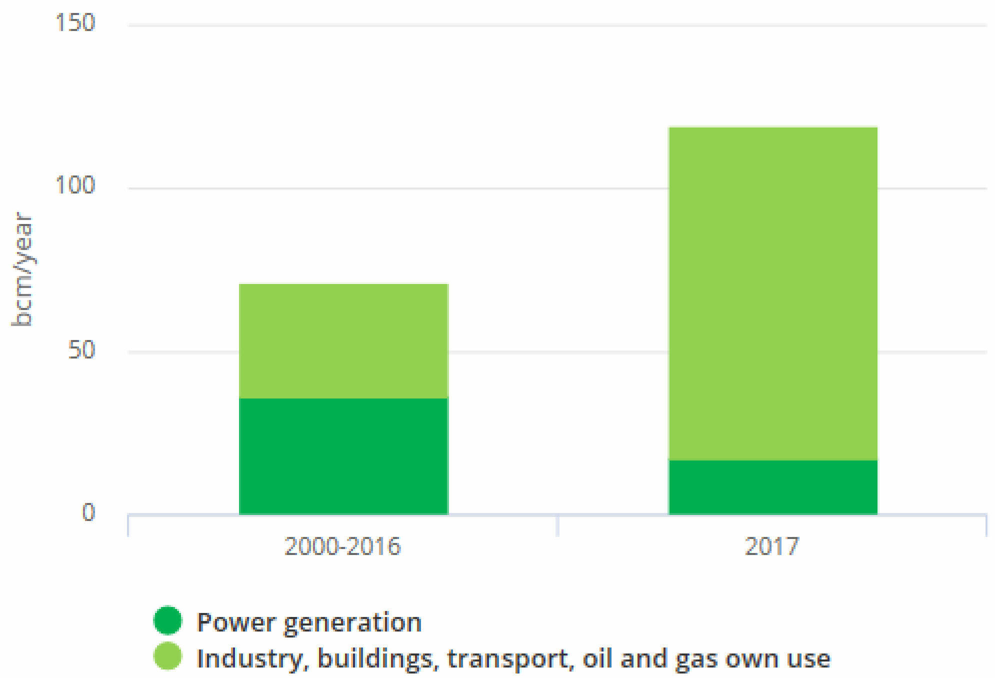
Chart 26: *Average year-on-year growth in oil demand*



Source: International Energy Agency; Global Energy & CO2 Status Report (online)

Global demand for natural gas grew by 3 %, largely owing to a relatively large supply and relatively low costs. China alone accounted for nearly 30 % of global growth. Over the past decade, half of global demand for gas came from the energy sector; last year, however, more than 80 % of the growth came from the industry and the buildings sector.

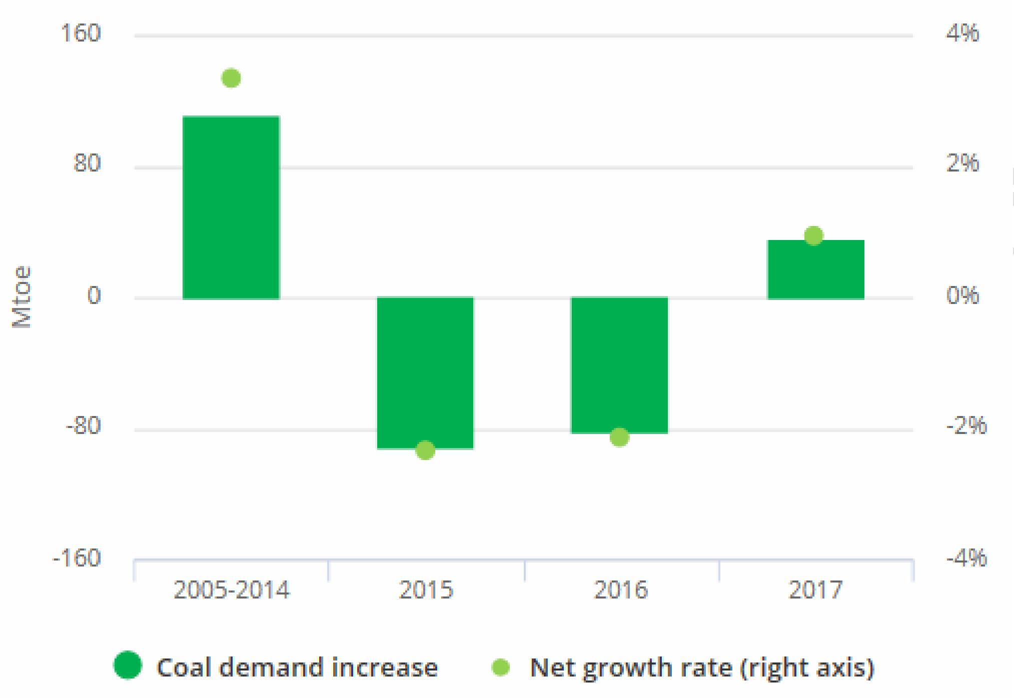
Chart 27: *Average year-on-year growth in natural gas demand*



Source: International Energy Agency; Global Energy & CO2 Status Report (online)

The global demand for coal rose by 1 % in 2017, a reverse in the declining trend of the last two years. This growth was mainly owing to demand in Asia, which was almost entirely driven by an increase in the generation of electricity from coal.

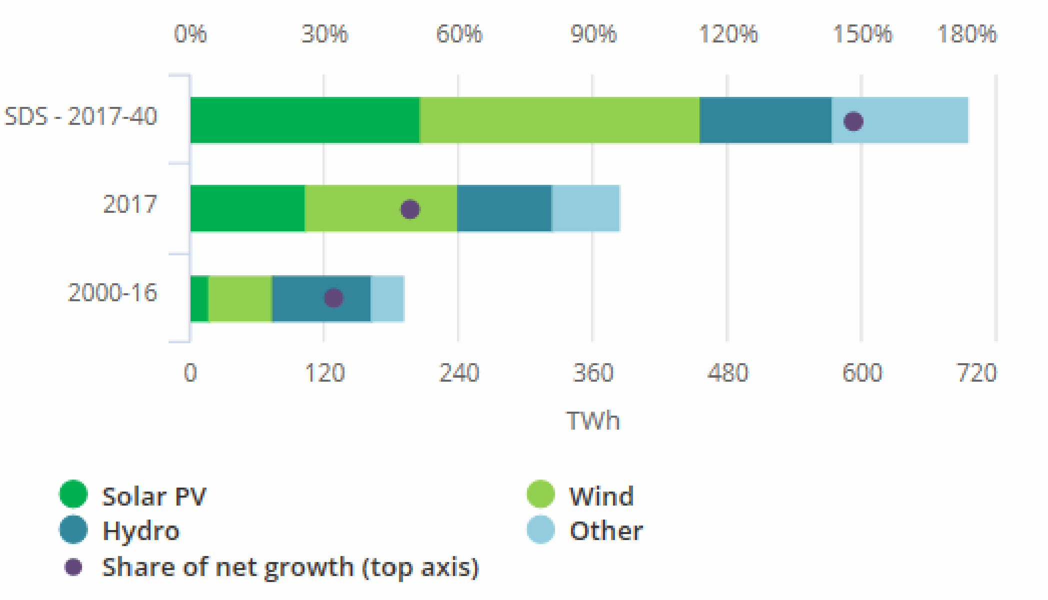
Chart 28: *Average year-on-year growth in coal demand*



Source: International Energy Agency; Global Energy & CO2 Status Report (online)

Renewable energy sources saw the highest growth of all energy sources in 2017, covering a quarter of the world's growth in energy demand. China and the United States were the leaders of this unprecedented growth and have contributed approximately 50 % of the increase in electricity production from renewable sources, followed by the European Union, India and Japan. Wind energy accounted for 36 % of the renewable energy growth.

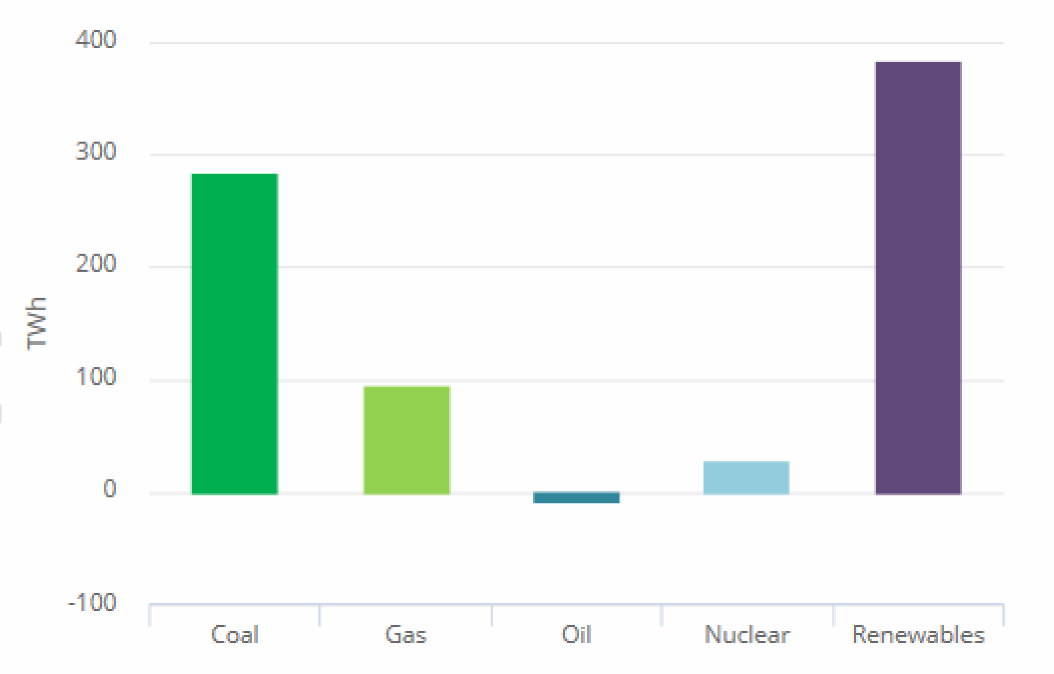
Chart 29: *Average year-on-year growth of global RES production (including a comparison with the sustainable development scenario)*



Source: International Energy Agency; Global Energy & CO2 Status Report (online)

The global demand for electricity grew by 3.1 % in 2017, which is significantly more than the overall increase in energy demand. China and India together accounted for around 70 % of this growth. Electricity generation from nuclear power plants increased by 26 TWh in 2017, as a relatively large volume of new nuclear capacity was commissioned.

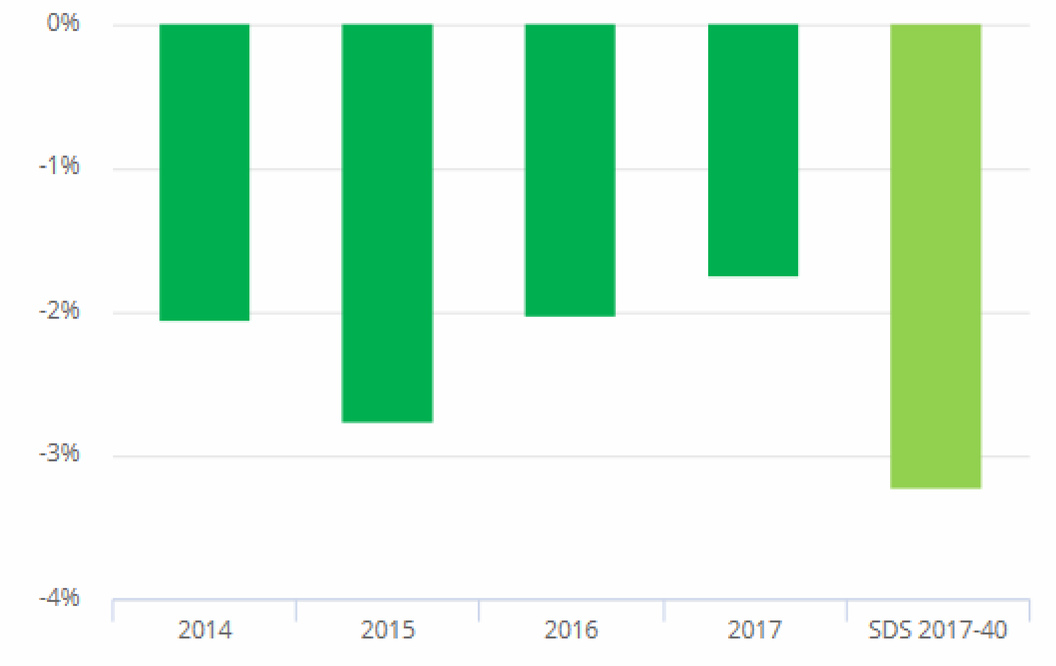
Chart 30: *Change in electricity mix by fuel in 2016–2017*



Source: International Energy Agency; Global Energy & CO2 Status Report (online)

The increase in global energy efficiency slowed dramatically in 2017, mainly owing to the lack of policies and also the relatively low prices of basic energy commodities. Global energy intensity improved by only 1.7 % in 2017 and by an average of 2.3 % over the past three years.

Chart 31: *Average year-on-year change in energy intensity (including a comparison with a sustainable development scenario)*

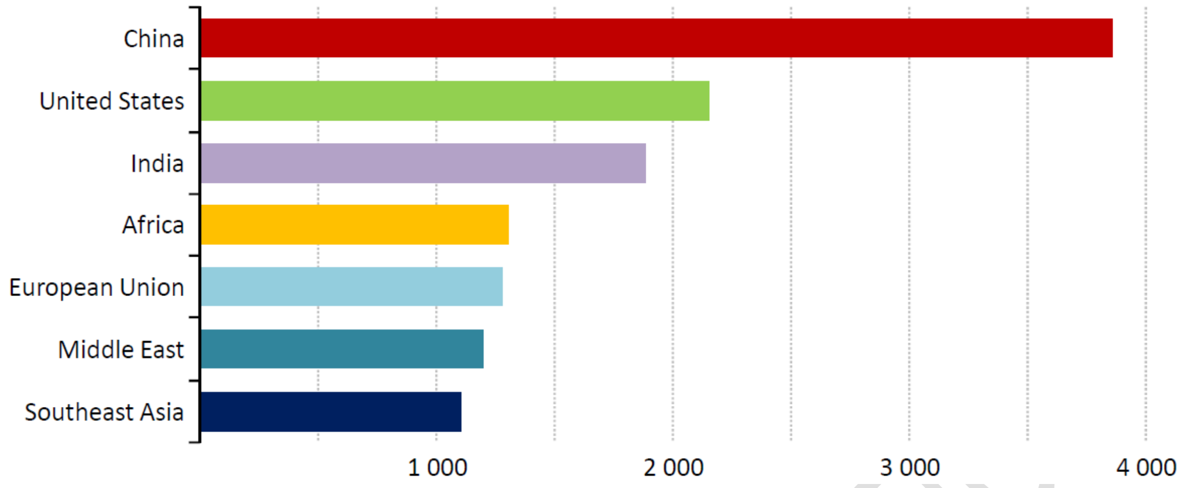


Source: International Energy Agency; Global Energy & CO2 Status Report (online)

World energy outlook

According to the New Policy Scenario of the International Energy Agency, rising incomes and a population increase of about 1.7 billion people, mostly in urban areas in emerging economies, will increase global energy demand by 2040 by more than a quarter. An increase in the global demand would then approximately double if there is no progressive improvement in energy efficiency, which is a strong policy tool to address concerns with regard to ensuring energy security and sustainability. In fact, almost all additional demand growth comes from emerging economies, primarily India. In 2000, Europe and North America accounted for more than 40 % of the world's energy demand and the emerging economies in Asia for about 20 %. By 2040, these shares will likely reverse.

Chart 32: *World energy demand by country, WEO 2018 (IEA), in Mtoe*



Source: World Energy Outlook 2018

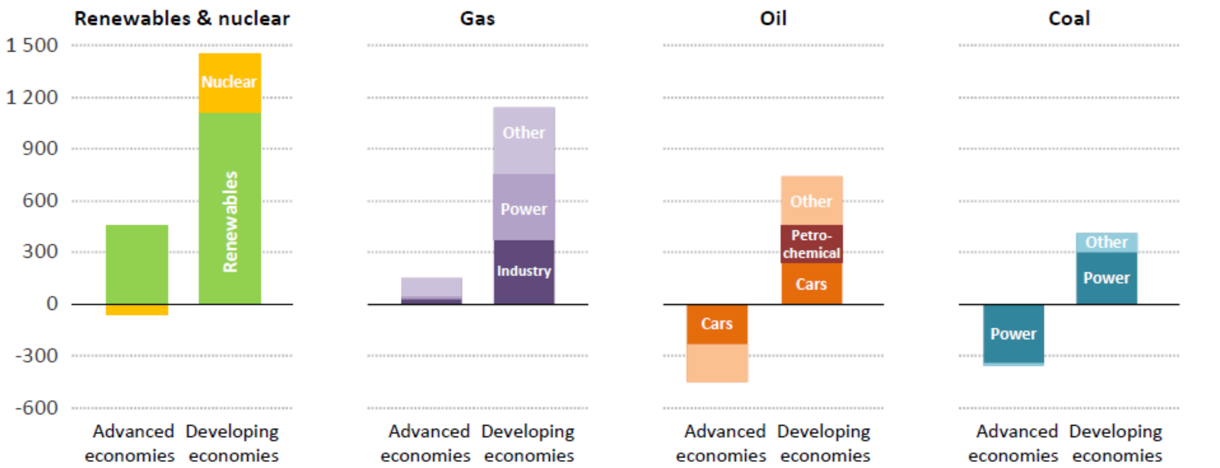
A significant shift in energy consumption to the Asian region is evident in all fuels and technologies as well as in energy investment. As expected, Asia will account for up to half of global natural gas growth, 60 % growth in wind and solar panels, more than 80 % increase in oil consumption, and more than 100 % increase in coal consumption and use of nuclear energy (owing to declines in other regions).

The world energy sector is transforming in a variety of ways owing to the shift in supply, demand and also owing to technological trends. International energy trade flows from the Middle East, Russia, Canada, Brazil and the United States are increasingly directed to Asia. This is also evidenced by the fact that, according to assumptions, Asia's share of global oil and gas trade will rise from about half to more than two thirds by 2040. New ways of converting energy are also visible at the regional level, as digitisation and increasingly cost-effective renewable energy technologies make it possible to use distributed and community-based energy supply models.

Since its inception about one hundred years ago, the electricity sector is undergoing its most dramatic transformation. Electricity is increasingly preferred as a fuel in economies with the dominance of 'lighter' industries, services and digital technologies. The share of the electricity sector in global final consumption is currently close to 20 % and its further development can be expected. Policy support and the reduction of technology costs lead to a rapid growth of variable renewable production sources, making the energy sector a frontrunner in the efforts to reduce emissions. However, it is essential to ensure that the whole system works so that it can deliver a reliable supply in the future.

In 2017, the use of coal saw a year-on-year increase after two years of decline, but the final investment decisions for new coal-fired power plants were well below the level seen in recent years. Once the current wave of construction of coal-fired power stations is over, the flow of new coal-fired power stations which will be gradually commissioned will slow down after 2020. However, it is still too early to write off coal from the global energy mix: the average age of coal-fired power plants in Asia is less than 15 years, compared with about 40 years in developed economies. With industrial use of coal showing a moderate increase by 2040, relative stagnation in global consumption can be expected, with declines in China, Europe and North America being offset by growth in India and Southeast Asia.

Chart 33: *Change in world energy demand by fuel, WEO 2018 (IEA), in Mtoe*



Source: World Energy Outlook 2018

The use of oil in road transport is expected to peak around mid-2020. Oil use in the petrochemical, freight, air and maritime industries, however, will continue to contribute to overall demand for oil. Reducing consumption in cars owing to higher drive efficiency will lead to a three times higher demand reduction by comparison with 3 million barrels per day (mb/d), which will be replaced by about 300 million electric cars in 2040. However, the pace of change and shift to other fuels in transport, which accounts for about a quarter of the total demand for oil, is not accompanied by equally rapid changes in other sectors. The industrial petrochemical sector is expected to be the largest source of oil growth. Assuming that the overall plastics recycling rate doubles, demand would decrease only by about 1.5 mb/d of the total projected increase by more than 5 mb/d by 2040. The overall growth in oil demand to 106 mb/d in 2040, according to the New Policies Scenario, comes almost exclusively from emerging economies.

Around 2030, natural gas is expected to 'overtake' coal consumption and become the second largest fuel in the global energy mix. Industrial consumers will account for the largest part of the 40 % increase in natural gas consumption. LNG gas trade will more than double by 2040, in particular in response to the growing demand of emerging economies led by China. Russia remains the world's largest gas exporter, owing to its expansion to Asian markets, but an increasingly integrated European energy market gives buyers more gas supply options. A higher share of wind and photovoltaic power plants reduces the use of gas capacity in Europe and the modernisation of existing buildings also helps to reduce gas consumption for heating. However, gas infrastructure still plays a crucial role, particularly in ensuring the demand for heat in the winter and ensuring an uninterrupted supply of electricity

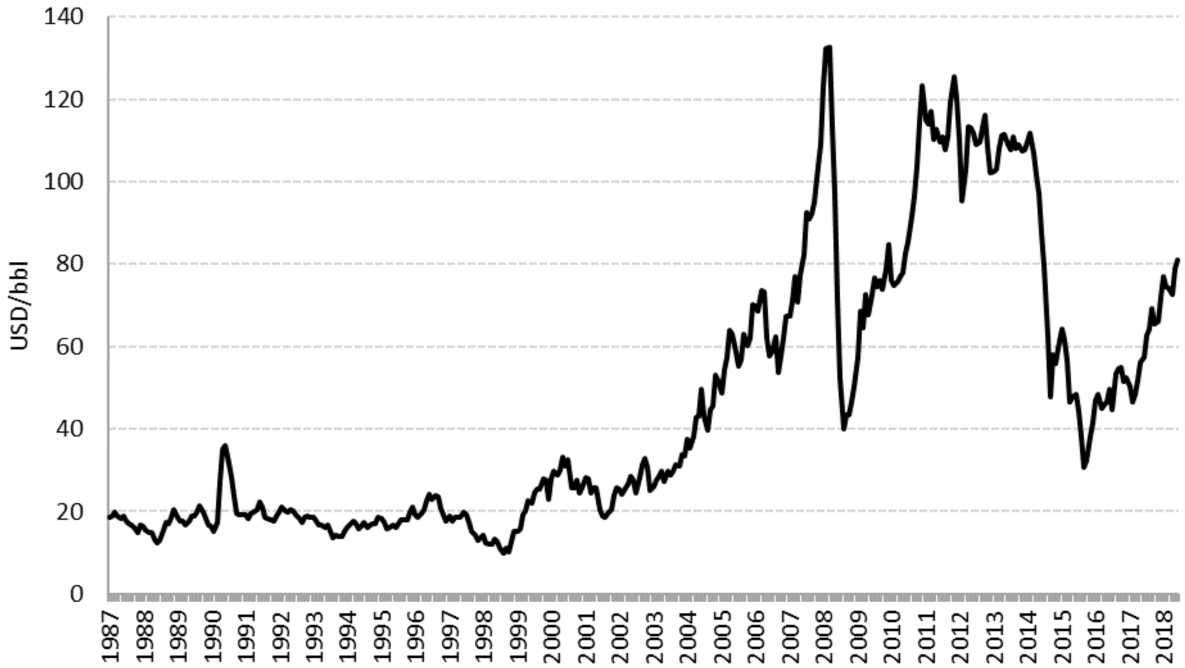
4.1.1.6 Historical development of international prices of oil, coal and natural gas

Historical development of oil prices

The period from around mid-2015 almost until the end of 2017 saw relatively low oil prices at 40–50 USD per barrel, with prices in early 2016 dropping to only USD 30 per barrel. The low-price period was caused by a number of factors, but a significant factor in this respect is the significant increase in unconventional oil production in the United States. In Q4 2017, there was a gradual rise in prices owing to a relatively high demand growth, but also owing to other factors, such as a reduction in production owing to the geopolitical situation (for example, a decrease in production in Venezuela).

The future development of oil prices is very difficult to estimate and for example according to the International Energy Agency it is necessary to prepare for a period of increased volatility of international prices. Despite a significant increase in production in the United States, there is a relatively significant increase in demand, which is already at 100 million barrels per day (mb/d) and is mainly driven by the consumption of Asian countries (Q3 2018). Investments in oil exploration and extraction have been very low for several years and there is a risk of a shortage of production in the medium term (i.e. about 5 years), which can mean a period of relatively high oil prices. A more detailed analysis and description of historical oil prices goes beyond this document and is closely monitored by specialised bodies and organisations such as the International Energy Agency (the Czech Republic has been a member of the International Energy Agency since 2001). On the basis of the task resulting from the State Energy Policy adopted in 2015, the Ministry of Industry and Trade prepares annually the Report on the Energy Sector Development in the Area of Oil and Petroleum Products, which also deals with the issues of historical price development.

Chart 34: *Historical development of oil prices (spot price of North Sea Brent FOB)*



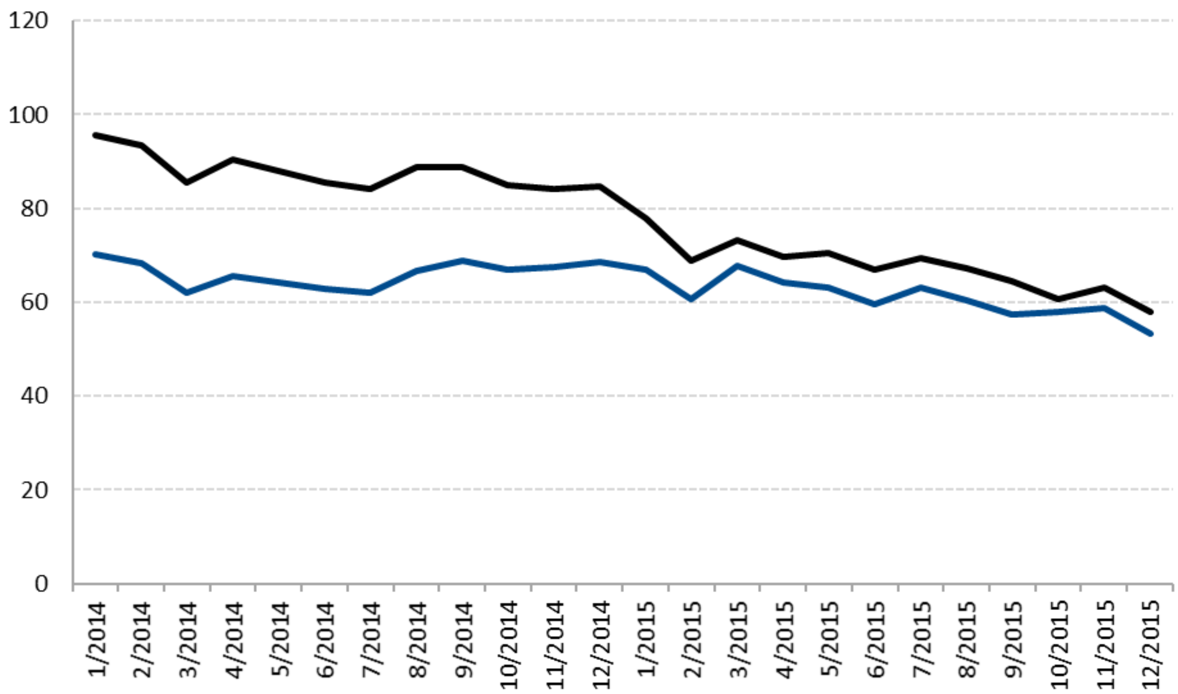
Source: U.S. Energy Information Administration (information available online)

Historical development of coal prices

World black coal prices, both conventional and spot prices, are traditionally determined primarily by U.S. and Australian coal prices. In recent years, black coal prices in Northwest Europe's ports peaked in the summer of 2008, and then declined substantially owing to the emerging global economic crisis. Prices start to gradually rise again in 2010 and in the middle of 2011 they are around a relatively high value of 120–130 USD per tonne. The absolute long-term peak was USD 139.05 per tonne in January 2011. However, already in the second half of the same year, prices fell to around USD 100 per tonne owing to unusually mild start of the winter. From that time, coal inventories grew, mainly those of electricity coal. In 2013 and 2014, coal energy prices were volatile but with a downward trend. For example, in 2013 the price of 1 TCE of electricity coal (CIF) in Northwest Europe ports was highest in

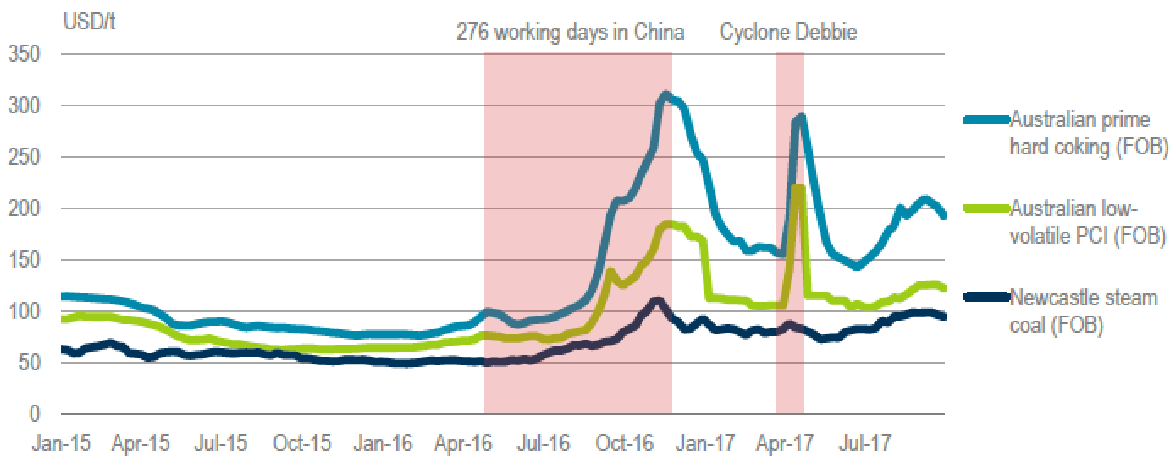
March, namely USD 105.11 (EUR 81.08) and the lowest in July – 85.26 USD (EUR 65.18). There was a remarkable decline of almost EUR 10 to EUR 71.50 per TCE in April. The year 2013 ended with an average December price of USD 97.07 per TCE (EUR 70.83 per TCE). The year 2014 started with an average January price of USD 95.48 per TCE (EUR 70.16 per TCE). In both cases, this was the year's maximum, as the price goes down afterwards and in March, for example, it reached USD 84.02 per TCE (EUR 67.92 EUR per TCE. The year 2014 ended with an average December price of USD 84.62 per TCE (EUR 68.63 per TCE). 2015 saw a further fall in the price of coal to USD 45 per TCE at the end of the year.

Chart 35: *Historical development of the price of black coal (USD per TCE)*



Source: Mineral resources in the Czech Republic (CGS); EURACOAL Market report (2016)

Chart 36: *Historical development of coal prices in 2015–2017 (USD per tonne)*

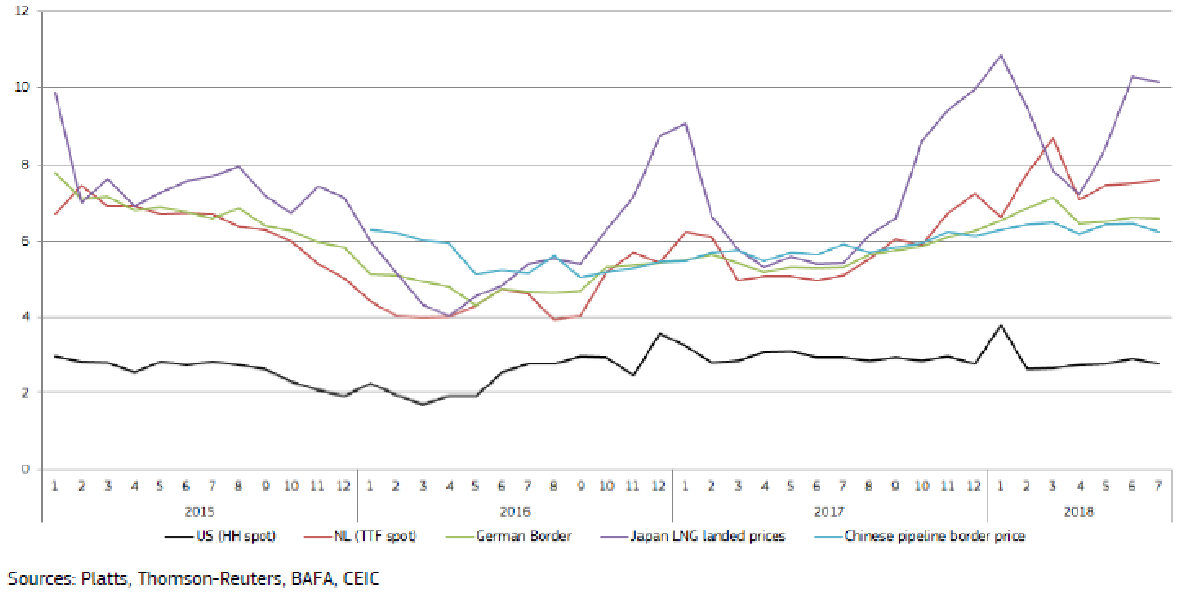


Source: Coal 2017 – Analysis and Forecast to 2022 (IEA); IHS Energy (2017)

Historical development of natural gas prices

Chart 37 shows an international comparison of wholesale gas prices. Over the past few years, international gas prices have been converging. However, this trend was interrupted in the last two winter seasons (2016–2017 and 2017–2018) when Asian prices increased sharply owing to strong seasonal demand. European and US prices also increased, but less, which led to a widening gap between regional prices.

Chart 37: *International comparison of gas prices for individual regions (USD/mmbtu)*



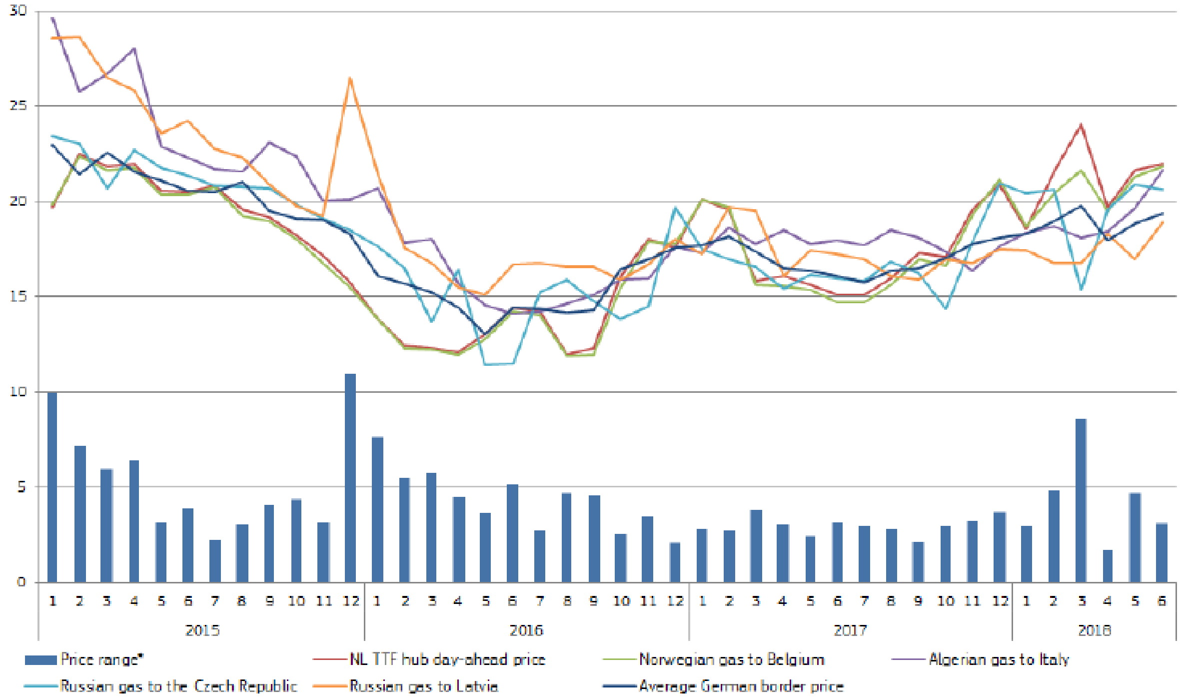
Source: Quarterly Report on European Gas Markets (volume 11, issue 2, second quarter of 2018)

Chart 38 compares the selection of estimated gas supply border prices from major exporters to the EU: Russia, Norway and Algeria. For comparison, the daily prices of the Dutch TTF gas hub are also presented.

Over the past three years, there has been a gradual price convergence, which has been caused by significantly declining oil prices in the second half of 2014 and in 2015 with a lagged impact on prices pegged to the price of oil. Greater emphasis on pricing based on demand and supply within the hub (as opposed to pricing based on oil price indexation) also contributed to partial price convergence.

In 2015–2016, the prices of Russian gas to Latvia and Algerian gas pegged to oil were typically higher than the hub prices, but in 2017 this gap virtually disappeared. In the second half of the year, demand and supply prices within the hub began to grow, while the pegged prices stabilised or even declined. As a result, in November/December 2017 the oil-pegged prices were lower than the hub prices. In Q1 2018, hub prices increased considerably, especially in March, owing to low temperatures. The oil-pegged prices remained relatively stable, because the delayed impact of oil price growth on world markets was yet to occur.

Chart 38: *Comparison of EU wholesale price estimates (EUR/MWh)*



Source: Eurostat COMEXT and European Commission estimations, BAFA, Platts
*The difference between the highest and lowest price depicted on the graph
Note: Border prices are estimations of prices of piped gas imports paid at the border of the importing country, based on information collected by customs agencies, and are deemed to be representative of long-term contracts.

Source: Quarterly Report on European Gas Markets (volume 11, issue 2, second quarter of 2018)

4.1.1.7 Carbon price in the Emissions Trading Scheme

The EU Emissions Trading Scheme (EU ETS) is a key instrument of EU climate policy because it covers almost half of all EU emissions. Emissions trading is therefore one of the means to meet the current target of reducing GHG emissions in the EU by at least 40 % by comparison with 1990, which means that the EU ETS sectors must reduce emissions by 43 % by comparison with 2005. The system includes emissions of carbon dioxide (CO_2), nitrous oxide (N_2O) and perfluorocarbons (PFCs).

The original system set-up foresaw such emission allowance (EUA) prices that would encourage emissions reduction, but their prices have been consistently too low and did not motivate producers to reduce emissions. Low prices were caused by a high surplus of allowances in the market from previous periods. The reason was bad estimate of the necessary allocation in the first period, the fall in industrial production as a result of the economic recession, the stagnation or drop in electricity as a result of austerity measures and massive support of especially renewable sources at the expense of fossils.

In December 2017, agreement was reached on European legislation dealing with emissions trading. The main agreed changes include: (i) a faster decrease in allowances (LRF 2.2 %); (ii) stricter market stability reserve (24 % deductions, cancellation from 2024); (iii) tightening of benchmarks; (iv) more carbon leakage measures; (v) new financial mechanisms (funds, derogations). On 27 September 2018, the European legislation on the Emissions Trading Scheme in 2021–2030 was officially approved.

Chart 39 indicates the historical development of the emission allowance price. It is evident from early 2018 there is a relative increase in the allowance price, *inter alia* owing to changes in the relevant European legislation, which will lead to a partial reduction of the quantity of the allowances traded. Table 52 then indicates the expected development of the emission allowance. This outlook is based on the recommended parameters for reporting greenhouse-gas emissions for 2019. However, it should be noted in this respect that the development of the emission allowance price is subject to a wide range of uncertainties, for example with regard to the expected development of the European economy or the further development of climate-energy policy at EU level.

Chart 39: *Development of the emission allowance price (EUR per tonne of CO2) in the spot market*

Source: European Energy Exchange (EEX)

Table 52: *Expected development of emission allowance price (in EUR per tonne of CO_2)*

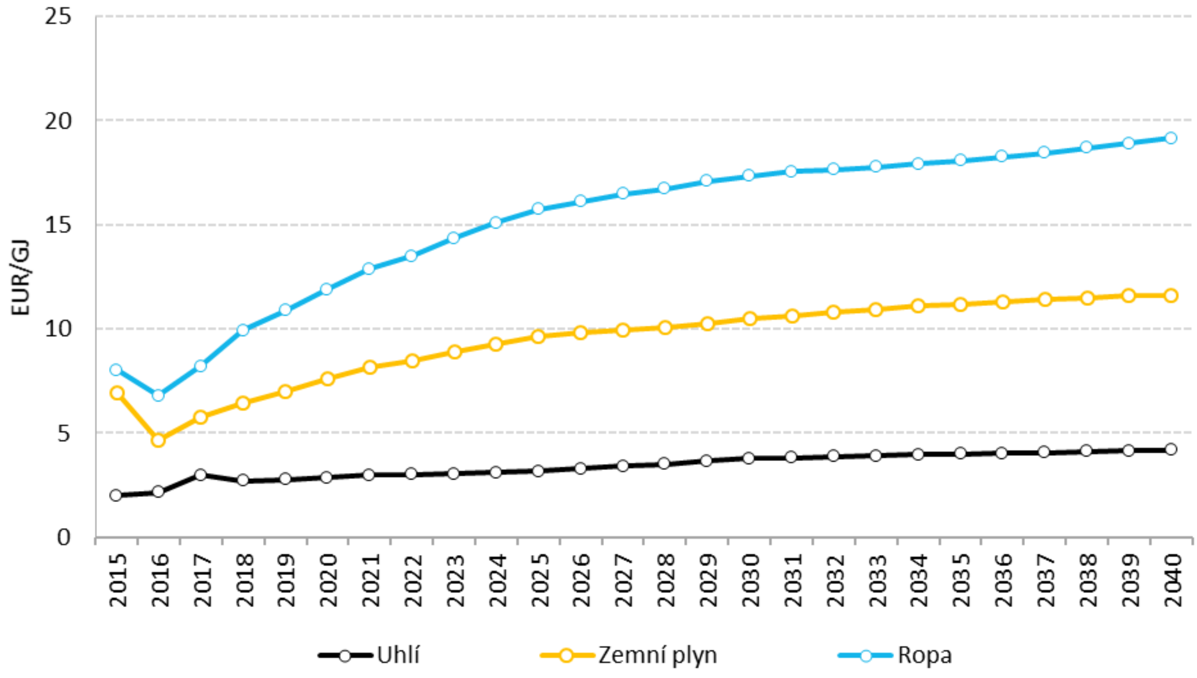
	2015	2020	2025	2030	2035	2040
2010 prices	7.2	14.4	21.6	32.1	40.3	48.0
2013 prices	7.5	15.0	22.5	33.5	42.0	50.0
2016 prices	7.8	15.5	23.3	34.7	43.5	51.7

Source: Recommended parameters for reporting greenhouse-gas emissions for 2019 (15 June 2018)

4.1.1.8 Prices of internationally traded fuels

Chart 40 provides the prices of internationally traded fuels (coal, gas and oil), which are based on the parameters for the preparation of the National Plan recommended by the European Commission. Comparable assumptions should ensure in this respect better comparability of national plans across Member States. The tables in Annex 3 to this document contain more detailed information about the forecasts shown in the chart. As these are fuel forecasts that were compiled some time ago, they were corrected by the European Commission. Still, it should be noted that the forecast prices of internationally traded fuels are subject to considerable uncertainty, primarily owing to the period of this prediction.

Chart 40: *Forecast prices of international fuels with correction in 2015–2024*



Uhlí – Coal

Zemní plyn – natural gas

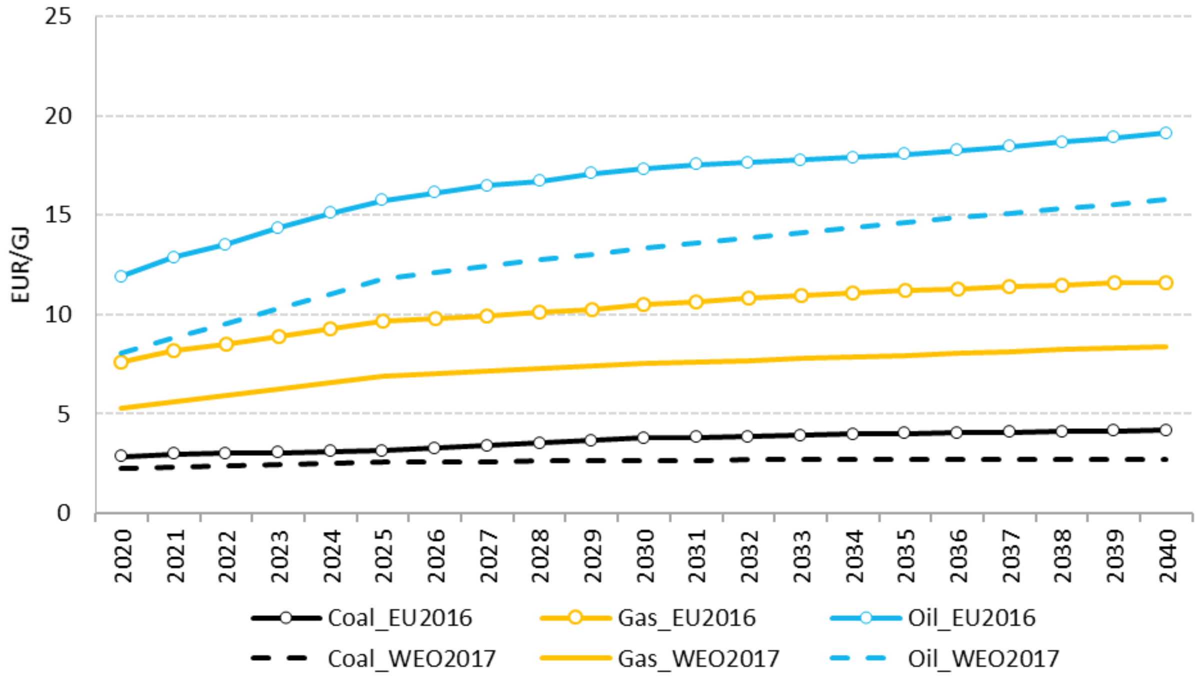
Ropa - Oil

Source: Recommended parameters for the preparation of the National Plan (August 2018)

4.1.1.9 Development of prices of non-regulated electricity depending on input assumptions

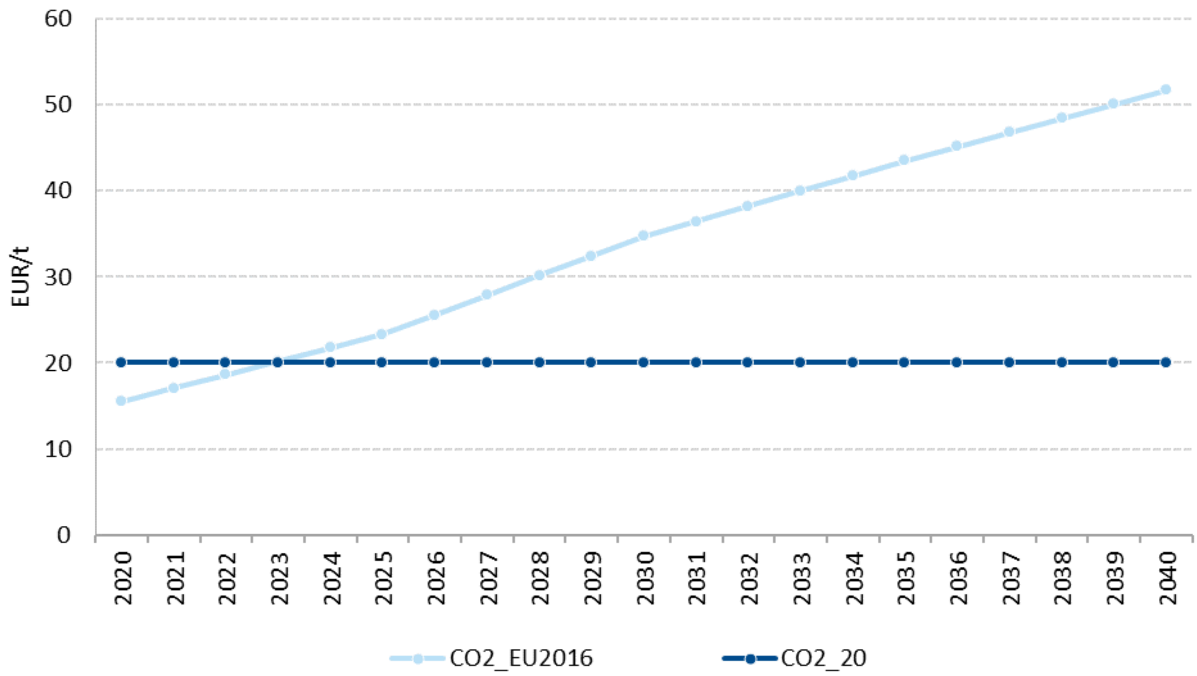
On the basis of input assumptions about basic fundamentals (i.e. in particular prices of internationally traded energy commodities), the pan-European model was used to create an outlook of the price of non-regulated electricity, which is then used in energy modelling and forms the basis for the costs of future support for renewable sources, for example. The outlook is then prepared in different scenarios, which takes into account the possible uncertainty of future developments. For comparison, data from the International Energy Agency (in particular from the World Energy Outlook 2017) is used as an alternative source of prices for internationally traded energy commodities (coal, natural gas, oil).

Chart 41: *Outlook for the price of basic fuels*



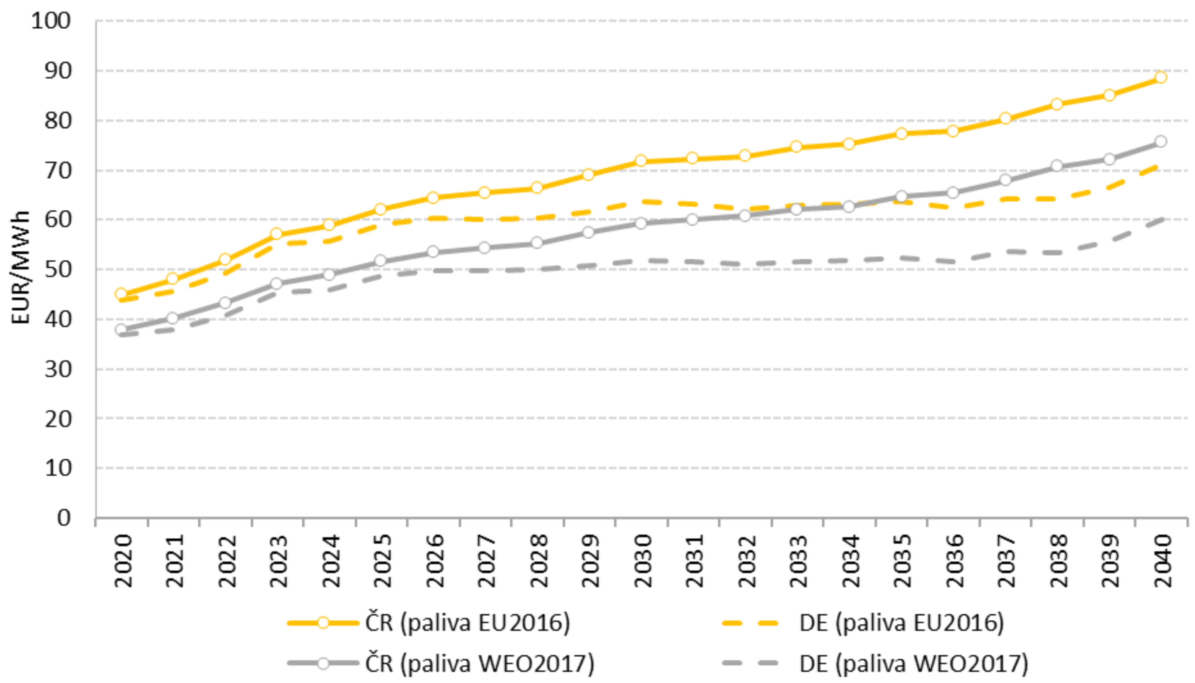
Source: Analysis based on the PLEXOS model

Chart 42: *Development scenarios of the emission allowance price*



Source: Analysis based on assumptions for the purpose of preparing the National Plan

Chart 43: *Development of the price of non-regulated electricity with allowance price on the basis of the EU2016 assumptions*

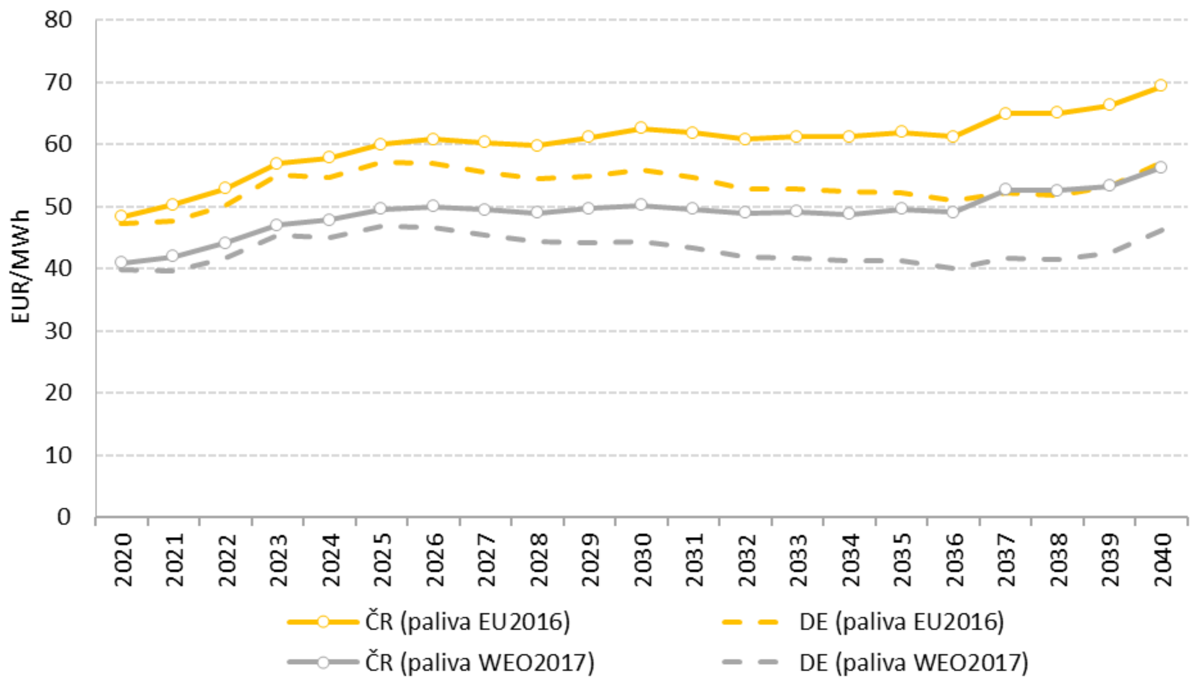


ČR – Czech Republic

Paliva - fuels

Source: Analysis based on the PLEXOS model

Chart 44: *Development of the price of non-regulated electricity with allowance price at EUR 20 per tonne*



ČR – Czech Republic

Paliva - fuels

Source: Analysis based on the PLEXOS model

iv. Technology cost developments

With regard to the technology cost developments, information based on the 'EU Reference Scenario 2016' provided by the European Commission for the purposes of preparing this document was used as much as possible. These assumptions are not provided here neither in spreadsheet nor graphical form because of the scope of this material. In the case of missing data and for verification purposes, national analyses were used, primarily the Expected long-term Balance Between Gas Supply and Demand, which is prepared annually by the operator of the electricity and gas market, OTE, a.s.

4.2 Dimension decarbonisation

4.2.1 GHG emissions and removals

i. Trends in current GHG emissions and removals in the EU ETS, effort sharing and LULUCF sectors and different energy sectors

As one of the parties to the UN Framework Convention on Climate Change, the Czech Republic is obliged to prepare and regularly update national inventory and reporting of greenhouse-gas emissions and removals. In addition, membership in the European Union includes additional requirements for the Czech Republic, such as fulfilling the obligations specified in Article 7 of EU Regulation No 525/2013. The National Inventory Report below outlines greenhouse-gas emissions for the period 1990–2016. The inventory of greenhouse-gas emissions and removals was prepared in accordance with the methodological guidelines of the Intergovernmental Panel on Climate Change: IPCC 2006 Guidelines (IPCC 2006).

According to the latest available inventory of greenhouse-gas emissions and removals, the Czech Republic's greenhouse-gas emissions in 1990–2016 decreased by 34.69 %, including the LULUCF sectors[112] and 35.24 % excluding the LULUCF sectors. The energy sector accounts for the largest share (81 %) of total emissions, of which 96 % is related to the combustion of fuels. Table 53, Table 54 and Chart 45 show the development of greenhouse-gas emissions and removals in this period, broken down by individual greenhouse gases and IPCC sectors[113].

Table 53: *GHG emissions in 1990–2016 [kt CO_2 eq.]*

<table>
<tr><th rowspan="2"></th><th rowspan="2">CO_2[1]</th><th rowspan="2">CH_4[3]</th><th rowspan="2">N_2O[3]</th><th rowspan="2">HFCs</th><th rowspan="2">PFCs</th><th rowspan="2">NF_3</th><th rowspan="2">SF_6</th><th colspan="2">Total[4]</th></tr>
<tr><th>Including LULUCF</th><th>Excluding LULUCF</th></tr>
<tr><td>1990</td><td>164,227.40</td><td>23,657.59</td><td>9,590.58</td><td colspan="3" rowspan="5">NO</td><td>84.24</td><td>19 9597.37</td><td>19 3034.57</td></tr>
<tr><td>1991</td><td>148,512.48</td><td>22,073.04</td><td>8,170.22</td><td>84.08</td><td>18 0785.92</td><td>17 1226.71</td></tr>
<tr><td>1992</td><td>144,074.22</td><td>20,711.08</td><td>7,385.39</td><td>85.41</td><td>17 4157.46</td><td>16 3780.20</td></tr>
<tr><td>1993</td><td>137,962.67</td><td>19,791.45</td><td>6,561.71</td><td>86.56</td><td>16 6245.21</td><td>15 6228.97</td></tr>
<tr><td>1994</td><td>131,532.51</td><td>18,658.51</td><td>6,509.15</td><td>87.66</td><td>15 8452.93</td><td>15 0676.84</td></tr>
<tr><td>1995</td><td>131,972.06</td><td>18,234.11</td><td>6,864.66</td><td>36.00</td><td>0.01</td><td>NO</td><td>88.68</td><td>15 8867.50</td><td>15 0666.46</td></tr>
</table>

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	CO_2[1]	CH_4[3]	N_2O[3]	HFCs	PFCs	NF_3	SF_6	Total[4]	
								Including LULUCF	Excluding LULUCF
1996	134,648.71	18,095.43	6,684.49	84.20	0.68	NO	98.31	16 1229.60	15 2905.84
1997	130,849.71	17,693.76	6,641.18	168.67	1.73	NO	96.10	15 7040.36	14 9393.44
1998	125,125.66	16,987.94	6,527.85	214.74	1.66	NO	94.98	15 0411.78	14 2779.92
1999	116,441.58	16,253.40	6,392.91	246.48	1.10	NO	95.94	14 0750.99	13 2754.69
2000	126,896.91	15,424.80	6,312.25	330.65	4.69	NO	108.40	15 0160.25	14 1411.56
2001	126,666.37	15,184.14	6,414.66	423.60	9.75	NO	98.82	14 9837.35	14 0769.80
2002	123,598.03	14,762.71	6,161.33	523.03	16.39	NO	121.28	14 6163.49	13 7469.17
2003	127,048.37	14,786.56	5,822.50	630.49	8.55	NO	144.69	14 9381.45	14 2156.45
2004	127,759.33	14,359.25	6,312.60	707.04	12.81	NO	120.61	15 0184.08	14 2553.80
2005	125,294.53	14,731.87	6,135.33	793.11	14.89	NO	111.84	14 8044.88	14 0506.82
2006	126,380.29	14,980.43	5,949.39	1,053.00	31.09	NO	105.12	14 9486.88	14 4052.97
2007	128,180.73	14,565.38	5,965.84	1,429.78	29.00	NO	93.79	15 1173.61	14 7907.74
2008	122,933.87	14,672.60	6,107.07	1,678.77	39.76	NO	88.67	14 6435.34	14 0064.37
2009	115,255.28	14,317.54	5,713.19	1,753.01	45.44	NO	89.05	13 8034.77	13 0249.41
2010	117,495.55	14,535.65	5,500.82	2,008.84	48.01	0.15	82.76	14 0535.27	13 4533.25
2011	115,023.30	14,538.52	5,686.72	2,241.77	8.24	0.59	88.64	138 480.32	13 1242.07
2012	110,914.08	14,528.99	5,603.45	2,380.17	6.19	0.89	92.44	13 4371.95	12 7306.27
2013	106,401.19	13,948.17	5,587.53	2,505.38	4.08	1.41	83.04	12 9285.77	12 2926.96
2014	104,060.31	13,954.58	5,825.53	2,695.69	3.02	2.37	79.90	12 7367.58	12 1060.88
2015	104,784.56	14,024.75	5,861.81	2,925.69	1.96	2.15	78.27	12 8419.12	12 1887.10
2016	106,543.30	13,804.46	6,092.07	3,121.50	1.44	2.15	78.63	13 0348.69	12 5011.55
%[2)]	-35.12	-41.65	-36.48	8,569.74	16,214.85	NA	-6.66	-34.69	-35.24

[1] *GHG emissions excluding emissions/removals from LULUCF*
[2] *by comparison with the baseline year*
[3] *including LULUCF*
[4] *including indirect emissions*

Source: CHMI

Table 54: *GHG emissions and removals in the period 1990–2016 by IPCC sectors [kt CO_2 eq.]*

	January Energy	2. Industrial processes and product use	March Agriculture	4. LULUCF	5. Waste

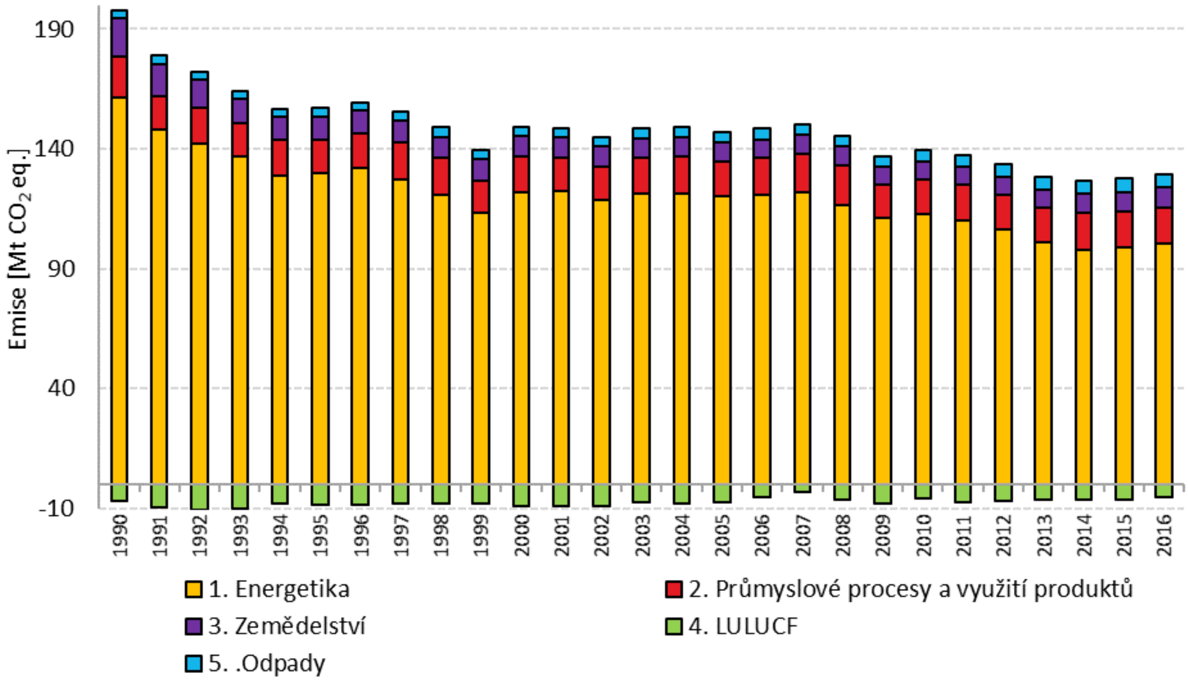
1990	161,339.98	17,113.01	15,898.12	-6,562.80	3,124.51
1991	147,957.10	13,847.99	13,702.88	-9,559.21	3,266.79
1992	142,438.58	14,609.67	11,859.32	-10,377.26	3,275.76
1993	137,047.96	13,451.41	10,465.88	-10,016.24	3,356.73
1994	128,983.49	14,690.24	95 30.55	-77 76.09	3,503.45
1995	129,812.10	14,211.15	95 88.19	-8,201.04	3,510.88
1996	131,766.17	14,899.73	92 96.98	-8,323.76	3,549.21
1997	126,985.97	15,797.67	88 89.20	-7,646.93	3,665.98
1998	120,645.43	15,899.75	85 24.23	-7,631.86	3,792.03
1999	113,594.51	13,354.90	85 95.05	-7,996.29	3,806.09
2000	121,973.32	14,804.42	83 71.40	-8,748.69	3,853.46
2001	122,217.03	14,017.60	84 93.33	-9,067.55	3,993.32
2002	118,898.93	13,782.21	82 93.06	-8,694.32	4,126.98
2003	121,382.55	14,801.58	78 66.08	-7,225.01	4,285.11
2004	121,141.48	15,712.44	80 89.63	-7,630.27	4,234.83
2005	120,346.04	14,549.02	7,803.15	-7,538.05	4,294.58
2006	120,773.00	15,575.84	7,670.18	-5,433.92	4,371.05
2007	121,647.69	16,320.09	7,843.31	-3,265.87	4,314.32
2008	116,670.55	16,236.68	7,991.66	-6,370.97	4,511.55
2009	111,154.39	13,719.72	7,583.63	-7,785.37	4,621.05
2010	112,645.46	14,653.08	7,411.91	-6,002.02	4,861.48
2011	110,177.11	14,858.85	7,585.63	-7,238.25	4,917.13
2012	106,159.49	14,654.13	7,581.34	-7,065.68	5,077.39
2013	100,847.75	14,497.67	7,764.78	-6,358.82	5,373.05
2014	97,861.37	15,345.08	7,958.76	-6,306.71	5,401.69
2015	98,957.27	14,993.33	8,158.20	-6,532.02	5,511.73
2016	100,280.60	15,221.74	8,519.68	-5,337.14	5,561.26
[1]%	1.35 %	1.49 %	4.54 %	-18.95 %	0.92 %
[2]%	-37.85 %	-11.05 %	-46.41 %	-18.68 %	77.99 %

[1] *Difference from the previous year*

[2] *Difference from the baseline year*

Source: CHMI

Chart 45: *GHG emissions and removals in the period 1990–2016 by IPCC sectors [Mt CO_2 eq.]*



Energetika – energy

Zemědělství – Agriculture

Odpady – Waste

Průmyslové procesy a využití produktů - Industrial processes and product use

Source: CHMI

Table 55 shows in more detail the trend of greenhouse-gas emissions by IPCC categories for selected years.

Table 55: *GHG emissions and removals for selected years by IPCC categories [kt CO_2 eq.] (part 1)*

Category	1990	1995	2000	2005	2010	2015	2016
Total emissions	190,912.83	14 8921.27	140,253.91	139,454.73	133,569.91	121,088.50	124,246.14
January Energy	**161,339.98**	**12 9812.10**	**121,973.32**	**120,346.04**	**112,645.46**	**98,957.27**	**100,280.60**
A. Fuel combustion (sectoral approach)	149,478.48	12 0507.09	114,847.26	113,936.92	106,853.95	94,569.51	96,249.72
January Energy sector	56,915.91	6 1850.19	62,061.93	63,165.64	62,123.38	53,678.15	54,449.09
2. Manufacturing and construction	51,234.04	2 6192.98	23,425.60	18,844.61	12,089.43	9,700.31	9,396.92
March Transport	7,284.03	9,354.55	11,932.42	17,106.65	17,007.86	17,744.33	18,449.82
4. Other sectors	34,044.50	23,109.37	17,247.37	14,546.55	15,304.13	13,065.91	13,546.23
5. Other	NO	NO	179.95	273.47	329.14	380.81	407.66
B. Fugitive emissions	11,861.51	9,305.01	7,126.06	6,409.12	5,791.51	4,387.76	4,030.88
January Solid fuels	10,779.39	8,468.06	6,249.66	5,513.41	4,894.36	3,774.33	3,420.64
2. Oil and natural gas and other emissions from energy production	1,082.12	836.95	876.40	895.71	897.15	613.43	610.25
2. Industrial processes	**17,113.01**	**14,211.15**	**14,804.42**	**14,549.02**	**14,653.08**	**14,993.33**	**15,221.74**
A. Mineral industry	4,082.45	3,019.09	3,633.37	3,345.75	3,048.42	2,575.79	2,816.07
Chemical industry	2,944.23	2,808.20	2,937.08	2,837.88	2,371.07	2,070.59	1,527.23
C. Metal industry	9,670.32	7,949.20	7,435.43	7,103.10	6,752.62	6,975.84	7,311.48
D. Non-energy products and solvent use	125.56	103.75	148.60	136.23	117.72	139.55	139.73
E. Electronics industry	NO,NE	NO,NE	11.17	6.64	41.93	5.32	6.39
F. Use of ODS	NO	36.01	332.75	802.49	2,016.65	2,927.20	3,122.53
G. Other product manufacture and use	290.46	294.90	306.04	316.93	304.69	299.04	298.31
March Agriculture	**15,898.12**	**9,588.19**	**8,371.40**	**7,803.15**	**7,411.91**	**8,158.20**	**8,519.68**
A. Enteric fermentation	5,754.89	3,588.22	3,048.32	2,848.43	2,720.02	2,895.96	2,957.46
B. Manure management	3,315.36	2,304.97	2,041.56	1,836.06	1,581.17	1,554.11	1,580.18
D. Agricultural land	5,531.71	3,474.46	3,120.69	2,979.97	2,937.48	3,356.62	3,603.26
G. Lime application on soils	1,187.63	111.26	113.21	64.51	61.97	164.41	168.01
H. Urea application	108.53	109.27	47.61	74.17	111.27	187.10	210.76

Source: CHMI

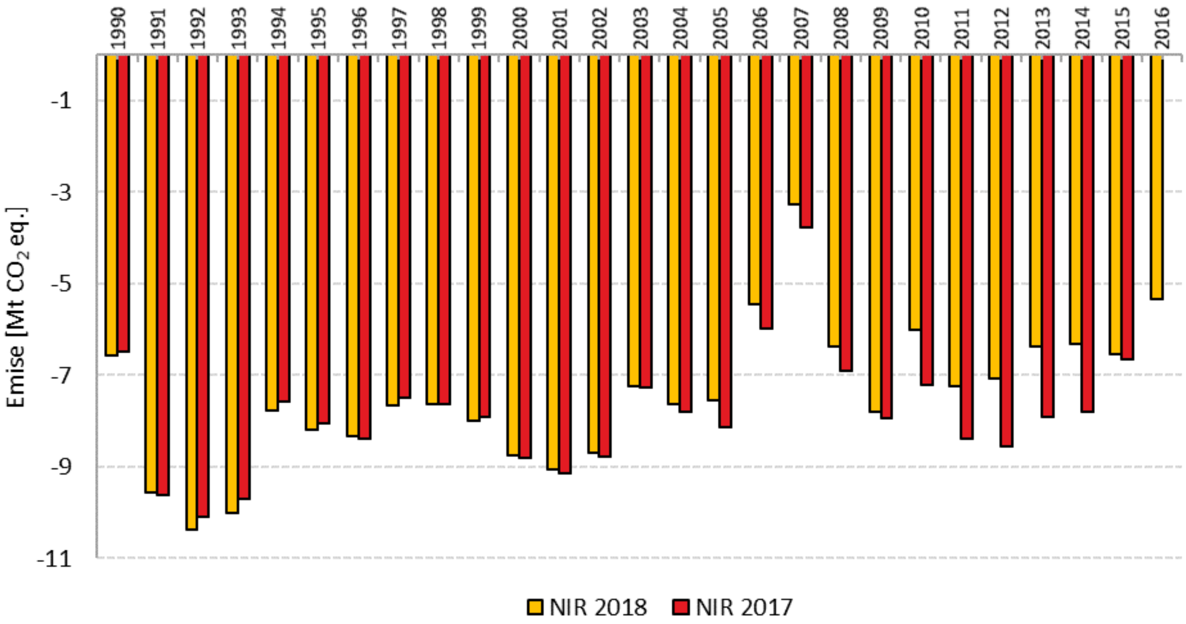
Table 56: *GHG emissions and removals for selected years by IPCC categories [kt CO_2 eq.] (part 2)*

Category	1990	1995	2000	2005	2010	2015	2016
4. Land use, land use change and forestry	**-6,562.80**	**-8,201.04**	**-8,748.69**	**-7,538.05**	**-6,002.02**	**-6,532.02**	**-5,337.14**
A. Forest land	-5,076.02	-7,359.82	-7,451.99	-6,130.21	-4,237.45	-5,967.69	-4,519.32
B. Cropland	213.22	234.25	224.98	244.82	172.20	131.92	124.36
C. Grassland	-96.83	-344.25	-404.90	-404.50	-460.66	-358.28	-661.65
D. Wetlands	21.48	9.08	26.34	21.17	34.11	25.09	25.03
E. Settlements	86.31	91.80	133.42	175.75	136.24	95.81	124.06
F. Other	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
G. Harvested wood products	-1,712.97	-833.55	-1,277.74	-1446.16	-1,647.58	-460.00	-430.67
5. Waste	**3,124.51**	**3,510.88**	**3,853.46**	**4,294.58**	**4,861.48**	**5,511.73**	**5,561.26**
A. Solid waste disposal	1,979.27	2,404.98	2,798.38	3,058.11	3,462.42	3,653.77	3,671.11
B. Biological treatment of solid waste	NE,IE	NE,IE	NE,IE	60.90	202.65	678.57	711.36
C. Incineration and open burning of waste	21.25	64.92	57.88	124.12	127.29	121.59	115.99
D. Wastewater treatment	1,123.99	1,040.98	997.20	1051.44	1,069.12	1,057.79	1,062.80
Memo items:							
International bunkers	528.22	562.83	593.83	978.94	965.41	895.14	964.06
Aviation	528.22	562.83	593.83	978.94	965.41	895.14	964.06
CO_2 emissions from biomass	6,445.39	5,787.22	6,652.88	8,667.39	12,342.53	16,193.69	16,461.81
Indirect N_2O emissions	2,111.77	728.70	554.23	526.19	427.33	344.49	366.48
Indirect CO_2 emissions	2,121.74	1745.19	1,157.65	1052.09	963.33	798.60	765.41
Total emissions excluding LULUCF	**197,475.63**	**157,122.31**	**149,002.60**	**146,992.78**	**139,571.94**	**127,620.52**	**129,583.28**
Total emissions including LULUCF	**190,912.83**	**148,921.27**	**140,253.91**	**139,454.73**	**133,569.91**	**121,088.50**	**124,246.14**
Total emissions including indirect CO_2, excluding LULUCF	**199,597.37**	**158,867.50**	**150,160.25**	**148,044.88**	**140,535.27**	**128,419.12**	**130,348.69**
Total emissions including indirect CO_2, including LULUCF	**193,034.57**	**150,666.46**	**141,411.56**	**140,506.82**	**134,533.25**	**121,887.10**	**125,011.55**

Source: CHMI

Table 57 shows that the LULUCF sectors show net emission removals throughout the 1990–2016 period. The removals fluctuate year-on-year, but overall they show a slightly declining trend (cf. Chart 46). The table shows preliminary data for counting LULUCF activities in the Kyoto Protocol 2nd commitment period (the final amount will be counted for the whole period).

Chart 46: *LULUCF removals in 1990–2016 [Mt CO_2 eq.]*



Emise - Emissions

Source: CHMI

Table 57: *Values for counting LULUCF emissions and removals under the Kyoto Protocol in 2013–2020 [kt CO_2 eq.]*

Kyoto Protocol activities	Net emissions / removals (kt CO_2 eq.)			
	2013	2014	2015	2016
A. Activities under Article 3.3				
A.1. Afforestation/reforestation	-498.47	-553.76	-593.74	-635.53
A.2. Deforestation	233.81	230.85	179.56	218.64
B. Activities under Article 3.4				
B.1. Forest management[114]	-5,932.14	-5,836.23	-5,970.69	-4,490.22

Source: CHMI

Verified emissions from stationary sources included in the EU ETS decreased by 18.11 % between 2005 and 2016. Emissions in non-ETS sectors show a rather fluctuating trend over the same period. In particular, emissions from the waste and transport sectors are increasing. However, the Czech

[114] Only removals above the benchmark level of -4 868 kt CO_2 eq. can be accounted

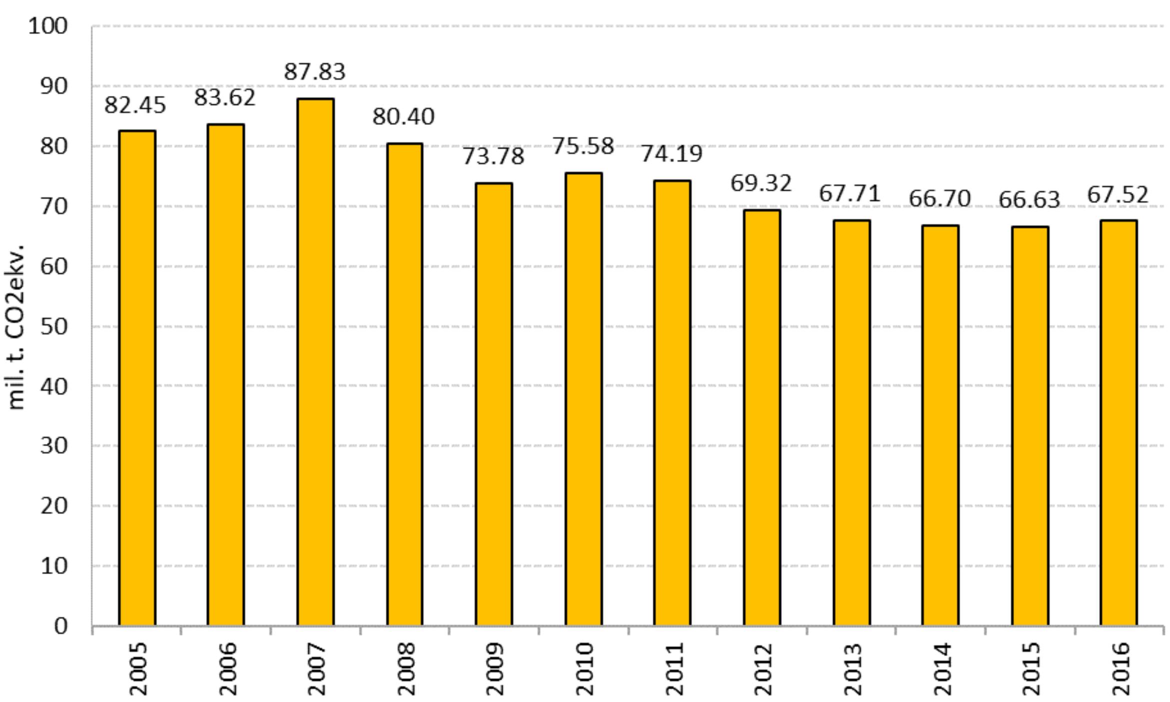
Republic should, with a large margin, meet its target for non-ETS sectors by 2020, which allows for a maximum emission increase from these sectors of 9 % by comparison with 2005.

Table 58: *Verified emissions from stationary installations in the EU ETS (Mtoe CO_2 eq.)*

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Emissions (EU ETS)	82.45	83.62	87.83	80.40	73.78	75.58	74.19	69.32	67.71	66.70	66.63	67.52

Source: EUTL

Chart 47: *Verified emissions from stationary installations in the EU ETS*



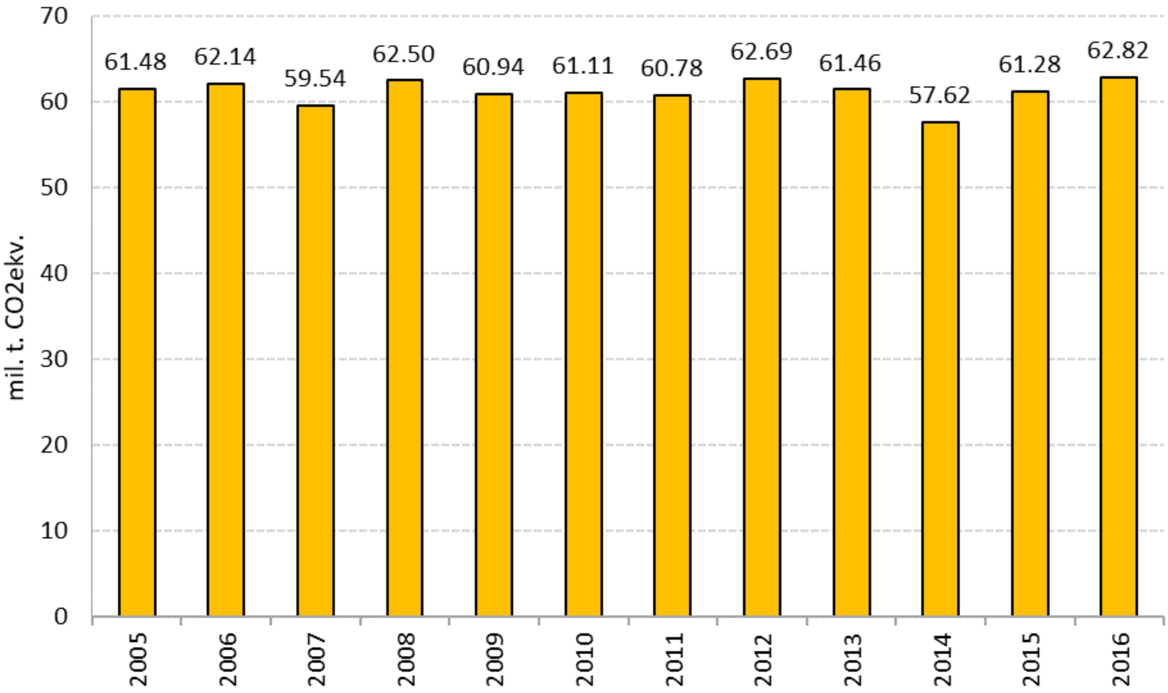
Source: EUTL

Table 59: *Emissions in non-ETS sectors in 2005–2016 (million tonnes of CO_2 eq.)*

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Emissions (non-ETS)	61.48	62.14	59.54	62.5	60.94	61.11	60.78	62.69	61.46	57.62	61.28	62.82

Source: EUROSTAT, CHMI

Chart 48: *Emissions in non-ETS sectors in 2005–2016*



Source: EUROSTAT, CHMI

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

The projections of greenhouse-gas emissions are based on the latest available inventory of greenhouse-gas emissions and removals as described in Chapter 4.2.1 (i). Emission projections contain two scenarios (WEM – assumes the effects of current policies and measures on the development of greenhouse-gas emissions, WAM – assumes the effect of planned policies and measures on the development of greenhouse-gas emissions). Emission projections are created separately for each of the sectors (1. Energy, 2. Industrial processes and product use, 3. Agriculture, 4. LULUCF, 5. Waste) with a specific emphasis on key emission sources (sources that have a significant impact on total emissions of the country with respect to absolute emission values, taking into account the observed emission trend and taking into account the level of uncertainty for the given source).

Projection of greenhouse-gas emissions from sector 1. Energy is based on data provided by the MIT. In particular, this data includes energy and heat production outlooks and final consumption outlooks by sector (industry, transport, services, households, agriculture and others) are particularly high. The MESSAGE model was used to create greenhouse gas projections[115], which is used for medium-term to long-term energy planning, for climate change policy analysis and developing national or regional scenarios.

Projection of greenhouse-gas emissions from sector 2. Industrial processes and product use are based on the outlooks for production of selected products such as cement, lime, iron, steel, etc., provided by the MIT, and on the outlooks prepared by industry experts (especially for fluorinated greenhouse gases). The actual projections of greenhouse-gas emissions are based on the methodology used in the

[115] Model for Energy Supply Strategy Alternatives and their General Environmental Impacts

inventory of emissions and greenhouse gas removals, which is in line with the IPCC Guideline 2006. For projections of fluorinated greenhouse-gas emissions used in refrigeration and air conditioning technology, the country-specific Phoenix model was used.

Projection of greenhouse-gas emissions from sector 3. Agriculture is based on the Strategy of the Ministry of Agriculture of the Czech Republic with a view to 2030 updated by the Minister of Agriculture's statement on this Strategy and on consultations with experts on policies and measures in agriculture and rural development. Significant inputs into the projections are data on livestock population trends, volume of nitrogen from fertilisers applied to agricultural land and the annual harvest of agricultural crops. The projections of greenhouse-gas emissions are based on the methodology used in the inventory of emissions and greenhouse gas removals, which is in line with the IPCC Guideline 2006.

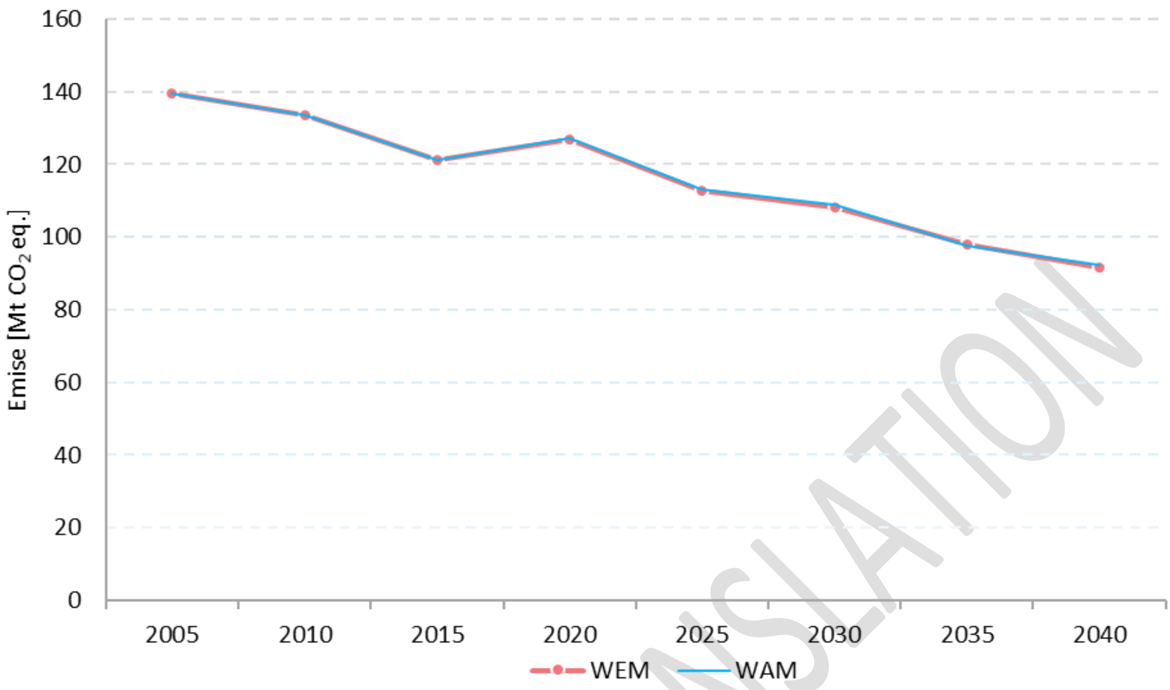
When making projections of greenhouse-gas emissions from sector 4. LULUCF, there is a specific focus on forest land category, which is a key category in the LULUCF sector, but also in the whole national inventory of greenhouse-gas emissions and removals. For this reason, forestry-related projections are prepared using the EFISCEN model[116]. The EFISCEN model is one of the most frequently used models for various tasks associated with the projections of forest resource developments in Europe. The projections of greenhouse-gas emissions for the other LULUCF categories are based on the correlation of the estimated 2016 emissions with the corresponding areas for the predicted years.

Projection of greenhouse-gas emissions from sector 5. Waste is based on the data provided in the Waste Management Plan of the Czech Republic, which contains waste management outlooks by 2024. The projections after 2024 were extrapolated based on trend and expert estimates. The actual projections of greenhouse-gas emissions are based on the methodology used in the inventory of emissions and greenhouse gas removals, which is in line with the IPCC Guideline 2006.

Chart 49 and Table 60 show the results of projections of total greenhouse-gas emissions for the WEM and WAM scenarios. In the short term until 2020, greenhouse-gas emissions are projected to increase by comparison with the current state, and from 2025 global emissions will start to decrease gradually for both scenarios. In both scenarios, there is an approximately 24 % decrease in total greenhouse-gas emissions by 2040 by comparison with the current state. The greenhouse gas emission projections under the WAM scenario are only slightly more unfavourable (see Table 60) than under the WEM scenario. The difference is owing to emission projections from the LULUCF sector, where the WAM scenario envisages changes in the age structure and species composition of the forest (for more detailed description, see below).

[116] European Forest Information Scenario Model

Chart 49: *The results of the projections of total greenhouse-gas emissions for WEM and WAM scenarios (including LULUCF)*



Emise - Emissions

Source: CHMI

Table 60: *The results of the projections of total greenhouse-gas emissions for WEM and WAM scenarios (including LULUCF) [Mt CO_2 eq.]*

	Historical emissions			**GHG emission projection**				
	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
WEM	139.45	133.57	121.09	126.83	112.85	108.22	97.84	91.59
WAM	139.45	133.57	121.09	127.18	113.12	108.71	97.78	92.29

Source: CHMI

Table 61 presents the results of projections of total greenhouse-gas emissions by type of gas. The most significant decrease in emissions by comparison with the current situation is expected for hydrogen fluoride hydrocarbons (HFCs). The use of HFCs is strictly limited by European legislation as well as globally (HFCs are on the list of controlled substances of the Montreal Protocol). Decrease in emissions is also expected for CO_2 and CH_4, while N_2O emissions are expected to grow slightly, which is linked to the increase in emissions from agriculture.

Table 61: *The results of the projections of total greenhouse-gas emissions for WEM and WAM scenarios for individual gases (including LULUCF) [Mt CO_2 eq.]*

	Historical emissions			GHG emission projection				
	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
	WEM							
CO_2	117.67	111.39	98.19	103.81	90.79	87.93	78.80	73.90
CH_4	14.73	14.54	14.02	13.61	13.09	12.07	11.39	10.23
N_2O	6.14	5.50	5.86	5.89	6.08	6.21	6.24	6.24
F – gases	0.92	2.14	3.01	3.51	2.88	2.00	1.41	1.21
	WAM							
CO_2	117.67	111.39	98.19	104.17	91.08	88.70	79.58	75.32
CH_4	14.73	14.54	14.02	13.61	13.08	11.80	10.55	9.51
N_2O	6.14	5.50	5.86	5.89	6.07	6.21	6.23	6.24
F – gases	0.92	2.14	3.01	Only WEM scenario				

Source: CHMI

Chart 50 and Table 62 shows the results of projections of total greenhouse-gas emissions by sector. The most significant decrease in total greenhouse-gas emissions by comparison with the current situation (approximately 32 %) is foreseen for sector 1. Energy. The projections are based on the data provided by the MIT. For sector 1. Energy, projections WEM and WAM scenarios were prepared. Unlike the WEM scenario, the WAM scenario envisages additional measures in transport. However, given the share of transport in total emissions from the energy sector, the differences between the WEM and the WAM scenarios are not significant.

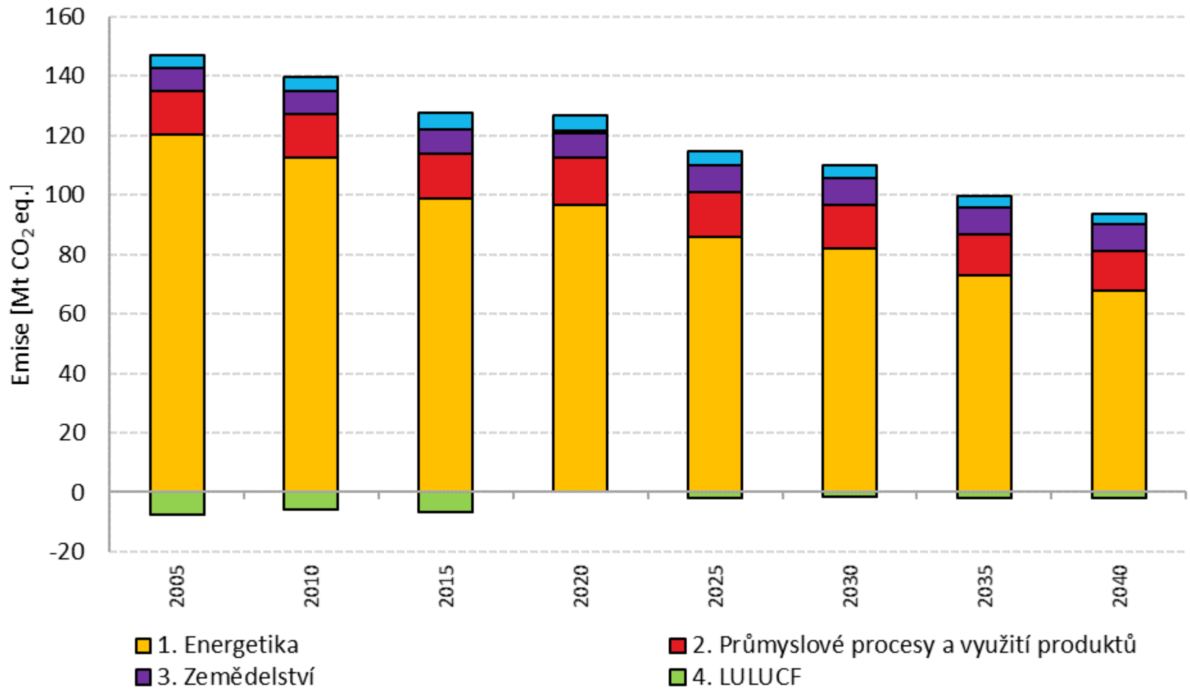
Given that the MIT prediction until 2040 of the production of selected products does not anticipate a downward trend in industrial production, greenhouse-gas emissions from sector 2. Industrial processes and product use are decreasing slowly. The reduction in emissions is mainly owing to the legislation on the use of fluorinated greenhouse gases, which requires manufacturers/importers/exporters to gradually shift to alternative refrigerants.

For sector 3. According to the projections, agriculture can be expected to see an increasing trend in greenhouse-gas emissions, especially for the manure management category and for the enteric fermentation category. The increase in emissions is owing to the expected increase in livestock population, which is based on the data from the Ministry of Agriculture.

The projections prepared for sector 4. LULUCF show the expected gradual loss of CO_2 removal capacity until 2040. The emission projections for sector 4. LULUCF include changes in age structure (WEM) and age structure and species composition (WAM – more diverse Czech forests with a significantly higher share of deciduous trees). Although until 2040, the WAM scenario appears to be slightly more negative in terms of emission sinks (removals), it should lead to more stable and resilient forests better adapted to changing environmental conditions – improving safety and sustainability of forest production.

For sector 5. According to the projections for waste, a reduction in greenhouse-gas emissions can be expected in both scenarios. The reduction of emissions is more pronounced for the WAM scenario, which is based on stricter coefficients for the recovery of landfill gas.

Chart 50: *Results of projections of total greenhouse-gas emissions for the WEM scenario by sector*



Energetika – energy

Zemědělství – Agriculture

Průmyslové procesy a využití produktů - Industrial processes and product use

Source: CHMI

Table 62: *Results of projections of total greenhouse-gas emissions for the WEM and WAM scenarios by sector*

	Historical emissions			GHG emission projection				
	2005	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
[Mt CO_2 eq.]	**WEM**							
January Energy	120.35	112.65	98.96	96.49	85.66	82.15	73.03	67.59
2. Industrial processes and product use	14.55	14.65	14.99	16.05	15.35	14.43	13.78	13.60
March Agriculture	7.80	7.41	8.16	8.36	8.77	9.05	9.15	9.17
4. LULUCF	-7.54	-6.00	-6.53	0.55	-1.74	-1.63	-1.73	-1.81

	Historical emissions			GHG emission projection				
	2005	2010	2015	2020	2025	2030	2035	2040
[Mt CO_2 eq.]	WEM							
5. Waste	4.29	4.86	5.51	5.38	4.81	4.22	3.61	3.03
	WAM							
January Energy	120.35	112.65	98.96	96.15	85.28	81.78	72.69	67.29
2. Industrial processes and product use	14.55	14.65	14.99	Only WEM scenario				
March Agriculture	7.80	7.41	8.16	Only WEM scenario				
4. LULUCF	-7.54	-6.00	-6.53	1.25	-1.09	-0.49	-0.61	-0.10
5. Waste	4.29	4.86	5.51	5.38	4.80	3.95	2.77	2.32

Source: CHMI

Table 63 shows a more detailed overview of the projections of greenhouse-gas emissions from sector 1. Energy, which accounted for up to 80 % of total Czech emissions (including LULUCF and indirect emissions) in 2016. The Energy sector is expected to see a gradual decrease in total greenhouse-gas emissions until 2040.

Table 63: *Projection of total greenhouse-gas emissions from the Energy sector for WEM and WAM scenarios*

	Historical emissions			GHG emission projection				
	2005	2010	2015	2020	2025	2030	2035	2040
[Mt CO_2 eq.]	WEM							
A. Fuel combustion (sectoral approach)	113.94	106.85	94.57	92.46	81.80	78.84	69.79	64.89
January Energy sector	63.17	62.12	53.68	51.49	42.54	42.24	36.26	34.02
2. Manufacturing and construction	18.84	12.09	9.70	9.86	9.83	9.68	9.61	9.52
March Transport	17.11	17.01	17.74	17.94	17.39	16.10	14.27	12.22
4. Other sectors	14.55	15.30	13.07	12.94	11.82	10.59	9.43	8.90
5. Other	0.27	0.33	0.38	0.23	0.23	0.23	0.23	0.23
B. Fugitive emissions	6.41	5.79	4.39	4.03	3.86	3.31	3.24	2.70
January Solid fuels	5.51	4.89	3.77	3.38	3.07	2.68	2.58	2.02

	Historical emissions			GHG emission projection				
	2005	2010	2015	2020	2025	2030	2035	2040
[Mt CO_2 eq.]	WEM							
2. Oil and natural gas and other emissions from energy production	0.90	0.90	0.61	0.65	0.79	0.63	0.65	0.69
	WAM							
A. Fuel combustion (sectoral approach)	113.94	106.85	94.57	92.12	81.43	78.47	69.45	64.59
January Energy sector	63.17	62.12	53.68	Only WEM scenario				
2. Manufacturing and construction	18.84	12.09	9.70	Only WEM scenario				
March Transport	17.11	17.01	17.74	17.60	17.01	15.73	13.93	11.92
4. Other sectors	14.55	15.30	13.07	Only WEM scenario				
5. Other	0.27	0.33	0.38	Only WEM scenario				
B. Fugitive emissions	6.41	5.79	4.39	Only WEM scenario				
January Solid fuels	5.51	4.89	3.77	Only WEM scenario				
2. Oil and natural gas and other emissions from energy production	0.90	0.90	0.61	Only WEM scenario				

Source: CHMI

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) as well as per technology in each of these sectors

The total share of renewable energy sources in gross final energy consumption according to EUROSTAT methodology stood at 14.89 % in 2016. Table 64 shows the development of the share of renewable energy sources in gross final consumption in 2004–2016. Chart 51 shows the same in graphical form.[117]

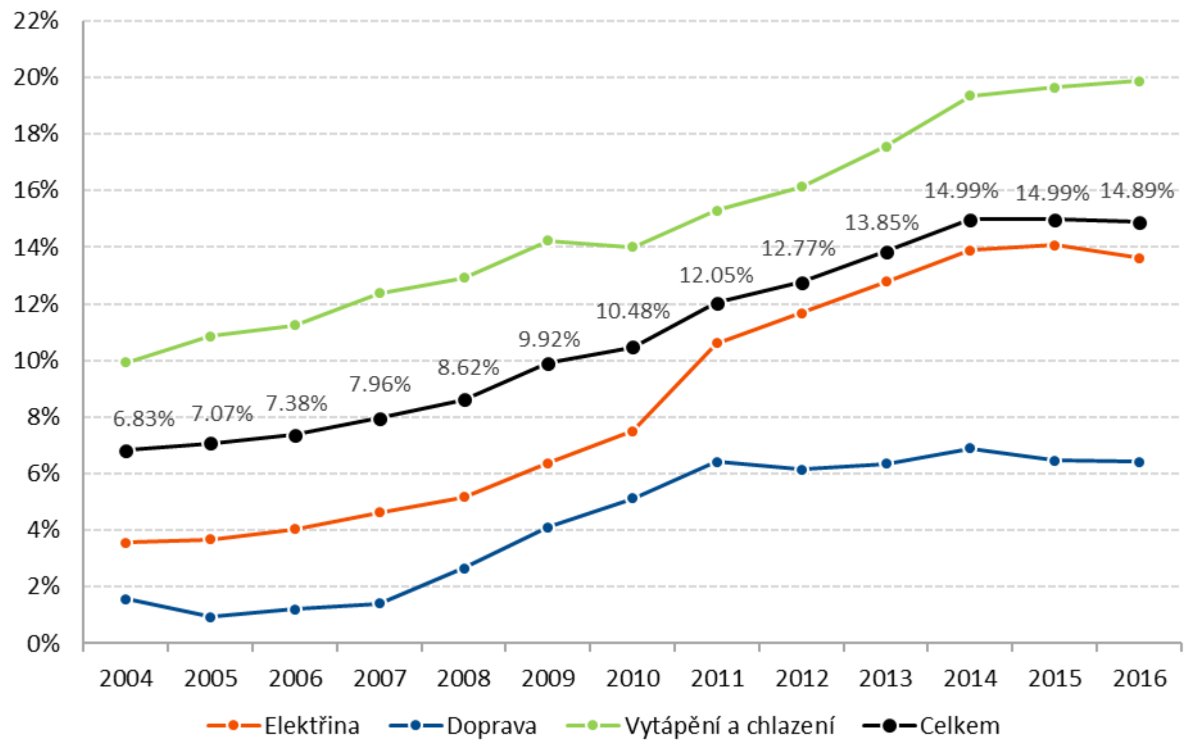
[117] At the time of finalising the Draft National Plan, preliminary figures for 2017 were already available. However, these values were only available in December 2018, so it was not possible to update all relevant parts. These updated values will potentially be added to the final version of the National Plan.

Table 64: *RES share in gross final consumption in 2004–2016 (%)*

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Electricity	3.55	3.69	4.04	4.62	5.18	6.38	7.52	10.61	11.67	12.78	13.89	14.07	13.61
Transport	1.57	0.94	1.20	1.40	2.66	4.11	5.12	6.43	6.15	6.34	6.90	6.45	6.42
Heating	9.93	10.85	11.25	12.38	12.91	14.24	14.01	15.29	16.14	17.56	19.35	19.64	19.87
Total	6.83	7.07	7.38	7.96	8.62	9.92	10.48	12.05	12.77	13.85	14.99	14.99	14.89

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

Chart 51: *RES share in total gross final consumption*



Elektřina – electricity

Doprava – Transport

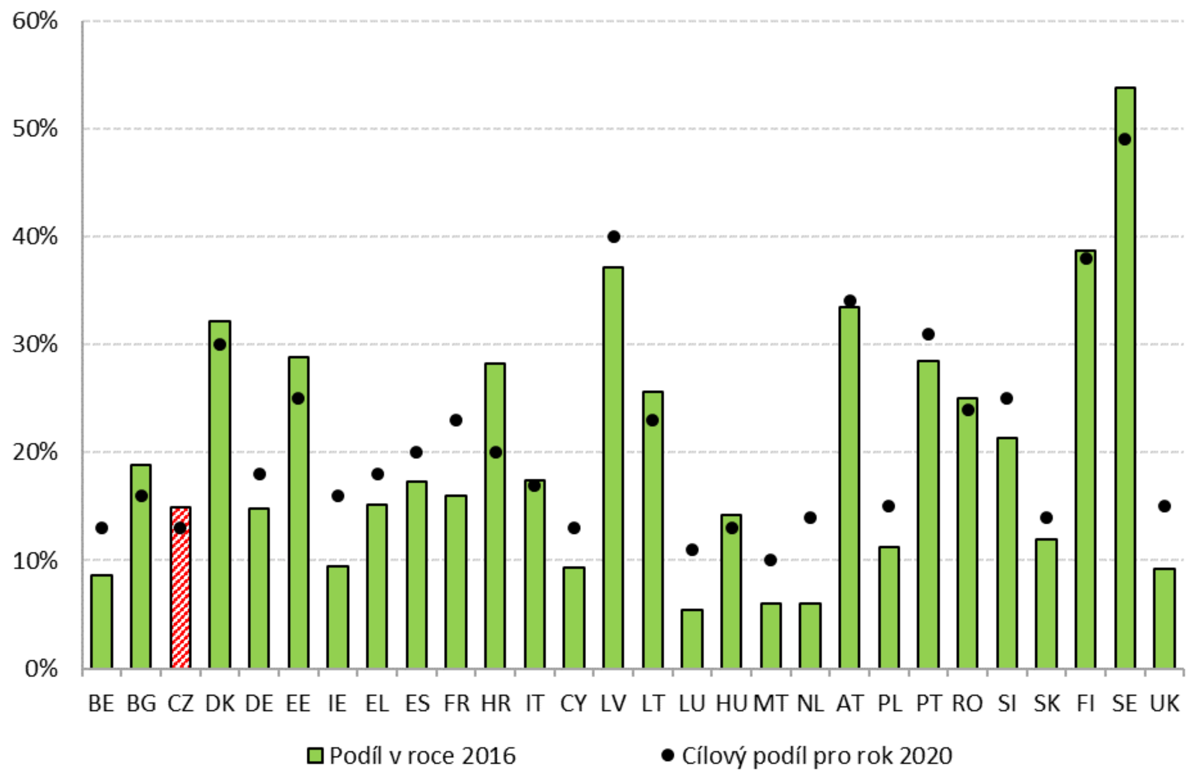
Vytápění a chlazení – Heating and cooling

Celkem - Total

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

The following chart shows the comparison of the share of renewable energy sources in each Member State in 2016 in the EUROSTAT methodology, including the RES share targets for each Member State by 2020. The Czech Republic was one of the 11 countries that already reached their 2020 target by 2016 (the Czech Republic reached its target in 2013).

Chart 52: *Comparison of the RES share in the EU (2016)*



Podíl v roce 2016 – share in 2016

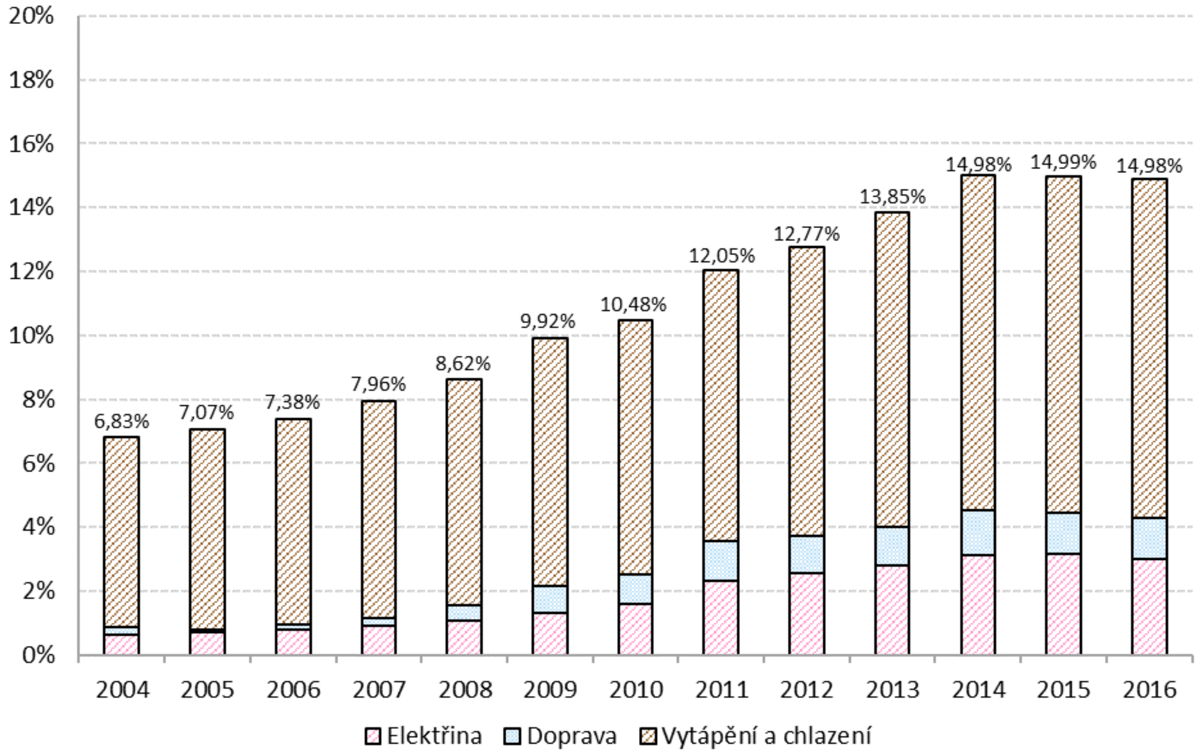
Cílový podíl pro rok 2020 – Target share in 2020

Source: RES share based on EUROSTAT methodology

Under Directive 2009/28/EC, the Czech Republic aims to achieve a 13 % share of renewable energy sources in final consumption by 2020. For 2015–2016, the Directive set the interim target of 9.1 %. The 2020 target was already achieved by the Czech Republic in 2013.

Chart 54 shows the evolution of the share of renewable energy sources in gross final consumption in the electricity sector since 2004 by fuels. In 2016, the share of renewable energy in the energy sector was 13.61 %. Renewable sources used in the production of electricity relative to the total share constitute approximately 3 %. Chart 55 shows the evolution of the share of renewable energy sources in gross final consumption in the transport sector in 2004–2016 by fuels. Renewable energy consumption in 2016 accounted for 6.42 % of total gross final consumption in the transport sector. The share of renewable energy sources in transport accounts for only about 1.3 % in the overall share. Chart 56 then shows the evolution of the share of renewable energy sources in the heating and cooling sector by fuels, which accounts for the largest share of approximately 10 % in the total share. The share of renewable sources in the heating and cooling sector is also the highest in comparison to other sectors; in 2016 it accounted for 19.87 %.

Chart 53: *RES share in gross final consumption (contributions of individual 'sectors')*



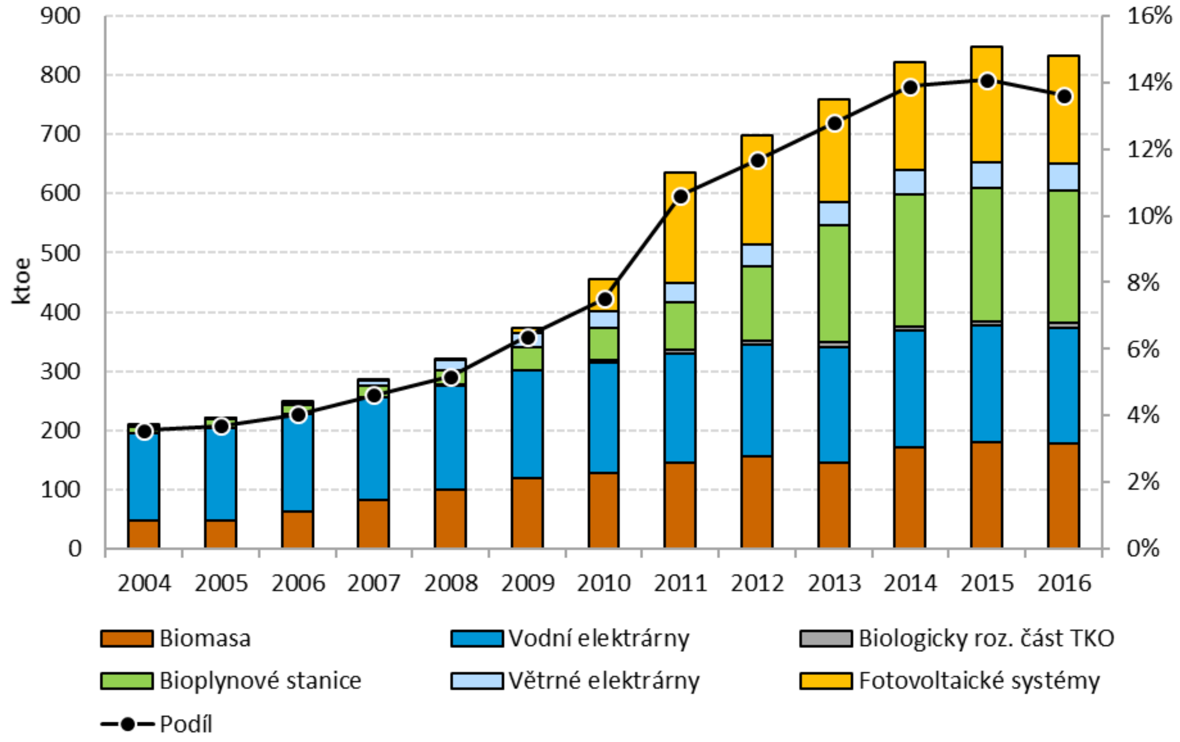
Elektřina – electricity

Doprava – Transport

Vytápění a chlazení – Heating and cooling

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

Chart 54: *RES share in gross final consumption in the electricity sector*



Biomasa – Biomass

Bioplynové stanice – Biogas stations

Vodní nelektrárny – Hydropower plants

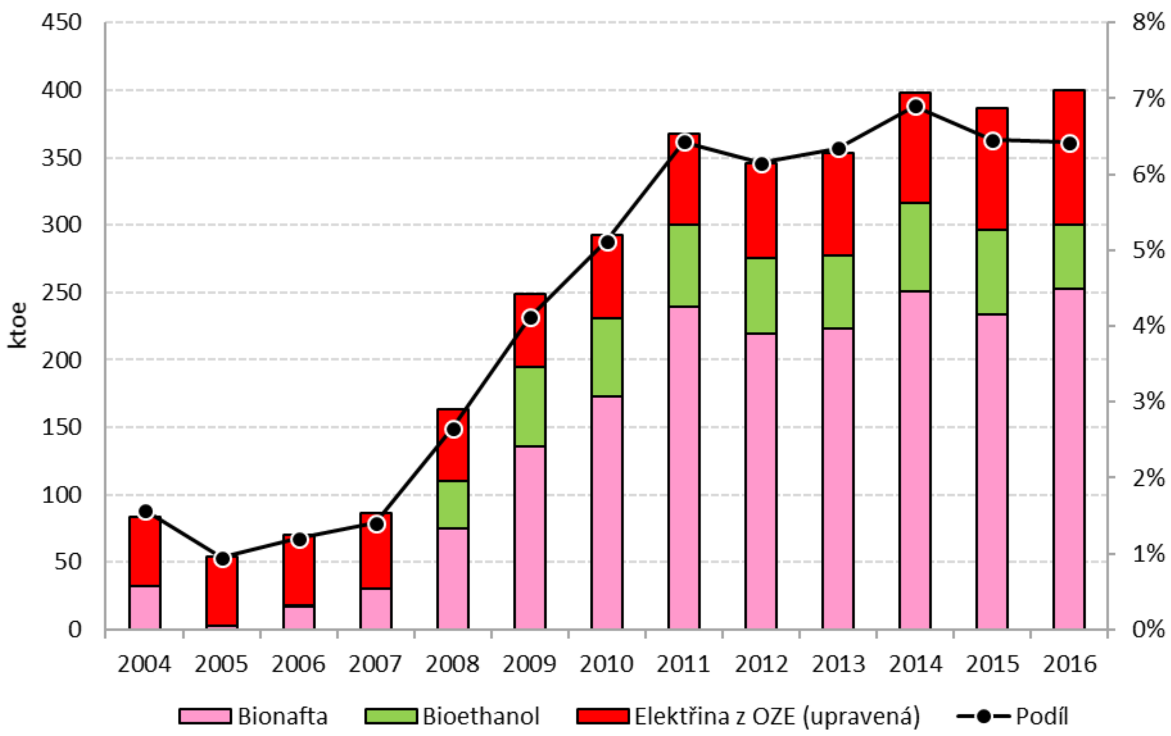
Větrné elektrárny – Wind power plants

Biologicky rozlož. Část TKO – Biodegradable part of SMW

Fotovoltaické systémy – PV systems

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

Chart 55: *RES share in gross final consumption in the transport sector*



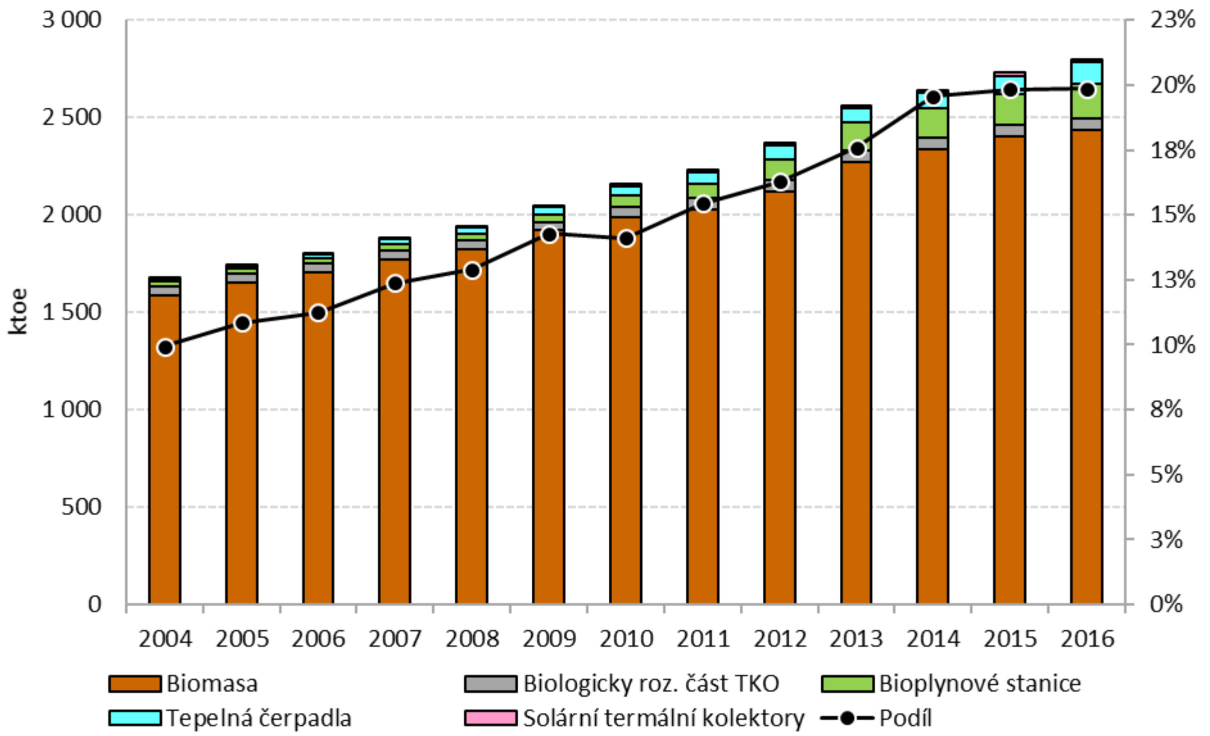
Bionafta – Biodiesel

Elektřina z OZE (upravená) – RES electricity (adjusted)

Podíl - Share

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

Chart 56: *RES share in gross final consumption in the heating and cooling sector*



Biomasa – Biomass

Bioplynové stanice – Biogas stations

Tepelná čerpadla – heat pumps

Biologicky rozlož. Část TKO – Biodegradable part of SMW

Solární termální kolektory – Solar thermal collectors

Podíl - Share

Source: RES share based on EUROSTAT methodology (MIT, CZSO)

ii. Indicative projections of development with existing policies for the year 2030 (with an outlook to the year 2040)

In this respect, it is somewhat unclear what is meant by the term 'existing policies', whether these are the policies and measures that were valid prior to the preparation of the National Plan, or whether it also includes policies proposed in this document.

The estimated developments in the implementation of the policies and measures outlined in Chapter 3.1.2 is shown in the Chapter 2.1.2. The information on the expected developments after 2030 (2040) is provided in the analytical parts of this document (specifically in Annex 1).

Where necessary, it is possible to prepare a trajectory of the development of renewable energy sources if only the policies valid prior to the preparation of the National Plan are in force. In this respect, a relative stagnation of the share of renewable energy sources and gradually also a relative decline could be expected.

4.3 Dimension energy efficiency

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

Table 65: *Current primary and final energy consumption in the economy and by sector*

	unit	2012	2013	2014	2015	2016
Consumption of primary energy sources	TJ	1,821,390	1,822,045	1,768,524	1,778,490	1,748,832
Total final energy consumption	TJ	1,027,160	1,016,942	988,934	1,013,060	1,036,268
Final energy consumption by sector:						
industry	TJ	322,037	309,255	305,929	309,439	308,205
transport	TJ	254,667	252,132	261,317	271,722	281,919
households	TJ	295,993	302,129	271,721	280,197	289,792
services	TJ	126,994	124,667	121,140	123,224	127,743
Gross value added by sector – 2005 prices:						
Industry	CZK million	1,382,926	1,331,526	1,393,856	1,451,040	1,509,416
Services	CZK million	1,954,295	1,983,183	2,033,796	2,142,527	2,172,730
Gross value added by sector – current prices:						
Industry	CZK million	1,346,426	1,346,252	1,477,294	1,562,192	1,614,104
Services	CZK million	2,206,690	2,223,576	2,314,585	2,470,997	2,572,985
Available household income	CZK million	2,205,828	2,207,679	2,284,609	2,383,321	2,463,541
Gross domestic product (GDP) – 2005 prices	CZK million	3,718,662	3,700,676	3,801,154	4,002,966	4,106,776
Gross domestic product (GDP) – current prices	CZK million	4,059,912	4,098,128	4,313,789	4,595,783	4,773,240
Production of electricity from heat power plants	GWh	81,993	80,760	80,587	77,984	77,479
Production of electricity from cogeneration	GWh	42,305	42,052	42,680	42,424	42,904
Production of heat from heat power plants	TJ	136,203	137,305	119,747	121,307	128,439
Production of heat from cogeneration incl. waste heat from industrial processes	TJ	106,180	107,005	94,380	95,794	100,759
Fuel consumption for the production of electricity from thermal power plants	TJ	972,982	955,940	934,323	900,297	886,649
Number of passenger-kilometres – Ministry of Transport	pkm million	107,794	107,172	110,114	113,814	118,957
Number of tonne-kilometres – Ministry of Transport	tkm million	68,087	71,509	71,421	76,613	68,172
Population (median) – CZSO	person	10,509,286	10,510,719	10,524,783	10,542,942	10,565,284

Source: June Progress report on meeting national energy-efficiency targets in the Czech Republic

ii. Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling[118]

According to the assessment of the potential of high-efficiency CHP and efficient district heating and cooling, the greatest potential for high-efficiency CHP is in small and medium-scale CHP sources using gaseous fuels of about 13.7 PJ by 2025. The second highest potential is in micro-cogeneration (5 PJ), followed by the potential in individual biomass boilers (4.5 PJ) by 2020. The analysis states that in the case of large sources and central heating plants the potential is already exhausted.

[118] In accordance with Article 14(1) of Directive 2012/27/EU.

Table 66: *Cogeneration potential*

Technology	Potential for the development of heat production in the Czech Republic by 2025	Comment
Large cogeneration sources using brown coal	None (austerity measures on the consumption side will offset the growth of new consumers)	Slight decline (thermal insulation); partly switching to other fuels
Large cogeneration sources using black coal	None (austerity measures on the consumption side will offset the growth of new consumers)	Slight decline (thermal insulation); partly switching to other fuels
Large cogeneration sources using gaseous or liquid fuels	None (austerity measures on the consumption side will offset the growth of new consumers)	Stagnation or slight decline (thermal insulation)
Biomass cogeneration sources	0.3 PJ for smaller sources (including co-firing with coal up to 4.5 PJ)	Use of biomass for co-firing and moderate development of smaller cogeneration sources
Biogas cogeneration stations	2 PJ (heat output from existing BGS + new BGS always with cogeneration)	Moderate development of new sources and heat output from existing ones
Waste incinerators with cogeneration	3 PJ	Development of municipal waste incineration plants in relation to waste management plans
Nuclear power plants	1.5 PJ	Potential heat output from Temelín power plant
Waste and chemical heat	Not quantified	Potential in the form of process heat use
Small and medium-sized cogeneration sources using gaseous fuels	13.7 PJ	Development in the form of replacement of heat plant sources or in new consumption points
Central heat plant sources	None (unless heat plants limit CHP owing to inefficient electricity production)	Decline in heat plants using solid fossil fuels and natural gas
Individual gas boilers	Not quantified But it can represent the easiest replacement of a central source.	Stagnation, possibly a slight transition to the use of gas heat pumps
Individual solid fossil fuel boilers	None	Despite the existing support for boiler replacement, the use of solid fuels is expected to decline.
Individual biomass boilers	4.5 PJ by 2020	Stagnation (pellet boilers in new buildings vs switching to other fuels in the existing ones)
Individual electric boilers and heat pumps	For new consumption, potential rather for heat pumps (8.3 PJ by 2020)	Significant increase in electric heat pumps, partly at the expense of electric boilers.
Micro-cogeneration	5 PJ	Development in the form of addition of separate heat production

Source: Assessment of the potential of high-efficiency cogeneration and efficient district heating and cooling for the Czech Republic (December 2015)

In this respect, it is also desirable to maintain central heat supply systems where their operation is more efficient and more environmentally friendly than individual heating technology. In order to ensure a sufficient level of energy security in the heating sector, maximum use of domestic primary energy sources is needed. In relation to central heat sources, it mainly involves the most efficient use of domestic coal within high-efficiency CHP, in line with best available techniques (BAT). At the same time, it is desirable to increase the share of biomass in final heat consumption, whether in the form of co-firing with coal on central heat sources or in the form of domestic biomass boilers. Within central heat supply, it is necessary to create suitable conditions for the use of waste heat.

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)[119]

4.3.1.1 National energy efficiency target by 2020

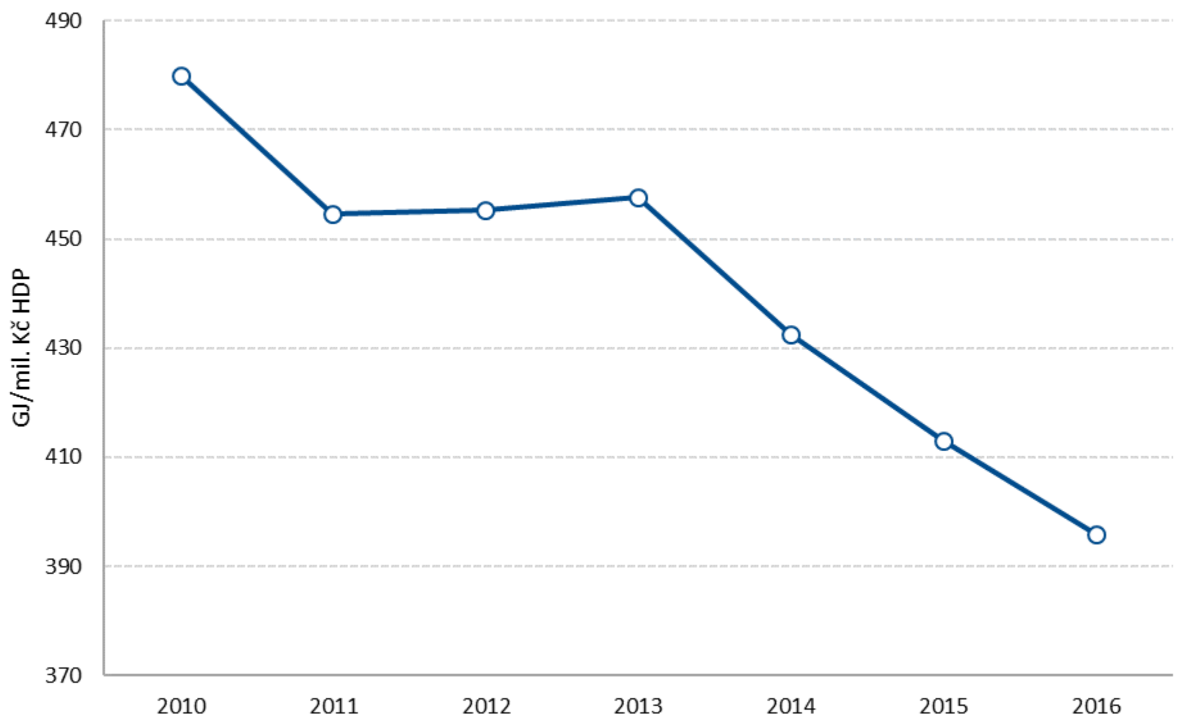
The analysis of the trend of energy consumption shows an annual increase in final energy consumption in recent years. There are two parallel trends in energy consumption in the Czech Republic. On the one hand, there has been a long-term reduction in the energy intensity of the economy per gross added value produced, while on the other hand the absolute level of final energy consumption has been rising for several years. The climb in final energy consumption is owing to rising consumption in the household sector and, above all, in the transport sector.

Consumption grew by 2.3 % year-on-year in 2016, which in absolute terms represents 23 PJ. The increase in final energy consumption is primarily owing to an increase in consumption in the household sector and, above all, in the transport sector. Conversely, the consumption in the industrial sector declined year on year. The fundamental fact is that, despite the increasing final energy consumption, the energy intensity of the economy has been decreasing for a long time. In 2016, it fell by 4 % year-on-year to 395.8 GJ per CZK one million of GDP[120]**.**

[119] This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in 2.3 and conversion factors.

[120] Gross domestic product at 2010 market prices (source: Eurostat).

Chart 57: *Development of energy intensity of the Czech Republic, 2010–2016*



Mil. Kč HDP – CZK million of GDP

Source: Eurostat

Household energy consumption (including external effects, see below) rose by almost 3.5 % year-on-year in 2016. However, the year-on-year increase in energy consumption in 2016 is to be seen in relation to external influences with an impact on energy consumption, in this respect, above all, in relation to climatic conditions. Energy consumption in 2014 and 2015 was affected by the above-average temperatures during the heating season, which led to reduced energy consumption for heating by comparison with 2013[121]. For this reason, it is necessary to see this level of consumption as a statistically unrelated value and the latest development of energy consumption in 2016 is to be compared with the year 2013, which is close to the average value of degree days in the period 2010–2016[122]. In 2016 household energy consumption decreased by more than 12 PJs in comparison with 2013.

In the previous period, household energy consumption was also influenced by the increase in the number of new apartment units, increase in the average floor area of apartment units[123] and a decrease

[121] In 2016, the value of degree days in the heating season was about 12 % higher than in 2014 and 4 % higher than in 2015. The value of degree days in 2016 was lower by 6 % compared to 2013, and 1 % lower compared with the average (Source: CHMI).
[122] In 2013, the value of degree days was close to the average values for 2010–2016, being 5 % above this average. In 2016, the value of degree days was 1 % lower than the average values (Source: CHMI).
[123] In 2004–2015 the average floor area of apartments increased by 5 % (Source: CZSO – ENERGO 2015).

in the number of people living in one apartment unit[124]. In terms of demography, consumption is influenced by an increase in population and in disposable household incomes[125], which leads to the increasing standard of living and influences consumer behaviour with an impact on energy consumption.

However, the final energy consumption adjusted for climate impacts in the household sector is stagnating. In 2016, the energy consumption for heating adjusted for climate impacts per apartment unit was at the same level as in 2015, equivalent to approximately 50 GJ per apartment. The relatively constant level of energy consumption combined with the effects of the above-mentioned factors that increase household energy consumption, ceteris paribus, means that to a significant extent household consumption is affected by improving energy performance of buildings. Measures to reduce the energy performance of buildings are implemented ‘spontaneously’ as a result of individual realisations without State support or as a result of implementation of Article 7 of the Directive. The analysis shows that the State supports only 30 % of projects for thermal insulation of apartments in family and apartment buildings, 6 % of heat pumps and 25 % of solar thermal systems. There are therefore significantly more projects outside the scheme of Article 7 of the Directive.

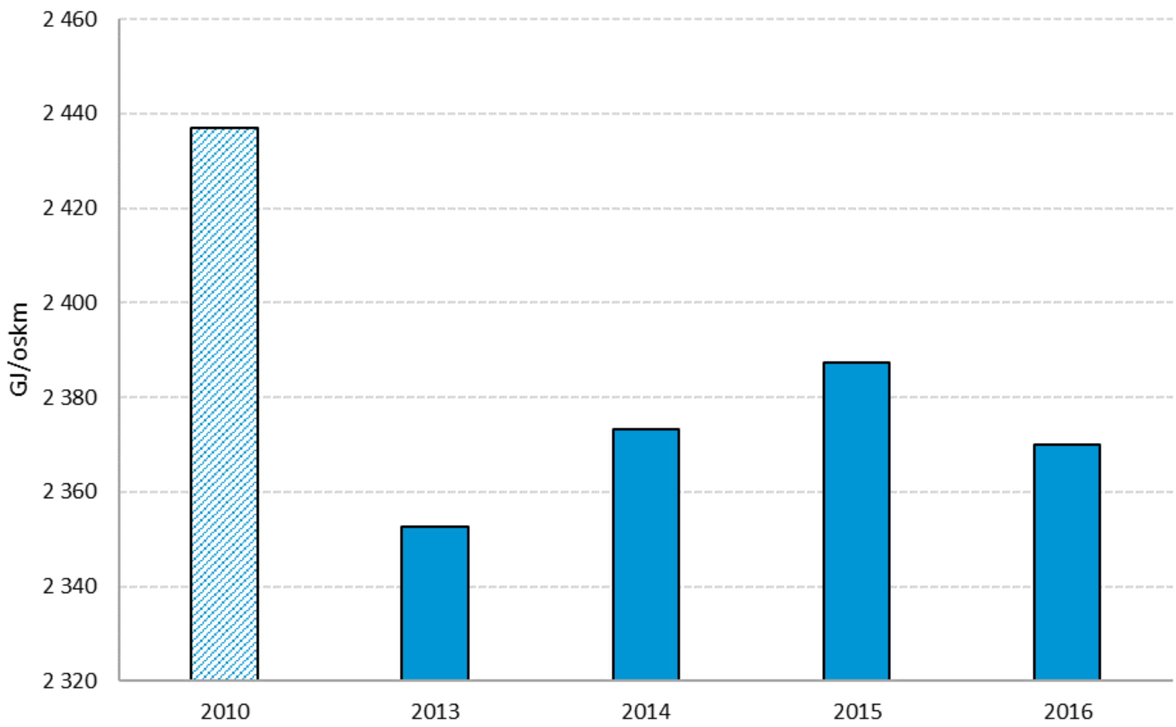
In the transport sector, there has been a consistent increase in energy consumption. Energy consumption in the transport sector rose by 4 % year-on-year in 2016, totalling around 10 PJ. The increase in consumption was due mainly to an increase in the number of passenger-kilometres, which grew by 4.5 % year-on-year. Despite the year-on-year increase in passenger-kilometres, energy consumption per person-km was reduced year-on-year in 2016 (including individual car and public transport[126]) as well as energy consumption per car (includes only individual car transport). Based on the development of these indicators, it is possible to assume that efficiency in passenger transport has increased.

[124] The decrease in the number of persons living in one apartment unit is due to the trend of independent living. The average number of persons in a flat decreased by 11 % between 2004 and 2015 (Source: CZSO – ENERGO 2015).

[125] Gross disposable income grew by 4.3 % year-on-year in 2015 and by 3.4 % year-on-year in 2016 (Source: Eurostat).

[126] Public transport includes rail, bus, air, inland waterways and urban public transport.

Chart 58: *Energy consumption in the transport sector per passenger kilometre, 2010–2016*



Oskm – passenger-km

Source: Ministry of Transport, Eurostat

Chart 59: *Energy consumption in the transport sector per car, 2010–2016*

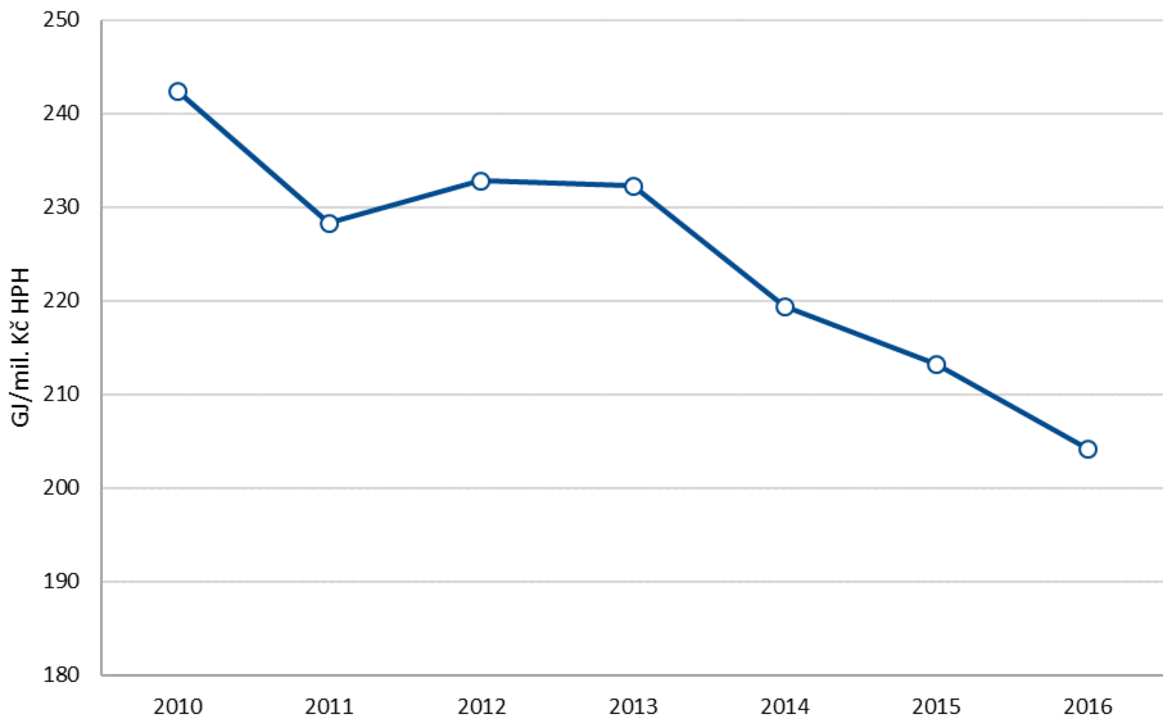
Automobil - car

Source: Ministry of Transport, Eurostat

Unlike other sectors, the industry sector saw a decrease in energy consumption. Consumption in this sector fell by almost than 4 % despite the fact that gross value added rose by 4 %. Based on this long-term trend, the industry's energy intensity of gross added value (GVA) has been steadily decreasing since 2012. By comparison with 2015, the industry's energy intensity declined by more than 4 % year-on-year. There has also been a consistent decline in the ratio of energy consumption to industrial production, which is measured against the Industrial Production Index (IPI)[127]. In 2016, this ratio declined by 3.7 % year-on-year, confirming the trend of increasing technical efficiency in the industry sector.

[127] The Industrial Production Index (IPI) measures the output of industrial sectors adjusted for price effects. The index is primarily calculated as the monthly base index, currently in relation to the average month of 2015.

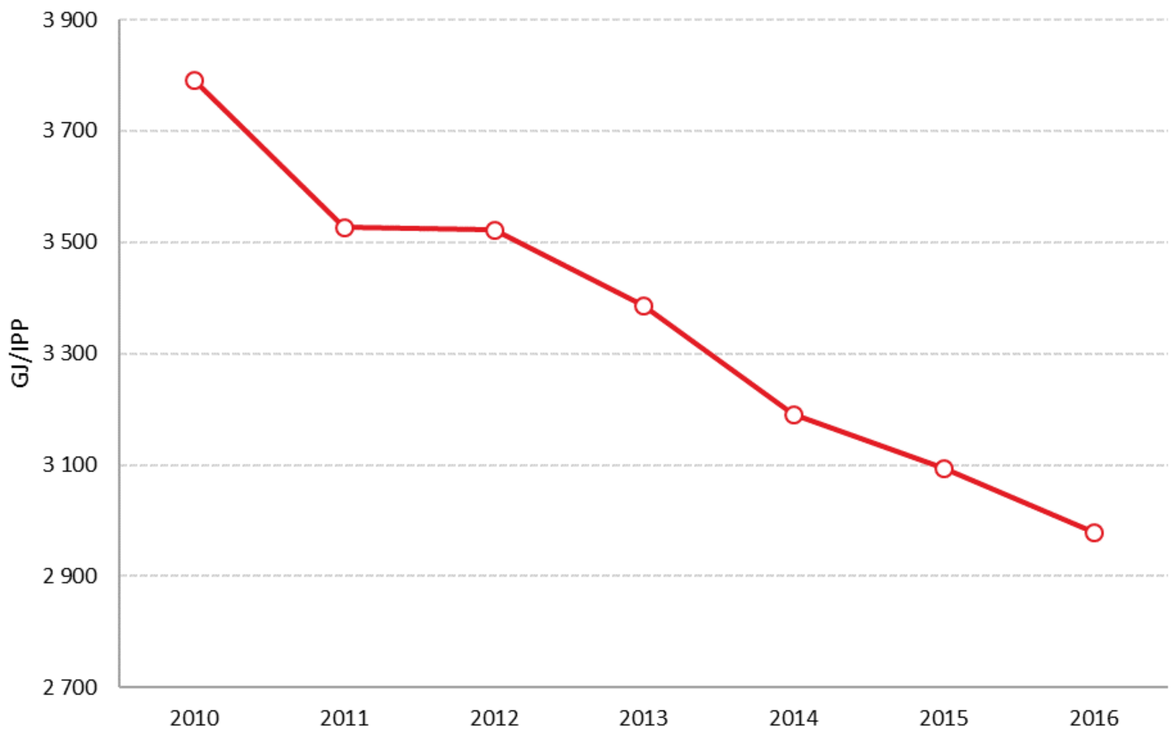
Chart 60: *Development of energy intensity of industry of the Czech Republic, 2010–2016*



Mil. Kč HPH – CZK million of GVA

Source: Eurostat

Chart 61: *Energy consumption in relation to industrial production, 2010–2016*

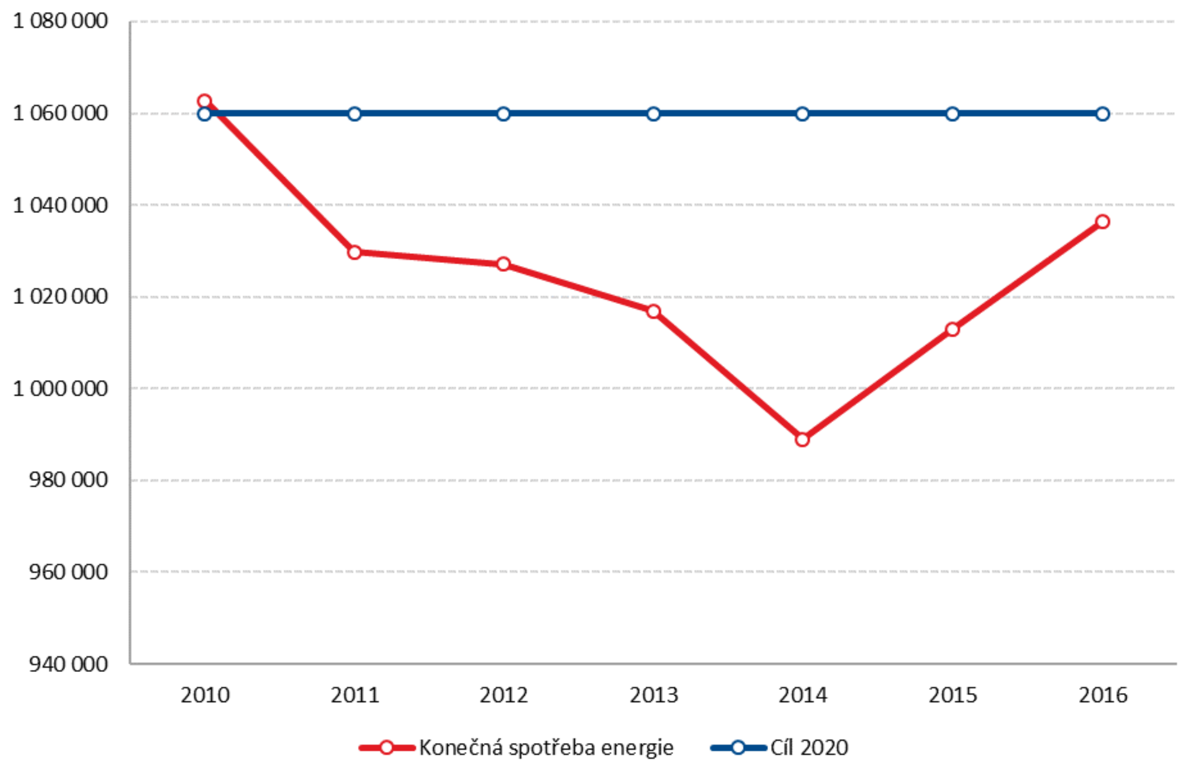


IPP - IPI

Source: Czech Statistical Office, Eurostat

In the services sector, final energy consumption grew year-on-year by around 3.5 %, which is approximately 4.5 PJ. The increase in consumption in the services sector was mainly owing to the increase in the economic performance of the sector and the increase in the number of employees. On average, energy consumption per employee in the services sector has increased on average since 2014, reaching approximately the 2013 level in 2016.

Chart 62: *Development of final energy consumption of the Czech Republic, 2010–2016 (in TJ)*



Konečná spotřeba energie – Final energy consumption

Cíl 2020 – 2020 target

Source: Eurostat

In view of the above, current data show the positive trend of progress towards the national energy efficiency target set in accordance with Article 3 of Directive 2012/27/EU.

4.3.1.2 Contribution of the Czech Republic to the non-binding EU target by 2030

The national target will be determined as the maximum potential for reducing energy consumption in individual sectors of the economy, i.e. at the limit of final energy consumption that the Czech Republic can realistically achieve. This potential reflects the effect of planned strategies, policies and measures to be implemented in the period up to 2030, under the following assumptions:

- considering the climatic conditions, an increase in the number of tropical days in the summer and significant changes and intensities of the heating season by comparison with 2016 are not envisaged;
- GDP growth in line with the assumptions in Chapter 4.14.1.1.2;
- annual increase in residential area, taking into account the demographic developments in the Czech Republic in accordance with the assumptions in Chapter 4.1.1.1;
- growth in transport performance in the transport sector;
- a change in the structure of the economy (growth of the services sector and a decrease of heavy industry);
- increase/decrease of production in industry.

Strategies and policies affecting the level of final energy consumption include, without limitation:

- Long-term strategy for the renovation of buildings pursuant to Article 2a of the Energy Performance of Buildings Directive;
- obligation under Article 5 of the Energy Efficiency Directive;
- obligation under Article 7 of the Energy Efficiency Directive;
- legislative and regulatory measures resulting from the transposition and implementation of national and EU legislation;
- planned strategies and policies in other areas including, *inter alia*, the transport sector and specified in the following strategic materials:
    - Czech Republic's State Energy Policy;
    - National Reform Programme (NRP);
    - State Environmental Policy;
    - Climate Policy in Czech Republic;
    - Strategic Framework for Sustainable Development of the Czech Republic;
    - Transport Policy of the Czech Republic for 2014–2020 with the Prospect of 2050

Table 67: *Development of primary energy sources by 2030 (PJ)*

Primary energy sources	2015	2016	2020	2025	2030
Coal and coal products	687.8	694.1	663.9	542.1	530.4
Oil and petroleum products	360.5	334.6	369.7	370.9	367.2
Natural gas	271.4	293.8	287.6	283.2	261.5
Renewable sources	179.1	180.4	196.3	215.5	234.8
Industrial and municipal waste	11.6	12.7	12.9	15.7	15.9
Nuclear power plants	292.6	263.0	339.3	339.5	339.8
Heat	-0.1	-0.1	-0.1	-0.1	-0.1
Electricity	-45.1	-39.5	-56.4	-27.9	-22.9
Total	1,758.0	1,739.0	1,813.2	1,739.0	1,726.6

Source: Prepared by MIT for the purposes of the National Plan

Table 68: *Development of final consumption by 2030 (PJ)*

Final consumption	2015	2016	2020	2025	2030

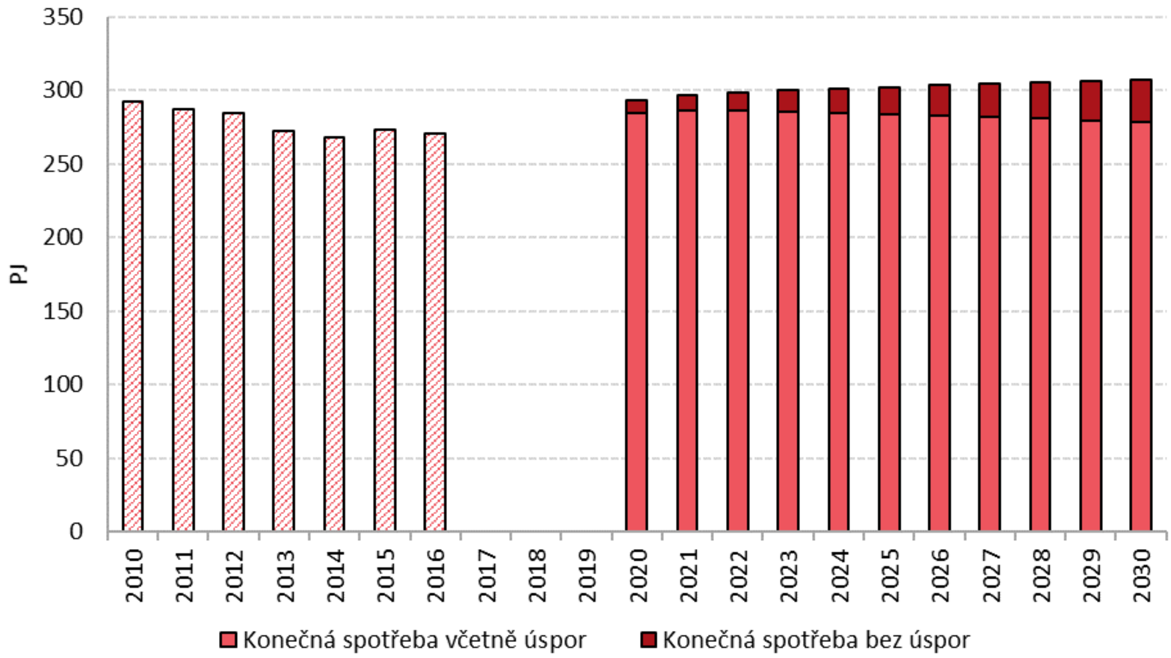
Industry	273.3	270.3	285.0	283.6	278.5
Transport	259.4	268.6	275.5	285.4	293.6
Households	285.0	296.8	288.5	281.6	273.8
Services	123.2	127.7	126.4	121.4	115.6
Agriculture	25.4	26.8	24.8	25.3	25.4
Other	5.5	3.1	3.1	3.1	3.1
Total	971.8	993.4	1,003.4	1000.3	990.1

Source: Prepared by MIT for the purposes of the National Plan

The outlook for the development of final consumption in the industry was determined on the basis of the prediction of the development of the naturally expressed output in basic industrial sectors (iron and steel, non-ferrous metals, chemical industry, etc.), in total 13 sectors and assumptions with regard to the expected change in energy intensity. In each of these sectors, the most energy-intensive products, accounting for a significant part of the sector’s energy consumption, were selected. These are productions that are statistically monitored by the Czech Statistical Office and it is therefore possible to evaluate historical trends and at the same time to continuously evaluate the differences between the anticipated and the real development. Energy consumption is also monitored for these products and it is therefore possible to determine the energy intensity of their production. In this respect, assumptions have been made on the expected reduction in energy intensity individually for each product, taking into account existing technologies and measures in the sector and the remaining potential for the use of technologies that meet the best available technology criterion. The monitored products form a significant part of the energy consumption of the industry sector; the energy consumption not directly related to the technological process was then quantified separately. Final consumption without energy savings then corresponds to developments in the industry sector, provided that there is no change in the energy intensity of individual products, which would remain constant at 2016 levels.

The main boundary conditions are the development of the production of individual products related to the overall assumptions about the economic development and the development of the energy intensity of the individual monitored products. This procedure allows the development of the quantities influencing the boundary conditions to be statistically monitored and the possible deviations to be evaluated.

Chart 63: *Development of final consumption in the industry sector*



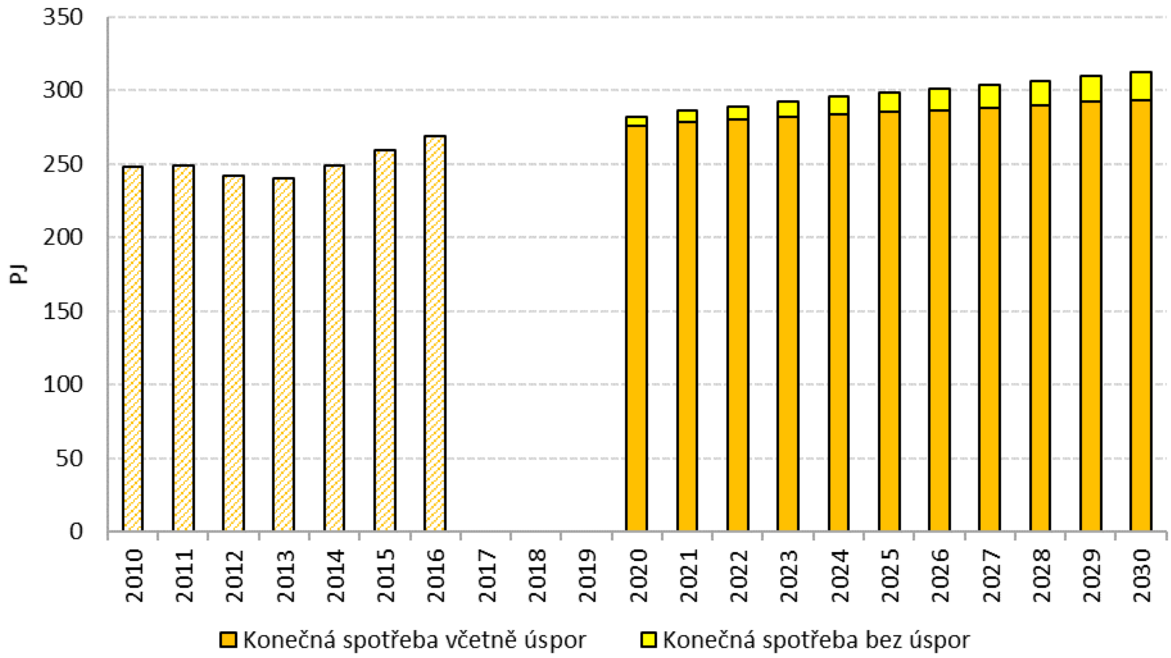
Konečná spotřeba včetně úspor – Final consumption incl. savings

Konečná spotřeba bez úspor – Final consumption excl. savings

Source: Prepared by MIT for the purposes of the National Plan

The expected development of final consumption in the transport sector is based in particular on the expected development of passenger and freight transport performances, which are also based on assumptions about the development of economic growth and other socio-economic variables. Detailed assumptions about the development of transport performance are part of this document. Final consumption without saving shown in the graph below shows a situation where there would be no decrease in energy intensity relative to the unit of transport performance. Final consumption, including savings, then assumes decreased intensity in relation to the expected development and the relevant policies in transport.

Chart 64: *Development of final consumption in the transport sector*



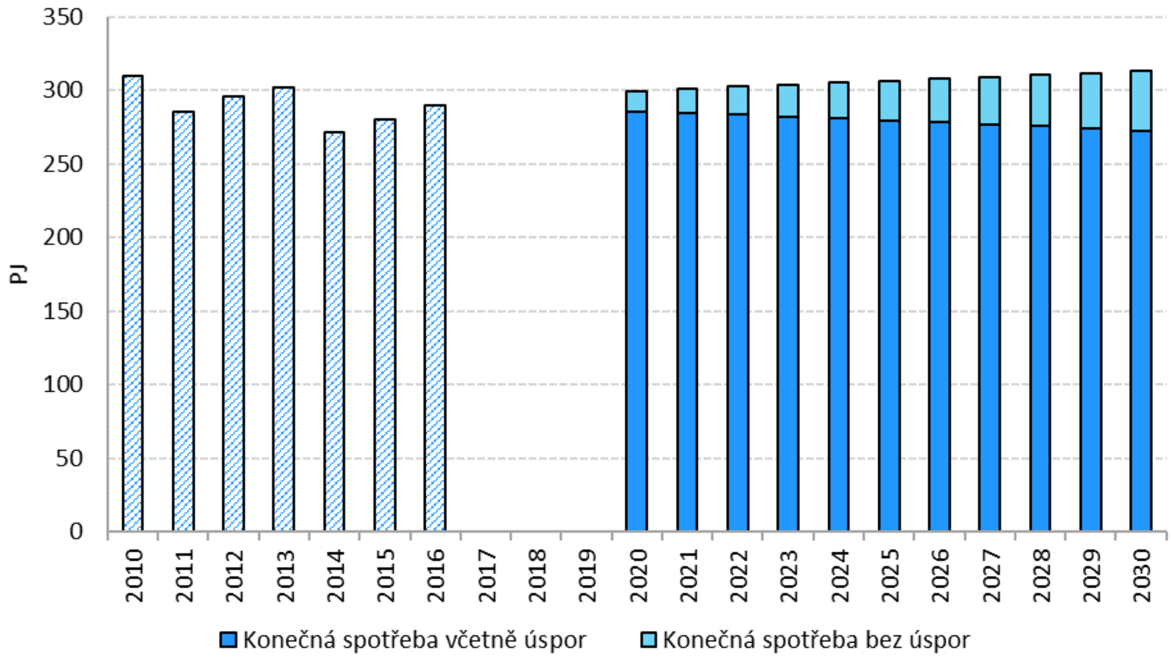
Konečná spotřeba včetně úspor – Final consumption incl. savings

Konečná spotřeba bez úspor – Final consumption excl. savings

Source: Prepared by MIT for the purposes of the National Plan

Energy consumption in the household sector reflects the rate and depth of renovation of existing buildings corresponding to the likely scenario of a long-term renovation strategy for buildings and, in case of new construction, requirements for the energy performance of new buildings. At the same time, however, continued construction is envisaged, in line with the assumptions of demographic change and the development of households.

Chart 65: *Development of final consumption in the household sector*



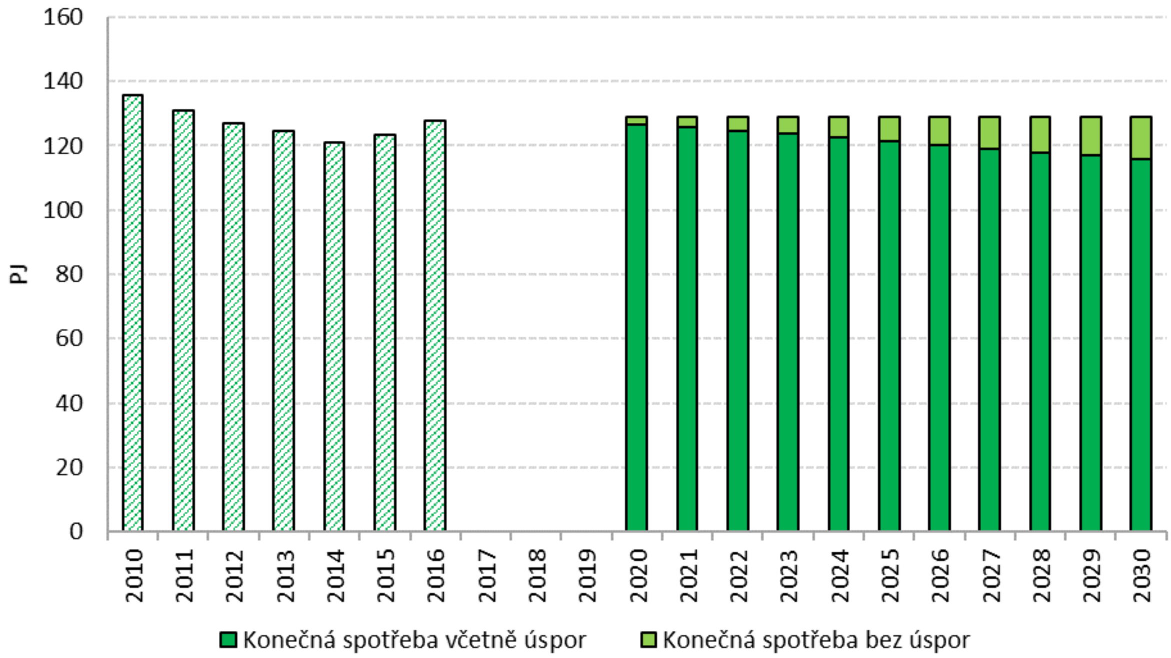
Konečná spotřeba včetně úspor – Final consumption incl. savings

Konečná spotřeba bez úspor – Final consumption excl. savings

Source: Prepared by MIT for the purposes of the National Plan

The evolution of final consumption in the services sector reflects the expected development of economic growth in this sector. At the same time, the assumptions of ongoing renovation of buildings in this sector in accordance with the renovation strategy are reflected.

Chart 66: *Development of final consumption in the services sector*



Konečná spotřeba včetně úspor – Final consumption incl. savings

Konečná spotřeba bez úspor – Final consumption excl. savings

Source: Prepared by MIT for the purposes of the National Plan

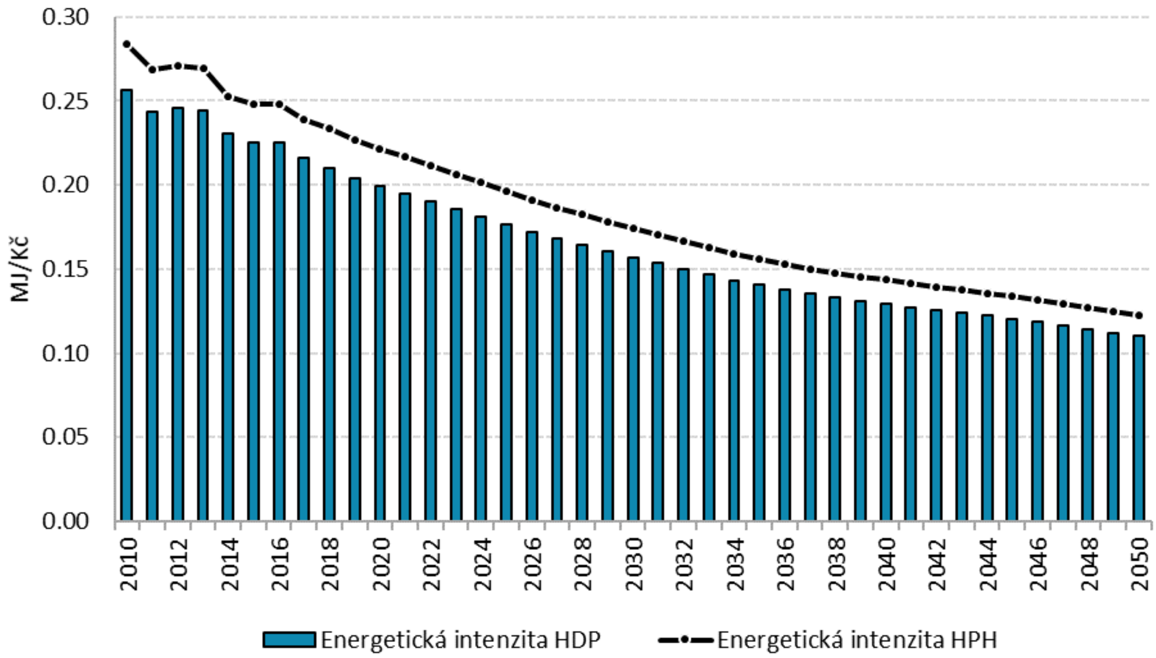
The following table and chart show the projected reduction in energy intensity of GDP and GVA production relative to the projected development of final consumption by 2030. In the event of economic growth based on the assumptions made about future developments, the energy intensity of GDP should increase by 30.24 % by 2030 by comparison with 2016 and that of GVA by 29.75 %.

Table 69: *Energy intensity of GDP and GVA in relation to final consumption (MJ/CZK)*

Energy intensity	2015	2016	2020	2025	2030
Gross domestic product	0.225	0.225	0.199	0.177	0.157
Gross value added	0.248	0.248	0.221	0.196	0.174

Source: Prepared by MIT for the purposes of the National Plan

Chart 67: *Energy intensity of GDP and GVA in relation to final consumption*



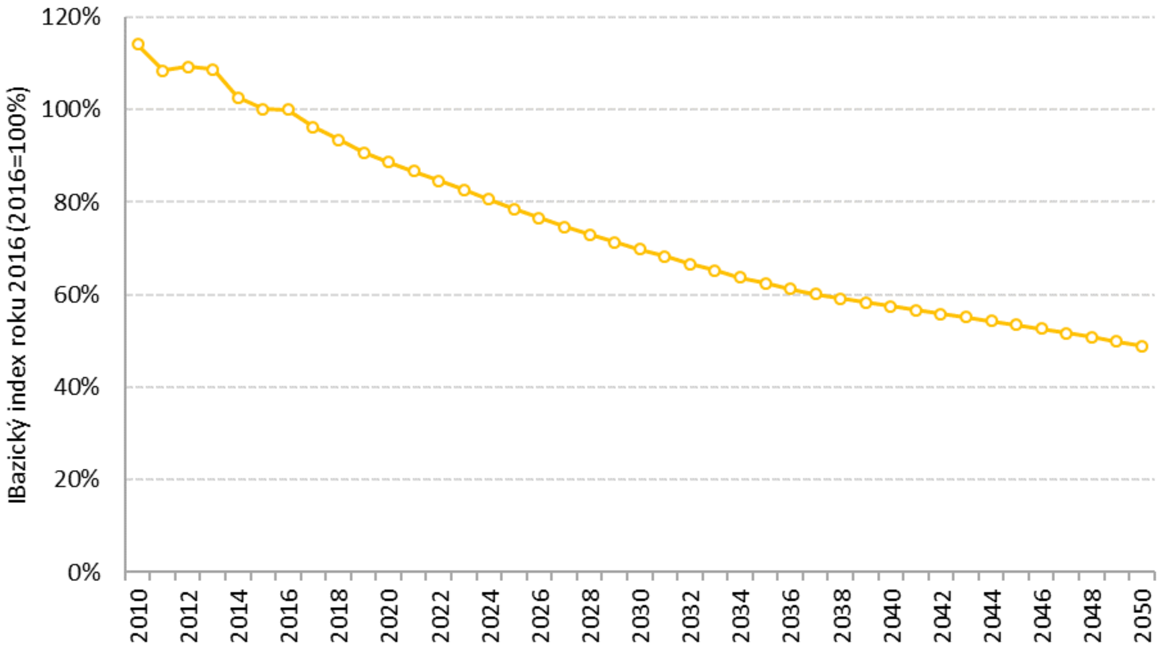
Energetická intenzita HDP – Energy intensity of GDP

Energetická intenzita HPH – Energy intensity of GVA

Kč - CZK

Source: Prepared by MIT for the purposes of the National Plan

Chart 68: *Basic index of energy intensity of GDP*



Bazický index roku 2016 – 2016 Basic index

Source: Prepared by MIT for the purposes of the National Plan

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

In 2010, the European Parliament adopted Directive 2010/31/EU on energy performance of buildings (EPBD II). Member States were required to introduce legislation by in 2012 to increase the energy performance of new and refurbished buildings in accordance with this Directive. The specification of the energy performance improvement in buildings must be carried out by individual Member States on a cost-optimal level so that the measures required by legislation are cost-effective. The EU requests that input data for cost-optimal level calculations be updated by 2017.

For the required optimisation, in June 2011 the European Commission issued methodological guidelines which partly specified the general methodological framework set out in the Directive.

Article 5 of Directive 2010/31/EU.

Calculation of cost-optimal levels of minimum energy performance requirements

January The Commission has establish by means of delegated acts in accordance with Articles 23, 24 and 25 by 30 June 2011 a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements.

The comparative methodology framework has been established in accordance with Annex III and shall differentiate between new and existing buildings and between different categories of buildings.

2. Member States have calculated cost-optimal levels of minimum energy performance requirements using the comparative methodology framework established in accordance with paragraph 1 and relevant parameters, such as climatic conditions and the practical accessibility of energy infrastructure,

and compare the results of this calculation with the minimum energy performance requirements in force.

Member States shall report to the Commission all input data and assumptions used for those calculations and the results of those calculations. The report may be included in the Energy Efficiency Action Plans referred to in Article 14(2) of Directive 2006/32/EC. Member States shall submit those reports to the Commission at regular intervals, which shall not be longer than five years. The first report shall be submitted by 30 June 2012.

March If the result of the comparison performed in accordance with paragraph 2 shows that the minimum energy performance requirements in force are significantly less energy efficient than cost-optimal levels of minimum energy performance requirements, the Member State concerned shall justify this difference in writing to the Commission in the report referred to in paragraph 2, accompanied, to the extent that the gap cannot be justified, by a plan outlining appropriate steps to significantly reduce the gap by the next review of the energy performance requirements as referred to in Article 4(1).

In this respect, it is also necessary to note that the Czech Republic has sent an update to the cost-optimal levels of minimum energy performance requirements in 2018.[128]

4.4 Dimension energy security

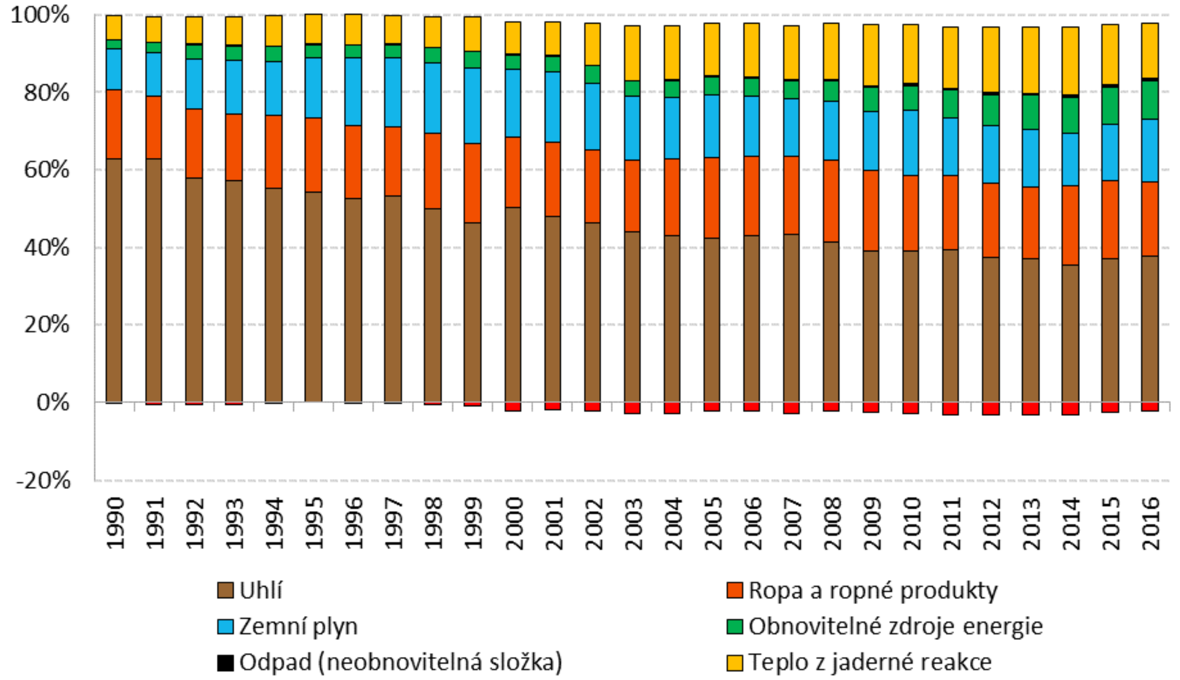
i. Current energy mix, domestic energy sources, import dependency, including relevant risks

4.4.1.1 Current energy mix

Chart 69 shows the evolution of the energy mix at the primary energy source level. In 2016 total primary energy sources amounted to 1 790.6 TJ. Solid fuels, especially brown and black coal, accounted for the largest share – 38.69 % (excluding electricity, which was negative). The second biggest source of energy is crude oil (and derived petroleum products), which accounted for 19.42 % in 2016. Natural gas accounted for 16.41 %. Nuclear reaction heat contributed 14.69 %. Renewables accounted for 10.08 %, and waste (its non-renewable component) accounted for around 1 % of the total energy mix.

[128] The update is in the form of a document entitled: Update of the inputs in the cost-optimal levels of buildings in the Czech Republic under Article 5 of the EPBD II available at: https://www.mpo-efekt.cz/upload/7799f3fd595eeee1fa66875530f33e8a/aktualizace-nakladoveho-optima-v10.pdf

Chart 69: *Evolution of the energy mix at the primary energy source level*



Uhlí – Coal

Zemní plyn – Natural gas

Ropa a ropné produkty – Oil and petroleum products

Obnovitekné zdroje energie – Renewable energy sources

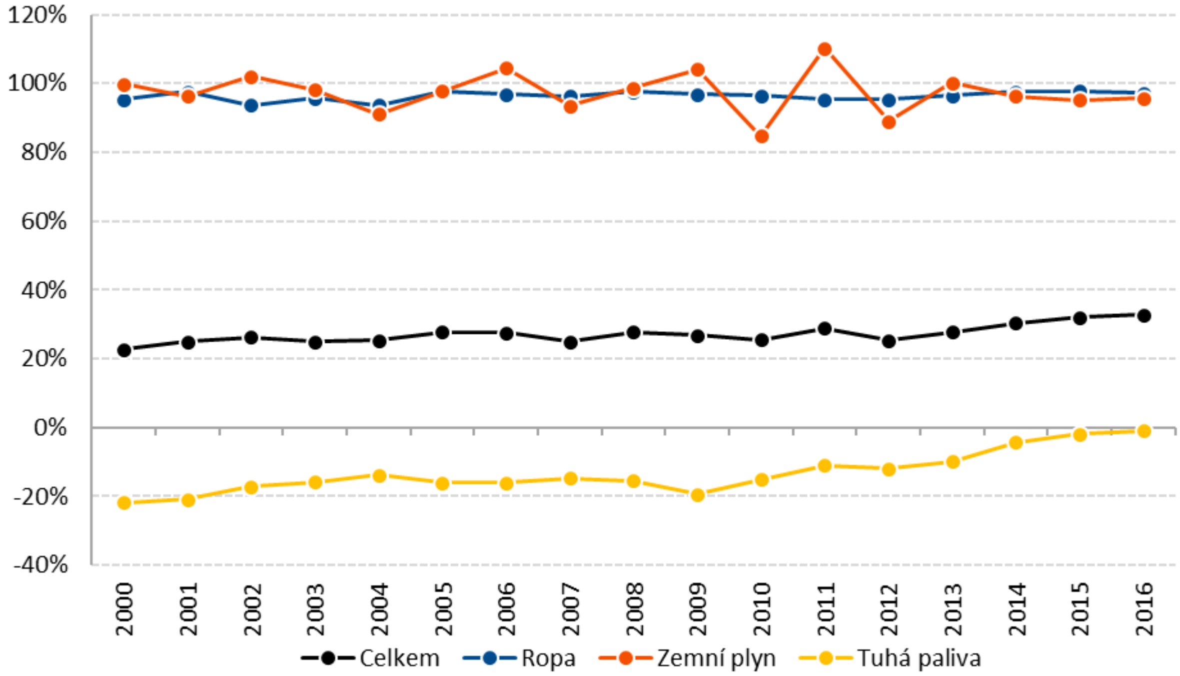
Odpad (neobnovitelná složka) – Waste (non-renewable component)

Source: Energy balance according to EUROSTAT methodology (1 December 2017)

4.4.1.2 Import dependence

According to the Eurostat database, the total import dependence of the Czech Republic is about 30 % (in 2016 it was 32.8 %). The Czech Republic is, in essence, fully dependent on imports from third countries in the field of oil and natural gas. The Czech Republic extracts oil and natural gas, but the quantities are marginal given the overall need. In the case of consumption of solid fuels, especially brown and black coal, the Czech Republic is currently self-sufficient. Nuclear fuel for both domestic nuclear power plants is also imported; after the cessation of uranium mining in 2017, the Czech Republic is also fully dependent on imports of feedstock for the enrichment and manufacture of nuclear fuel. The Czech Republic is also an electricity exporter (about 11 TWh in 2016).

Chart 70: *Import dependence by major fuels*



celkem – total

Ropa – oil

Zemní plyn – natural gas

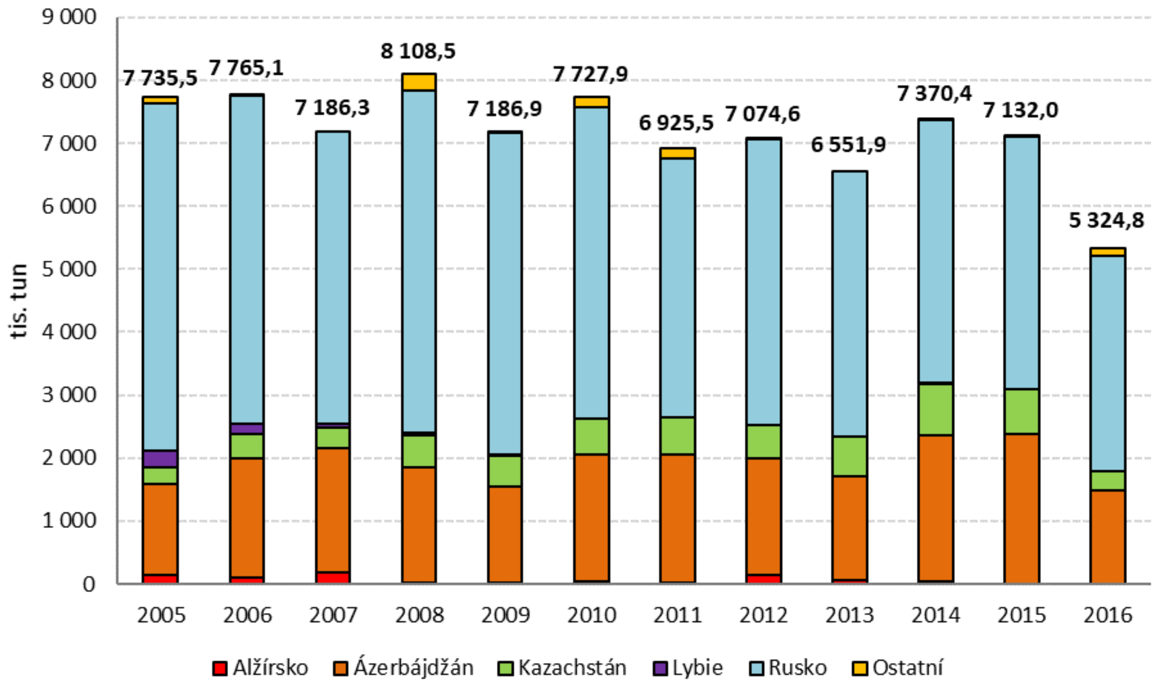
Tuhá paliva – solid fuels

Source: EUROSTAT

4.4.1.3 Oil and petroleum products

In 2017 the Czech Republic imported 7 813.6 thousand tonnes of crude oil (average imports over the last 10 years total 7 127.5 thousand tonnes). The largest part was imported from the Russian Federation (52.47 %), Azerbaijan (31.04 %) and Kazakhstan (12.62 %); other countries accounted for 3.86 %. Domestic mining in 2016 was only 117 thousand tonnes. The Czech Republic uses two crude oil pipelines: the Druzhba pipeline (transport capacity available to the Czech Republic is 9 million tonnes of oil per year), which mainly transports oil from Russia, and the IKL pipeline (transport capacity of 10 million tonnes of oil per year), which transports oil from the Caspian Sea. The Czech Republic thus enjoys diversification of both sources and transport routes. In 2017, oil import costs totalled CZK 72 396 million (the average over the last 10 years is CZK 84 947 million). The Czech Republic also imports some petroleum products as well as exports a part of its own petroleum products. The total negative balance of foreign trade in oil and petroleum products is therefore approximately CZK 80 billion. In 2017, the negative balance was CZK 91.7 billion; in 2014, however, it was CZK 136.3 billion. The Czech Republic processes oil in two refineries in Litvínov and Kralupy. The aggregate processing capacity of both refineries is approximately 8.7 million tonnes of oil per year. The domestic refinery output covers approximately 80 % of national gasoline and diesel consumption. The refinery in Litvínov – Záluží processes in particular the Russian Export Blend, which is transported to the Czech Republic by the Druzhba pipeline (and a relatively small quantity also by the IKL pipeline). The refinery in Kralupy processes 'sweet crude oil', i.e. low-sulphur crude oil imported into the Czech Republic by the IKL oil pipeline, namely oil from the Caspian Sea, i.e. the Azeri, CPC and Turkmen blends, as well as crude oil from North Africa.[129]

Chart 71: *Imports of petroleum into the Czech Republic by country of origin in 2005–2016*



tis. Tun – thousand tonnes

Alžírsko – Algeria

Azerbajdžán – Azerbaijan

Kazachstán – Kazakhstan

Lybie – Lybia

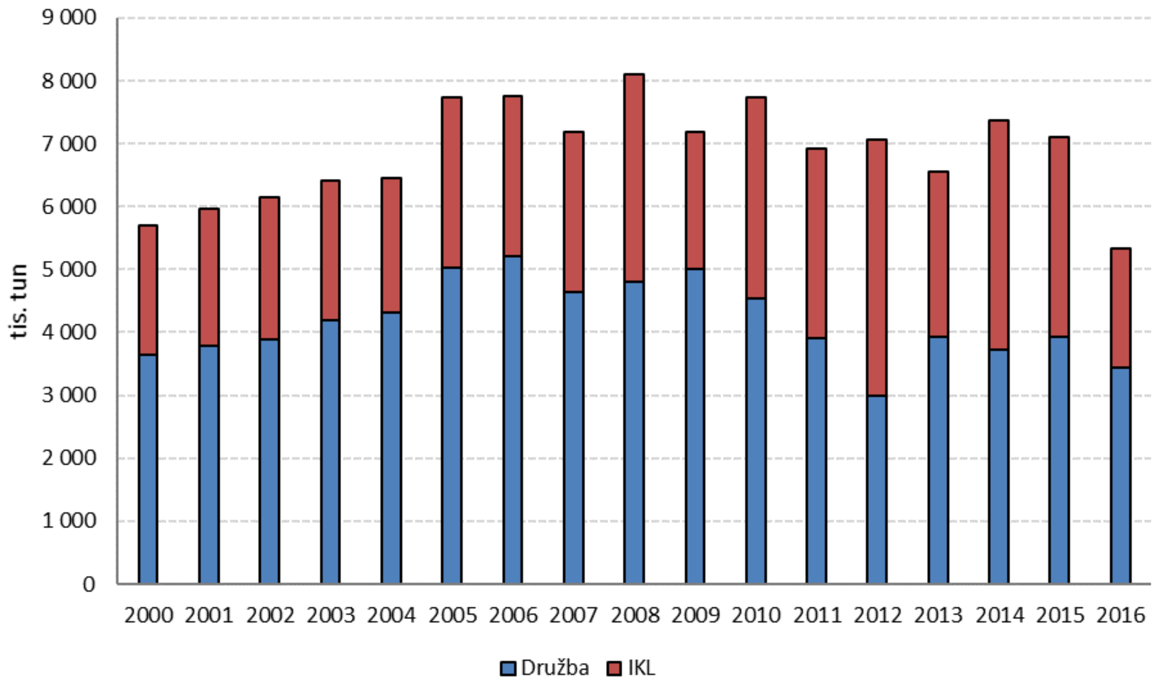
Rusko – Russia

Ostatní - Other

Source: Czech Statistical Office

[129] For more information, see the Report on the Development of the Energy Sector in Oil and Petroleum Products 2016, available at: https://www.mpo.cz/cz/energetika/statni-energeticka-politika/zprava-o-vyvoji-energetickeho-sektoru-v-oblasti-ropy-a-ropnych-produktu-za-rok-2016--235988/

Chart 72: *Development of crude oil imports into the Czech Republic by Družba and IKL pipelines, 2000–2016*

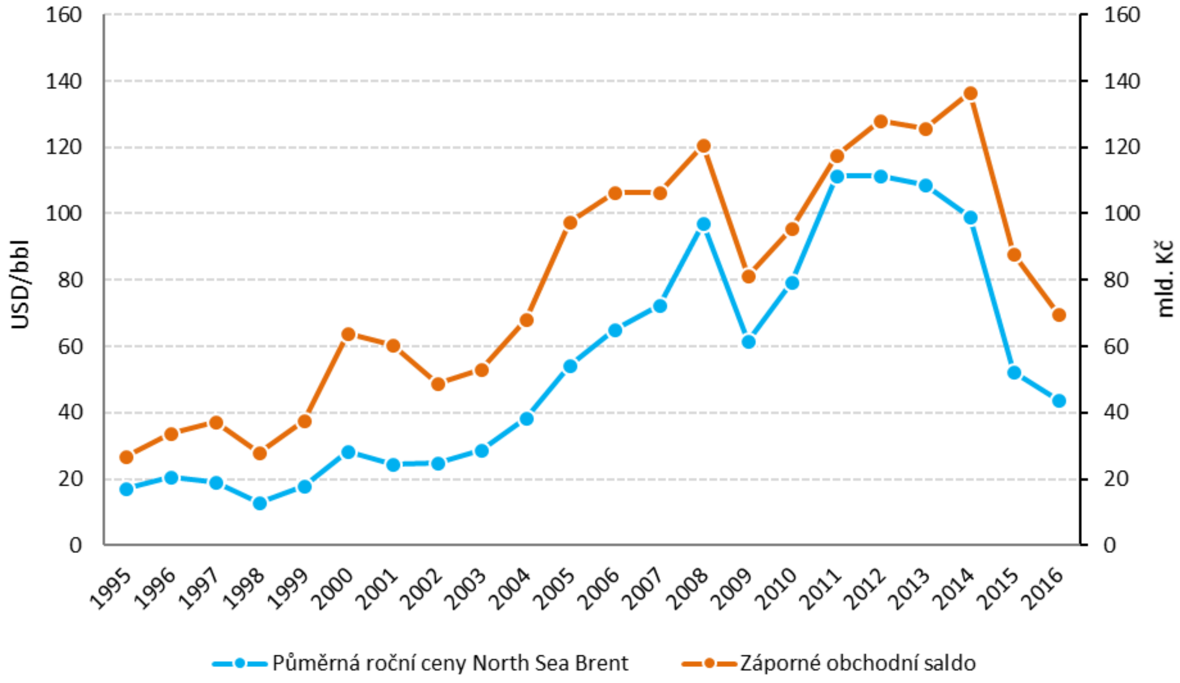


Tis. Tun – thousand tonnes

Družba - Druzhba

Source: MERO, a.s.

Chart 73: *Price development of crude oil Brent and negative foreign trade balance in the oil sector*



Průměrná roční cena North Sea Brent – Average annual price of North Sea Brent

Záporné obchodní saldo – Negative trade balance

Mld kč. – CZK billion

Source: Oil and petroleum products – 2016 balance (MIT)

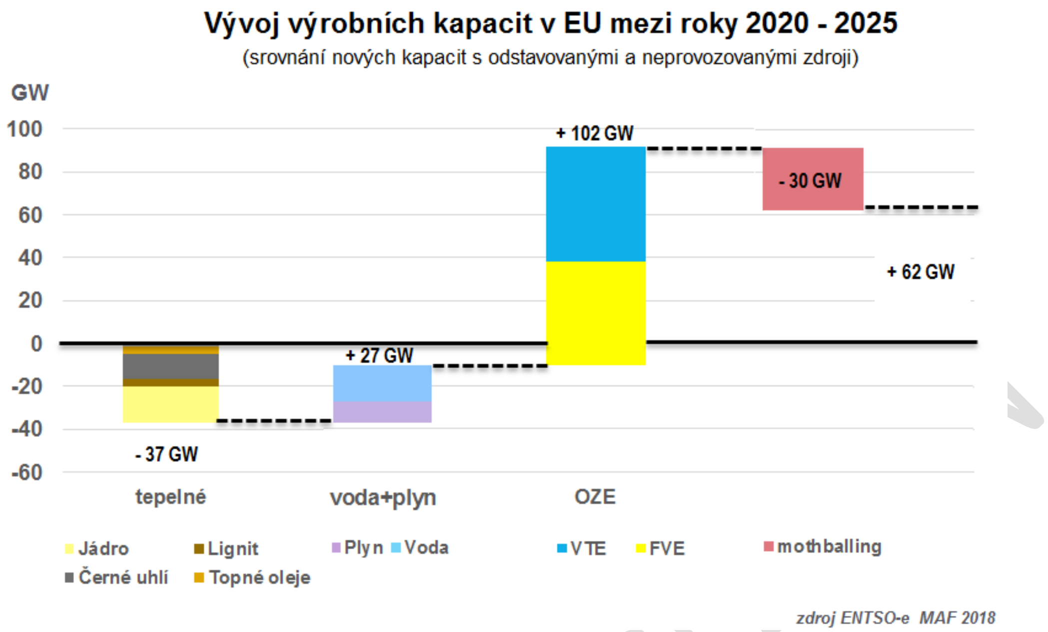
4.4.1.4 Production capacity development and ensuring electricity balance in the long term

The transmission system operator, ČEPS, a.s., thoroughly analyses the current risks associated with the development of production capacities in the EU. To this end, and in accordance with Regulation (EC) No 714/2009, it prepares and publishes on a yearly basis the Assessment of the Czech Electricity System Production Adequacy. The current assessment covers the period until 2030 and is available on the ČEPS, a.s. and MIT websites.

The main conclusion of the assessment is that the production adequacy of the Czech Republic is dependent on the operation of system sources, i.e. of all existing nuclear power plants, and is threatened by the shutdown of nuclear as well as coal production sources.

It is evident that the position of individual TSOs on the future availability of production capacities is gradually changing, given the real risks of an aging production portfolio and the adoption of further environmental measures requiring demanding technological interventions and investments for operators of conventional installations. The following figure shows the development of production capacities in 2020–2025, including the possible impacts and risks envisaged for the construction and operation of sources in the EU.

Chart 74: *Development of EU production capacities in 2020–2025 (GW)*



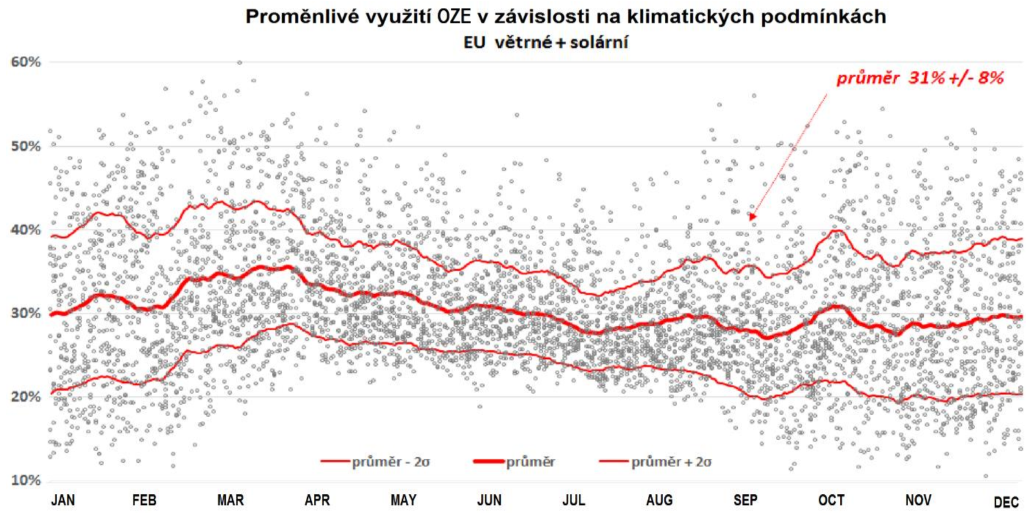
Vývoj výrobních kapacit v EU mezi roky 2020-2025 - Development of EU production capacities in 2020–2025
Srovnání nových kapacit s odstavovanými a neprovozovanými zdroji – Comparison of new capacities with sources being shut down and not operated sources
Tepelné – Thermal
voda+plyn – water+gas
OZE – RES

Jádro – Nuclear
Černé uhlí – Black coal
Lignit – Lignite
Topné oleje – Heating oils
Plyn – Gas
Voda – Water
VTE – WPP
FVE – PVPP
Zdroj - Source

Source: Assessment of the Czech Electricity System Production Adequacy 2030; Midterm Adequacy Forecast 2018

The above data illustrate the development of EU production capacities in 2020–2025. It is evident that after the end of the lifetime of the classical thermal sources covering the baseline load, these sources will be compensated mainly by renewable sources (RES) and partly by hydro and gas sources. Also included in the resulting balance by the ENTSO-E methodology is ‘mothballing’ of up to 30 GW, and at the same time it is necessary to adjust the increase in RES for seasonality (for example, only a small part of the total installed capacity may be available in winter).

Chart 75: *Variable use of RES depending on climatic conditions*



Proměnlivé využití OZE v závislosti na klimatických podmínkách - Variable use of RES depending on climatic conditions

EU větrné + solární – EU wind + solar

Průměr - average

Source: Assessment of the Czech Electricity System Production Adequacy 2030

Owing to the variability of climatic conditions, the value of unavailable RES may reach extreme values of up to about 90 GW in extreme cases owing to the installed capacity of 102 GW. The chart below shows the dependence of the RES actually available depending on the climatic conditions that determine the extent to which the total RES potential can be used. For example, during the night hours when there is almost no wind, the usability of the total RES potential may only be around 10 %. The ENTSO-E methodology uses for simulations the European climate database, which contains detailed meteorological data for each hour and country; from this data, the actual usability of RES is then determined. Based on this data, RES installation scenarios in individual EU Member States in 2025 were prepared. Chart 75 shows the annual development of average production at daily maximum with variance under different climatic conditions (thirty-year values). The total average annual rate of utilisation of installed RES capacity is 31 +/- 8 % (standard deviation).

The resulting balance must also cover consumption requirements. ENTSO-E has consistently (see SOAF, MAF reports) considered the average year-on-year increase in EU electricity consumption of 1 %. In simulations, this increase is equivalent to an increase of 40 GW of the EU system load in 2020–2025.

Table 70: *Summary of the EU power balance in 2020–2025 (GW)*

EU balance	Capacity change
Production capacity	+ 62 GW
Variable use of RES	up to - 70 GW
Increase in EU maximum load	- 40 GW
Expected deficit	up to - 48 GW

Source: Assessment of the Czech Electricity System Production Adequacy 2030

The overall summary of the balance shows that the replacement of conventional heat sources for RES sources is insufficient, and that there is lack of production capacities which must be operated in baseline load. If the anticipated increase in consumption is not covered, the emerging electromobility and heat pumps may also be at risk. The above-mentioned overview of the expected development of production capacities in Europe shows that the national adequacy assessment should be carried out taking into account the expected situation in neighbouring countries and that one cannot rely only on foreign electricity imports. Therefore, in the medium and long term, we consider the objective of energy system self-sufficiency to be highly relevant in terms of the current energy policy of the Czech Republic and the risks to ensuring the security of supply (SoS).

The adequacy assessment of the production capacities of the Czech electricity system, prepared for this year and planned to be issued in November 2018, envisages four baseline scenarios with calculations for 2025 and 2030.

Individual scenarios can be briefly characterised as follows:

Technically best possible scenario (Scenario 1)

This optimistic scenario is characterised mainly by the full operation of the Dukovany NPP (DNP) and the operation with full fuel supply for the coal-fired power stations with a normal use of power until 2030.

Most likely scenario (Scenario 2)

It is based on the best estimates of the future development of the Czech electricity system according to data from the operators of generating facilities collected by a questionnaire survey. It includes production restrictions owing to e.g. compliance with emission limits (BREF/BAT), availability of electricity coal or increased downtime in older plants.

Decentralised energy sector (Scenario 3)

It envisages the development of smaller decentralised, especially cogeneration plants and the growth of the installed capacity of RES according to the SEP. Two blocks of the Dukovany nuclear power plant are being gradually wound down and baseline mothballing is considered as in Scenario 2.

Worst scenario (Scenario 4)

Pessimistic scenario illustrating the worst possible development. It is represented by the slow development of new technologies combined with a higher rate of mothballing (critical mothballing). The risk of this scenario is also the non-renewal of Dukovany NPP operation and compliance with stricter emission standards with no exemptions (BREF/BAT).

The table below shows a comparison of the most important factors defining the individual scenarios

Table 71: *Scenarios considered for production adequacy assessment in 2018*

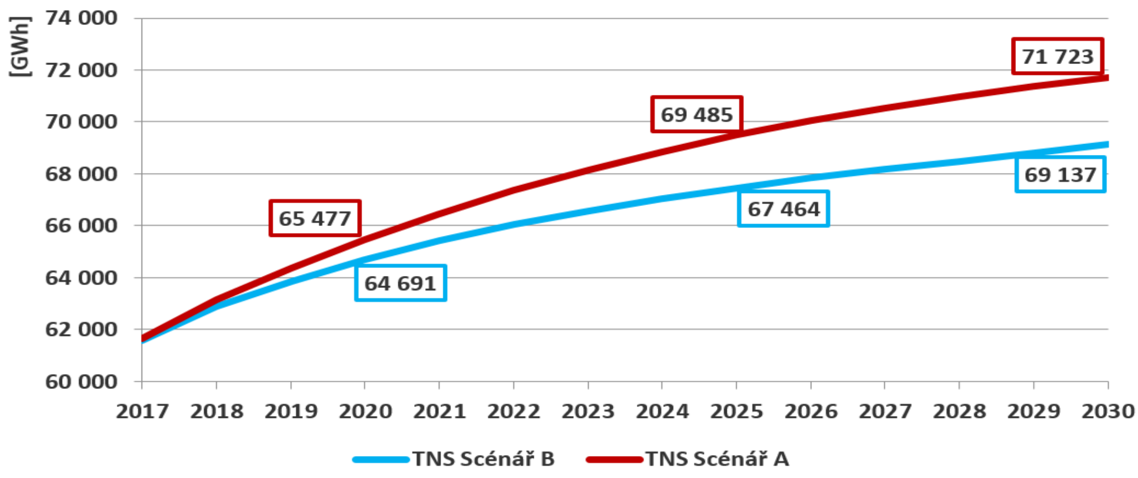
Scenario description	Scenario	DNP units in operation	Consumption	Renewable sources	Mothballing
Technically best possible scenario	1	4	B	critical scenario	no
Most likely scenario	2	4	B	critical	baseline

				scenario	
Decentralised sources	3	2	B	SEP	baseline
Technically worst	4	0	B	current trend	critical

Source: Assessment of the Czech Electricity System Production Adequacy 2030

In addition to the number of units of the Dukovany NPP in operation, each scenario is characterised by consumption, the rate of growth of renewable sources (RES in the table above) and mothballing. The following figures illustrate the expected development of the above-described effects.

Chart 76: *Development of electricity consumption according to scenarios A and B for the Czech Republic*

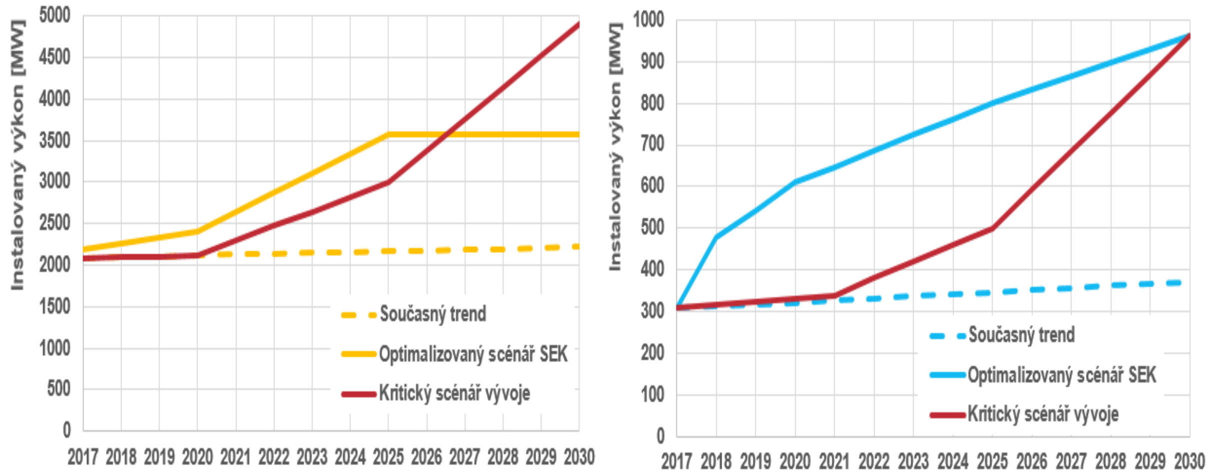


TNS scénář - DNC Scenario

Source: Assessment of the Czech Electricity System Production Adequacy 2030

The conservative consumption scenario A is based on the prediction of GDP growth (assuming average economic growth) and its energy intensity. The decline in electricity intensity of GDP is slowing down and the rate of domestic net consumption growth (DNC) is gradually decreasing. Scenario B includes the projected development of electromobility, micro-cogeneration and heat pumps, and anticipates a lower increase in electricity consumption than scenario A (despite higher expected economic growth), owing to strong measures to increase energy efficiency and effectiveness. With faster economic growth and new investments, more energy-efficient technologies and processes are being applied, the effect of which gradually outweighs the tendencies to increase electricity consumption. This leads to lower DNC by comparison with Scenario A. Scenario B was selected for the purpose of analyses, mainly owing to new development trends such as electromobility and heat pumps.

Chart 77: *Scenarios of PVPP development (left) and WPP (right) in the Czech Republic*



Instalovaný výkon – installed capacity

Současný trend – current trend

Oprimalizovaný scénář SEK – Optimised SEP scenario

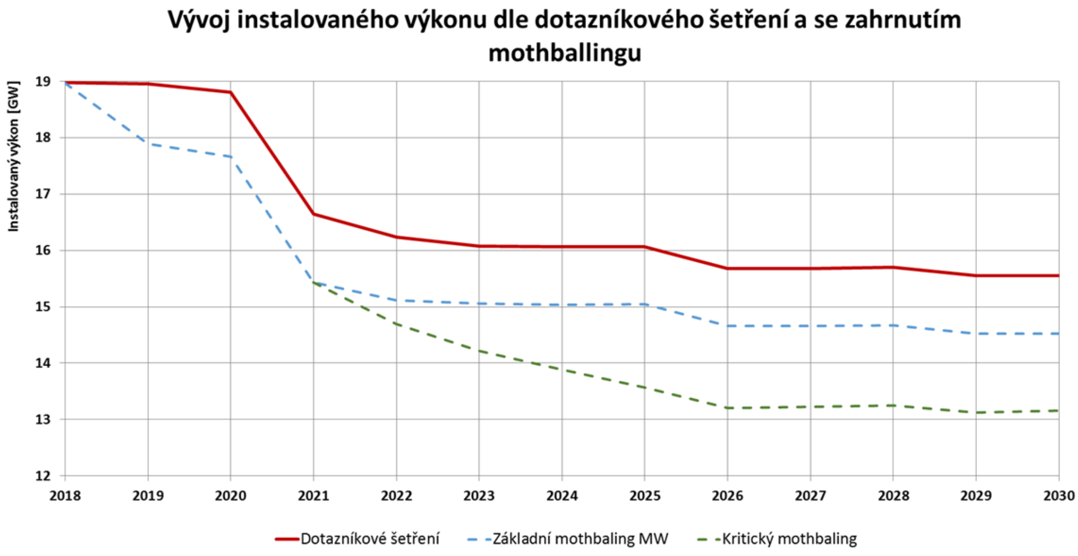
Kritický scénář vývoje – Critical scenario

Source: Assessment of the Czech Electricity System Production Adequacy 2030

There are three scenarios for the development of PVPP and WPP. The current trend is rather of analytical significance and describes a situation where the development of other installations would follow the current trend. In addition, scenario according to the SEP is considered, when the year 2018 was adjusted to actual values. The critical scenario considers higher PVPP growth and is based on the assumption that PVPP technology will gradually become cheaper and that roof installations will become economically advantageous without financial support.

The figure below shows the expected development of the installed capacity according to the questionnaire survey of ČEPS, a.s. from November 2017. The chart also shows variants of baseline and critical mothballing.

Chart 78: *Development of installed capacity according to questionnaire survey including mothballing*



Instalovaný výkon – installed capacity

Vývoj instalovaného výkonu dle dotazníkového šetření se zahrnutím mothballingu - Development of installed capacity according to questionnaire survey including mothballing

Dotazníkové šetření – Questionnaire survey

Základní mothballing – Basic mothballing

Kritický mothballing – Critical mothballing

Source: Assessment of the Czech Electricity System Production Adequacy 2030

Results for individual scenarios are characterised by ENS and LOLE values. LOLE indicates the number of hours for which the given period (typically a year) is greater than the expected production, including import. LOLE does not take into account the amount of uncovered load. Every hour when load is uncovered, even minimally, is counted. ENS indicates the missing energy to cover the expected (typically annual) consumption, including the envisaged import.

Simulations use advanced SW tools using probability simulations based primarily on the Monte Carlo approach. The table below shows the results for the average of all calculated simulations for 2025 and 2030.

Table 72: *Results of the production adequacy assessment for 2025 and 2030*

Scenario	**2025**		**2030**	
	LOLE	**Balance**	**LOLE**	**Balance**
Technically best possible scenario	normal	system export	normal	equal balance (balance export)

Most likely scenario	deteriorated	equal balance (balance export)	deteriorated	equal balance (balance export)
Decentralised energy system	deteriorated	equal balance	extreme	equal balance (balance import)
Technically worst scenario	extreme	system import	extreme	system import

Source: Assessment of the Czech Electricity System Production Adequacy 2030

It is apparent from the production adequacy analyses that even in the most optimistic scenario (‘Technically best possible scenario’) there are non-zero LOLE values, which, although they are normal values with an equal balance, do not yet require special measures. These LOLE values are max. 3 hours per year based on the probability quantile selected.

In more pessimistic scenarios (‘Most likely estimate’ and ‘Decentralised energy sector’), LOLE values are already deteriorated and represent situations where operating measures need to be taken, but the system is still in balance, assuming energy self-sufficiency.

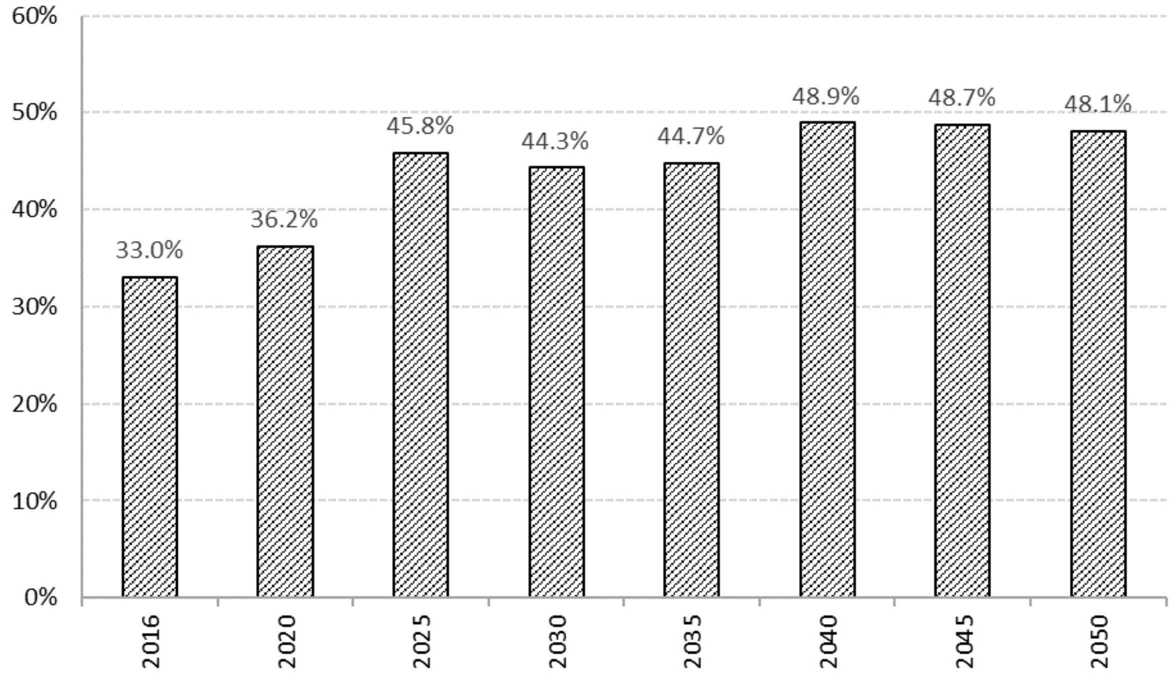
In terms of ensuring balance (with respect to the low probability - high impact principle), the fourth critical scenario (‘Technically worst scenario’) shows extremely high LOLE values and system operability cannot be safely ensured even with high import considerations that are in conflict with the State Energy Policy. By comparison with the results and procedures applied in the surrounding electricity systems and within ENTSO-E, critical conditions are considered at LOLE values of above 6 hours per year.

The above results lead to the conclusion that it would be appropriate for the Czech Republic to choose the LOLE security standard as soon as possible and to start working on measures for its fulfilment. In terms of ensuring sufficient production capacities, it seems best to examine the possibility of securing capacitive mechanisms, which would allow the existing old coal-fired units to be left in operation or as backup for emergencies and outside market mechanisms. In line with the State Energy Policy, ČEPS, a.s. recommends the scenario of production self-sufficiency of the Czech Republic, rather than dependence on the import of electricity from abroad, which may not be guaranteed for every hour. The risk involve, in particular, the loss of conventional production sources across the EU and the limited interconnectivity of international interconnectors.

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

The development of energy security is relatively difficult to be described quantitatively. Annex 2, which provides a detailed list of parameters and variables, includes an indicator of import dependence. This indicator is currently at around 33 %. The Czech Republic is almost fully dependent on imports of natural gas and oil, which make up a significant part of domestic energy consumption. Even in the future it can be assumed that the Czech Republic will be almost exclusively dependent on these fuels. An increase in import dependence may also be facilitated by an increase in the use of these fuels, particularly natural gas, which will be important as a partial replacement of domestic coal. In the future, import dependence can be expected to increase, especially owing to the decreasing domestic coal consumption at the expense of imported fuels. Also, the Czech Republic is currently a relatively large net electricity exporter, but in the future a relative reduction of the exported quantity can be expected. Chart 79 shows the expected development of import dependence. Energy security does not only depend on import dependence but also on a number of other circumstances, such as diversification rate, country of origin, etc. This information should be available or derivable from analytical data in Annex 2.

Chart 79: *Expected development of import dependence*



Source: Prepared by MIT for the purposes of the National Plan

4.5 Dimension internal energy market

4.5.1 Electricity interconnectivity

i. Current interconnection level and main interconnectors[130]

The methods of determining the degree of electricity interconnectivity may vary according to what the total available transmission capacity of all the profiles of the given system is related to. The 10 % interconnection target under the Barcelona Agreement is measured as the ratio of net transmission capacity to installed production capacity – with an emphasis on the integration of the internal electricity market. The current Czech Republic's State Energy Policy determines the degree of integration into international networks (the degree of Czech Republic’s interconnectivity) as the total available transmission capacity in relation to the maximum load determined by the share of the total export/import capacity of the transmission system in the given year and the outlook for the maximum net load of the transmission system for the given year.

For the purpose of comparing the two above-mentioned methods of determining the degree of electricity interconnectivity, the outlooks of interconnectivity rates (export/import) for the years 2019, 2024 and 2030 on the basis of data from ČEPS, a.s. are provided. It should be reiterated that the determination of the ‘maximum’ transmission capacity of the system depends on several variable

[130] With reference to the overviews of the existing transmission infrastructure compiled by the Transmission System Operators (TSOs).

assumptions, so in order to ensure complete comparability of outputs, the calculation would have to take place under fixed and identical conditions, especially for security reserves, which mainly take into account the circular flows, which develop over time. Owing to uncertainties in the energy environment, especially in the energy mix, these values can be considered as indicative.

Table 73: *Expected interconnectivity level in 2019, 2024 and 2030*

Year / method of determining interconnectivity / transmission capacity	According to the Barcelona Agreement [related to installed capacity]		According to the Czech Republic's State Energy Policy [related to maximum load]	
	Export capacity [%]	Import capacity [%]	Export capacity [%]	Import capacity [%]
2019	29.6	28.0	55.6	52.6
2024	38.7	35.4	57.9	53.0
2030 (Scenario A)	44.1	38.0	58.0	50.0
2030 (Scenario B)	44.1	38.0	60.2	51.8

Source: Data from ČEPS, a.s., the transmission system operator

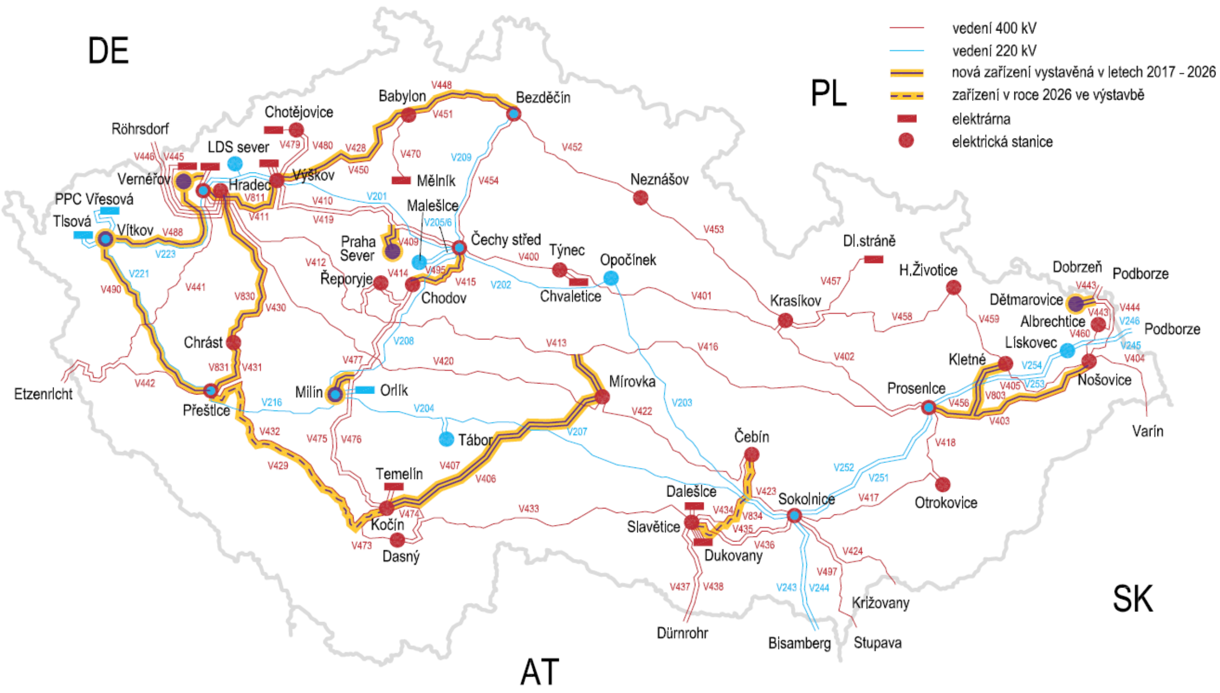
The values in the table above (under the Barcelona Agreement) differ from the EU 2017 communication[131], because the new calculations of ČEPS, a.s. include tools for the effective management of circular flows on the basis of implemented investment measures in 2017. In particular, these include the reflection of the impact of PST on the determination of the security reserve in the calculation.

ii. Projections of interconnector expansion requirements (including for the year 2030)[132]

Projections of interconnector expansion requirements are provided primarily in the Plan for the Development of the Czech Transmission System 2017–2026 (in its updated version 2019–2028), which is undergoing the approval process at the time of preparation of this document. Estimates of further extension of the transmission system are detailed in subchapter 4.5.2.3.

[131] Communication on strengthening Europe's energy networks COM(2017) 718, 23.11.2017
[132] With reference to the national network development plans and TSO regional investment plans.

Figure 6: *Czech transmission network development scheme (as of 2026)*



Vedení 400 kV – 400 kV line

Vedení 220 kV – 220 kV line

Nova zařízení vystavěná v letech 2017-2026 – New facilities built in 2017-2026

Zařízení v roce 2026 ve výstavbě – Facility under construction in 2026

Elektrárna – Power plant

Elektrická stanice - substation

Source: Czech transmission network development scheme under the Plan for the Development of the Czech Transmission System 2017–2026

4.5.2 Energy transmission infrastructure

i. Key characteristics of the existing transmission infrastructure for electricity and gas[133]

4.5.2.1 Key characteristics of the existing electricity infrastructure

The key characteristics of the existing infrastructure and the estimates of network expansion requirements are part of the published Plan for the Development of the Czech Transmission System 2017–2026 (its updated version for 2019–2028), which is undergoing the approval process at the time of preparation of this document and is subject to updates every two years.

The transmission system in the Czech Republic is operated by ČEPS, a.s. ČEPS, a.s. provides electricity transmission in the required volume and with high reliability. The continuous renewal and development of the transmission system by its operator leads to the increased transfer capacity of the elements during the reconstruction and replacement of the equipment, and thus the transmission

[133] With reference to the overviews of the existing transmission infrastructure compiled by the TSOs.

system provides with high reliability the connection and output of the capacity of large sources, distribution supply and the required cross-border transmission of electricity.

Table 74: *Length of the transmission system lines in the Czech Republic*

Facility description	Line length (km)
400 kV line	3,735
of which double and multiple	1,338
220 kV line	1,909
of which double and multiple	1,038
110 kV line	84
of which double and multiple	78

Source: Plan for the Development of the Czech Transmission System 2017–2026

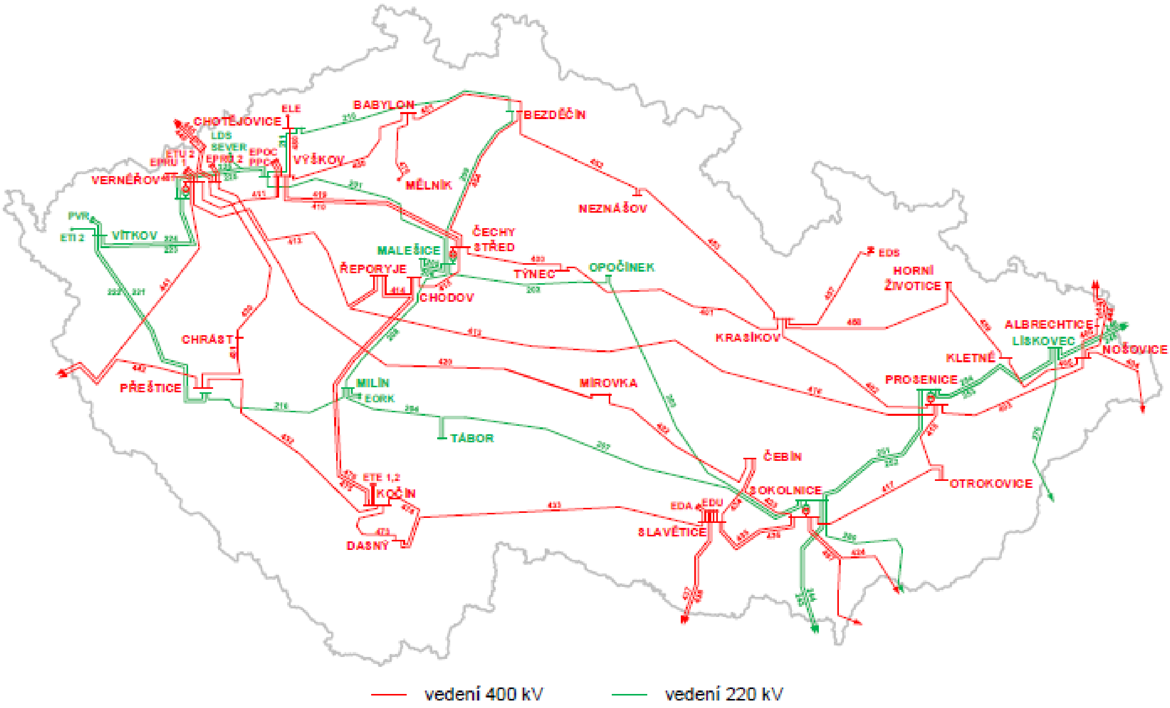
Table 75: *Number of cross-border lines, substations and transformers within the transmission system*

Facility description	Number of facilities
Cross-border 400 kV line	11
Cross-border 220 kV line	6
400 kV substations	26
220 kV substations	14
110 kV substations	1
400/220 kV transformers	4
400/110 kV transformers	49
220/110 kV transformers	21
Phase-shifting transformers, 400 kV (PST)	4

Source: Plan for the Development of the Czech Transmission System 2017–2026

Since 2017, phase-shifting transformers (PST) located on the cross-border Hradec-Röhrsdorf lines in the 420 kV substation in Hradec u Kadaně have been in operation. Their task is to avoid negative effects on the Czech transmission system by effectively limiting the large fluctuations of power across the cross-border profile between the Czech Republic and Germany. In 2017, a new 400/110 kV transformer station was commissioned in Vernéřov in order to allow an increase in the reserved power input (capacity) in the area, which is related, among other things, to the loss of capacity supplied to the 110 kV grid by the shutdown of Prunéřov I power plant.

Chart 80: *Transmission system – current state*



Vedení 400 kV – 400 kV line

Vedení 220 kV – 220 kV line

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

4.5.2.2 Key characteristics of the existing gas infrastructure

General characteristics of the gas system

The gas system is a set of all facilities used for the production, consumption, storage and transport of natural gas. The gas system consists mainly of: (i) pipeline infrastructure with different operating parameters; (ii) control actuators – compressor and reduction stations, closures, measuring fittings etc.; (iii) gas-storage facilities for the storage of natural gas; (iv) generating facilities of conventional and non-conventional gas which can be injected into the gas system; (v) off-take and transfer points.

In terms of the operational role, it is possible to divide the system into two hierarchical units:

- Transmission system – high-pressure gas pipeline system (VHP, HP), actuators and related objects connected with foreign gas systems. The transmission system is further subdivided into the transit system and national transmission system.
- Regional and local distribution systems – system of high-pressure, medium-pressure and low-pressure gas pipelines (HP, MP, LP), actuators and related technological objects used for the distribution of gas to final customers.

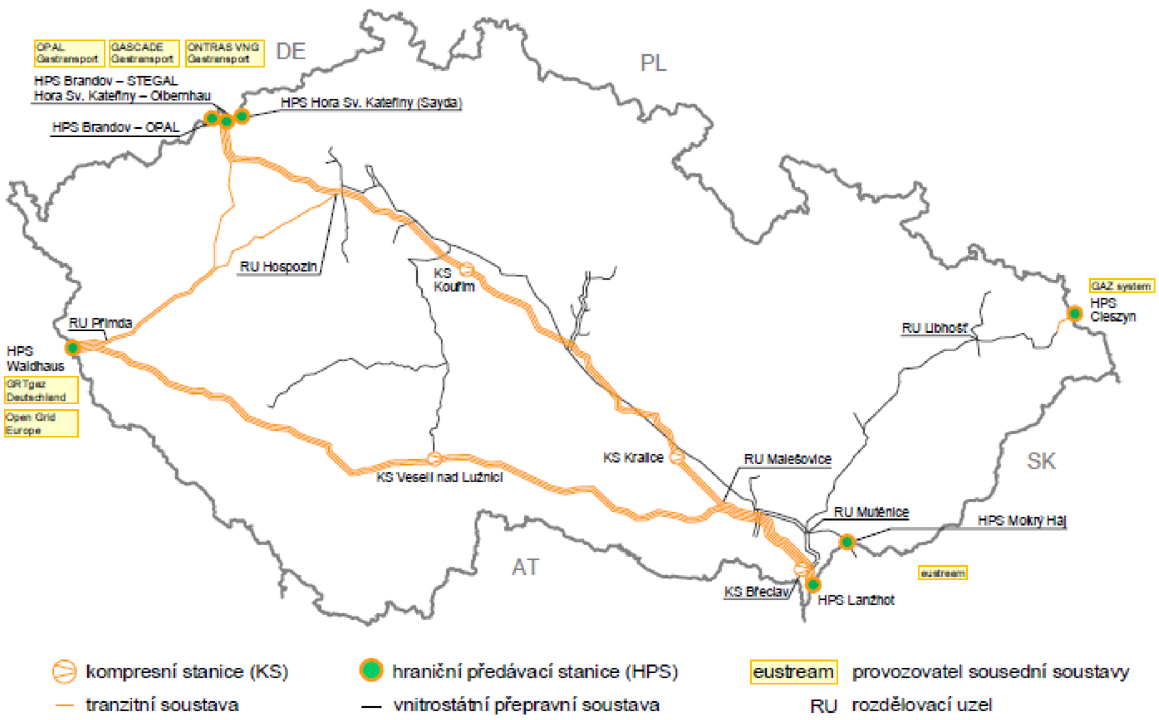
Within the Czech Republic gas is further transferred from the transmission system to distribution systems and directly connected customers. In addition, there are 8 gas-storage facilities connected to the transmission system. Supply is ensured through 968 transfer stations where a commercial gas quantity meter is installed. Gas quality is measured at 27 nodes in the system.

Transmission system

Gas pipelines for international transit and domestic transmission with the length of about 3 820 km in total, with nominal diameters from DN 80 to DN 1400 and with nominal pressures from 4 to 8.4 MPa, i.e. the 'transmission system', are operated in the Czech Republic by NET4GAS. The transmission system provides especially for the following functions: (i) transmission of natural gas from long-distance international gas pipelines to transfer stations or to adjacent transmission systems; (ii) supply to selected customers[134]; (iii) transmission of gas to the storage facilities in the gas injection mode and transmission of gas from the storage facilities to consumption points in the gas use mode.

The transport system can be divided into four main branches. The North branch leads from Lanžhot to Brandov / Hora Sv. Kateřiny; the South branch leads from Lanžhot to Rozvadov and the West branch connects the North and South branches. In the Southeastern part of the country, the Moravian branch provides gas supplies to the Moravian regions and connects to the Polish transmission network. The North, South and West branches are connected in key distribution nodes of Malešovice, Hospozín and Přimda.

Figure 7: *Czech Republic's Transmission System*



Kompresní stanice (KS) – Compressor station (CS)

Hraniční předávací stanice (HPS) – Border transfer station (BTS)

Provozovatel sousední soustavy –neighbouring system operator

Tranzitní soustava – Transit system

Vnitrostátní přepravní soustava – National transmission system

RU rozdělovací uzel – DN – Dividing node

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134 In order for a customer to be able to directly receive supplies from the transit system, it must meet the technical criteria given by the transmission operator and must off-take at least 100 GWh of gas energy from the VHP system or at least 10 GWh from the HP system annually.

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Individual transfer points are connected to transit and domestic transmission systems, in total there are 96 transfer points to distribution networks and storage facilities. The transmission system is interconnected by seven border transfer stations with neighbouring transmission systems. Eight clients are connected directly to the transmission system. The following table shows the transmission system pipelines.

Table 76: *Pipeline routes of the transmission system*

Specification	Operating overpressure (MPa)	Pipeline width (mm)	Pipeline lengths (km)
Transit system	4.0 to 8.4	800 to 1 400	2,471
Gazela gas pipeline	4.9 to 8.4	1,400	166
National transmission system	2.5 to 6.4	150 to 700	1,181

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Reverse gas flows in the transmission system

During the Gas Crisis in January 2009, a provisional reverse flow was made in the West-East direction, which allowed not only to supply customers in the Czech Republic but also in Slovakia. The gas was supplied via the transfer station Hora Svaté Kateřiny to the Czech Republic. As a result, gas supplies to customers in the Czech Republic were not reduced.

The implementation of the reverse flow within the European Energy Programme for Recovery (EEPR) involves the following structures / modifications:

1. Modification at the border transfer station (BTS) Hora Svaté Kateřiny allowed an increase in the amount of gas transmitted from Germany to the Czech Republic from 18 m^3 per day to 25 m^3 per day.
2. Modification of the pipeline at the interconnection point Hospozín allowed an increase in the amount of gas transmitted between Olbernhau and Waidhaus up to 15 million m^3 per day.
3. Modification of the pipeline at the Kralice nad Oslavou compressor station allowed the use of compression work for gas transmission in the west-east direction.
4. Modification of the pipeline at the Malešovice interconnection point allowed an increase in the gas transmission from the BTS Hora Svaté Kateřiny to the Rozvadov distribution node.
5. Modification of the pipeline system at the Břeclav compressor station enabled the use of compression work for the transmission to Slovakia.
6. Modification in BTS Lanžhot allowed the measurement of gas transmitted from the Czech Republic to Slovakia.
7. Modification of the compression station Kouřim pipeline system allowing the reverse flow was completed in 2011.

Transit system

The task of the transit system is to ensure the transmission of natural gas by very high pressure pipelines (VHP) to other countries and to ensure gas supplies to domestic customers. Thanks to the liberalisation of the gas sector, the use of the transmission system is determined by the market where the system users who want to transmit gas through the system compete for the transmission capacity. The exception is the Gazela gas pipeline, which is exempt from third party access (rTPA) to transmission capacity until the end of 2034. This exception is only granted for the transmission capacities in the direction Brandov-Waidhaus. This means that system users cannot compete for the capacity of this gas pipeline in auctions, as all of the capacity has already been allocated through an alternative allocation mechanism.

Between 2015 and 2016, projects increasing the capacity by 12 million m^3 a day were successfully completed on the transmission system in the direction to Lanžhot, also along the south branch in the direction Rozvadov – Veselí nad Lužnicí – Břeclav – Lanžhot, which previously served for the transmission of gas from Lanžhot to Bavaria. In addition to the gas storage facility in Tvrdonice, a single direct buyer is currently connected to the transit system: the Počerady gas-fired power plant.

National transmission system

The task of the national transmission system (NTS) is to transmit gas from the transit system to the distribution transfer stations. The NTS consists of gas pipelines with lower widths (150 to 700 mm) with operating pressures of 2.5 to 6.4 MPa. The total length of the national transmission system routes is 1 181 km. The connection to the transit system is at six transfer nodes. Owing to the existing pressure conditions, compressor stations are not installed on the national transmission system, but all gas-storage facilities operated within the Czech gas system are connected to the system. There is also a connection to the Slovak gas system on the NTS (Mokrý Háj). This connection is currently not being used.

Border transfer stations

In places at the border of the Czech Republic, where NET4GAS's transmission system is connected to the transmission systems of TSOs of the neighbouring countries, gas volume and quality are measured at border transfer stations (BTS). These places are, on the Czech-Slovak border, Lanžhot and Mokrý Háj (BTS on the Slovak side), on the Czech-Saxon border, Brandov and Hora Sv. Kateřiny, on the Czech-Bavarian border, Waidhaus (BTS on the German side) and, on the Czech-Polish border, Cieszyn (BTS on the Polish side).

Table 77: *Capacities of border transfer stations (billion m^3 per year)*

Profile and border transfer station	Input capacity to the Czech Republic	Output capacity from the Czech Republic
SK-CZ	56	31
Lanžhot	56	31
Mokrý Háj	0	0
PL-CZ (Cieszyn)	0	1
AT-CZ	0	0
DE-CZ	73	54
Waidhaus	15	37
Hora Svaté Kateřiny – Sayda	5	7
Hora Svaté Kateřiny – Olbernhau/Brandov STEGAL	13	10
Brandov OPAL (for the Gazela pipeline)	40	0

Total capacity	129	86

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Virtualisation of border points

On the basis of Article 19 of Commission Regulation (EU) 2017/459 establishing a network code on capacity allocation mechanisms in gas-transmission systems (NC CAM), transmission system operators are obliged to set up a virtual interconnection point (VIP) where two or more interconnection points connect the same two adjacent entry-exit systems.

In the case of the Czech Republic, two virtual interconnection points are planned:

- VIP Brandov – GASPOOL with German Gaspool trade zone as of 1 November 2018;
- VIP Waidhaus with the German NCG trade zone as of 1 March 2019.

All available fixed and interruptible capacity will be offered at the VIP. No capacity beyond the existing contractual relationships will be offered on physical interconnection points that will become part of the VIP.

Compressor stations

The required pressure in gas pipelines is generated by four compressor stations, which are located in Kralice nad Oslavou and in Kouřim on the North branch and in Veselí nad Lužnicí and Břeclav on the South branch. All compressor stations are capable of bidirectional operation. Total installed capacity of the compressors is 243 MW.

Table 78: *Total installed capacity of compressor stations (MW)*

Compressor station name	Number of combustion turbines and their output	Installed capacity
Kralice nad Oslavou (north branch)	5x 6 MW + 2x 13 MW	56 MW
Kralice nad Oslavou (north branch)	5x 6 MW + 2x 13 MW	56 MW
Břeclav (south branch)	9x 6 MW + 1x 23 MW	77 MW
Veselí nad Lužnicí (south branch)	9x 6 MW	54 MW

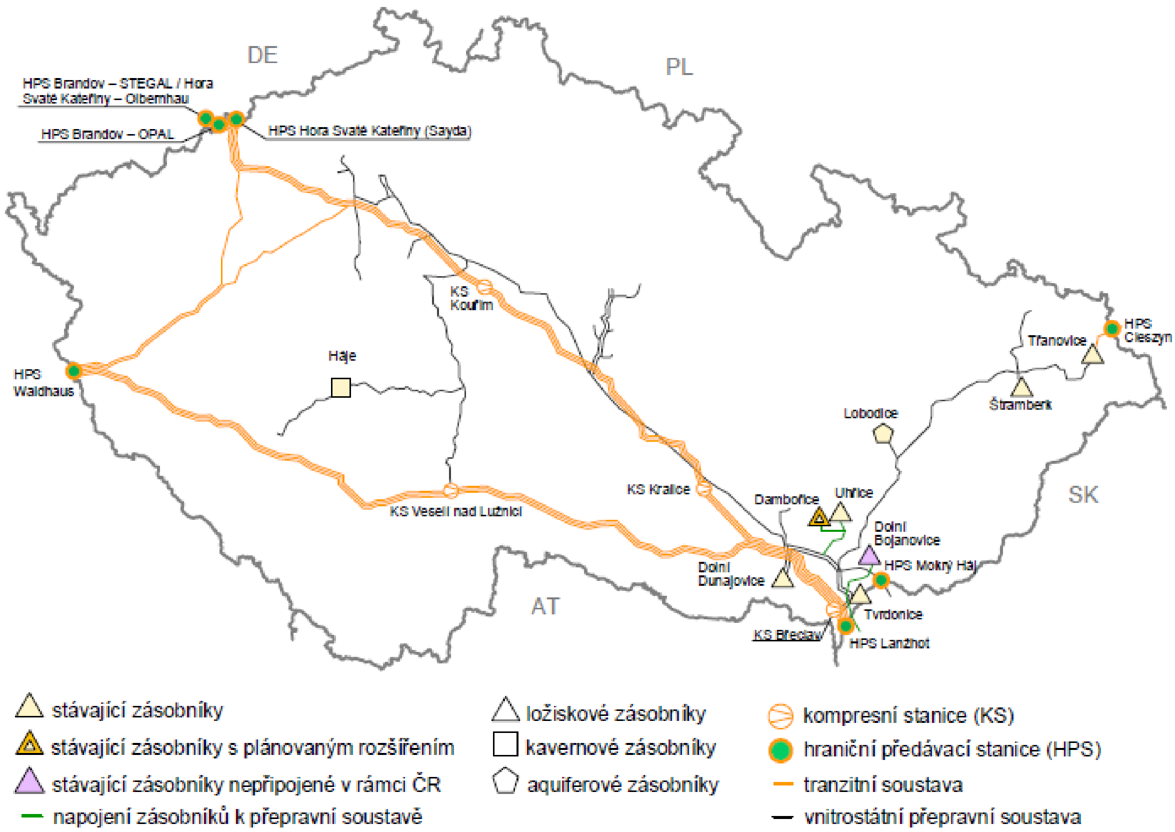
Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Gas-storage facilities

A total of 9 storage facilities are currently in operation in the Czech Republic, of which 7 deposit storage facilities, 1 aquifer storage facility (Lobodice) and 1 cavern storage facility(Háje). The main role of storage facilities in the system is to cover peak demand in the heating season, which could not be covered by gas imports. Traders use them for economic reasons, because in the heating season, gas prices are usually higher than in low season. Finally, the storage facilities are an important element of the system in terms of security of gas supply in crisis situations.

In recent years, the dynamic properties of storage facilities in the Czech Republic have been improved by an increase in their deliverability. The available capacity of the storage facilities connected to the Czech system totals 3 177 million m^3, and their maximum deliverability is 70 million m^3 per day. The capacity of the storage facilities located in the Czech Republic totals 3 753 million m^3, and their maximum deliverability is almost 79 million m^3 per day.

Chart 81: *Gas-storage facilities – current state and plans for expansion*



Stávající zásobníky – existing storage facilities

Stávající zásobníky s plánovaným rozšířením – existing storage facilities with planned extension

Stávající zásobníky nepřipojené v rámci čr – existing storage facilities not connected in the Czech Republic

Napojení zásobníků k přepravní soustavě – connection of storage facilities to the transmission system

Ložiskové zásobníky - deposit storage facilities

Kavernové zásobníky – cavern storage facilities

Aquiferové zásobníky – aquifer storage facilities

Kompresní stanice (KS) – Compressor station (CS)

Hraniční předávací stanice (HPS) – Border transfer station (BTS)

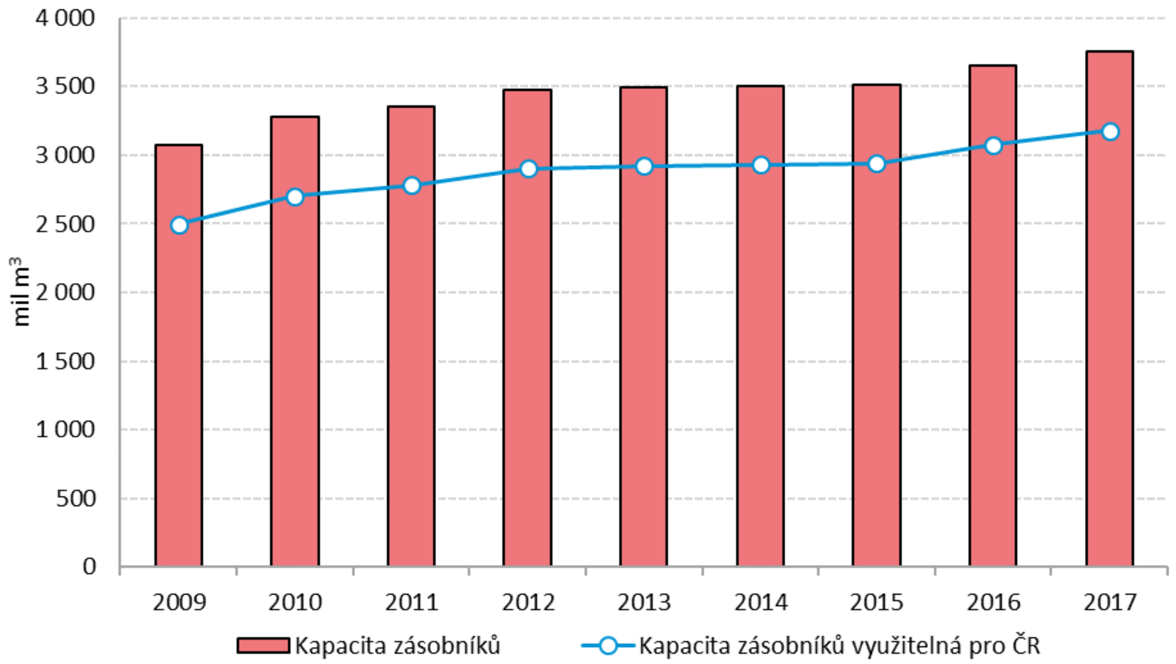
Provozovatel sousední soustavy –neighbouring system operator

Tranzitní soustava – Transit system

Vnitrostátní přepravní soustava – National transmission system

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Chart 82: *Development of the capacity of natural gas-storage facilities in the Czech Republic*



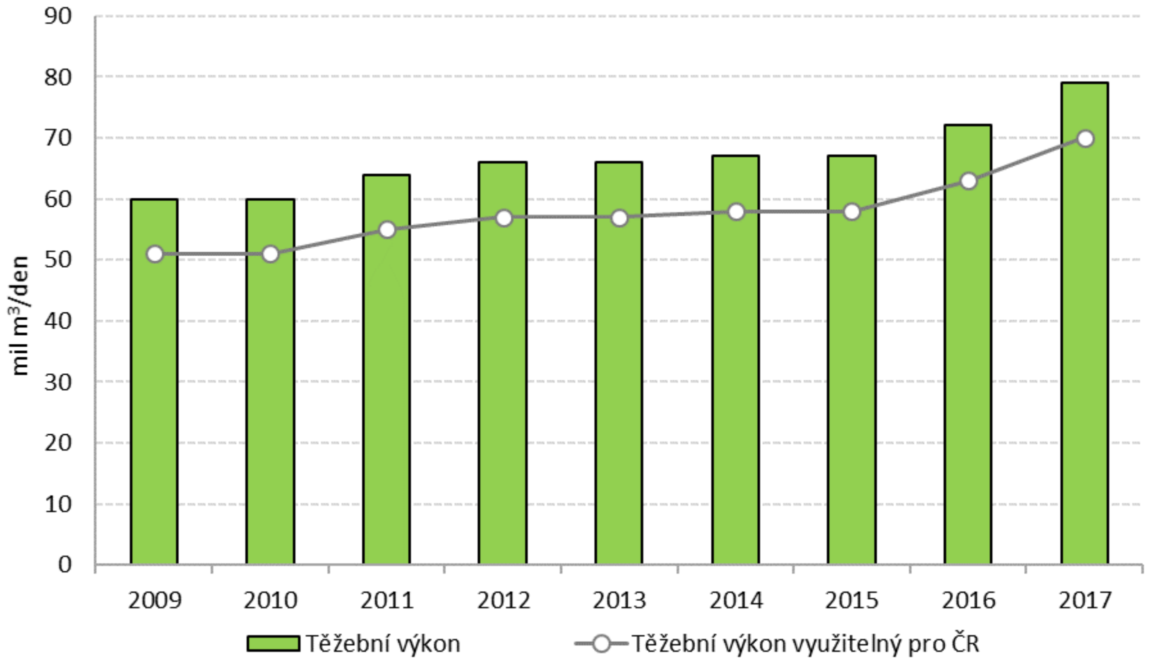
mil m3 – m3 million

Kapacita zásobníků – capacity of storage facilities

Kapacita zásobníků využitelná pro čr – capacity of storage facilities usable for the Czech Republic

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Chart 83: *Development of the deliverability of natural gas-storage facilities in the Czech Republic*



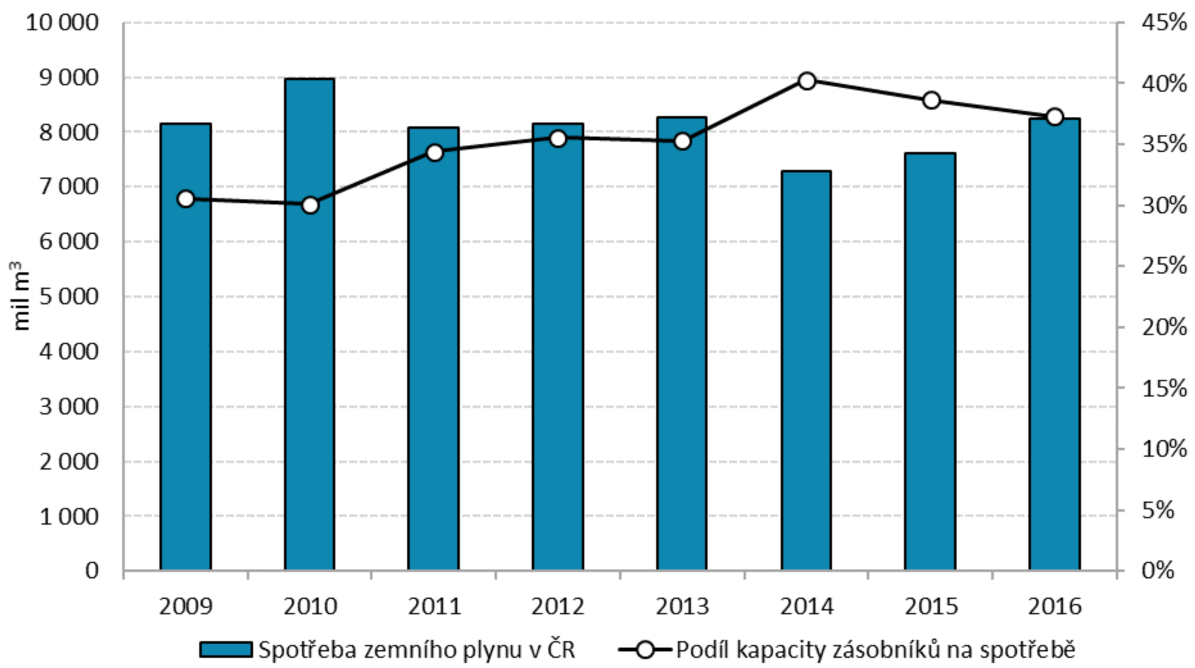
Těžební výkon – Deliverability

Těžební výkon využitelný pro čr – Deliverability usable for the Czech Republic

Mil m3 / den – m3 million per day

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Chart 84: *Share of the capacity of natural gas-storage facilities in domestic consumption*



mil m3 – m3 million

Podíl capacity zásobníků na spotřebě – Share of storage facility capacity in consumption

Source: Annual Report on the Operation of the Gas System of the Czech Republic 2016 (ERO)

Distribution systems

The task of the distribution system is to transport gas to end customers. Gas is mostly transmitted to the distribution systems from the transmission system through transfer stations; a small part of the gas supply comes from domestic extraction. Pipeline systems of distribution networks are the most extensive part of the entire gas system. They are operated at different pressure levels, as high pressure (from 0.4 to 4 MPa), medium pressure (from 5 kPa to 0.4 MPa) and low pressure (up to 5 kPa) pipelines. For reasons of supply reliability, individual regional distribution systems (over 90 000 customers) are operated in a grid configuration and can be mutually interconnected with back-up connections. No compressor stations are operated and no gas tanks are connected within distribution. In a few cases, distribution networks are connected to foreign systems – this concerns the supply of island areas or, where relevant, back-up cross-border supply facilities.

Currently, regional distribution networks are operated by three entities:

– **GasNet** provides distribution in the North, Central, West and East Bohemia and also in South and North Moravia. It is further divided into 4 sub-regional networks.

- **E.ON Distribuce** provides distribution in South Bohemia.
- **Pražská plynárenská Distribution** provides distribution on the territory of the capital city of Prague.

In addition to regional distribution networks, there are local distribution systems, often operated within major industrial plants. Recently, there has been a growing number of cases where operators of these local systems take over local distribution from municipalities, which previously invested in their construction but do not want to operate them. At present, 65 local distribution systems are operated.

ii. Projections of network expansion requirements at least until 2040 (including for the year 2030)[135]

4.5.2.3 Projections of infrastructure expansion requirements in the electricity sector

Transmission system development

In order to ensure the safety and reliability of operation, the transmission system operator prepares every two years the Ten-Year Plan for the Development of the Czech Republic's Transmission System . The plan presents two types of measures, which are briefly summarised in the following list and are described in detail further below:

- strategic solution: strategic investments in the medium and long term leading to the strategic development of the electricity system (maintenance, new lines, gradual phase-out of the 220 kV network);
- dynamic measures: partial investment technical measures allowing the connection of customers (often limited or conditional) within a shorter period than is possible with the strategic solution. In particular, this concerns connecting new sources to the transmission system or developing TS/DS transformation links.

Strategic solution

Renewal of station equipment and lines

The TSO renews the TS station equipment and lines to the extent ensuring the required security and reliability of TS operation. The typical lifetime of power equipment – especially lines – is 40 years and is affected by the method of maintenance and the conditions of the environment in which the equipment is operated. Replaceable parts of the equipment are replaced after the end of their lifetime; correct maintenance can extend the lifetime of pole structures up to twice the lifetime. After each replacement of lines and insulators, the line failure rate decreases.

Strengthening transmission capability

TSOs prepare and implement systemic measures to strengthen the TS transmission capability, to modernise and duplicate existing lines and to build new lines, and to expand and modernise substations. The construction of new 400 kV lines aims to supplement and reinforce the 400 kV system and to replace the 220 kV network. The 220kV network tasks will be gradually assumed by the reinforced 400kV network by 2040. The possibilities of building new lines in the new corridors are limited and the preparation is lengthy (10 years or more). Therefore, when renewing the 400 kV line,

[135] With reference to the national network development plans and TSO regional investment plans.

TSOs build double lines within the routes of the existing lines. The following table summarises the construction of new lines.

Table 79: *Length of new lines in the TS until 2050 (km)*

Construction of TS lines	Length of new 400kV lines in 2017–2025	Length of new 400 kV lines in 2026-2050
Construction of TS lines within a new route	189	70
Construction of double TS line within the original line route	572	629
Total length of new TS lines	761	699

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

International cooperation

Within the interconnected ENTSO-E, coordination is important in the planning of future forms of electricity networks and their further cooperation. The list of projects of common interest specified in Commission Delegated Regulation (EU) 2016/89 also contains five projects being prepared by ČEPS[136]. These projects meet not only the requirements for ensuring the safety and reliability of the transmission system operation, but also contribute towards the European targets with regard to the security of the operation of the entire interconnected system.

Reactive power compensation in the TS

Decentralised production and higher cabling rate lead, in particular at a time of lower load, to an increase in the generated reactive power in the DS and the associated increase in voltage at the given transfer station TS/110 kV. The duplication of transmission lines will increase the transmission capacities, but will also increase the reactive power generated by TS lines. In order to maintain voltage within the appropriate limits, TS uses available reactive power compensation tools and plans to build more than 1,000 MVAr of compensation facilities.

Dynamic measures

At the same time as the above-mentioned, often time-consuming, measures, short- and medium-term solutions are also sought, which are acceptable for a transitional period. These include, in particular, TS line modernisation with an increase in the permissible line temperature to 80°C, dynamic line loading, automatic power reduction of sources and deeper coordination of transmission and distribution network operation.

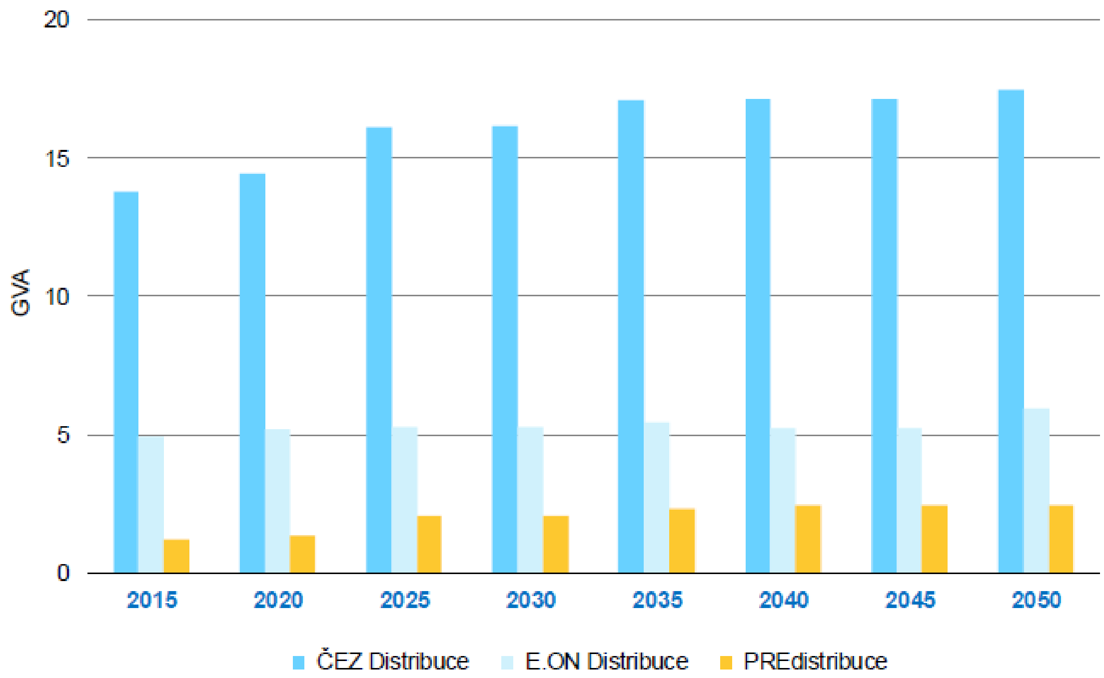
New TS substations and transformer power

The TS/110 kV transformation link will be strengthened only for 400/110 kV transformation, with the transformation power to increase by 9 550 MVA by 2050. With respect to the phasing out of the 220/110 kV (4 200 MVA) transformation, the overall increase in TS/110 kV transformer power will be 5 350 MVA by 2050, with the projected increase in peak consumption by 2050 being between 600

[136] Projects of Common Interest are updated as needed and the provision of these specific projects in the National Plan does not mean that these projects can be considered binding.

and 3 400 MW (depending on the scenario) by comparison with the values measured in winter 2017. The development of installed TS/110 kV transformer power is shown in the following figure. The construction of new substations in the TS responds to the long-term trends in the given area, such as the decommissioning of large sources in 110 kV networks, the development of consumption and also the phasing out of the 220 kV system. By 2025, this involves the construction of a new 400/110 kV transformation in 4 locations (new 400 kV substations in Vítkov, Dětmarovice, Prague North and Milín). In the period 2026–2050 the construction of 400 kV substations is planned in the Opočínek, Lískovec, Malešice, Tábor and Rohatec, which will gradually replace the 220 kV substations. The following figures show the anticipated development of the TS according to ČEPS for 2025 and 2050.

Chart 85: *Installed power of TS/110 kV transformers (GVA)*



Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

New technologies in the transmission system

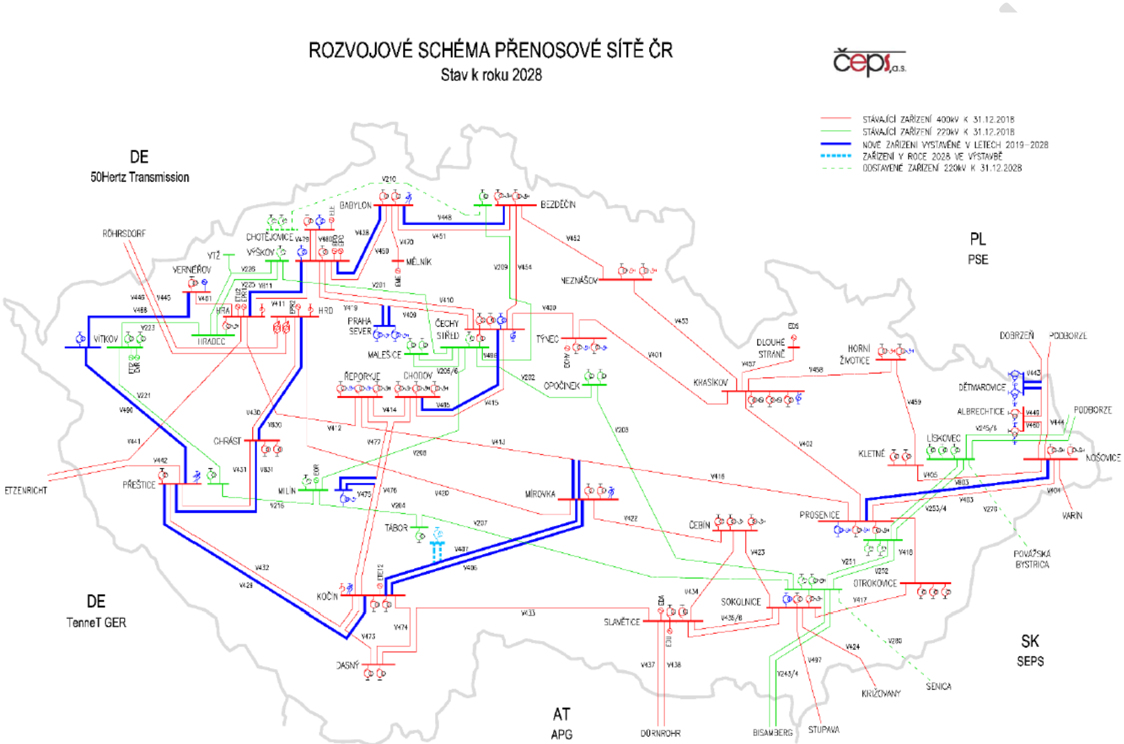
The implementation of new elements is motivated by efforts to maintain the reliability of operation under new conditions. Specifically, this involves increased demands on interstate electricity transmission and increasing representation of decentralised sources and their expected future development. With limited possibilities to construct line structures, new technologies are already introduced in the Czech transmission system to increase the transmission capabilities of the lines and to increase the reliability and efficiency of TS operation. These include in particular:

- the construction of compact equipment in the TS;
- dynamic loading of the TS elements to increase network transmission capabilities;
- higher dispatcher control functions (prediction models, operation optimisation, protection against defects,
- business models);
- remote control of TS substations;

– automatic power reduction on sources to prevent the occurrence and spread of network failures.

Other potentially useful technologies not yet used in the Czech transmission system include the use of high-temperature conductors or superconductors and the flexible alternating current transmission system (FACTS). If unsuitable operating parameters are indicated, the above mentioned new technologies can be used to eliminate the unsuitable states. The development of the transmission network is shown in the following figures.

Figure 8: *Czech transmission network development scheme (as of 2028)*



Rozvojové schema přenosové sítě ČR stav k roku 2008 - Czech transmission network development scheme (as of 2028)

stávající zařízení 400 kv k 31. 12. 2018 – existing 400 kV facility as of 31 December 2018

stávající zařízení 220 kv k 31. 12. 2018 – existing 220 kV facility as of 31 December 2018

nové zařízení vystavěné v letech 2019–2028 – new facility built in 2019–2028

zařízení v roce 2028 ve výstavbě – facility under construction in 2028

ostavené zařízení 220 kV k 31. 12. 2028 – Shut-down 220 kV facility as of 31 December 2028

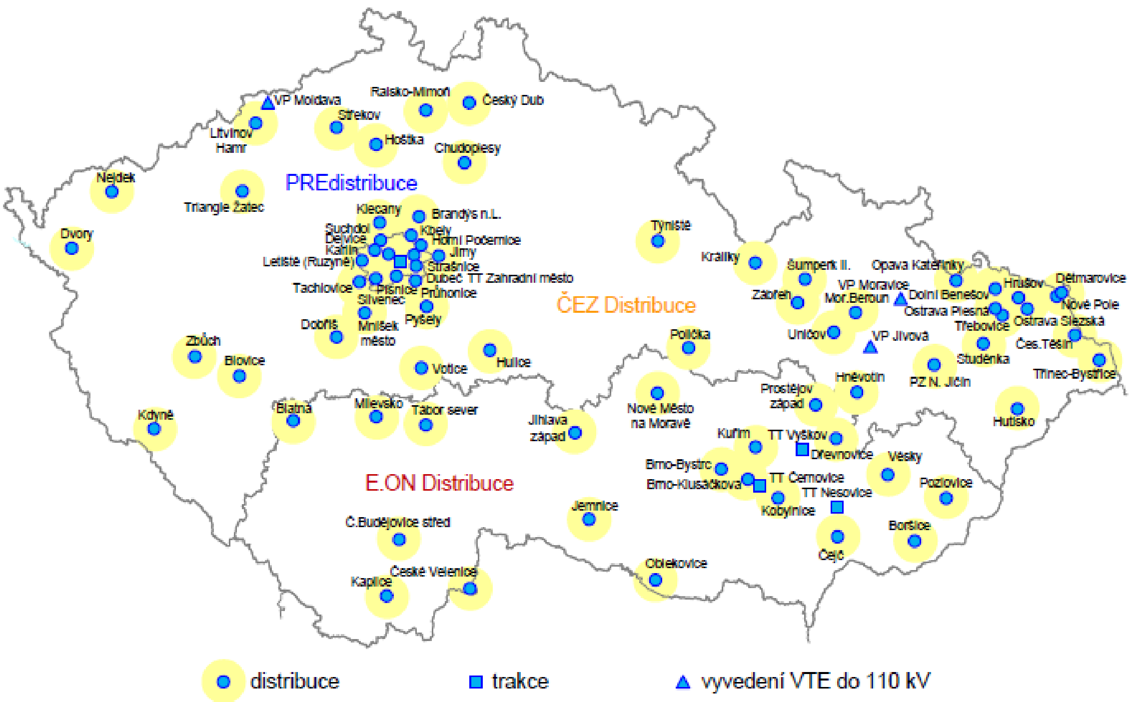
Source: ČEPS, a.s.

Distribution networks

Development of 110 kV networks

The development of 110 kV networks is prepared for a shorter period of time, so the operation of these networks is analysed in detail only for 2025. The development of 110 kV networks is based on the current needs of regions and the economic potential of distributors. The individual distribution companies must prepare the development so as to permanently meet the requirements of customers for the supply of electricity and the requirements of producers for power output. The development of distribution networks is influenced by changes in the TS, especially in the TS/110 kV transformation link, which affect both the development of the 110 kV networks in the respective node areas and their operational connection. The development is mainly focused on strengthening and reconstruction of the existing 110 kV lines. The new 110 kV substations are planned according to the expected load according to the requirements of customer in the respective regions. The construction of 81 new 110 kV stations is being prepared. Their location is shown in the following figure and their distribution and number in the following table. The following table gives an overview of the lengths of new and reconstructed 110 kV lines.

Figure 9: *Planned 110 kV substations*



Distribuce – distribution

Trakce – traction

Vyvedení VTE do 110 kV – WPP output to 110 kV

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Table 80: *Planned 110 kV substations (number)*

110 kV substations	ČEZ Distribuce	E.ON Distribuce	PREdistribuce	Total
Distribution transformer station 110 kV/HV	44	20	10	74
Traction transformer station	0	3	1	4
Power output from WPP and PVPP	3	0	0	3
Total number of 110 kV stations	47	23	11	81

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Table 81: *Length of new and renovated 110 kV lines (km)*

Construction of 110 kV lines	ČEZ Distribuce	E.ON Distribuce	PREdistribuce	Total
Construction of 110 kV lines within a new route	616	201	73	890
Renovation of 110 kV lines within orig. route	523	474	19	1,016
Total length of new and renov. lines	1,139	675	92	1,906

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

Development of HV and LV networks

The development of HV and LV distribution networks and their further construction is administratively and economically complex. In addition to the construction of new lines and renovation of existing lines, HV and LV networks will make increasing use of new technologies, which should keep the currently relatively comfortable operation and increase operational reliability. In addition to strengthening and expanding existing distribution networks, the following elements will be used in the development of the TS:

- HV/LV transformers with an on-load tap changer;
- development of automated voltage control systems even at lower voltage levels;
- control of the production of active and reactive power of decentralised sources according to the needs of network operation;
- the control of the selected part of consumption according to the needs of the network operation or according to the requirements of the trader;
- electricity storage controlled according to the needs of the network or according to the requirements of the trader.

Increase in the installed capacity of new decentralised sources will greatly influence the development of high-voltage and low-voltage networks. The operational needs of the distribution networks, particularly in the field of stress profile support, will require greater integration of new decentralised sources into the DS control system. Also in accordance with the DS Operating Rules, this aspect determines the size of the decentralised source power supply to the particular HV or LV network. Networks will be gradually fitted with devices allowing bidirectional communication between the DSO and the consumers / network nodes. At the same time, a number of autonomous devices will be used, which, on the basis of data exchange, will be able to evaluate the state of the network and take appropriate steps to make the system more efficient without the intervention of the dispatcher. These include, for example, automatic reconfiguration of connection in the case of a failure, re-connection to the electricity system after a failure, etc. In this context, the use of reclosers, intelligent section breakers, HV/LV transformers with an on-load tap changer and other similar devices. These measures, together with the regulatory capabilities of decentralised sources, will make it easier to integrate more of these sources into the DS.

Distribution companies implement pilot projects to verify the security, operational reliability and clarity of distribution network management with new technologies. The use of and, primarily, the manner to manage new technological elements in distribution networks should allow:

- power balance closure of the production – consumption chain, including maximum storage at the distribution network level;
- efficient utilisation and coordination of production, consumption and storage in the DS to reduce transmission losses in networks and to minimise the reserved power at TS/110 kV transformations;
- more efficient operation and management of networks with maximum automation.

4.5.2.4 Projections of infrastructure expansion requirements in the gas sector

Role of the gas industry in general

Reducing greenhouse-gas emissions in the Czech and European economy will lead to new system solutions. Therefore, in the future it is possible to anticipate the use of conversion potential of the gas sector, which would allow the storage of currently unnecessary gaseous energy. This would help reduce overload of the transmission network, strengthen energy security and reduce emissions. Typically, this would enable the production of hydrogen by electrolysis (Power2Gas technology) and possibly its methanisation into the form of synthetic methane.

The decarbonisation process and the development of new technological solutions will have an impact on the use of the gas system in the Czech Republic. It is currently not possible to precisely determine the impact of decarbonisation in the European and Czech context on the Czech gas network and the concrete information on how this network will be used with a view to minimising the transmission system operator's sunk costs. At present, technological solutions for the gas sector decarbonisation are not developed to a large extent in both the EU and the Czech Republic, and it is therefore appropriate to keep developing this infrastructure for future use for both natural gas and new types of gases. A combination of natural gas with CCS or CCU may be considered for the storage or utilisation of carbon produced from natural gas splitting. The possible future use of gas infrastructure can therefore be crucial to meeting the energy needs of end customers.

Transmission system

The planned changes in the transmission system are updated every year in the form of the NET4GAS Ten-Year Development Plan. The plan is subject to approval by the ERO; the last proposal is from 2018 for the period 2019–2028. The investment projects of the development plan are divided into four areas: (i) connection of gas-fired power plants; (ii) output to the domestic zone; (iii) connection of new storage capacities; (iv) increase of cross-border capacities.

As part of the system development plan, the development of maximum daily consumption and output capacity in individual regional networks and regions is also analysed. The results show that the output capacities into the regional distribution systems are several times higher than the maximum daily consumption in the given regions. The exception is Northern Moravia, which is supplied with only a single line of the national transmission system. The current situation is only partly satisfactory, but the requested capacity for gas injection into the local storage facilities exceeds the technical capacity of the system and in the heating season the system would not be able to cover the demand in the region without storage facilities. Such a situation greatly complicates the possibility of connecting new large gas customers in the area. NET4GAS's response to these complications is the preparation of the Moravia pipeline project (Moravia Capacity Extension).

Table 82: *Projects whose implementation ensures appropriate transmission system capacity to meet the requirements necessary to ensure gas supply the security*[137]

Project category	Project code	Project name	State	Interconnection point of the transmission system	Approximate capacity increase (GWh/d)	Expected commissioning	PCI Status
Increasing output capacity to domestic	DZ-3-002	Moravia project	non-FID	X domestic	134-157[a)]	2022	NO
	DZ-3-005	Moravia Capacity Extension	non-FID	X domestic	158[a)]	2022	NO

[137] These projects are updated as needed in line with the update of the Ten-Year Development Plans. Their list below is therefore illustrative and in this context it cannot be seen as binding.

zone							

Source: Ten-Year Plan for the Development of the Transmission System in the Czech Republic 2019–2028

Table 83: *Other projects that ensure the adequacy of the transmission system and/or affect the security of gas supply for the Czech Republic according to the N-1 formula under Regulation (EU) 2017/1938*[138]

Project category	Project code	Project name	State	Interconnection point of the transmission system	Approximate capacity increase (GWh/d)	Expected commissioning	PCI Status
Connection of power plants and heating plants	E-2-001	Connection of a power plant	non-FID	X domestic	4.93	2021	NO
Increasing output capacity to domestic zone	DZ-3-003	Connection of a directly connected customer	FID	X domestic	0.3	2019	NO
	DZ-3-004	Connection of a directly connected customer	non-FID	X domestic	0.7	2022	NO
Connection of new storage capacities	UGS-4-003	Connection of a gas storage facility	non-FID	E,X ZP	extraction: 94 injection: 73	SSO: N/A) TSO: 2021 provided that connection agreement is signed by 3Q/2018	NO
Projects increasing cross-border capacity	TRA-N-133	Bidirectional Austrian-Czech Interconnection (BACI)	non-FID	E,X CZ/AT (Reintal)	at least 201	2024	YES
	TRA-N-136	Czech-Polish Interconnection Gas Pipeline (CPI)	non-FID	E,X CZ/PL (Hať)	PL>CZ: 153 CZ>PL: 219	2022	YES
	TRA-F-752	Capacity4Gas - DE/CZ	FID	E DE/CZ (Brandov-EUGAL)	Phase 1: 665	2019	NO
					Phase 2: +454	2021	
	TRA-F-918	Capacity4Gas - CZ/SK	FID	X CZ/SK (Lanžhot)	333	2020	NO

[138] These projects are updated as needed in line with the update of the Ten-Year Development Plans. Their list below is therefore illustrative and in this context it cannot be seen as binding.

Source: Ten-Year Plan for the Development of the Transmission System in the Czech Republic 2019–2028

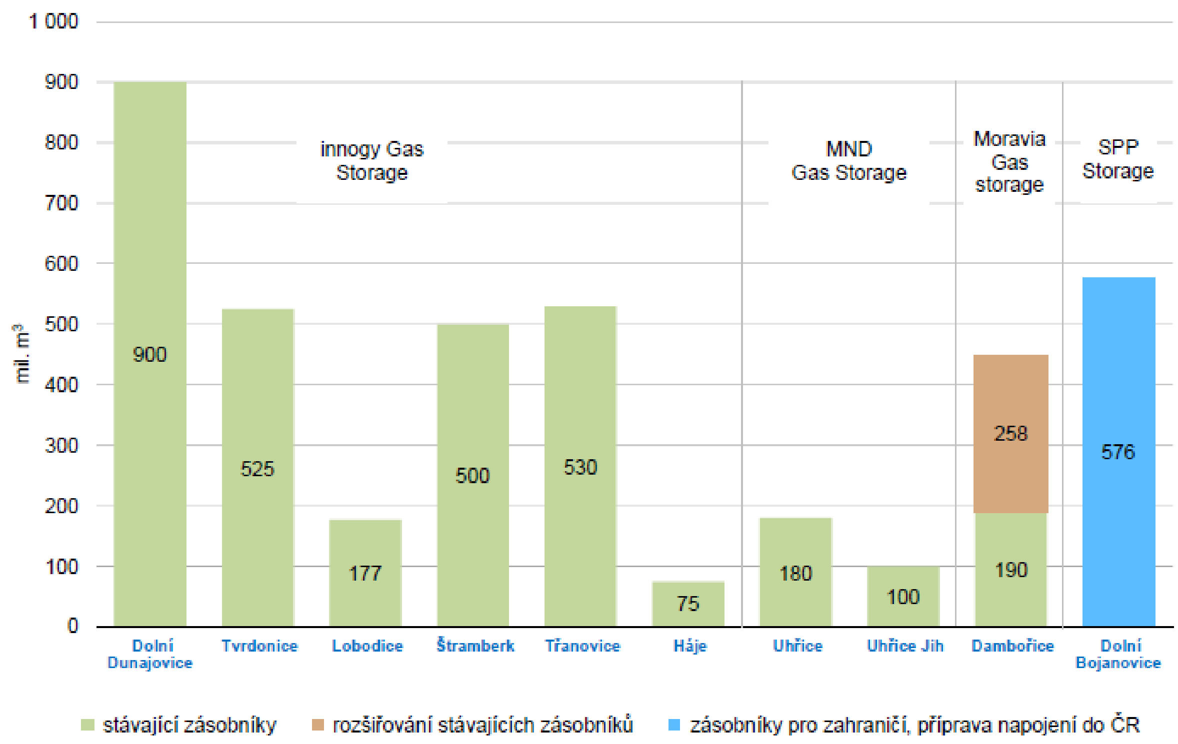
Gas-storage facilities

At present, there is a certain development of Dambořice storage facility, which will be progressive. The capacity will increase from the current 190 million m^3 to 250 million m^3 in 2018, to 298 million m^3 in 2019, to an estimated 315 million m^3 in 2020 and then to the final 448 m^3; deliverability will gradually increase from 4.5 to 7.5 million m^3 per day and the injection rate from the current 3.5 to 4.5 million m^3 per day.

The increase in Dambořice storage facility parameters is the only development project of storage facilities in the Czech Republic. Furthermore, only the connection of the Dolní Bojanovice storage facility (576 million m^3) is expected in the Czech system. The implementation of other projects that were previously announced is not very realistic from the 2017 perspective: These include, for example, a cavern storage facility in Dolní Rožínka (200 million m^3), a cavern storage facility in Okrouhlá Radouň (200 to 400 million m^3), a deposit storage facility near Břeclav (200 million m^3).

Chart 86 shows the current state and the expected development of natural gas storage. Chart 87 shows the maximum amount of stored gas in 2019–2028 for the Czech Republic according to the plans of underground storage facility operators. Chart 88 shows the expected maximum daily gas extraction output in 2019–2028 for the Czech Republic. Chart 89 then shows the expected share of natural gas storage capacity in domestic consumption based on the Ten-Year Transit Development Plan.

Chart 86: *Gas-storage facilities – current state and development*



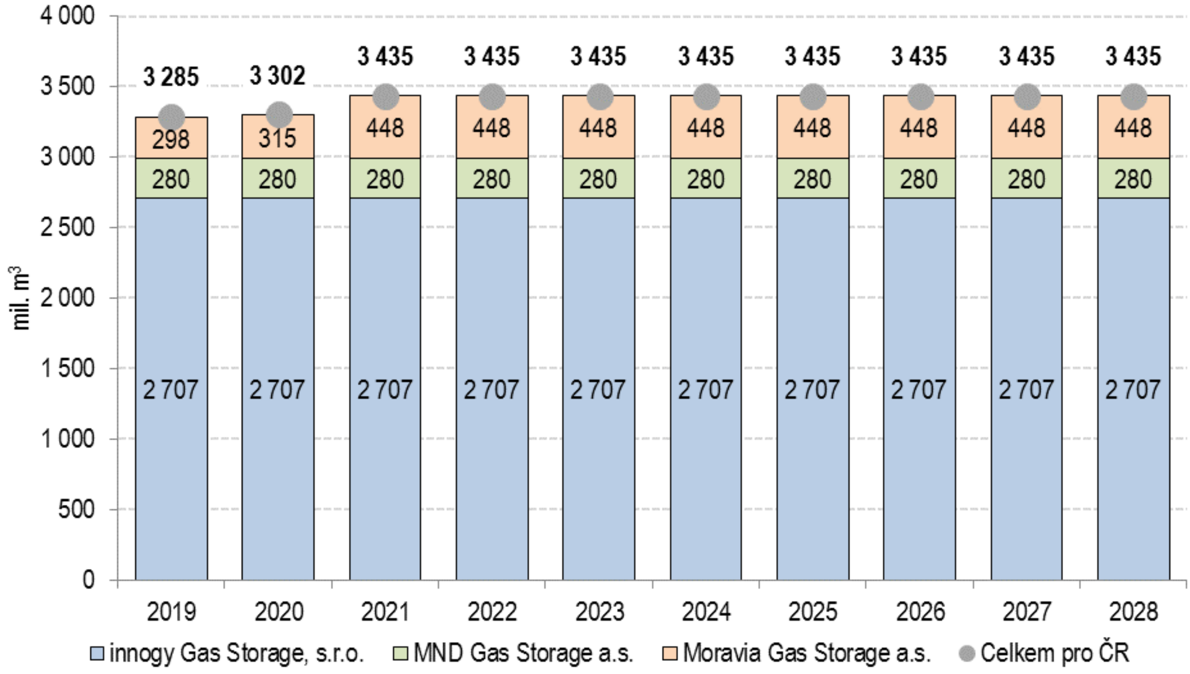
Stávající zásobníky – existing storage facilities

Rozšiřování stávajících zásobníků – extension of existing storage facilities

Zásobníky pro zahraničí, příprava napojení do čr – Storage facilities for abroad, preparation of connection to the Czech Republic

Source: Expected long-term balance between gas supply and demand (OTE, a.s., 2017)

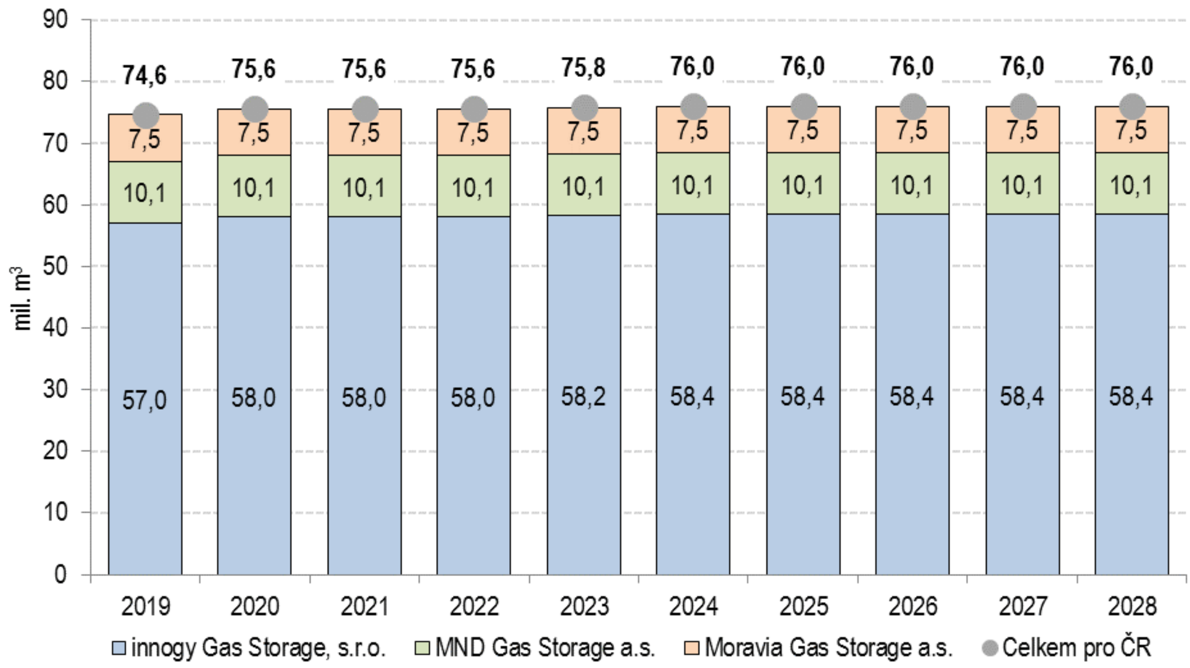
Chart 87: *Maximum amount of stored gas in 2019–2028 for the Czech Republic*



Celkem pro ČR – Total for the Czech Republic

Source: Energy Regulatory Office

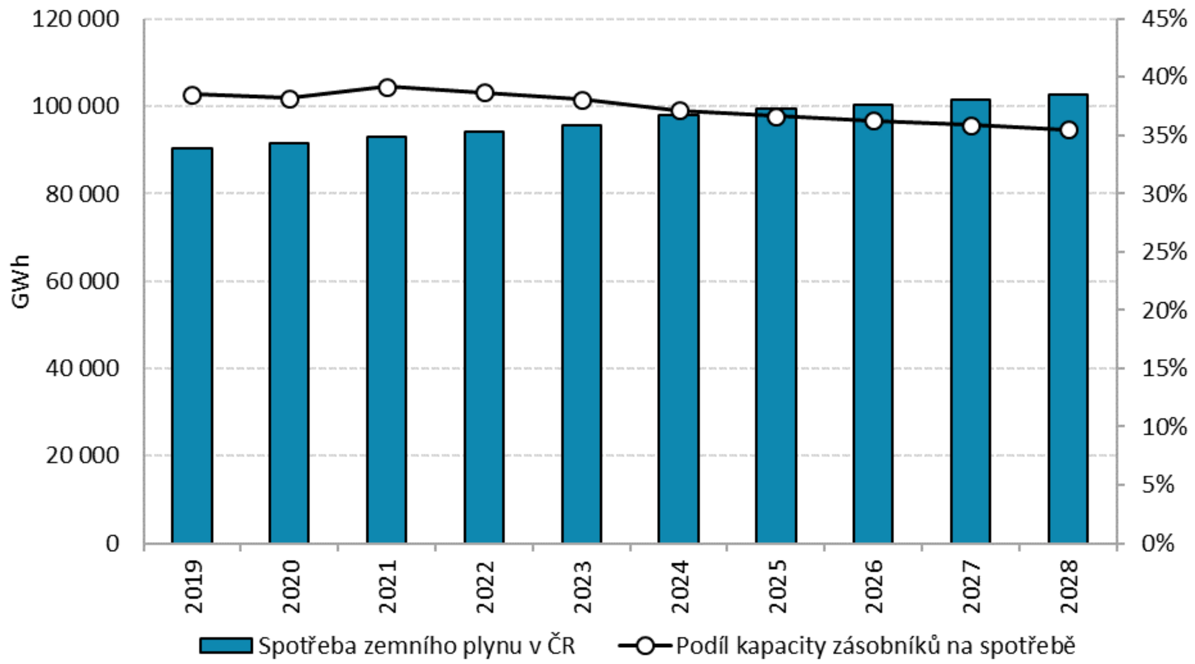
Chart 88: *Maximum daily gas extraction output in 2019–2028 for the Czech Republic.*



Celkem pro ČR – Total for the Czech Republic

Source: Energy Regulatory Office

Chart 89: *Expected share of the capacity of natural gas-storage facilities in domestic consumption*



Spotřeba zemního plynu v ČR – Natural gas consumption in the Czech Republic

Podíl kapacity zásobníků na spotřebě – Share of storage facility capacity in consumption

Source: Ten-Year Plan for the Development of the Transmission System in the Czech Republic 2019–2028

Distribution systems

While several large-scale development projects could be implemented on the transmission system, distribution networks are considered complete. All cities with more than 5,000 inhabitants and a total of 78 % of all municipalities have been connected to gas supply. The development of distribution is minimal in HP networks – only units of km per year. Increases are more likely to be expected in local MP and LP networks where new routes increase by approximately 100 km per year.

The State Energy Policy assumes that in the period until 2040 natural gas will allow for a gradual transition away from the use of solid fuels in final consumption and small heat supply systems, partial compensation for the loss of supply from coal-fired plants nearing the end of lifetime, and a partial departure from liquid fuels in transport. Distribution networks will play a key role in fulfilling this assumption. Therefore, it is necessary to ensure their high reliability and security of operation in accordance with European standards and their necessary development in line with the growth of final gas consumption.

In order to ensure reliability of operation, the distribution companies are currently focusing primarily on the renewal of existing networks and other facilities where they invest considerable funds. The high standard of safe operation will be maintained, in particular, by continuing technical risk mitigation, which is an integral part of the planned network restoration.

In terms of development of the distribution system, this will involve the connection of existing coal-fired sources in their transition to natural gas, the connection of new energy-efficient cogeneration and micro-cogeneration units, especially in the case of inefficient heat supply systems, connection of new CNG and LNG filling stations and creation of conditions for connecting biomethane-producing stations. It should be stressed that in many cases this will only involve the cost of building the connection because there is enough network capacity within the range of the above facilities.

Both the renewal and development of distribution networks are made more difficult by high administrative complexity, especially at the investment preparation phase. Here, the State should amend legislation to create the conditions for a major acceleration of the preparation and execution of line energy infrastructure. It will also be necessary to ensure territorial protection of areas and corridors for the regeneration and development of distribution systems through spatial planning tools.

Among the crucial aspects in the planning of investment projects is also the economic aspect of the distribution system operation, which consists in increasing the efficiency of distribution, thereby optimising the cost of network operation in relation to the distributed gas quantity, and improving network economy. Where effective, new modern trenchless technologies are used in the construction of networks to reduce already-high execution costs.

4.5.3 Electricity and gas markets, energy prices

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

4.5.3.1 Legislative context

EU Directives and the Regulation on market liberalisation and ensuring the principle of regulated access to networks, namely Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC; Regulation (EC) No 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity, are implemented through the functioning electricity market. In the liberalised gas market, this involves the implementation of Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC and Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005.

The EU's energy strategy is continually streamlined and corrected through the adoption of 'liberalisation packages'.

At the end of 2016, the European Commission (EC) has published proposals for changes that have a significant impact on the future structure and functioning of the European energy market. The set of EU legislation proposals entitled 'Clean Energy for All Europeans' is a comprehensive set of measures to promote the transition to clean energy. The aim is to make the electricity market more efficient and transparent, to increase the share of renewables in energy, to increase energy savings and to strengthen the position of consumers.

4.5.3.2 Market model

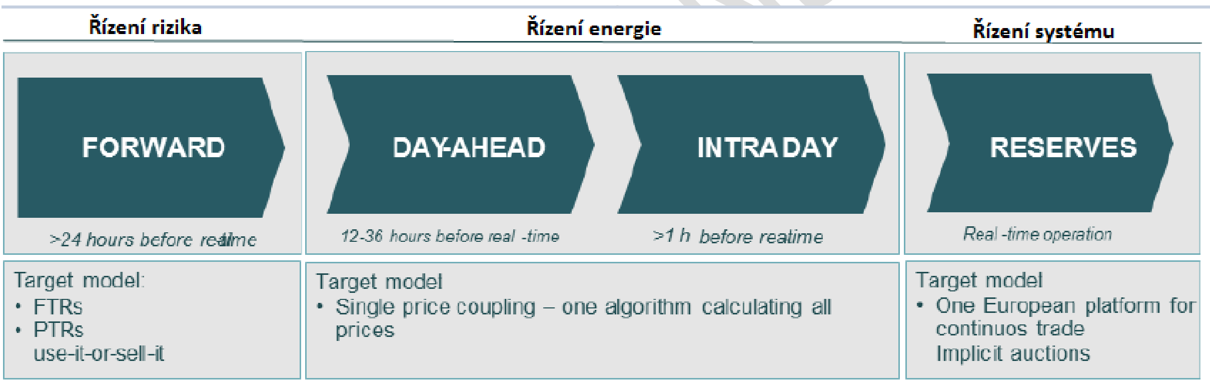
According to the energy-only market proposal, short and long-term market equilibrium should be effectively ensured by market mechanisms according to the established market framework. In practice, this means that responsibility is shared among market participants, market operator and system operator, i.e. between non-regulated and regulated entities. From the administrative perspective, it is possible to say that a significant part of the system balance planning preceding the hour of supply is left to the market participants, while ensuring the balance between electricity supply and demand at each moment of operation is entrusted to the transmission system operator. Markets are organised in consecutive time zones and their results are binding on individual participants.

Physical energy exchange takes place in real time, where equality of electricity supply and demand must apply at all times. Planning of the system operation is carried out by the transmission system operator on the basis of commercial results in the electricity markets. Based on these data, the TSO plans the system load and the required reserve power to ensure safe operation of the electricity system.

The entity's deviation from contractual values, i.e. the off-take / delivery from/to the electricity system in a quantity other than that based on the trading position of the entity, raises the need for electricity system regulation by the TSO and is therefore subject to a financial penalty.

Figure 10 then shows the time trajectory of the markets.

Figure 10: *Target model of electricity market in the EU*



Řízení rizika – risk management

Řízení energie – energy management

Řízení systému – system management

Source: European Commission: Electricity Market Functioning: Current Distortions, and How to Model Their Removal

A functioning and transparent day-ahead electricity market with the follow-up intraday market is the cornerstone of the European electricity market model. The intraday gas market is dominant in the gas sector in this respect. Bids on the day-ahead or intraday market represent expectations of the market participants for the following day. Changes in weather forecasts, unexpected outages in the production base or in industry indicate that a deviation from planned consumption/production is inevitable. The deviation from planned consumption or production values is then charged in the billing, depending on the magnitude and direction of the deviation by comparison with the system deviation.

These deviations have to be compensated by the TSO in real time so that the European synchronous electricity system is in equilibrium at all times (this equilibrium is represented by a stable 50 Hz frequency). Balancing energy, which is needed to ensure the system's balance, is ensured by the TSO by activating support services, by purchases on the balancing market with balancing energy and in emergency cases from abroad. Depending on the trades on the balancing market, the TSO activates support services. The costs incurred to ensure the power balance of the system are then spread among market participants based on the magnitude of their deviation.

By comparison with the electricity market, where all deviations are settled financially at the price determined on the basis of the direction and magnitude of the system deviation, the ‘linepack flexibility service’ can be used in the gas sector to evaluate and settle deviations. The reason is the natural storage capacity of the gas system. It enables the trading position of clearing entities to oscillate within the set flexibility so that, if these limits are not exceeded, there are no additional costs of balancing these deviations. Deviations at or below these limit values do not affect the smooth and safe operation of the gas system.

4.5.3.3 Overview of the market situation in the Czech Republic

The rights and obligations of individual participants in the electricity and gas markets are laid down in Act No 458/2000, on the conditions for business and on the performance of State administration in the energy sector and amending certain acts, as amended (the Energy Act), and implementing decrees to this Act.

Electricity sector

Electricity sector is further regulated by ERO Decree No 408/2015, on electricity market rules (the ‘Electricity Market Rules’), which was amended in 2017 by Implementing Decree No 127/2017 (effective from 1 June 2017).

The electricity market model in the Czech Republic is based on the principle of balancing responsibility of individual ‘balance responsible parties’.

Electricity market participants are subject to balancing responsibilities and may contractually transfer the balancing responsibility to another ‘balance responsible party’.

Under Section 22 of the Energy Act, electricity market participants are defined as:

- i) electricity producers;
- ii) transmission system operator;
- iii) distribution system operators;
- iv) market operator;
- v) electricity traders;
- vi) customers.

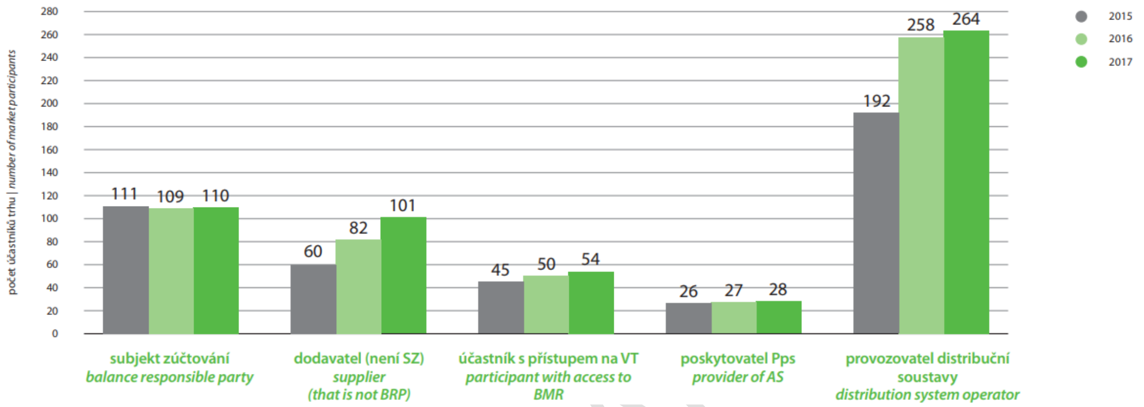
The table and figure below show the number of registered electricity market participants by participant type at the end of 2017 and the year-on-year change by comparison with 2016.

Table 84: *Number of electricity market participants*

Počet účastníků trhu s elektřinou ke konci roku 2017
Number of electricity market participants at the end of 2017

typ účastníka | *type of participant*	počet k 31. 12. 2017 *number at 31 December 2017*	meziroční změna *year-on-year change*
subjekt zúčtování balance responsible party	110	+1
dodavatel supplier	101	+19
účastník s přístupem na VT participant with access to BMR	54	+4
poskytovatel PPS AS provider	28	+1
provozovatel distribuční soustavy distribution system operator	264	+6
provozovatel přenosové soustavy transmission system operator	1	0

Počet účastníků na trhu s elektřinou registrovaných u OTE v letech 2015–2017
Number of electricity market participants registered with OTE in 2015–2017



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Gas sector

The gas industry is regulated by the Energy Act and primarily by the related ERO Decree No 349/2015, on the gas market rules (the 'Gas Market Rules'), as amended by Implementing Decree No 416/2016 (effective from 1 January 2017).

Gas market participants are:

i) gas producers;
ii) transmission system operator;
iii) distribution system operators;
iv) gas storage facility operators;
v) gas traders;
vi) customers;
vii) market operator.

The gas market model is based on the same principle where a gas market participant with the right of regulated access to the transmission system or distribution system has balancing responsibility and is the 'balance responsible party', or may contractually delegate its balancing responsibility to another 'balance responsible party'.

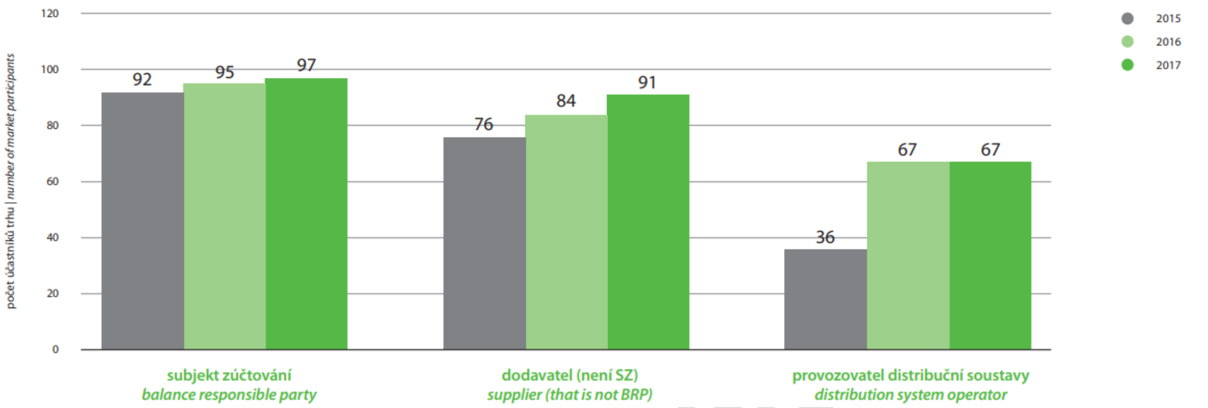
The table and figure below show the number of registered gas market participants by participant type at the end of 2017 and the year-on-year change by comparison with 2016.

Table 85: *Number of gas market participants*

Počet účastníků trhu s plynem ke konci roku 2017
Numbers of gas market participants at the end of 2017

typ účastníka | *type of participant*	počet k 31. 12. 2017 *at 31 December 2017*	meziroční změna *year-on-year change*
subjekt zúčtování balance responsible party	97	+2
dodavatel supplier	91	+7
provozovatel distribuční soustavy distribution system operator	67	0
provozovatel přepravní soustavy transmission system operator	1	0
provozovatel zásobníku plynu gas storage operator	4	0

Počet účastníků na trhu s plynem registrovaných u OTE v letech 2015–2017
Number of gas market participants registered with OTE in 2015–2017



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Supplier change – electricity market

Since 1 January 2006, the electricity market in the Czech Republic has been open to all customers, each of whom may choose any electricity supplier. In the Central System of the Market Operator (CS OTE), each supplier change is related to a specific off-take point (OP), i.e. the meter point where electricity is transferred and accepted between two market participants (where electricity is taken off). Any change of supplier, which replaces a trader of a vertically integrated undertaking, will require a new registration of the off-take point in the market operator's system. This ensures the record of the metered supply and off-take of electricity by individual suppliers to the Czech system and their assignment to the relevant 'balance responsible party'. The figure below shows an overview of the number of electricity supplier changes in recent years.

Table 86: *Number of electricity supplier changes*

Počet uskutečněných změn dodavatele elektřiny
Number of executed changes of electricity supplier

měsíc | *month*	počet uskutečněných změn dodavatele elektřiny | *number of executed changes of electricity supplier*			
	rok | *year*			
	2003–2014	2015	2016	2017
leden January	439 309	98 499	116 140	100 449
únor February	147 267	14 883	20 966	19 468
březen March	148 833	14 550	19 446	24 268
duben April	155 088	18 371	22 276	22 104
květen May	137 569	12 305	17 604	23 718
červen June	141 398	12 631	20 434	22 183
červenec July	142 200	14 989	24 046	27 449
srpen August	157 949	13 606	20 055	24 574
září September	146 148	18 010	27 852	28 022
říjen October	152 072	19 259	26 394	22 230
listopad November	166 081	18 830	23 650	21 170
prosinec December	162 762	21 823	20 673	22 212
celkem total	**2 096 676**	**277 756**	**359 536**	**357 847**
celkem 2003–2017 total 2003–2017	**3 091 815**			

Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

In 2017, there were 357 847 electricity supplier changes registered in the market operator's system. The comparison of the supplier changes in recent years shows that in 2016 the retail electricity market experienced a major revival in terms of supplier changes. As follows from the statistics on the number of supplier changes registered in the Central System of the Market Operator, consumer interest in electricity supplier change has remained almost the same in the past two years. In recent years, there has been an increase in wholesale electricity prices on energy exchanges, and a number of smaller vendors, who have so far offered cheaper electricity than large suppliers have been forced to reflect this development in their price offers. Competition in the electricity market thus constantly forces individual suppliers to improve the supply of their business products. When changing the electricity supplier, apart from the actual price of the commodity, the final consumer is interested in the accompanying services. Customers have a relatively wide variety of electricity supply offers, allowing them to find the optimal product for their needs. This is in turn reflected in an increased customer motivation to change the electricity supplier.

Supplier change – gas market

As of 1 January 2007, all final gas customers have the right to a free supplier change and thus also the possibility to influence part of their total gas supply costs. Thus, 2017 marked the seventeenth year of open gas market where every gas customer could select the supplier of their choice. The market operator's system individually registers all customer off-take points (OPs) where a supplier change replaced a trader belonging to the given network or the registration was explicitly requested by that trader. The remaining OPs (i.e. off-take points of the trader belonging to the given network) are registered in the market operator's system as a summary number. This ensures the registration of the entire metered gas supply and off-take of individual suppliers and, at the same time, their assignment to the 'balance responsible party'. The number of gas supplier changes for OPs by off-take category in individual months of 2017 is shown in the following figure.

Table 87: *Gas supplier changes for OPs by off-take category in 2017*

Počet změn dodavatele plynu u OPM podle kategorie odběru v jednotlivých měsících roku 2017
Number of changes of gas supplier at OPMs according to type of supply in specific months of 2017

měsíc | *month*	celkem | *total*	kategorie odběru | *customer supply category*			
		VO	SO	MO	DOM
leden 2017 January 2017	36 730	250	1 050	11 536	23 894
únor 2017 February 2017	13 750	2	25	1 189	12 534
březen 2017 March 2017	15 832	2	24	1 165	14 641
duben 2017 April 2017	16 404	2	11	1 311	15 080
květen 2017 May 2017	18 519	1	17	1 440	17 061
červen 2017 June 2017	15 260	2	23	1 023	14 212
červenec 2017 July 2017	16 639	1	24	1 287	15 327
srpen 2017 August 2017	14 828	3	42	1 444	13 339
září 2017 September 2017	18 069	7	61	1 867	16 134
říjen 2017 October 2017	17 495	0	28	1 378	16 089
listopad 2017 November 2017	24 614	24	26	1 449	23 115
prosinec 2017 December 2017	19 405	11	26	1 116	18 252
celkem za 2017 total in 2017	**227 545**	**305**	**1 357**	**26 205**	**199 678**

Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

The above table shows the number of OPs by off-take category with supplier change in the individual months of 2017. For the year 2017, there were 227 545 changes, which is approximately 23 500 more than in 2016 (203 950 changes). This is an almost 12 % year-on-year increase in supplier changes.

Table 88: *Gas supplier changes 2011–2016*

	2011	**2012**	**2013**	**2014**	**2015**	**2016**
Large customer	537	979	449	330	329	617
Medium-sized customer	1,142	3,951	3,061	1,572	1,326	1,973
Small customer	26,994	27,829	29,091	23,704	21,642	28,441
Household	333,268	316,297	264,680	174,783	154,465	172,949
Total	**361,941**	**348,056**	**297,281**	**200,389**	**177,762**	**203,950**

Source: OTE, a.s.

4.5.3.4 Trading on the electricity market in the Czech Republic

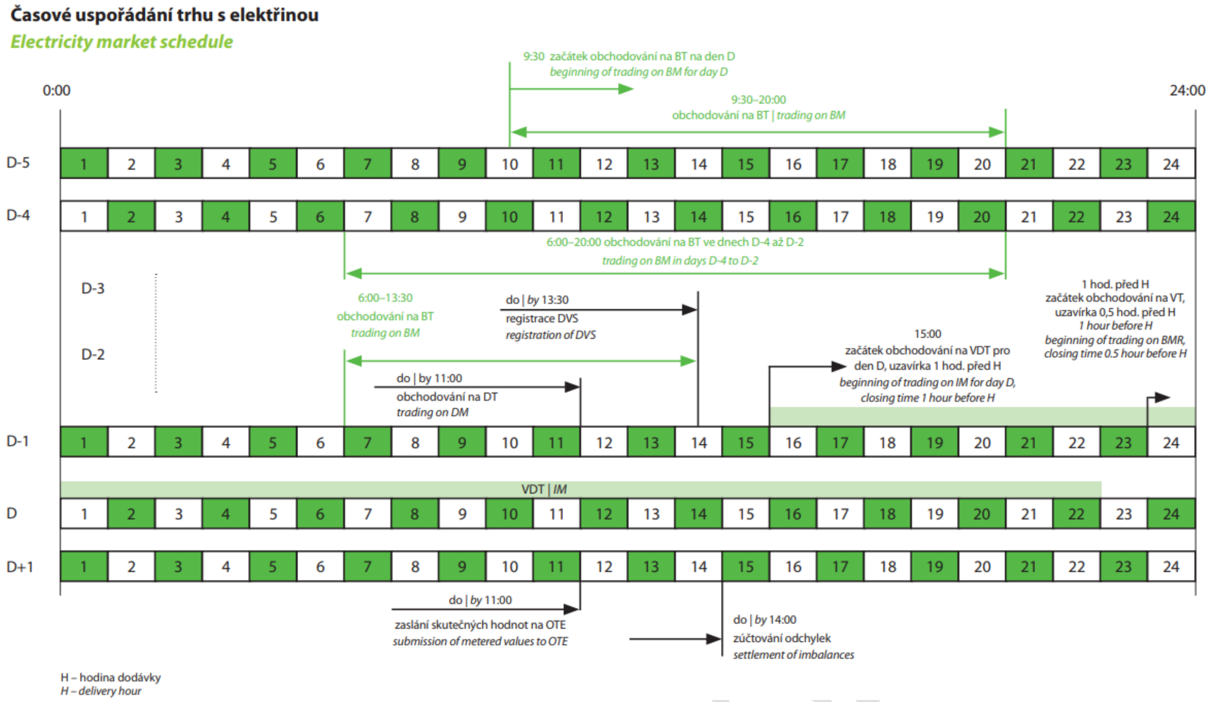
In the Czech Republic, **electricity is traded** through:

- bilateral trading;
- organised short-term market:
  - – block market (BM);
  - – day-ahead spot market (DM);
  - – intraday market (IM).

Electricity trading in the Czech Republic also involves balancing responsibility (including trading in balancing energy and balancing energy market).

Energy legislation requires market participants – balance responsible parties – to register their bilateral transactions in the OTE system through the entity–relationship diagrams (ERDs). The time slots for individual electricity market activities are shown in the following figure.

Figure 11: *Electricity market schedule*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Bilateral transactions

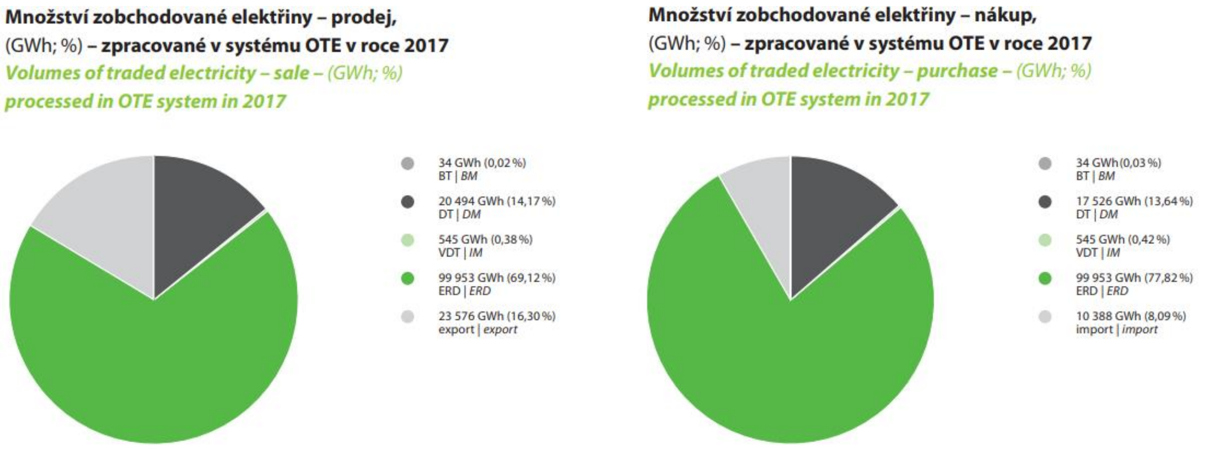
As noted above, when market participants sell or purchase electricity through bilateral transactions, they are required to register these transactions in the OTE system.

The bilateral national electricity supply transactions were submitted to the market operator for registration by the individual balance responsible parties in the form of entity–relationship diagrams (ERDs) by 13:30 hours on the day preceding the day on which the supply was to take place; this was also the closing time for the bilateral transaction. The OTE system registers only the amount of bilateral trade electricity, without its price. The financial settlement of these transactions takes place directly between trading parties outside the OTE system; OTE is not the central counterpart of these trades. The registration of these entity–relationship diagrams is, among other things, subject to the condition of the financial security of the balance responsible party given the possible imbalances of the balance responsible party that these transactions might cause.

By means of bilateral transactions, OTE system registers trades concluded through both classical bilateral contracts as well as brokerage platform trades, forward exchange trades, etc. In 2017, OTE system registered 99.95 TWh in the form of national entity–relationship diagrams. The following figure shows the amount of electricity traded and registered in OTE system in 2017.

In addition to the above, there are also electricity trades with financial settlement on commodity exchanges, which serve to hedge long-term risks against the rise/fall in electricity prices.

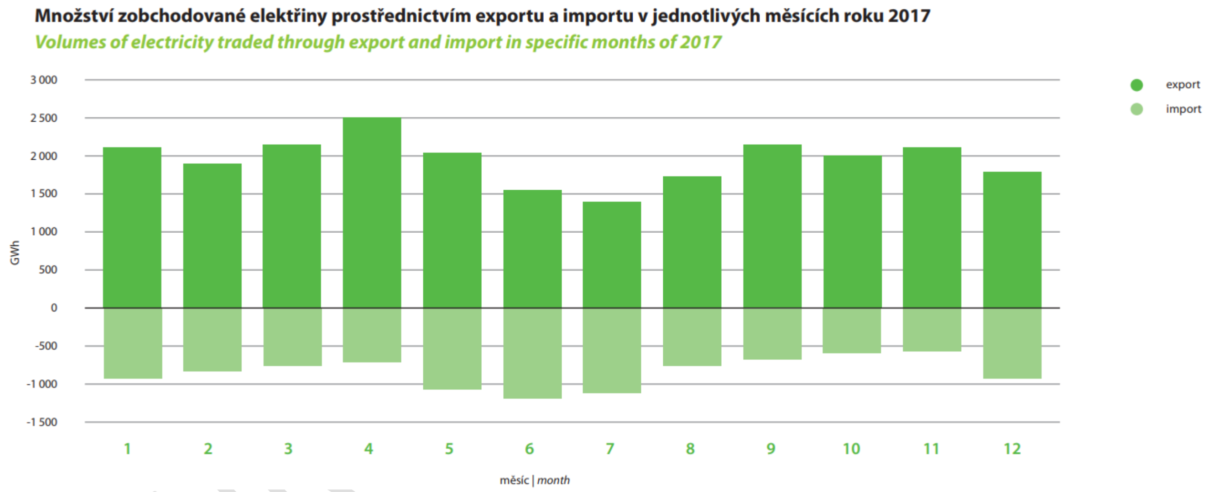
Chart 90: *Amount of electricity traded (purchase and sale) registered in OTE system in 2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

The value of contractually concluded cross-border export trades amounted to 23 576 GWh in 2017; imports amounted to 10 388 GWh in 2017. The breakdown of these transactions in individual months of 2017 is shown in the following figure.

Chart 91: *Amount of electricity traded through export and import in 2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Organised short-term electricity market

The organised short-term market in the Czech Republic is an important form of electricity trading. Thanks to a substantial increase in liquidity in recent years, the energy market participants have a reliable guarantee that they can buy or sell the relevant commodity in response to the current situation in the system or in their production or customer's portfolio, even shortly before delivery (day, hour). The aim and purpose of the short-term market is not only to reduce the risk of imbalance, but also to increase the security and reliability of supplies. The essential importance of liquid short-term markets is also pricing, when the prices of transactions on these markets are used as a basis for the settlement of financial instruments traded on commodity exchanges or serve as a guideline for the prices of other contracts between the supplier and the customer.

Table 89: *Comparison of the basic parameters of individual markets*

	elektřina | *electricity*				plyn | *gas*
	BT | *BM*	DT | *DM*	VDT | *IM*	VT | *BMR*	VDT | *IM*
forma trhu type of market	kontinuální párování continuous matching	denní aukce daily auction	kontinuální párování continuous matching	kontinuální párování continuous matching	kontinuální párování continuous matching
obchodovaná perioda traded period	12 nebo 24 hod. 12 or 24 hours	1 hod. 1 hour	1 hod. 1 hour	1 hod. 1 hour	**24 hod. **24 hours
minimální možné obchodovatelné množství minimum tradable volume	1 MW × 12, nebo 24 hod. 1 MW × 12 or 24 hours	1 MWh	1 MWh	1 MWh	0,1 MWh
maximální možné obchodovatelné množství maximum tradable volume	*50 MW × 12, nebo 24 hod. *50 MW × 12 or 24 hours	99 999 MWh	99 999 MWh	99 999 MWh	99 999,9 MWh
nejmenší možný inkrement množství smallest quantity increment	1 MW × 12, nebo 24 hod. 1 MW × 12 or 24 hours	0,1 MWh	0,1 MWh	0,1 MWh	0,1 MWh
měna obchodování trading currency	Kč CZK	EUR	EUR	Kč CZK	EUR
minimální možná cena minimum price	1 Kč/MWh CZK 1/MWh	-500 EUR/MWh	-3 500 EUR/MWh	-99 999 Kč/MWh CZK -99,999/MWh	0,01 EUR/MWh
maximální možná cena maximum price	9 999 Kč/MWh CZK 9,999/MWh	***3 000 EUR/MWh	3 500 EUR/MWh	99 999 Kč/MWh CZK 99,999/MWh	4 000 EUR/MWh
nejmenší možný inkrement ceny smallest price increment	1 Kč/MWh CZK 1/MWh	0,01 EUR/MWh	0,01 EUR/MWh	1 Kč/MWh CZK 1/MWh	0,01 EUR/MWh
možnost nulové ceny zero price option	NE NO	ANO YES	ANO YES	NE NO	NE NO
čas otevření trhu market opens at	9:30 D-5	neomezené unlimited	15:00 D-1	H-1:00	10:30 D-1
čas uzavření trhu market closes at	13:30 D-1	11:00 D-1	H-1:00	H-0:30	5:00 D+1

* V rámci jedné nabídky | *Within one bid.*
** Plynárenský den od 6:00 do 6:00 hod. | *Gas day from 6:00 to 6:00.*
*** Druhá aukce je vyhlašována při dosažení či překročení dolní meze ceny -150 EUR/MWh nebo horní meze ceny 500 EUR/MWh.
Second auction is announced whenever the bottom price limit of EUR -150/MWh or the top price limit of EUR +500/MWh are reached or exceeded.

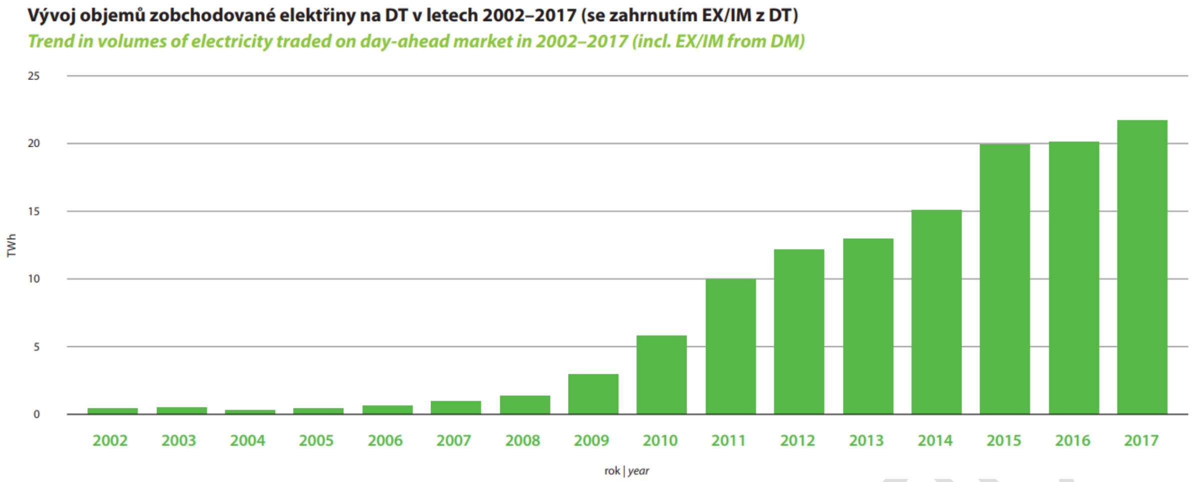
Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Day-ahead electricity market

The day-ahead electricity market in the Czech Republic is based on the principle of the implicit allocation of cross-border capacities (MC) and is operated jointly with the Slovak, Hungarian and Romanian markets under the name of 4M MC. These four day-ahead markets are coupled by PCR, which is also implemented in the interconnected MRC region.

The day-ahead market of the Czech Republic operated within 4M MC on the MC principle, market participants in the CZ, SK, HU and RO therefore satisfy their electricity purchase or sale requirements for the next day in all four market areas without the need for explicit transmission capacity. The development of volumes of electricity traded on day-ahead market is illustrated in the following figure.

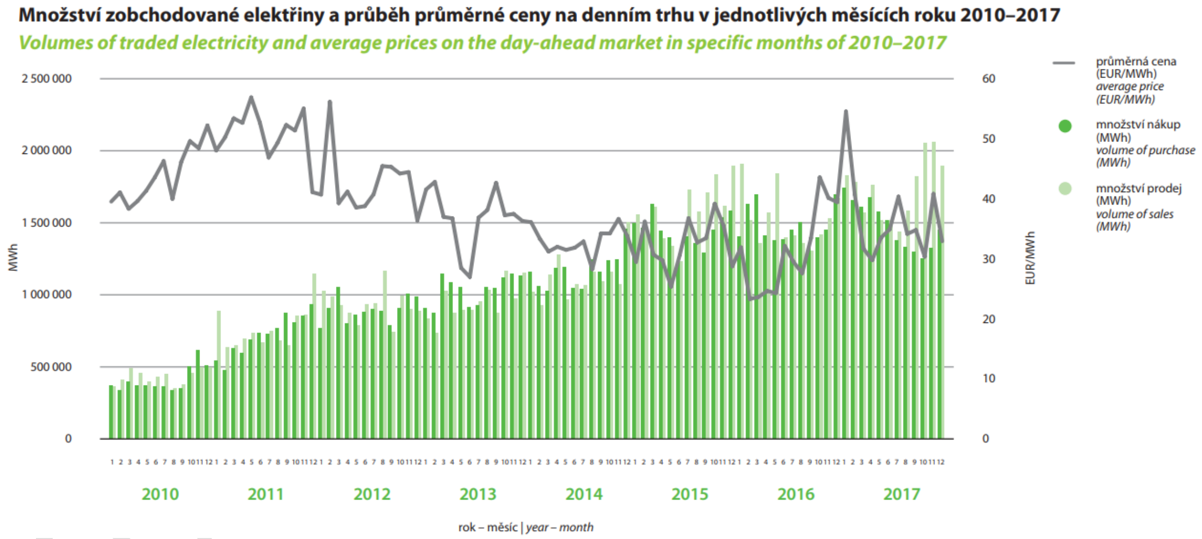
Chart 92: *Trend in volumes of electricity traded on day-ahead market in 2002–2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

The volume of electricity trades concluded on the OTE day-ahead market in 2017 reached a new annual maximum of 21.75 TWh. The total volume traded on day-ahead market in the Czech Republic in 2017 represented about 1/3 of domestic net consumption. The average price of trades on OTE day-ahead market reached EUR 36.46/MWh in 2017.

Chart 93: *Volumes of traded electricity and average prices on the day-ahead market in 2017*

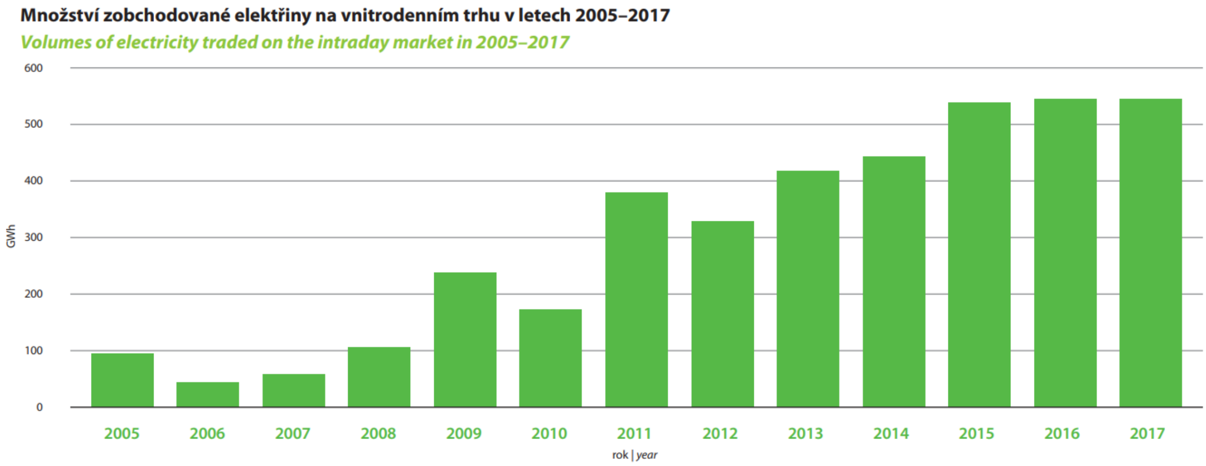


Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Intraday electricity market

Through an organised intraday electricity market, traders anonymously offer or demand electricity on a trading day, up to a limit of 60 minutes prior to delivery or off-take. Intraday trading opens at 15:00 for all trading hours of the following day. The volume of trades concluded in 2017 on the intraday electricity market reached almost 545 GWh.

Chart 94: *Volumes of electricity traded on the intraday market in 2005–2017*

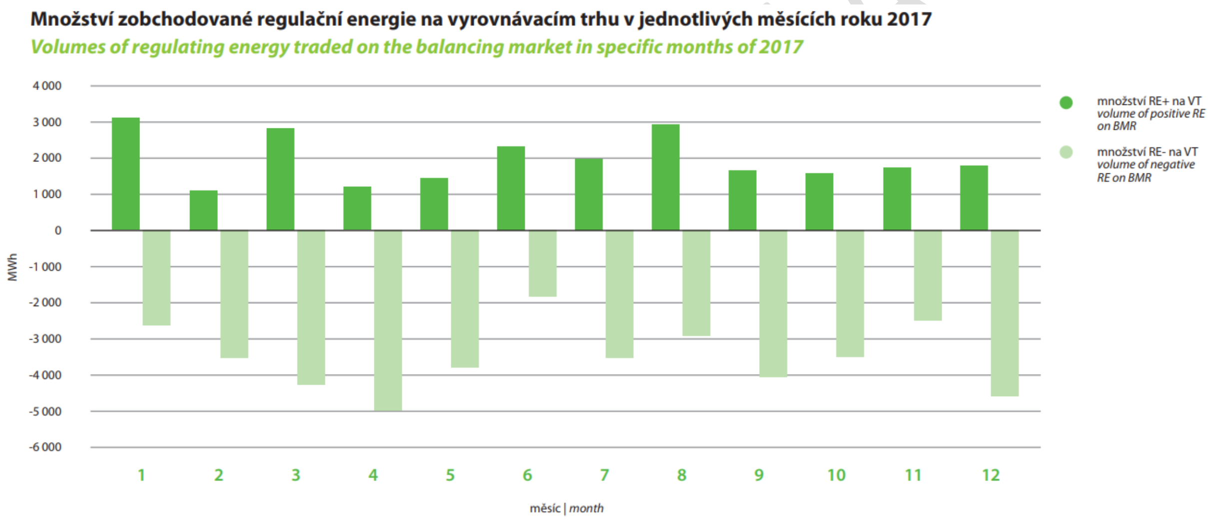


Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Balancing energy market

A specific trading venue just before the time of delivery or off-take is the balancing energy market. In this market, participants may, up to 30 minutes before the trading hour, offer or demand electricity only in the form of positive or negative balancing energy, where in both cases the transmission system operator is the counterpart of that trade. It is therefore the last possibility for market participants to adjust their business position. Balancing energy purchased in this market helps the transmission system operator to effectively control and equalise the power balance of the electricity system. Several factors influence the liquidity of the balancing energy market. The primary effort of the transmission system operator is to reduce the costs of support services. Market participants then create pressure by imbalance prices, which forces the balance responsible party to exercise the option of minimising its imbalance at a time close to the trading hour. This market is expected to be gradually phased out with the implementation of Commission Regulation (EU) 2017/2195 of 23 November 2017 establishing a guideline on electricity balancing.

Chart 95: *Volumes of balancing energy traded on the balancing market in 2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

4.5.3.5 Trading on the gas market in the Czech Republic

The gas market model is based on the principle of balancing responsibility where a gas market participant with the right of regulated access to the transmission system or distribution system has balancing responsibility and is the 'balance responsible party', or may contractually delegate its balancing responsibility to another 'balance responsible party'. The business unit is one gas day starting at 6:00 o'clock on a given calendar day and ending at 6:00 o'clock of the next calendar day.

In the Czech Republic, **gas is traded** through:

- bilateral trading;
- organised short-term market;
  – intraday market (IM);
  - market with unused flexibility.

Electricity trading in the Czech Republic also involves the balancing responsibility.

In addition to the above, there are also gas trades with financial settlement on commodity exchanges, which serve especially to hedge long-term risks against the rise/fall in gas prices.

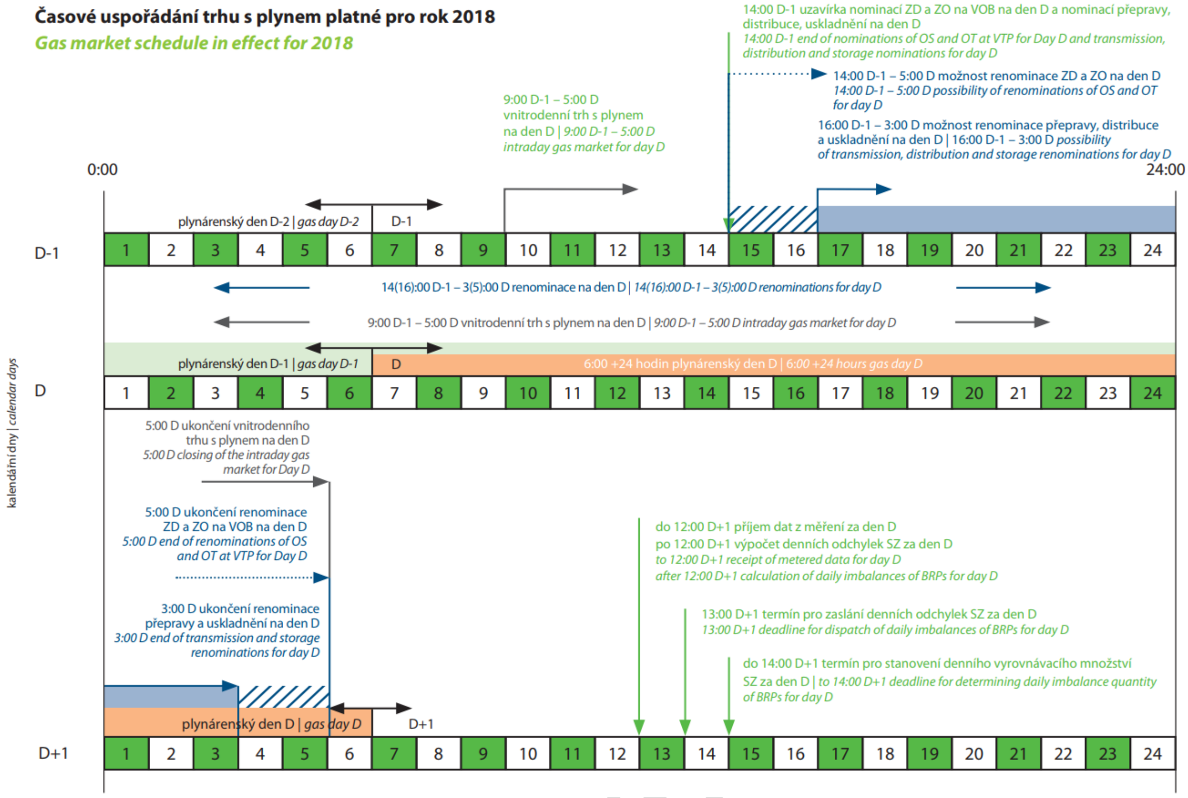
The trades and transmitted quantities of gas are registered by sending ‘nominations’.

Nominations are divided into:

- transmission nomination – a command for the transmission of gas at the entry and exit points of the border transfer stations (BTS), i.e. the export and import of gas from/to the transmission system in the Czech Republic, an order for the transmission of gas at the input or output points of virtual gas-storage facilities for the transmission of gas to the customer off-take point directly connected to the transmission system with a reserved capacity of at least 5 000 MWh per day;
- storage nomination – an order to inject or deliver the said amount of gas to or from the virtual gas storage facility;
- distribution nomination – an order to distribute gas at the entry points of gas production plants and at the entry and exit points of cross-border gas pipelines (CGP), i.e. export and import of gas from/to a given distribution system in the Czech Republic;
- delivery nomination (DN) and the off-take nomination (ON) – transactions that are carried out via VTP between individual traders (gas transfer at VTP); what is nominated at VTP must be delivered / off-taken.

All nominations are registered by the balance responsible party with the market operator or the relevant operators by 14:00 hours of the day preceding the commencement of the gas delivery day. After this time, transmission nominations are matched with neighbouring transmission system operators, distribution nominations are matched with neighbouring distribution or transmission system operators, storage nominations are matched between the transmission system operator and the gas storage facility operator, and virtual trade point nominations are matched between the individual balance responsible parties. However, market participants have other options to adjust their trade position. Until almost the end of the ‘D’ gas day, the balance responsible party may adjust its position by sending a renomination or a corrective nomination of its obligations. Quantity is nominated as one-off nomination for the entire gas day. The gas market schedule is shown in the figure below.

Figure 12: *Gas market schedule in effect for 2018*



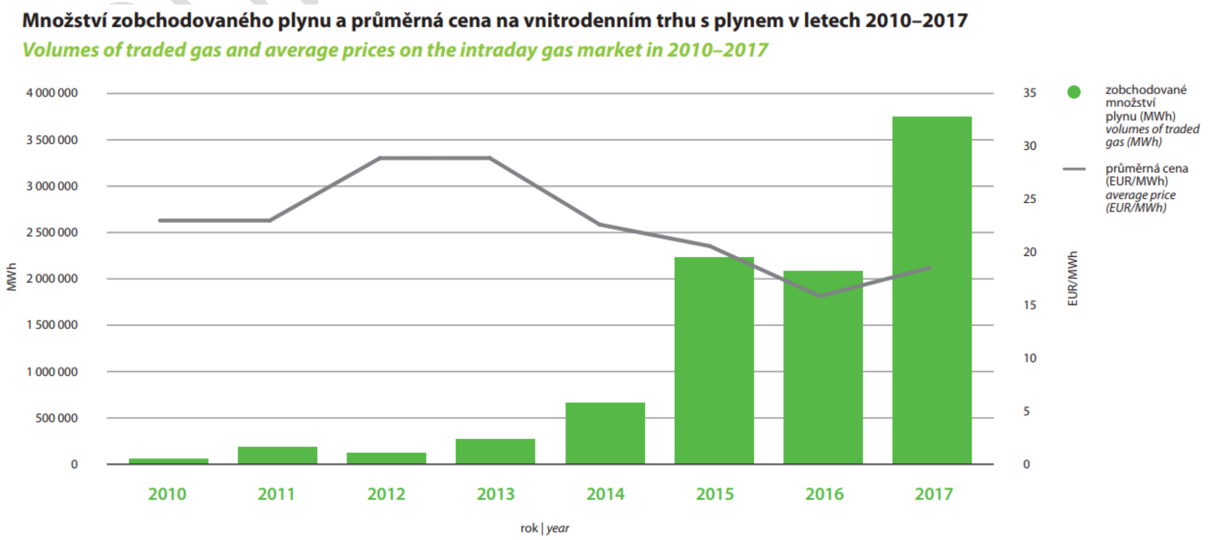
Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

Organised short-term gas market

The short-term gas market in the Czech Republic is represented by the intraday gas market. It allows market participants to continue trading even during the gas day. The intraday gas market for the given delivery day opens at 9:00 o'clock on the day preceding the gas day in which the delivery occurs and ends one hour before the end of the gas day when the delivery occurs.

In 2017, the intraday gas market saw trades totalling 3 747 GWh of gas. The average price of gas traded in the intraday market in 2017 was EUR 18.02/MWh.

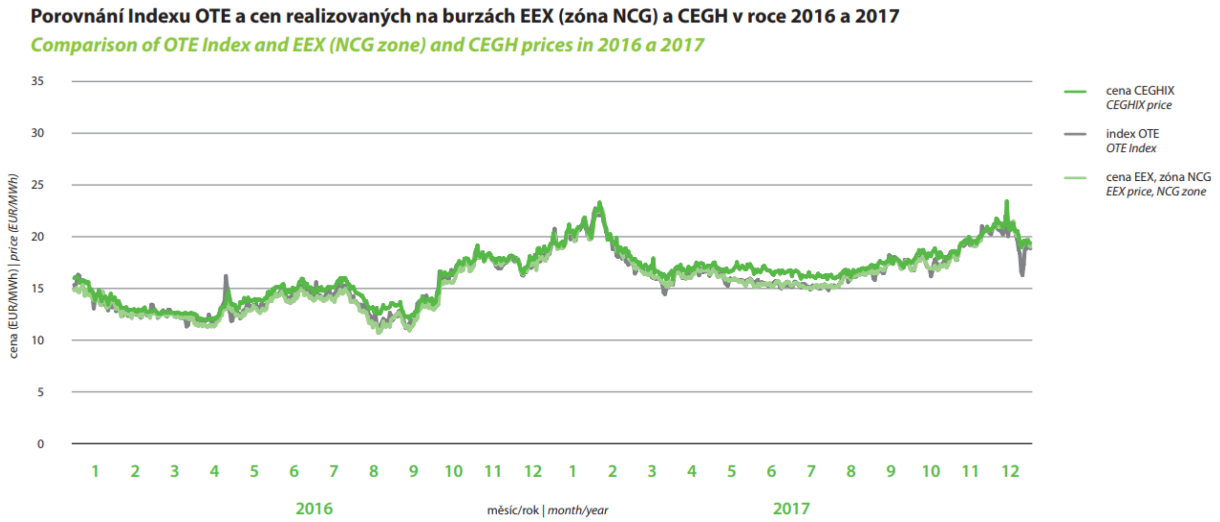
Chart 96: *Volumes of traded gas and average prices on the intraday gas market in 2010–2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

The OTE Index is determined on the basis of prices obtained on the intraday gas market organised by the market operator. The course of the OTE Index and the prices realised on EEX exchange in Germany (Daily Reference Price for the NCG zone) and the CEGH exchange in Austria during 2016 and 2017 are shown in the figure below.

Chart 97: *Comparison of OTE Index and EEX and CEGH prices in 2016 and 2017*



Source: Annual Report on the Electricity and Gas Markets in 2017 (OTE, a.s.)

The high correlation of gas prices in the OTE market and the EEX exchange proves the sufficient cross-border capacities and maturity of the Czech short-term organised gas market.

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

The gradual European integration of electricity markets extends the possibilities for mutual trade and makes it possible to make better use of the potential of electricity production in individual countries. At the same time, however, the interconnection leads to the natural interaction of the individual national energy systems.

Over the last few years, there were ongoing preparations, within spot trading in electricity, for the coupling of the regional project 4M MC to MRC on the basis of the implicit flow-based allocation of cross-border capacities within CORE, established by the CACM Regulation and consisting of 12 EU Member States[139]. The PCR solution is already being used in price-coupled markets in Europe and its further use can therefore be seen as a basis for a future pan-European solution.

Concerning intraday trading in electricity, 2018 saw the conclusion of the implementation of a platform for the single intraday continuous trading with the implicit allocation of cross-border capacities within the Cross-Border Intraday Coupling (XBID) project, which was established as the technical solution for the single intraday coupling in Europe under the MCO Plan. The XBID project responds to market needs by creating a more transparent and efficient continuous trading environment that enables market participants to easily trade their intraday positions across EU markets without the need for explicit allocation of transmission capacity.

[139] France, Germany, Belgium, the Netherlands, Austria, Czech Republic, Slovakia, Poland, Hungary, Slovenia, Croatia and Romania.

Within the creation of a single gas market in the EU, the integration of gas markets lags far behind the integration of electricity markets. In addition to infrastructure projects that are geared towards facilitating the reservation of capacities for gas traders or making areas that are not directly coupled accessible for trading (e.g. between the Czech Republic and Austria through TRU[140]), no integration projects are currently under discussion with the aim of coupling organised gas markets in our region.

In this context, the Czech Republic is working on completing the internal energy market, specifically the internal gas market, in particular by removing infrastructure bottlenecks and market barriers between the Czech Republic and its neighbours, namely Poland and Austria.

4.6 Dimension 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)

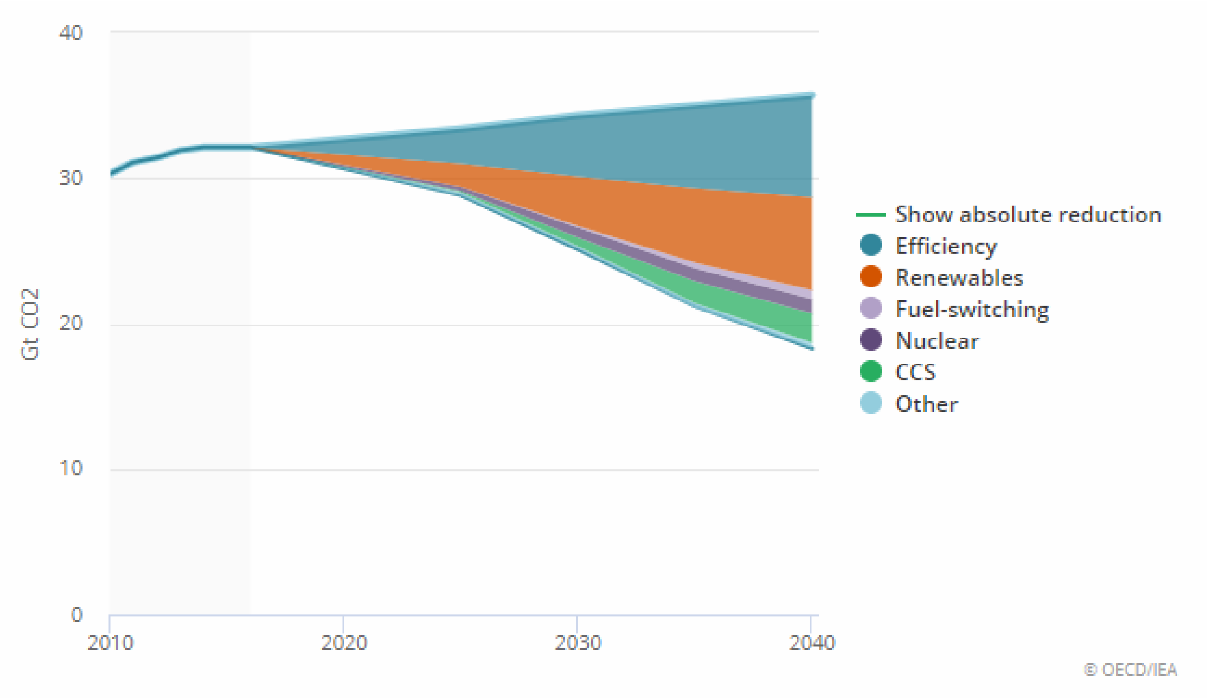
In the Czech Republic's view, the current state of the low-carbon technologies sector and its position on the global market goes beyond the scope of this document and it is not effective to carry out this assessment in isolation at Member State level.

The Czech Republic, however, carefully monitors the state of low-carbon technologies in order to be able to respond to this development. Since 2001, the Czech Republic has been a member of the International Energy Agency (IEA), which also addresses the state of low-carbon technologies and monitors their development with a view to achieving long-term targets in the field of global greenhouse gas emission reductions. This information is included especially in the 'Energy Technology Perspectives (ETP)' and 'Tracking Clean Energy Progress (TCEP)'.

Within TCEP, the International Energy Agency monitors the necessary additional CO_2 reduction to achieve the Sustainable Development Scenario, by comparison with the New Policies Scenario, which breaks down the necessary reduction to individual low-emission technologies / technologies, as well as demand-side measures (in particular increase in energy efficiency).

[140] For more information on this service, see NET4GAS website at: https://www.net4gas.cz/cz/media/tiskove-zpravy/zpravy/cesky-rakousky-trh-plynem-se-propojuji-diky-nove-sluzbe-trading-region-upgrade-tru.html

Chart 98: *Additional CO_2 reduction in the SDS by comparison with NPS*



Source: Tracking Clean Energy Progress (International Energy Agency)

Within TCP, the IEA evaluates the contribution of individual technologies to achieving the objectives defined in the SPS. Altogether, there are a total of 30 low-carbon technologies (or procedures, these are not just technologies as such), which are ranked in five categories, namely (i) power; (ii) buildings; (iii) transport; (iv) industry and (v) energy integration. Renewable sources are further subdivided into a total of eight sub-categories (i.e. a total of 37 categories).

According to the latest available assessment, in 2017 only four categories were 'on track', namely, (i) solar PV; (ii) electric vehicles; (iii) lighting and (iv) data centres and networks. 22 technologies were labelled as 'more efforts needed' and 11 technologies were labelled 'off track'.[141]

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

It is not possible to precisely determine the exact level of public funding of research and innovation for low-carbon technologies. The 'low-carbon technologies' category is not defined and in place in the Czech Republic for the purposes of statistical surveys. The situation is further complicated by the fact that basic research does not have to be clearly assigned to low-carbon technology. Table 90 shows State budget expenditure for research, development and innovation in the period 2016–2019, when years 2016 and 2017 are actual figures, and years 2018 and 2019 are figures approved within the State budget. On the basis of the National Priorities of Oriented Research, 18 % of the total public expenditure should be allocated to Sustainable Energy and Material Resources (Table 31). However, this breakdown is made difficult by the approach to research in the Czech Republic, which is broken down partly to ministries and partly within national support programmes (for example within the Technological Agency of the Czech Republic, the Grant Agency of the Czech Republic and others, see Table 90).

[141] For more information on the methodology and overall evaluation process, see https://www.iea.org/tcep/.

Table 90: *State budget expenditure on research, development and innovation by 2019 (CZK thousand) thousands)*

	2016 actual	**2017 actual**	**State budget 2018**	**State budget 2019**
Office of the Government of the Czech Republic	62,486,218	76,370,186	79,403,981	65,506,346
Ministry of Foreign Affairs	0	9,986,613	25,152,000	25,336,000
Ministry of Defence	397,053,604	483,263,504	436,040,000	414,486,150
Ministry of Labour and Social Affairs		9,977,391	60,000,000	80,000,000
Ministry of the Interior	364,055,447	640,874,187	608,321,000	798,822,402
Ministry of the Environment	0	153,231,534	248,379,554	257,600,199
Grant Agency of the Czech Republic:	3,927,443,928	4,107,793,016	4,333,066,000	4,390,784,794
Ministry of Industry and Trade	640,374,977	1,927,225,968	2,993,928,152	2,924,604,421
Ministry of Transport	0	15,332,946	50,000,000	50,000,000
Ministry of Agriculture	858,044,769	875,396,428	884,726,000	982,682,952
Ministry of Education, Youth, and Sports	15,296,759,600	16,690,662,807	18,751,885,565	19,734,339,959
Ministry of Culture	375,571,758	388,182,239	521,382,000	487,296,138
Ministry of Health	1,190,098,792	1,588,405,901	1,557,640,512	1,552,100,648
Ministry of Justice	7,890,470	7,050,373	0	0
Institute for the Study of Totalitarian Regimes	2,931,128	4,286,063	0	0
Academy of Sciences of the Czech Republic	4,777,930,160	5,231,659,779	5,684,692,000	6,022,421,793
Technological Agency of the Czech Republic	2,823,387,117	2,923,837,660	4,335,548,383	4,274,646,444
Total	30,724,027,967	35,133,536,594	40,570,165,147	42,060,628,246

Source: State budget expenditure on research, development and innovation in 2019

Information on the scope of public funds directed to the energy sector can be obtained from the Central Register of Projects (the 'CRP' category). For the energy sector, the relevant categories are JE (non-nuclear energy, energy consumption and use) and JF (nuclear energy). Table 91 provides support for JE and JF. It shows that between 2009 and 2015, almost CZK 3.6 billion was allocated in selected public procurement procedures for projects with JE and JF as the main field; the total costs amounted to approximately CZK 5.2 billion. For projects with JE and JF as the secondary field, public support amounted to approximately CZK 1.1 billion with the total cost of over CZK 1.5 billion. Table 92 shows the approved targeted support and total costs for 2016–2020 (projects approved before September 2016).

In 2018–2025, the energy sector should be allocated public funds for applied research of at least CZK 4 billion / CZK 5.7 billion of total funds, which corresponds to the approved funds under the THÉTA programme (assuming that all allocated funds are disbursed). Of course, energy research expenditure is not limited to this programme and will therefore very likely be higher, but this cannot be precisely quantified.

Table 91: *Realised targeted support and total costs in JE, JF, CZK thousands (2009–2015)*

		2009	2010	2011	2012	2013	2014	2015
JE, JF as main field	Grant	314,843	428,187	586,492	726,330	606,529	489,885	436,152
	Costs	430,067	584,891	810,218	1,039,751	886,811	729,510	672,983
JE, JF as secondary field	Grant	86,743	117,971	177,803	195,609	187,285	178,226	153,883
	Costs	114,850	156,195	235,471	265,468	269,272	267,247	237,796

Source: Underlying study of THÉTA (TA CR, September 2016)

Table 92: *Approved targeted support and total costs in JE, JF, CZK thousands (2016-2020)*

		2016	2017	2018	2019	2020
JE, JF as main field	Grant	348,428	267,920	151,052	114,173	568
	Costs	540,405	407,460	218,280	164,684	887
JE, JF as secondary field	Grant	90,320	69,258	43,900	27,071	469
	Costs	138,903	107,366	67,016	42,403	629

Source: Underlying study of THÉTA (TA CR, September 2016)

Table 93 shows the basic science and research indicators. In addition, it shows the development of workers in science and research (in science and research centres). However, not all of these people carry out scientific work. Table 94 shows the number of science and technology specialists. Table 95 then describes the development of patens, in a breakdown to national patents and European patents valid for the Czech Republic. However, it should be emphasised that this information is not specific to energy and climate or low-carbon technologies, but it is an aggregate for the whole of the Czech Republic and for all science and research sectors. Detailed data specifically on energy and climate are not available.

Table 93: *Basic science and research indicators (number; CZK million) thousands)*

	2005	2009	2010	2011	2012	2013	2014	2015	2016	2017
R&D centres (number)	2,017	2,345	2,587	2,720	2,778	2,768	2,840	2,870	2,830	3,113
R&D workers (number)	43,370	50,961	52,290	55,697	60,329	61,976	64,443	66,433	65,783	69,718
R&D expenditure (CZK million) thousands)	38,146	50,875	52,974	62,753	72,360	77,853	85,104	88,663	80,109	90,377

Source: Statistical Yearbook of the Czech Republic (2018), Chapter 23. Science, research and innovation[142]

Table 94: *Science and technology specialists (thousands of persons)*

	2014	2015	2016	2017
Natural sciences, mathematics and statistics	8.0	11.9	9.7	9.7
Biological and related sectors	13.3	12.0	16.1	21.0
Production, construction and related sectors	56.7	64.2	67.5	72.8
Electrical engineering, electronics and electronic communications	12.2	13.1	17.6	20.0
Architecture, spatial planning, design and related sectors	17.0	16.9	19.1	21.0
Other	4.4	3.1	3.0	0.0
Total	111.6	121.3	133.1	144.5

Source: Statistical Yearbook of the Czech Republic (2018), Chapter 23. Science, research and innovation

Table 95: *Development of patents (number)*

Indicator	2010	2014	2015	2016	2017
National patents	911	688	749	781	669
European patents validated for the Czech Republic	3,693	4,543	4,827	5,961	6,901
Total	**4,604**	**5,231**	**5,575**	**6,742**	**7,570**

Source: Statistical Yearbook of the Czech Republic (2018), Chapter 23. Science, research and innovation

Further comprehensive information is available in the document ‘Analysis of the state of research, development and innovation in the Czech Republic and their international comparison’, which is prepared every year. The last available document is for 2016[143].

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

Breakdown of current price elements

It should be noted that the ‘assignment’ of this subchapter is relatively unclear, as it is not stated what commodities/fuels these prices should concern. According to the requirement for breakdown to price elements, including the network element, it can be deduced that this is the requirement for network commodities, i.e. electricity and natural gas (the prices of heat are very region-dependent). Therefore, below is information on the prices of electricity, gas, and black coal. The Czech Republic also

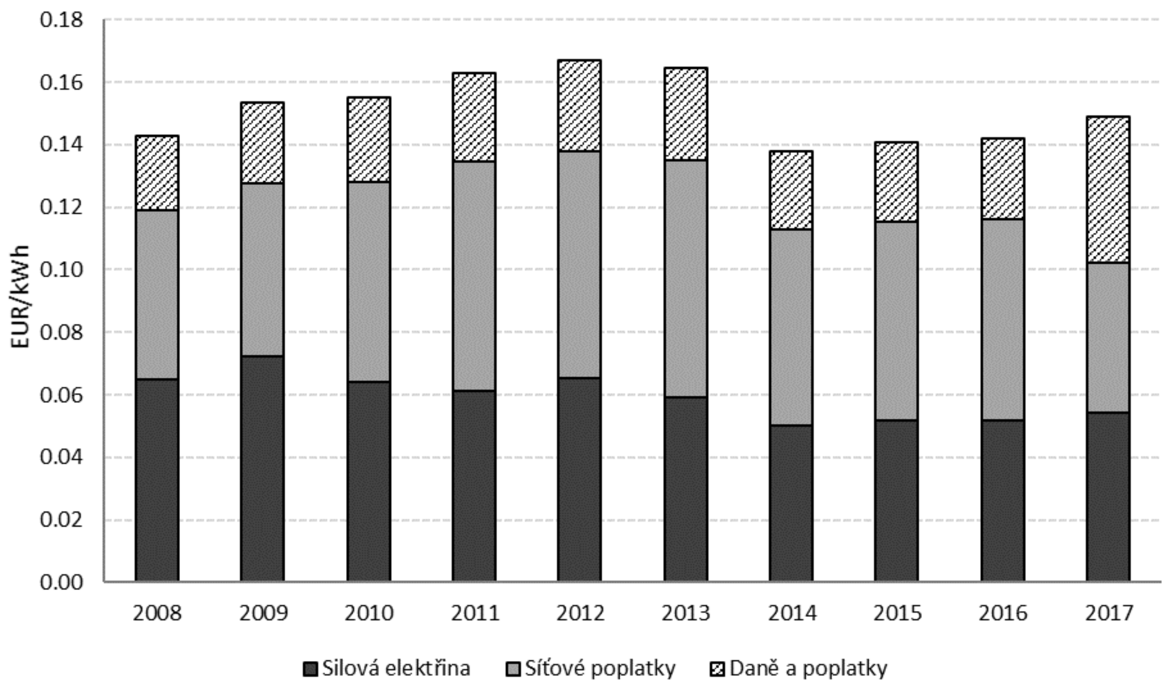
142 Available at: https://www.czso.cz/csu/czso/23-veda-vyzkum-a-inovace
143 The document is available at: https://www.vyzkum.cz/FrontClanek.aspx?idsekce=799467

monitors the prices of other fuels/commodities, such as car gasoline and diesel fuel, LPG, light and fuel oil, etc.

Electricity prices

Electricity prices (as well as prices of natural gas) are available in the publicly available EUROSTAT databases (underlying data are sent by the Czech Statistical Office). Below is information on electricity price developments for the household and non-household sectors. Detailed information is available from EUROSTAT.[144] Prices are also available in different consumption ranges; the prices may vary between the ranges. Below are only selected ranges. Chart 99 shows the development of the electricity price for the household sector for the annual consumption of 2.5–4.9 MWh in EUR/kWh, broken down into individual price components, i.e. the non-regulated electricity, network charges and taxes and charges. Chart 100 shows a comparison of prices of the Czech Republic with neighbouring countries and Hungary in purchasing power parity. Chart 101 shows the price of electricity broken down into individual elements for non-household sectors for the selected consumption range. Chart 102 shows a price comparison for the non-household sector.

Chart 99: *Electricity price for households (annual consumption range of 2.5–4.9 MWh)*



Silová elektřina – Non-regulated electricity

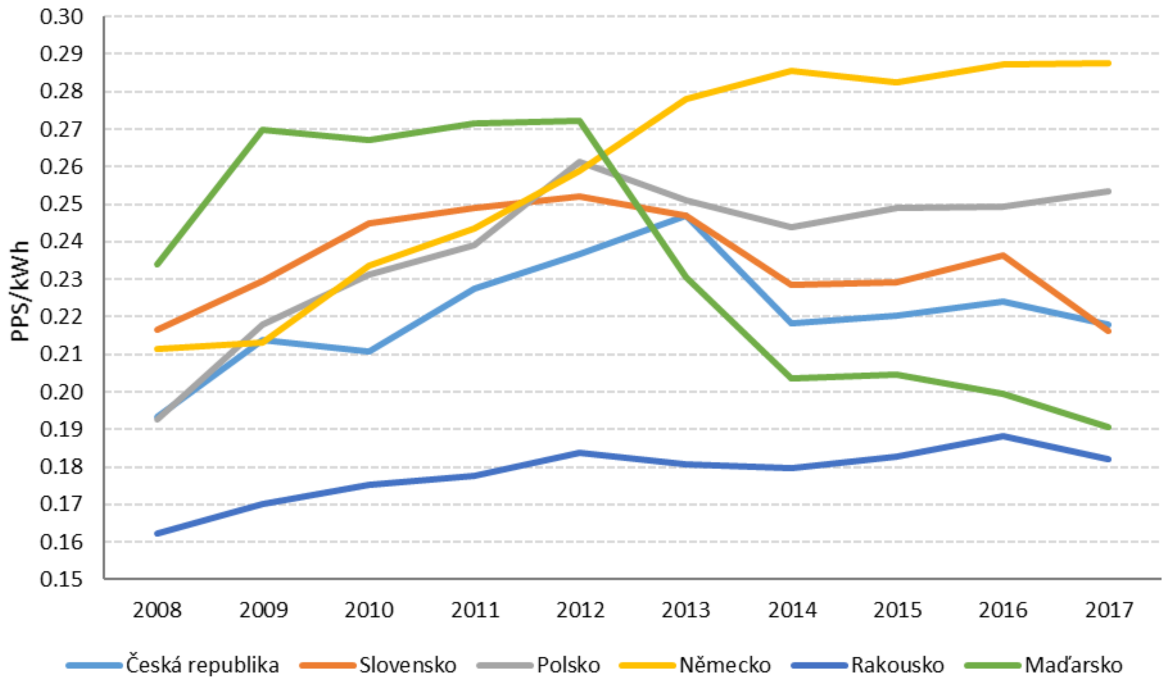
Síťové poplatky – Network charges

Daně a poplatky – Taxes and charges

Source: EUROSTAT (Electricity prices components for household consumers; nrg_pc_204_c)

[144] This database is referred to as 'Energy statistics – price of natural gas and electricity (ngr_price)', which is available at https://ec.europa.eu/eurostat/web/energy/data/database

Chart 100: *Comparison of electricity prices for households (annual consumption range of 2.5–4.9 MWh)*



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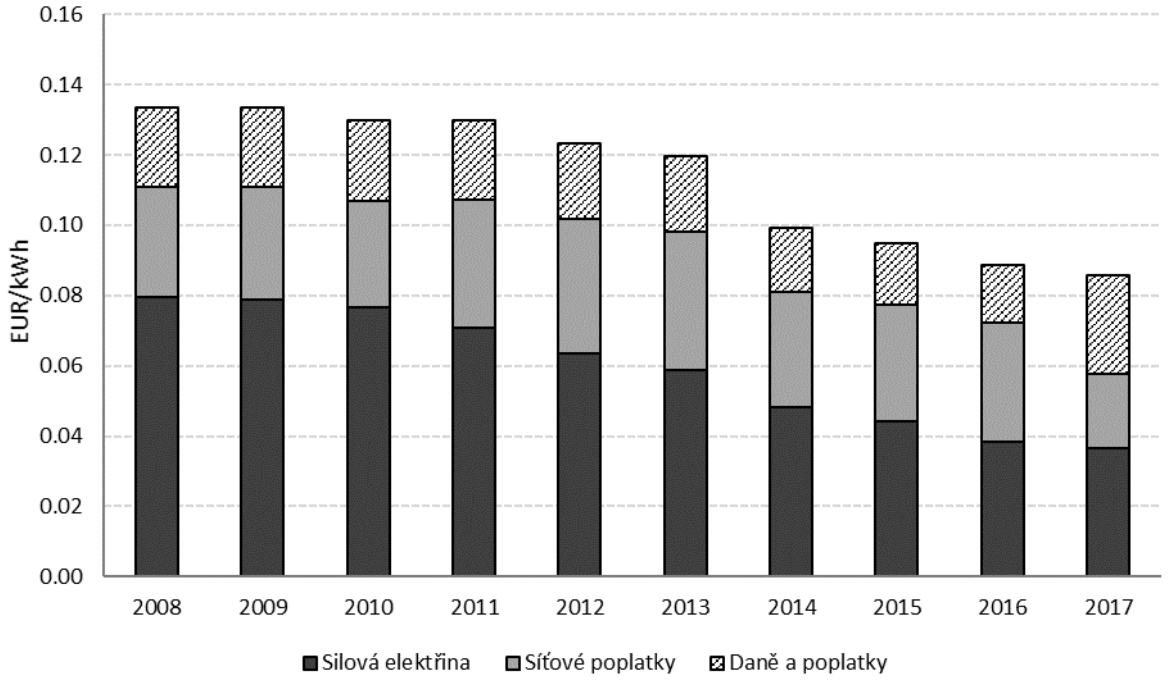
Source: EUROSTAT (Electricity prices for household consumers; nrg_pc_204)

Chart 101: *Electricity price for non-households (annual consumption range of 500–2 000 MWh)*



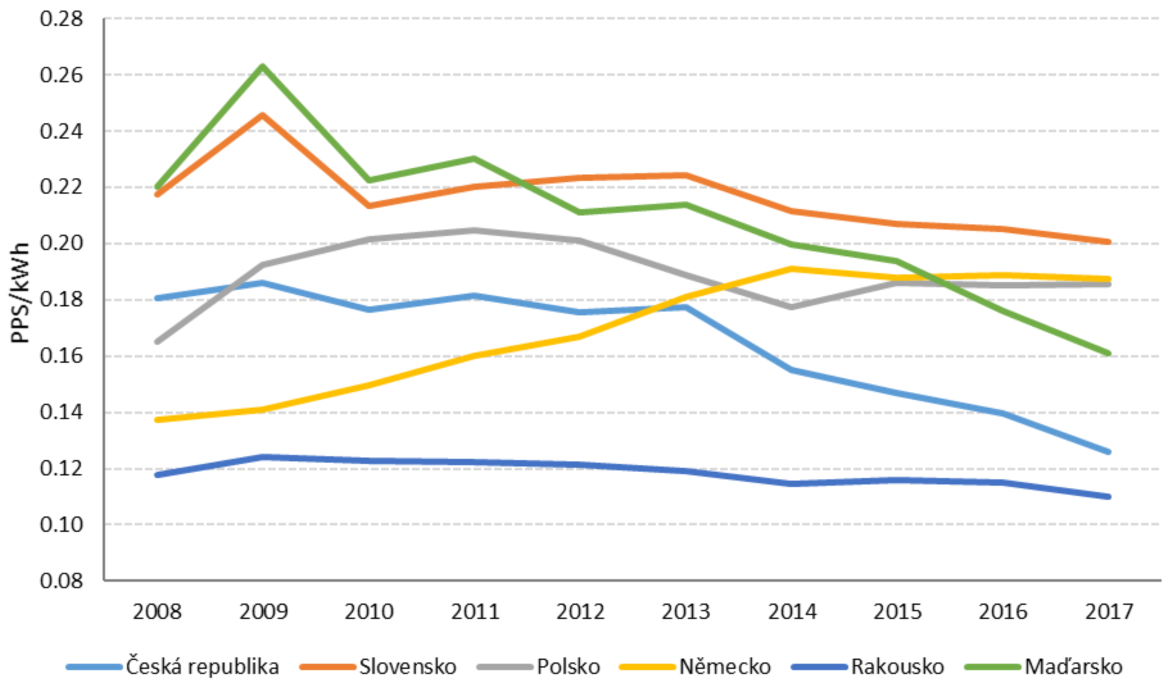
Silová elektřina – Non-regulated electricity

Síťové poplatky – Network charges

Daně a poplatky – Taxes and charges

Source: EUROSTAT (Electricity prices components for non-household consumers, Electricity prices for non-household consumers; nrg_pc_205_c, nrg_pc_205)

Chart 102: *Comparison of electricity price for non-households (annual consumption range of 500–2000 MWh)*



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Source: EUROSTAT (Electricity prices for non-household consumers; nrg_pc_205)

Table 96 shows the share of individual electricity supply components in 2018 according to the price decision of the Energy Regulatory Office for regulated prices in electricity and gas sectors for 2018 to illustrate the breakdown to regulated and non-regulated price components. Table 97 then shows the quarterly development of electricity prices for industry and households, including taxes.

Table 96: *Share of individual electricity supply components in 2018*

	Households	Small entrepreneurs	Wholesalers (VHV)	Wholesalers (HV)
Price of non-regulated electricity	43.31 %	38.4 %	75.26 %	61.85 %
Distribution price	33.57 %	41.2 %	4.49 %	18.89 %
Transmission price	4.24 %	4.1 %	6.84 %	5.84 %
SRES support	14.23 %	13.6 %	8.45 %	9.34 %

System services price	2.79 %	2.7 %	4.97 %	4.08 %
Price for market operator activities	1.87 %	0.1 %	0.00007 %	0.003 %

Source: ERO price decision for regulated prices in electricity and gas for 2018

Table 97: *Electricity price for industry and households, including taxes*[145]

	Price for industry in CZK/MWh						Price for households in CZK/MWh					
	Tr. tax	**Cons. tax**	**VAT (%)**	**VAT**	**Total tax**	**Total**	**Tr. tax**	**Cons. tax**	**VAT (%)**	**VAT**	**Total tax**	**Total**
1Q2016	2,179.1	28.3	0.0	0.0	28.3	2,207.4	3,122.0	28.0	0.21	662.0	690.0	3,812.0
2Q2016	2,151.0	28.3	0.0	0.0	28.3	2,179.3	3,122.0	28.0	0.21	662.0	690.0	3,812.0
3Q2016	2,144.2	28.3	0.0	0.0	28.3	2,172.5	3,122.0	28.0	0.21	662.0	690.0	3,812.0
Q4 2016	2,152.0	28.3	0.0	0.0	28.3	2,180.3	3,122.0	28.0	0.21	662.0	690.0	3,812.0
Q1 2017	2,054.1	28.3	0.0	0.0	28.3	2,082.4	3,127.0	28.0	0.21	663.0	691.0	3,818.0
Q2 –2017	2,038.2	28.3	0.0	0.0	28.3	2,066.5	3,127.0	28.0	0.21	663.0	691.0	3,818.0
Q3 2017	2,030.7	28.3	0.0	0.0	28.3	2,059.0	3,127.0	28.0	0.21	663.0	691.0	3,818.0
Q4 2017	2,040.0	28.3	0.0	0.0	28.3	2,068.3	3,127.0	28.0	0.21	663.0	691.0	3,818.0
Q1 2018	2,047.7	28.3	0.0	0.0	28.3	2,076.0	3,205.0	28.0	0.21	679.0	707.0	3,912.0
Q2 2018	2,048.5	28.3	0.0	0.0	28.3	2,076.8	3,238.0	28.0	0.21	686.0	714.0	3,952.0
Q3 2018	2,077.9	28.3	0.0	0.0	28.3	2,106.2	3,302.0	28.0	0.21	699.0	727.0	4,029.0

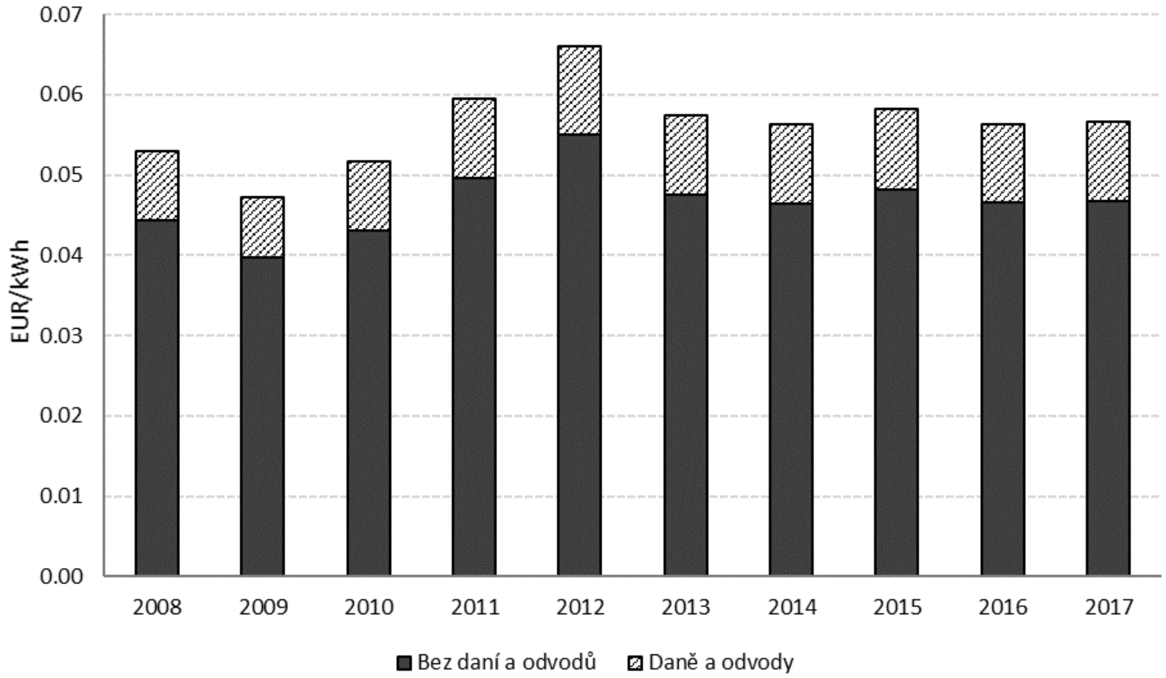
Source: Information for the 'Energy prices & taxes' report prepared for IEA purposes

Prices of natural gas

Chart 103 shows the development of natural gas price for the household sector for the annual consumption of 20–200 GJ in EUR/kWh, broken down into individual price components (tax and non-tax components). Chart 104 shows a comparison of prices of the Czech Republic with neighbouring countries and Hungary in purchasing power parity. Chart 105 shows the price of natural gas broken down into individual elements for non-household sectors for the selected consumption range. Chart 106 shows a price comparison for the non-household sectors.

[145] On this basis of these statistical data, the International Energy Agency prepares on a quarterly basis the publication 'Energy prices and taxes'. The latest available version of this publication is for Q3 2018.

Chart 103: *Gas price for households (annual consumption range of 20–200 GJ)*

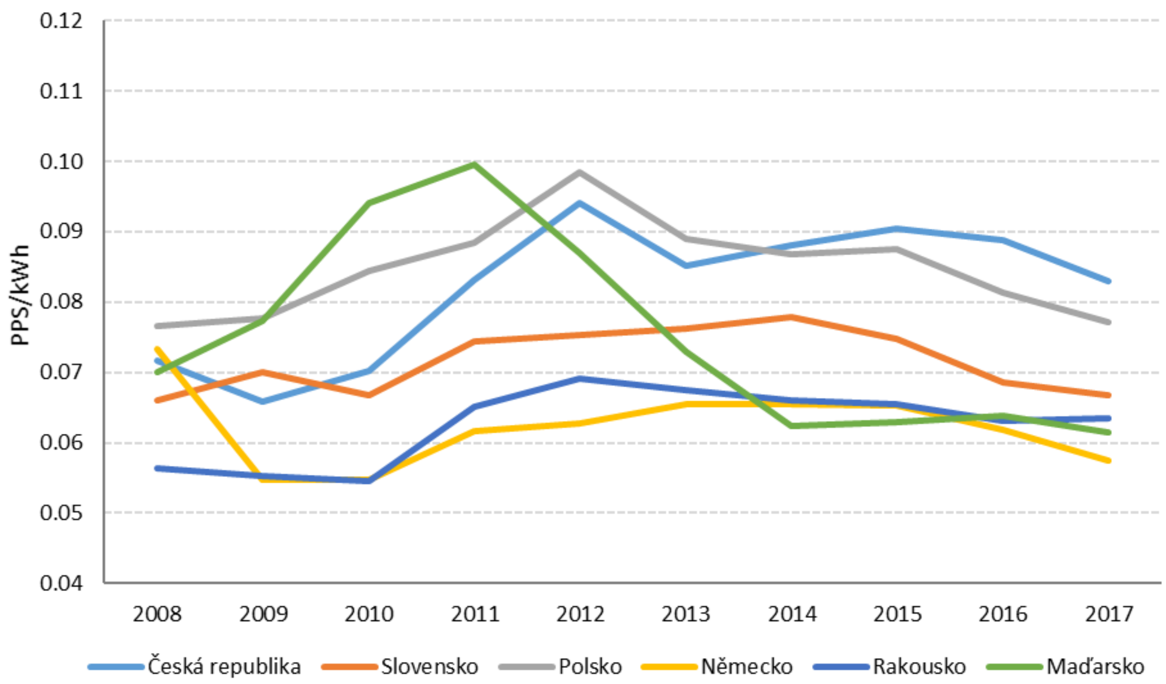


bez daní a odvodů – excluding taxes and deductions

Daně a odvody – taxes and deductions

Source: EUROSTAT (Gas prices for household consumers; nrg_pc_202)

Chart 104: *Comparison of gas prices for households (annual consumption range of 20–200 GJ)*



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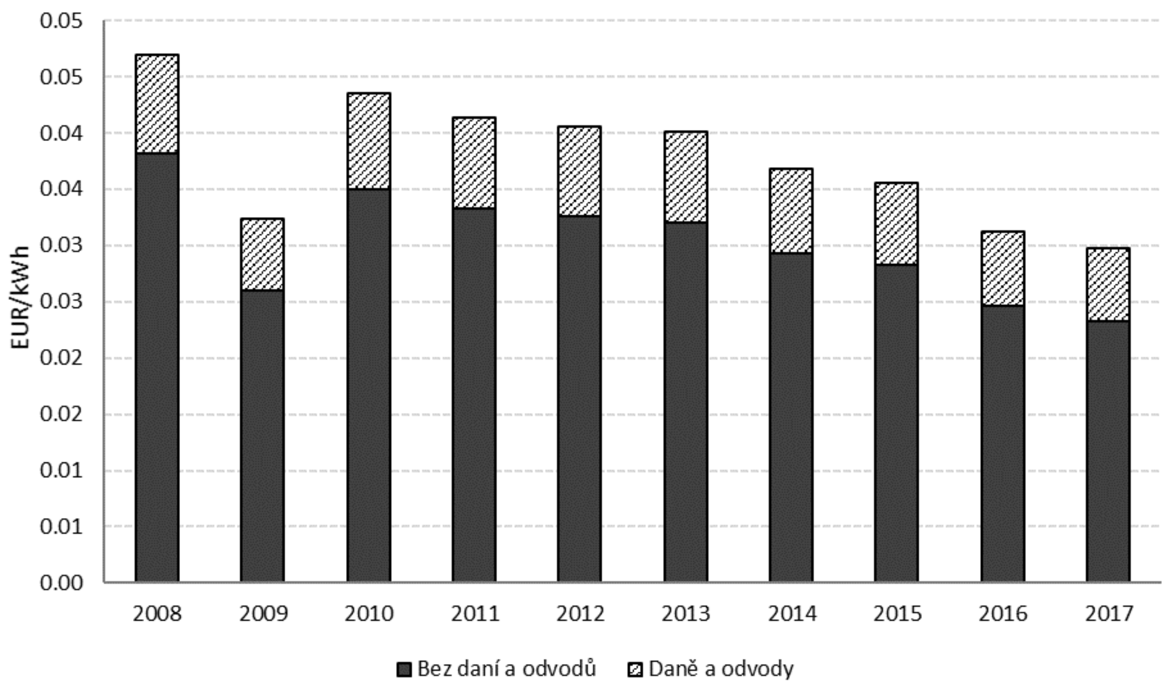
Source: EUROSTAT (Gas prices for household consumers, nrg_pc_202)

Chart 105: *Gas price for non-households (annual consumption range of 10–100 TJ)*

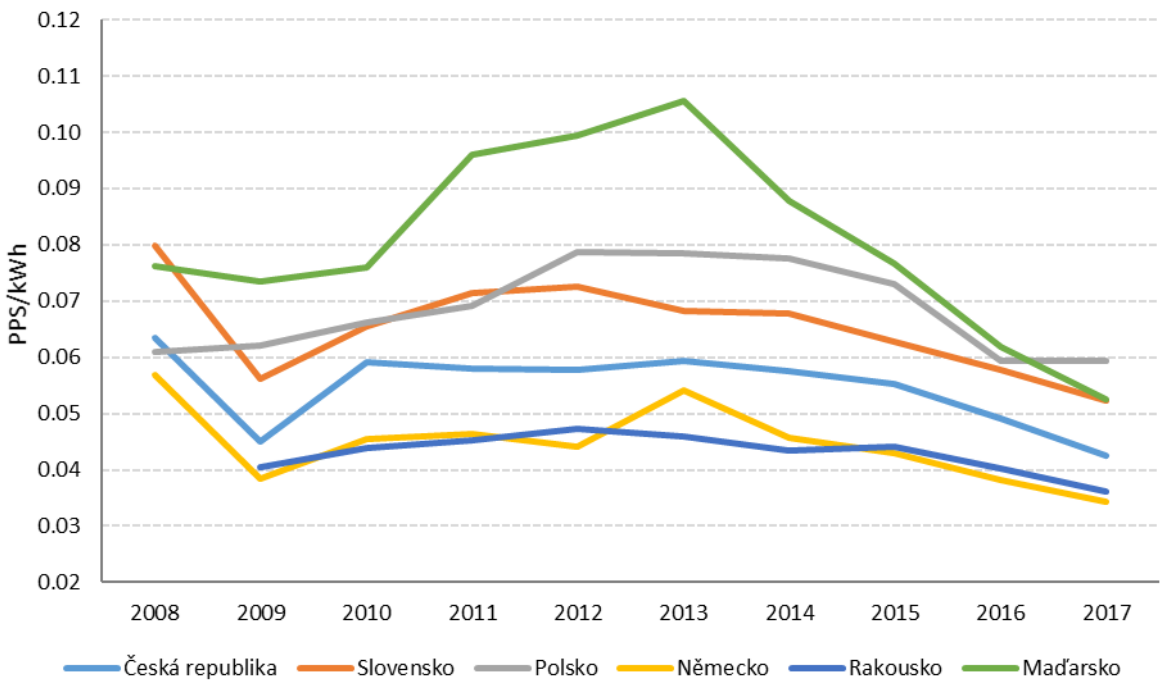


bez daní a odvodů – excluding taxes and deductions

Daně a odvody – taxes and deductions

Source: EUROSTAT (Gas prices for non-household consumers; nrg_pc_203)

Chart 106: *Comparison of gas prices for non-households (annual consumption range of 10–100 TJ)*



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Source: EUROSTAT (Gas prices for non-household consumers; nrg_pc_202)

Table 98 then shows the share of individual components for the supply of natural gas in 2018 according to the price decision of the Energy Regulatory Office for regulated prices in electricity and gas sectors for 2018 to illustrate the breakdown into regulated and non-regulated price components. Table 99 then shows the quarterly development of electricity prices for industry and households, including taxes.

Table 98: *Share of individual natural gas supply components in 2018*

	All customer categories
Trade and commodity	75.73 %
Distribution	22.84 %
Transmission	1.35 %
OTE services	0.08 %

Source: ERO price decision for regulated prices in electricity and gas for 2018

Table 99: *Natural gas prices for industry and households, including taxes*[146]

	Price for industry in CZK/MWh						**Price for households in CZK/MWh**					
	Tr. tax	**Cons. tax**	**VAT (%)**	**VAT**	**Total tax**	**Total**	**Tr. tax**	**Cons. tax**	**VAT (%)**	**VAT**	**Total tax**	**Total**
1Q2016	716.5	30.6	0.0	0.0	30.6	747.1	1,354.5	0.0	0.21	284.4	284.4	1,638.9
2Q2016	703.3	30.6	0.0	0.0	30.6	733.9	1,296.2	0.0	0.21	272.2	272.2	1,568.4
3Q2016	704.0	30.6	0.0	0.0	30.6	734.6	1,267.8	0.0	0.21	266.2	266.2	1,534.0
Q4 2016	714.2	30.6	0.0	0.0	30.6	744.8	1,267.8	0.0	0.21	266.2	266.2	1,534.0
Q1 2017	655.6	30.6	0.0	0.0	30.6	686.2	1,271.2	0.0	0.21	267.0	267.0	1,538.2
Q2 2017	655.8	30.6	0.0	0.0	30.6	686.4	1,262.3	0.0	0.21	265.1	265.1	1,527.4
Q3 2017	665.4	30.6	0.0	0.0	30.6	696.0	1,262.3	0.0	0.21	265.1	265.1	1,527.4
Q4 2017	666.2	30.6	0.0	0.0	30.6	696.8	1,262.3	0.0	0.21	265.1	265.1	1,527.4
Q1 2018	659.3	30.6	0.0	0.0	30.6	689.9	1,258.0	0.0	0.21	264.2	264.2	1,522.2
Q2 2018	659.2	30.6	0.0	0.0	30.6	689.8	1,254.6	0.0	0.21	263.5	263.5	1,518.0
Q3 2018	670.0	30.6	0.0	0.0	30.6	700.6	1,254.6	0.0	0.21	263.5	263.5	1,518.0

Source: Information for the 'Energy prices & taxes' report prepared for IEA purposes

[146] On this basis of these statistical data, the International Energy Agency prepares on a quarterly basis the publication 'Energy prices and taxes'. The latest available version of this publication is for Q3 2018.

Black coal prices

Table 100: *Black coal prices for industry and households, including taxes*

	Price for industry in CZK/MWh[147]						Price for households in CZK/MWh					
	Tr. tax	Cons. tax	VAT (%)	VAT	Total tax	Total	Tr. tax	Cons. tax	VAT (%)	VAT	Total tax	Total
1Q2016							2,663.0	133.0	0.21	587.0	720.0	3,383.0
2Q2016							2,710.0	133.0	0.21	597.0	730.0	3,440.0
3Q2016							2,699.0	133.0	0.21	595.0	728.0	3,427.0
Q4 2016							2,729.0	133.0	0.21	601.0	734.0	3,463.0
Q1 2017							2,788.0	133.0	0.21	614.0	747.0	3,535.0
Q2 2017							2,772.0	133.0	0.21	610.0	743.0	3,515.0
Q3 2017							2,772.0	133.0	0.21	610.0	743.0	3,515.0
Q4 2017							2,853.0	133.0	0.21	627.0	760.0	3,613.0
Q1 2018							2,923.0	133.0	0.21	642.0	775.0	3,698.0
Q2 2018							2,892.0	133.0	0.21	635.0	768.0	3,660.0
Q3 2018							2,910.0	133.0	0.21	639.0	772.0	3,682.0

Source: Information for the 'Energy prices & taxes' report prepared for IEA purposes

iv. Description of energy subsidies, including for fossil fuels

However, a detailed description of energy subsidies is relatively extensive. The description is also given in the relevant chapters of this document, particularly in relation to renewable energy sources and energy efficiency. However, all energy subsidies are in accordance with the State aid rules and the relevant EU bodies are informed of these subsidies. More detailed information on energy subsidies, including fossil fuel subsidies, will be included into the final version of the plan.

[147] This information is not publicly available.

5 IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES[148]

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

The Czech Republic has partial evaluations of the planned policies in Section 3. These evaluations are available either in the relevant strategic materials or in the materials evaluating the legislative impacts. The Czech Republic also used to prepare a more detailed overview of impacts, in particular on renewable energy and energy-efficiency targets, during the preparation of the draft National Plan (some of these impacts are given in the relevant parts of this document). However, owing to time reasons, these impacts cannot be summarised comprehensively in the draft National Plan. However, the Czech Republic will prepare this information for the final version of the National 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 section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

With regard to the timeframe for the drafting of the National Plan, it has not been possible to prepare or obtain such comprehensive impacts (some of these impacts have already been assessed in the case of the adoption of the relevant policy)[149]. The Czech Republic will attempt to address these impacts in the final version of the National Plan.

5.3 Overview of investment needs

The Czech Republic monitors partial investment needs, for example in the area of infrastructure. As part of the preparation of the draft National Plan, it quantified in more detailed investment needs (State aid requests) with a view to meeting the RES and energy-efficiency targets. Some of this information is already given in the relevant chapters. However, owing to time reasons, these impacts cannot be

[148] Planned policies and measures are options under discussion that have a realistic chance of being adopted and implemented after the submission of the national plan. The resulting estimates under section 5.1. will therefore include not only the implemented and adopted policies and measures (estimates with existing policies and measures), but also planned policies and measures.

[149] The Czech Republic has already highlighted this in the negotiations on the Energy Union Governance Regulation (some of the requirements have been added by the European Parliament during the negotiation process). The reason is not only the complexity of preparing such extensive impact analyses, but also the administrative costs associated with their preparation. The Czech Republic carries out these analyses in the case of policies and measures that may have impacts in the tax area, but carrying out this evaluation on a document with such a wide focus as this one can be very problematic.

summarised comprehensively in the draft National Plan. However, the Czech Republic will prepare this information for the final version of the National Plan.

5.4 Impacts of planned policies and measures described in section 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

However, owing to time reasons, these impacts cannot be summarised comprehensively in the draft National Plan. However, the Czech Republic will prepare this information for the final version of the National Plan. The impact of the planned policies on other Member States will also be possible to be effectively assessed only on the basis of regional cooperation, which will fully take place only as part of the finalisation of the National Plan.

Annex 1 Simplified energy balance in the EUROSTAT methodology for 2016, 2020, 2025, 2030

Table 101: *Simplified energy balance in the EUROSTAT methodology for 2016 (PJ)*

	2016	Total	Coal	Technological gases	Oil and products	Natural gas	Renewable sources	Industrial waste	Municipal waste	Nuclear power plants	Heat	Electricity
+	Production	1,138.89	668.74		7.73	7.55	179.15	10.36	2.39	262.97		
+	Recycled products	6.57	5.74		0.83							
+	Import	904.41	124.29		431.14	281.15	18.05				0.03	49.74
-	Export	330.40	131.53		92.89		16.65				0.08	89.25
+	Balance differences	32.80	26.85		1.00	5.07	-0.12					
=	**Primary energy sources**	**1,739.01**	**694.09**		**334.56**	**293.76**	**180.44**	**10.36**	**2.39**	**262.97**	**-0.05**	**-39.51**
+	Yields	805.79	68.99	57.68	250.76						128.44	299.92
=	**Household sources total**	**2,544.80**	**763.08**	**57.68**	**585.32**	**293.76**	**180.44**	**10.36**	**2.39**	**262.97**	**128.39**	**260.41**
+	Transformation charge	1,332.75	655.28	28.53	252.56	60.39	63.91	0.66	1.78	262.97	1.01	5.68
	+ Refining fuels	421.95	171.13		250.82							
	+ Electricity and heat charge	910.79	484.14	28.53	1.73	60.39	63.91	0.66	1.78	262.97	1.01	5.68
+	Distribution losses	29.39	1.36	1.62		4.62					7.11	14.69
+	Own energy consumption	95.00	11.90	13.91	7.23	3.33					27.38	31.25
+	Non-energy consumption	77.46	18.04	0.75	54.47	4.20						
+	Final consumption	992.1	68.89	12.77	271.48	221.23	116.53	9.70	0.61		89.13	201.78
	+ Industry	270.3	28.85	12.77	6.12	84.37	20.17	9.08			25.44	83.53
	+ Transport	268.6	0.04		247.83	2.28	12.58					5.89
	+ Services	127.7	1.26		1.09	47.21	2.62	0.62	0.61		19.14	55.18
	+ Households	296.8	38.44		1.88	83.47	75.01				44.25	53.77
	+ Agriculture and fisheries	26.8	0.31		14.09	2.57	6.15				0.30	3.41
	+ Other unspecified	1.8			0.47	1.32						
=	**Total consumption**	**2,526.72**	**755.47**	**57.58**	**585.73**	**293.76**	**180.44**	**10.36**	**2.39**	**262.97**	**124.62**	**253.40**

Table 102: *Simplified energy balance in the EUROSTAT methodology for 2020 (PJ)*

	2020	Total	Coal	Technological gases	Oil and products	Natural gas	Renewable sources	Industrial waste	Municipal waste	Nuclear power plants	Heat	Electricity
+	Production	1,167.31	604.82		7.78	8.84	193.72	10.43	2.42	339.30		
+	Recycled products	5.50	5.00		0.50							
+	Import	921.32	110.22		466.73	278.77	19.71				0.03	45.87
-	Export	264.86	56.14		89.20		17.12				0.08	102.32
+	Balance differences											
=	**Primary energy sources**	**1,813.22**	**663.90**		**369.74**	**287.61**	**196.30**	**10.43**	**2.42**	**339.30**	**-0.05**	**-56.45**
+	Yields	881.33	69.87	58.03	303.09						125.09	325.23
=	**Household sources total**	**2,694.54**	**733.77**	**58.03**	**672.84**	**287.61**	**196.30**	**10.43**	**2.42**	**339.30**	**125.04**	**268.79**
+	Transformation charge	1,488.98	644.15	30.46	342.38	56.48	67.04	0.66	1.84	339.30	1.00	5.68
	+ Refining fuels	513.44	172.50		340.94							
	+ Electricity and heat charge	975.55	471.65	30.46	1.44	56.48	67.04	0.66	1.84	339.30	1.00	5.68
+	Distribution losses	29.03	0.78	1.10		4.51					7.09	15.55
+	Own energy consumption	96.90	11.94	13.59	6.79	3.48					27.37	33.73
+	Non-energy consumption	77.37	17.81	0.75	54.62	4.20						
+	Final consumption	1,002.3	59.10	12.13	269.05	218.94	129.26	9.77	0.58		89.59	213.83
	+ Industry	283.8	27.91	12.13	6.61	88.24	21.41	9.15			27.38	90.93
	+ Transport	275.5	0.06		246.11	3.95	18.56					6.87
	+ Services	127.6	0.97		1.01	45.51	2.65	0.62	0.58		18.53	57.71
	+ Households	288.8	29.96		1.83	77.98	80.49				43.40	55.17
	+ Agriculture and fisheries	24.8	0.20		13.02	1.96	6.16				0.28	3.15
	+ Other unspecified	1.8			0.47	1.30						
=	**Total consumption**	**2,694.54**	**733.77**	**58.03**	**672.84**	**287.61**	**196.30**	**10.43**	**2.42**	**339.30**	**125.04**	**268.79**

Table 103: *Simplified energy balance in the EUROSTAT methodology for 2025 (PJ)*

	2025	Total	Coal	Technological gases	Oil and products	Natural gas	Renewable sources	Industrial waste	Municipal waste	Nuclear power plants	Heat	Electricity
+	Production	953.70	368.93		7.72	8.84	212.93	10.23	5.51	339.53		
+	Recycled products	5.50	5.00		0.50							
+	Import	982.88	168.93		469.73	274.32	19.71				0.03	50.17
-	Export	186.50	0.73		90.45		17.12				0.08	78.11
+	Balance differences											
=	**Primary energy sources**	**1,738.97**	**542.13**		**370.89**	**283.16**	**215.52**	**10.23**	**5.51**	**339.53**	**-0.05**	**-27.95**
+	Yields	847.08	66.23	57.16	305.14						121.19	297.36
=	**Household sources total**	**2,586.05**	**608.35**	**57.16**	**676.03**	**283.16**	**215.52**	**10.23**	**5.51**	**339.53**	**121.14**	**269.41**
+	Transformation charge	1,389.55	532.20	30.61	344.58	56.12	74.21	0.67	4.92	339.53	1.00	5.69
	+ Refining fuels	511.21	168.03		343.18							
	+ Electricity and heat charge	878.34	364.17	30.61	1.40	56.12	74.21	0.67	4.92	339.53	1.00	5.69
+	Distribution losses	27.10	0.76	1.06		4.44					7.06	13.78
+	Own energy consumption	93.20	11.94	12.99	6.70	3.58					27.34	30.65
+	Non-energy consumption	76.60	17.81	0.75	53.84	4.20						
+	Final consumption	999.6	45.64	11.75	270.91	214.82	141.30	9.56	0.58		85.74	219.29
	+ Industry	282.7	21.13	11.75	6.55	90.82	23.67	8.94			25.68	94.16
	+ Transport	285.4	0.06		247.94	7.05	22.49					7.85
	+ Services	122.6	0.63		0.91	42.29	2.73	0.62	0.58		17.78	57.04
	+ Households	281.9	23.73		1.78	70.23	87.13				42.00	57.02
	+ Agriculture and fisheries	25.3	0.09		13.28	3.14	5.27				0.28	3.22
	+ Other unspecified	1.8			0.47	1.30						
=	**Total consumption**	**2,586.05**	**608.35**	**57.16**	**676.03**	**283.16**	**215.52**	**10.23**	**5.51**	**339.53**	**121.14**	**269.41**

Table 104: *Simplified energy balance in the EUROSTAT methodology for 2030 (PJ)*

	2030	Total	Coal	Technological gases	Oil and products	Natural gas	Renewable sources	Industrial waste	Municipal waste	Nuclear power plants	Heat	Electricity
+	Production	973.32	368.93		7.66	8.84	232.18	10.02	5.93	339.77		
+	Recycled products	5.50	5.00		0.50							
+	Import	951.25	161.43		467.00	252.69	19.71				0.03	50.40
-	Export	186.25	4.93		90.79		17.12				0.08	73.32
+	Balance differences											
=	**Primary energy sources**	**1,726.62**	**530.42**		**367.17**	**261.53**	**234.77**	**10.02**	**5.93**	**339.77**	**-0.05**	**-22.92**
+	Yields	836.49	64.33	55.86	303.68						116.61	296.01
=	**Household sources total**	**2,563.11**	**594.75**	**55.86**	**670.85**	**261.53**	**234.77**	**10.02**	**5.93**	**339.77**	**116.56**	**273.08**
+	Transformation charge	1,378.76	527.10	30.42	342.99	44.13	81.63	0.67	5.34	339.77	1.00	5.71
	+ Refining fuels	507.03	165.43		341.60							
	+ Electricity and heat charge	871.73	361.67	30.42	1.39	44.13	81.63	0.67	5.34	339.77	1.00	5.71
+	Distribution losses	26.17	0.76	1.01		4.09					7.03	13.28
+	Own energy consumption	92.19	11.94	12.48	6.60	3.51					27.32	30.33
+	Non-energy consumption	75.82	17.81	0.75	53.06	4.20						
+	Final consumption	990.2	37.14	11.19	268.20	205.60	153.13	9.35	0.58		81.21	223.76
	+ Industry	278.4	19.49	11.19	6.43	89.08	24.09	8.72			23.26	96.11
	+ Transport	293.6	0.06		245.41	9.16	29.42					9.57
	+ Services	116.8	0.30		0.80	38.88	2.81	0.62	0.58		17.02	55.81
	+ Households	274.1	17.29		1.72	61.74	93.69				40.65	59.04
	+ Agriculture and fisheries	25.4			13.37	5.44	3.12				0.28	3.24
	+ Other unspecified	1.8			0.47	1.30						
=	**Total consumption**	**2,563.11**	**594.75**	**55.86**	**670.85**	**261.53**	**234.77**	**10.02**	**5.93**	**339.77**	**116.56**	**273.08**

Annex 2 Detailed list of parameters and variables[150]

1. General parameters and variables

Table 105: *Population*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Population (year average)	CZK thousand	10,517.2	10,496.7	10,509.3	10,510.7	10,524.8	10,542.9	10,565.3	10,662.1	10,712.4	10,691.9	10,607.8	10,548.5
Population (as of 1 January)	thousand	10,462.1	10,486.7	10,505.4	10,516.1	10,512.4	10,538.3	10,553.8	10,652.4	10,711.9	10,685.9	10,615.8	10,552.3

Table 106: *Gross domestic product*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
GDP (prices of the given year)	CZK billion	3,962.5	4,034.8	4,060.9	4,098.1	4,314.8	4,596.8	4,769.0	5,838.4	7,249.5	8,922.0	10,929.0	12,960.9
GDP (2010 prices)	CZK billion	3,962.5	4,033.9	4,001.7	3,981.3	4,089.4	4,307.5	4,412.0	5,029.8	5,662.3	6,312.8	7,004.6	7,522.1

Table 107: *Gross value added*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
GVA (prices of the given year)	CZK billion	3,583.1	3,640.3	3,649.5	3,668.3	3,899.6	4,136.6	4,285.8	5,254.9	6,524.0	8,029.4	9,836.6	11,664.6
GVA (2010 prices)	CZK billion	3,583.1	3,655.0	3,624.2	3,606.4	3,729.0	3,905.2	3,998.6	4,526.2	5,096.4	5,681.0	6,303.6	6,770.3

Table 108: *Gross value added by sector*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

[150] The annex contains a complete list of quantitative data required by the Energy Union Governance and Climate Action Regulation. Absent values are either not available or will be added if possible when this document is finalised.

Industry	CZK billion												
Construction	CZK billion												
Services	CZK billion												
Agriculture	CZK billion												

Table 109: *Average household size*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Average household size	persons/household	2.507	2.496	2.419	2.407	2.396	2.387	2.378	2.342	2.333	2.324	2.315	2.306

Table 110: *Number of households*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Number of households	CZK thousand	4,195.3	4,205.5	4,344.3	4,367.2	4,391.9	4,416.3	4,442.7	4,552.1	4,662.9	4,744.1	4,805.2	4,877.4
Number of households, EU-SILC	CZK thousand	4,149.7	4,180.6	4,254.9	4,282.5	4,304.5	4,324.7	4,347.8	4,452.8	4,561.3	4,640.6	4,700.4	4,771.1

Table 111: *Available household income*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Available income	CZK billion	2,178.9	2,184.1	2,205.7	2,207.7	2,284.6	2,383.3	2,474.0	3,009.1	3,735.8	4,597.8	5,632.7	6,679.5
Available income + NISD	CZK billion	2,206.9	2,212.0	2,233.5	2,236.7	2,314.9	2,412.2	2,506.5	3,051.9	3,789.0	4,663.2	5,712.8	6,774.4

Table 112: *Passenger transport performances*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

Car transport	pkm million	63,570.0	65,490.0	64,260.0	64,650.0	66,260.0	69,705.0	72,255.0	76,200.0	77,300.0	77,732.0	78,167.0	78,602.3
Rail transport	pkm million	6,590.7	6,714.0	7,264.7	7,600.6	7,796.5	8,298.1	8,843.4	9,753.2	10,410.0	11,203.0	11,862.0	12,355.5
Bus transport	pkm million	10,335.7	9,266.7	9,015.4	9,025.6	10,010.2	9,995.9	10,257.1	12,579.0	13,725.0	14,860.0	15,813.6	16,359.9
Air transport	pkm million	10,902.0	11,585.6	10,611.6	9,603.9	9,756.6	9,701.0	10,202.6	12,646.3	13,487.0	14,337.0	15,262.8	15,917.4
Inland waterway transport	pkm million	12.8	14.8	17.3	16.2	20.7	13.5	12.2	14.9	15.2	15.3	15.4	15.6
Public transport	pkm million	15,617.4	15,281.5	16,624.8	16,276.2	16,270.2	16,100.0	17,387.1	18,398.4	19,364.3	20,259.0	20,950.0	21,455.6
Passenger transport performances	pkm million	107,028.6	108,352.6	107,793.7	107,172.4	110,114.3	113,813.6	118,957.4	129,591.8	134,301.5	138,406.3	142,070.8	144,706.3

Table 113: *Cargo transport performances*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Road transport	tkm million	51,832.1	54,830.3	51,228.0	54,893.0	54,092.0	58,713.7	50,314.7	47,312.0	54,520.1	61,485.0	68,936.7	74,762.3
Rail transport	tkm million	13,770.4	14,315.8	14,266.2	13,964.9	14,574.2	15,261.1	15,618.0	16,249.1	17,167.0	18,087.0	19,003.2	19,835.8
Inland waterway transport	tkm million	679.5	695.0	669.3	693.5	656.5	584.9	620.4	680.0	768.8	864.8	944.5	998.5
Air transport	tkm million	22.4	22.0	16.6	24.3	35.0	31.1	30.9	33.6	34.5	35.6	36.9	38.2
Cargo transport performances	tkm million	66,304.3	69,863.0	66,180.1	69,575.7	69,357.7	74,590.7	66,584.1	64,274.6	72,490.4	80,472.4	88,921.3	95,634.8

Table 114: *International prices of basic fuels (EUR/boe)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

Oil	EUR/boe						46.65	39.52	69.17	91.47	100.77	105.12	111.30
Natural gas	EUR/boe						40.40	27.12	44.15	56.08	60.99	65.14	67.34
Coal	EUR/boe						11.71	12.54	16.58	18.36	22.04	23.34	24.32

Table 115: *International prices of basic fuels (EUR/GJ)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Oil	EUR/GJ						8.02	6.80	11.90	15.73	17.33	18.08	19.14
Natural gas	EUR/GJ						6.95	4.66	7.59	9.64	10.49	11.20	11.58
Coal	EUR/GJ						2.01	2.16	2.85	3.16	3.79	4.01	4.18

Table 116: *International prices of basic fuels (EUR/toe)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Oil	EUR/toe						335.86	284.54	498.05	658.59	725.51	756.83	801.36
Natural gas	EUR/toe						290.91	195.24	317.85	403.80	439.13	469.00	484.81
Coal	EUR/toe						84.28	90.31	119.39	132.21	158.67	168.02	175.13

Table 117: *CZK/EUR exchange rate*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
CZK/EUR (ECU)	CZK/EUR	25.3	24.6	25.1	26.0	27.5	27.3	27.0	24.6	23.1	22.0	21.4	20.9

Table 118: *EUR/USD exchange rate*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
EUR/USD exchange rate	EUR/USD	1.3	1.4	1.3	1.3	1.3	1.1	1.1	1.2	1.2	1.2	1.2	1.2

Table 119: *Emission allowance price*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

Emission allowance price (€'10)	EUR/tCO_2						7.2		14.4	21.6	32.1	40.3	48.0
Emission allowance price (€'13)	EUR/tCO_2						7.5		15.0	22.5	33.5	42.0	50.0
Emission allowance price (€'16)	EUR/tCO_2						7.8		15.5	23.3	34.7	43.5	51.7

Table 120: *Number of degree days*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Number of heating degree days	dd°C	3,832.5	3,390.4	3,389.6	3,430.7	3,391.5	3,387.6	3,383.9	3,369.8	3,354.1	3,340.1	3,327.4	3,315.9
Number of cooling degree days	dd°C	107.5	126.0	120.4	120.7	121.1	120.9	121.2	122.5	124.0	125.4	126.7	128.0

Table 121: *Cost of key technologies*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
[to be specified]													
[to be specified]													
[to be specified]													
[to be specified]													

2. Energy balances and indicators

2.1. Energy supply

Table 122: *Production (including recycled products)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	ktoe	20,729.9	20,895.6	20,141.5	17,673.6	16,848.4	16,795.4	15,972.7	14,445.9	8,811.7	8,811.7	6,870.1	2,957.1
Technological gases	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil and petroleum products	ktoe	268.8	334.0	313.6	256.0	260.4	206.0	184.5	185.9	184.4	183.0	181.6	180.1
Natural gas	ktoe	201.7	189.4	213.9	205.9	211.9	204.8	180.2	211.2	211.2	211.2	211.2	211.2
Renewable sources	ktoe	3,251.1	3,479.6	3,727.3	4,117.5	4,197.4	4,279.2	4,278.9	4,626.8	5,085.8	5,545.5	5,786.4	5,840.9
Non-renewable waste comp.	ktoe	200.8	219.9	225.2	216.3	250.7	277.3	304.5	307.0	376.0	380.9	379.1	377.4
Nuclear sources	ktoe	7,298.3	7,361.8	7,892.6	7,995.1	7,884.9	6,988.1	6,281.0	8,104.0	8,109.6	8,115.2	9,427.0	11,081.5
Heat	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	ktoe	31,950.6	32,480.3	32,514.1	30,464.4	29,653.7	28,750.9	27,201.8	27,880.8	22,778.7	23,247.5	22,855.4	20,648.2

Table 123: *Net imports*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	ktoe	-2,862.4	-2,050.9	-2,081.5	-1,680.6	-693.7	-264.6	-172.9	1,291.7	4,017.4	3,737.7	3,772.0	3,569.7
Technological gases	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil and petroleum products	ktoe	8,974.9	8,641.9	8,512.9	8,263.9	8,886.9	8,712.0	8,079.1	9,017.0	9,058.9	8,985.6	8,932.0	8,763.3
Natural gas	ktoe	6,846.0	7,505.4	6,101.4	6,961.4	5,951.6	6,164.4	6,715.1	6,658.4	6,552.0	6,035.3	5,901.1	7,210.0
Renewable sources	ktoe	-119.2	-36.1	-31.8	-76.7	-15.5	-6.0	33.5	61.7	61.7	61.7	61.7	61.7
Non-renewable waste comp.	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nuclear sources	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Heat	ktoe	-2.1	-1.9	-1.7	-1.3	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
Electricity	ktoe	-1,285.3	-1,465.5	-1,472.1	-1,452.0	-1,401.5	-1,076.1	-943.6	-1,348.2	-667.5	-547.5	-410.7	-106.9
Total	ktoe	11,552.0	12,592.9	11,027.3	12,014.7	12,726.6	13,528.4	13,710.0	15,679.4	19,021.3	18,271.7	18,254.9	19,496.7

Table 124: *Import dependence*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Import dependence	%	25.5 %	29.0 %	25.6 %	27.7 %	30.4 %	32.2 %	33.0 %	36.2 %	45.8 %	44.3 %	44.7 %	48.9 %

Table 125: *Electricity import by country of origin*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
[country to be specified]	%												
[country to be specified]	%												
[country to be specified]	%												

Table 126: *Natural gas import by country of origin*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
[country to be specified]	%												
[country to be specified]	%												
[country to be specified]	%												

Table 127: *Primary energy sources by fuel*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	ktoe	18,860.0	18,314.2	17,320.8	17,310.3	15,997.9	16,427.6	16,578.1	15,857.0	12,948.5	12,668.8	10,761.6	6,646.3
Technological gases	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Oil and petroleum products	ktoe	8,983.2	8,743.7	8,623.5	8,282.7	8,811.6	8,610.7	7,990.8	8,831.2	8,858.5	8,769.7	8,697.3	8,515.9
Natural gas	ktoe	8,069.5	6,809.2	6,856.1	6,946.4	6,182.1	6,482.8	7,016.3	6,869.6	6,763.2	6,246.5	6,112.2	7,421.2

Renewable sources	ktoe	3,129.8	3,439.9	3,687.9	4,050.0	4,176.0	4,278.8	4,309.7	4,688.6	5,147.5	5,607.3	5,848.2	5,902.6
Non-renewable waste comp.	ktoe	200.8	219.9	225.2	216.3	250.7	277.3	304.5	307.0	376.0	380.9	379.1	377.4
Nuclear sources	ktoe	7,298.3	7,361.8	7,892.6	7,995.1	7,884.9	6,988.1	6,281.0	8,104.0	8,109.6	8,115.2	9,427.0	11,081.5
Heat	ktoe	-2.1	-1.9	-1.7	-1.3	-1.1	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2	-1.2
Electricity	ktoe	-1,285.3	-1,465.5	-1,472.1	-1,452.0	-1,401.5	-1,076.1	-943.6	-1,348.2	-667.5	-547.5	-410.7	-106.9
Total	ktoe	45,254.3	43,421.3	43,132.4	43,347.5	41,900.5	41,988.0	41,535.6	43,307.9	41,534.6	41,239.7	40,813.5	39,836.8

2.2. Electricity and heat

Table 128: *Gross electricity production by fuels*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	GWh	46,900.0	46,685.0	43,978.0	41,113.0	40,727.0	41,141.0	41,974.0	41,090.9	32,510.3	32,444.6	25,966.1	13,859.0
Technological gases	GWh	2,839.0	2,838.0	2,589.0	2,598.0	2,804.0	2,696.0	2,667.0	2,854.3	2,914.9	2,890.7	2,832.5	761.0
Oil and petroleum products	GWh	199.0	174.0	113.0	79.0	105.0	94.0	92.0	85.4	82.4	81.7	79.9	78.1
Natural gas	GWh	1,362.0	1,397.0	1,479.0	2,025.0	1,806.0	2,264.0	3,710.0	3,941.7	3,924.5	3,532.3	3,444.2	8,200.3
Renewable sources	GWh	6,494.3	7,946.5	8,796.3	10,213.4	10,223.7	10,696.3	10,585.8	11,173.4	11,777.2	11,840.0	13,117.2	14,321.3
Non-renewable waste comp.	GWh	27.1	66.5	64.9	64.9	69.1	77.5	81.3	94.9	266.8	289.9	289.9	289.9
Nuclear sources	GWh	27,998.0	28,283.0	30,324.0	30,745.0	30,325.0	26,841.0	24,104.0	31,102.5	31,124.0	31,145.4	36,179.7	42,529.5
Heat	GWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Electricity	GWh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	GWh	85,819.4	87,390.0	87,344.1	86,838.3	86,059.8	83,809.9	83,214.1	90,343.0	82,600.0	82,224.6	81,909.4	80,039.0

Table 129: *CHP share in total electricity and heat production*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
CHP share in electricity production	%												
CHP share in heat production	%												

Table 130: *Loss of installed capacity*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Nuclear energy	GW												
Solid fuels	GW												
Oil (including ref. gas)	GW												
Gas (including tech. gases)	GW												
Biomass/waste	GW												
Hydro (excl. pumped storage)	GW												
Wind	GW												
Photovoltaic	GW												
Geothermal and other RES	GW												
Other (hydrogen, methanol)	GW												
Total	GW												

Table 131: *Increase in installed capacity*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Nuclear energy	GW												
Solid fuels	GW												
Oil (including ref. gas)	GW												
Gas (including tech. gases)	GW												
Biomass/waste	GW												
Hydro (excl. pumped storage)	GW												
Wind	GW												
Photovoltaic	GW												
Geothermal and other RES	GW												
Other (hydrogen, methanol)	GW												

Total	GW												

Table 132: *Heat production information*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Heat production	GWh												
Heat production within CHP	GWh												

Table 133: *Capacity of cross-border interconnectors*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Capacity of cross-border interconnectors	MW												

Table 134: *Use rate of cross-border interconnectors*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Use rate of cross-border interconnectors	%												

2.3. Transformation sector

Table 135: *Electricity and heat production charge*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	ktoe	24,294.3	23,621.4	22,332.6	20,946.1	20,273.8	20,310.0	20,270.2	19,747.0	15,247.1	15,142.3	12,133.4	6,192.4
Technological gases	ktoe	1,283.8	1,295.2	1,193.9	1,257.9	1,303.9	1,194.3	1,194.3	1,275.5	1,281.7	1,273.7	1,255.0	550.0
Oil and petroleum products	ktoe	161.8	186.8	138.7	88.8	91.7	87.0	72.6	60.2	58.7	58.2	57.2	56.4
Natural gas	ktoe	2,099.2	1,975.0	2,021.7	2,218.2	1,870.0	2,020.5	2,528.4	2,364.7	2,349.5	1,847.6	1,659.3	3,975.1
Renewable sources	ktoe	1,545.7	1,891.8	2,153.0	2,537.0	2,605.5	2,718.2	2,675.7	2,806.7	3,107.2	3,417.7	3,781.9	4,116.1
Non-renewable waste comp.	ktoe	69.5	97.4	98.7	92.3	94.4	97.7	102.0	104.4	234.3	251.8	251.8	251.8
Nuclear sources	ktoe	12,793.4	12,904.8	13,835.2	14,014.9	13,821.6	12,249.7	11,010.1	14,205.8	14,215.6	14,225.4	16,524.8	19,425.0

Heat	ktoe	13.2	17.7	18.1	18.1	20.7	15.2	42.1	42.0	42.0	41.9	41.9	39.8
Electricity	ktoe	121.3	143.3	149.4	184.6	206.5	251.3	237.7	237.8	238.4	238.9	239.5	240.1
Total	ktoe	42,382.2	42,133.4	41,941.3	41,357.9	40,288.0	38,943.8	38,133.1	40,844.1	36,774.4	36,497.6	35,944.7	34,846.7

Table 136: *Transformation charge (other)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Transformation charge	ktoe	22,839.9	21,442.8	21,474.4	20,297.7	22,152.1	21,116.6	17,666.4	21,496.5	21,403.2	21,228.3	21,160.8	19,618.2

2.4. Power consumption

Table 137: *Primary energy sources, final energy consumption and non-energy consumption*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Primary energy sources	ktoe	45,254.3	43,421.3	43,132.4	43,347.5	41,900.5	41,988.0	41,535.6	43,307.9	41,534.6	41,239.7	40,813.5	39,836.8
Final energy consumption	ktoe	24,333.7	23,542.8	23,538.7	23,291.5	22,581.5	23,211.0	23,727.5	23,962.6	23,891.3	23,647.9	23,476.4	23,219.3
Non-energy consumption	ktoe	5,279.3	4,791.0	5,030.2	4,865.9	5,297.8	4,524.7	3,242.9	3,239.5	3,206.9	3,174.4	3,141.8	3,109.2

Table 138: *Final consumption by sector*[151]

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Industry	ktoe	6,979.7	6,854.1	6,806.6	6,500.6	6,402.9	6,527.6	6,456.7	6,806.1	6,773.4	6,652.5	6,597.1	6,541.8
Households	ktoe	7,506.9	6,926.0	7,182.2	7,329.5	6,596.4	6,807.8	7,089.5	6,891.5	6,725.3	6,539.7	6,358.4	6,158.2
Services	ktoe	3,244.3	3,126.8	3,032.9	2,977.3	2,893.1	2,943.0	3,051.0	3,018.6	2,899.1	2,761.6	2,624.0	2,486.5
Transport	ktoe	5,916.1	5,935.6	5,788.9	5,738.7	5,948.1	6,194.6	6,415.4	6,581.1	6,816.7	7,013.1	7,187.9	7,334.8
Agriculture and fisheries	ktoe	546.7	548.7	564.3	610.7	616.1	607.7	640.5	592.1	603.6	607.8	635.8	624.8
Other	ktoe	140.0	151.6	163.8	134.7	124.9	130.3	74.4	73.2	73.2	73.2	73.2	73.2
Total	ktoe	24,333.7	23,542.8	23,538.7	23,291.5	22,581.5	23,211.0	23,727.5	23,962.6	23,891.3	23,647.9	23,476.4	23,219.3

Table 139: *Final consumption by fuels*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Coal and coal products	ktoe	1,984.6	1,934.8	2,006.5	1,968.7	1,702.8	1,683.1	1,645.4	1,411.5	1,090.1	887.1	708.5	660.0
Technological gases	ktoe	335.6	341.0	330.8	312.9	323.6	311.3	305.1	289.8	280.8	267.4	265.4	263.3
Oil and petroleum products	ktoe	6,267.6	6,168.3	6,057.4	5,893.4	6,153.8	6,420.3	6,484.3	6,426.1	6,470.6	6,405.8	6,356.8	6,206.5
Natural gas	ktoe	6,088.4	5,508.4	5,386.9	5,367.0	4,806.7	5,024.2	5,284.0	5,229.4	5,131.0	4,910.6	4,886.5	4,853.9

[151] There is a small difference between final consumption by sectors and final consumption by fuels. This discrepancy will be removed or explained.

Renewable sources	ktoe	2,248.1	2,360.7	2,459.7	2,600.1	2,688.1	2,728.8	2,783.3	3,087.4	3,375.0	3,657.6	3,690.7	3,554.5
Non-renewable waste comp.	ktoe	161.2	164.3	168.9	163.7	196.9	221.6	246.3	247.4	242.3	237.2	235.5	233.8
Nuclear sources	ktoe	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heat	ktoe	2,525.8	2,385.2	2,423.3	2,346.0	2,076.8	2,066.6	2,128.7	2,139.7	2,047.8	1,939.7	1,869.5	1,797.7
Electricity	ktoe	4,662.3	4,613.2	4,633.2	4,581.3	4,580.9	4,698.0	4,819.4	5,107.3	5,237.6	5,344.5	5,472.6	5,653.0
Total	ktoe	24,273.5	23,475.7	23,466.6	23,233.0	22,529.6	23,153.8	23,696.5	23,938.6	23,875.1	23,649.8	23,485.5	23,222.7

Table 140: *Energy intensity of GDP and GVA*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Energy intensity of GDP	toe/EUR	288.834	264.709	271.080	282.800	282.108	266.003	254.492	212.086	169.342	143.515	124.851	110.667
Energy intensity of GVA	toe/EUR	154.925	143.115	147.484	151.573	151.687	146.684	145.190	117.231	97.342	82.302	71.843	64.513

Table 141: *Energy intensity of GVA by sector*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Industry	toe/EUR												
Households	toe/EUR												
Services	toe/EUR												

Table 142: *Energy intensity of transport*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Passenger transport	toe/pkm												
Freight transport	toe/tkm												

2.5. Prices

Table 143: *Electricity prices by sector*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

Industry	EUR/MWh	107.4	113.7	111.4	111.0	91.6	87.0	79.8	N/A	N/A	N/A	N/A	N/A
Households	EUR/MWh	121.2	131.1	133.9	133.1	111.5	112.2	115.5	N/A	N/A	N/A	N/A	N/A
Services	EUR/MWh	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 144: *Prices of diesel*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Prices of diesel	EUR/L	0.10	0.13	0.14	0.14	0.14	0.11	0.08	N/A	N/A	N/A	N/A	N/A

Table 145: *Prices of gasoline*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Gasoline 98	EUR/L	0.61	0.71	0.77	0.72	0.69	0.56	0.48	N/A	N/A	N/A	N/A	N/A
Gasoline 95	EUR/L	0.54	0.65	0.71	0.66	0.62	0.48	0.40	N/A	N/A	N/A	N/A	N/A

Table 146: *Prices of natural gas*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Industry	EUR/MWh	33.2	35.2	36.7	34.5	31.2	29.3	26.2	N/A	N/A	N/A	N/A	N/A
Households	EUR/MWh	43.1	49.7	56.7	52.2	48.0	49.9	48.0	N/A	N/A	N/A	N/A	N/A

2.6. Investments

Table 147: *Investments in the energy and industry sectors relative to total investments*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Investment in energy for ec.	% of GDP												
Investment in energy for ind.	% of GVA												

2.7. Renewable energy

Table 148: *Share of renewable sources in gross final consumption*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Heating and cooling	%	14.0 %	15.3 %	16.1 %	17.6 %	19.3 %	19.6 %	19.9 %	22.0 %	26.0 %	30.0 %	N/A	N/A
Electricity sector	%	7.5 %	10.6 %	11.7 %	12.8 %	13.9 %	14.1 %	13.6 %	14.0 %	14.5 %	14.2 %	N/A	N/A
Transport	%	5.1 %	6.4 %	6.1 %	6.3 %	6.9 %	6.5 %	6.4 %	8.8 %	9.5 %	14.0 %	N/A	N/A
Total	%	10.5 %	12.0 %	12.8 %	13.8 %	15.0 %	15.0 %	14.9 %	16.3 %	18.6 %	20.8 %	N/A	N/A

Table 149: *More detailed information on the contribution of the transport sector*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Transport sector to total target	%												
Advanced biog. (part A)	%												
Advanced biog. (part B)	%												
Food biofuels	%												
Other biofuels	%												

Table 150: *Final consumption of renewable energy sources*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Heating and cooling	ktoe	3,780.7	3,912.8	4,156.2	4,486.0	4,629.6	4,783.0	4,907.8	5,331.9	6,148.5	6,886.6	N/A	N/A
Electricity sector	ktoe	755.3	1,069.1	1,175.4	1,279.5	1,385.1	1,425.3	1,392.0	1,468.1	1,563.8	1,556.6	N/A	N/A
Transport	ktoe	447.1	572.1	530.4	537.8	610.5	581.3	594.4	854.0	982.7	1,277.4	N/A	N/A
Total	ktoe	4,983.1	5,554.0	5,862.1	6,303.4	6,625.1	6,789.6	6,894.2	7,654.1	8,695.1	9,720.6	N/A	N/A

Table 151: *Final consumption of waste heat and RES in DH*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Final consumption of waste heat in H&C	ktoe												
Final consumption of RES in DH	ktoe												
Final consumption of waste heat from H&C	ktoe												

Table 152: *Share of waste heat and RES in DH*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040

Share of waste heat in H&C	%												
Share of RES in DH	%												
Share of waste heat from H&C	%												

Table 153: *Data on the energy produced, energy consumed and the electricity supplied to the electricity system (if available)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
[to be specified]													
[to be specified]													
[to be specified]													
[to be specified]													

Table 154: *Other national trajectories (if available)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
[to be specified]													
[to be specified]													
[to be specified]													
[to be specified]													

3. Indicators related to greenhouse-gas emissions and removals

Table 155: *GHG emissions by sector (EU ETS, Effort Sharing Regulation, LULUCF)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
EU ETS	tCO2eq	78,473,173	N/A	N/A	N/A	N/A	66,656,661	N/A	63,075,105	56,246,473	55,881,083	49,865,706	47,665,396
Effort Sharing Regulation	tCO2eq	N/A	N/A	N/A	N/A	N/A	54,428,565	N/A	63,749,266	56,597,741	52,334,638	47,973,760	43,914,208
LULUCF	tCO2eq	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 156: *Emission intensity of GDP (including LULUCF)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Emission intensity of GDP	tCO2eq/GDP	35,224	N/A	N/A	N/A	N/A	26,347	N/A	21,723	15,568	12,131	8,953	7,067

Table 157: *Emission intensity of electricity and heat production*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Emission intensity of el. and heat prod.	tCO2eq/MWh	0.43	N/A	N/A	N/A	N/A	0.40	N/A	0.36	0.31	0.30	0.26	0.24

Table 158: *Emission intensity of final energy consumption by sectors*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Industry	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	1.49	N/A	1.45	1.45	1.45	1.46	1.45
Households	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	1.35	N/A	1.30	1.18	1.04	0.91	0.89
Services	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	0.96	N/A	0.95	0.91	0.87	0.83	0.79
Passenger transport	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	1.85	N/A	1.92	1.97	1.92	1.78	1.57
Freight transport	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	0.98	N/A	0.93	0.96	0.92	0.83	0.71
Total	tCO2eq/toe	N/A	N/A	N/A	N/A	N/A	6.62	N/A	6.55	6.46	6.21	5.80	5.42

Table 159: *Number of cattle*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Dairy cattle	CZK thousand	384	N/A	N/A	N/A	N/A	376	N/A	369	387	401	405	408
Other cattle	CZK thousand	966	N/A	N/A	N/A	N/A	1,031	N/A	1,061	1,113	1,154	1,165	1,172
Pigs	CZK thousand	1,909	N/A	N/A	N/A	N/A	1,560	N/A	1,600	1,900	2,100	2,200	2,200
Sheep	CZK thousand	197	N/A	N/A	N/A	N/A	232	N/A	235	240	250	250	250
Poultry	CZK thousand	24,838	N/A	N/A	N/A	N/A	22,508	N/A	23,780	24,180	26,695	26,695	26,695

Table 160: *Consumption of nitrogenous substances*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Application of synthetic fertilisers	kt	225,982	N/A	N/A	N/A	N/A	270,023	N/A	280,739	280,739	280,739	280,739	280,739
Fertilisers	kt	85,635	N/A	N/A	N/A	N/A	84,355	N/A	89,404	96,367	101,760	103,197	103,689
Nitrogen fixed by plants	kt	120,795	N/A	N/A	N/A	N/A	144,852	N/A	139,085	137,996	139,692	141,205	141,982
Nitrogen returned to the soil[152]	kt	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 161: *Area of cultivated organic soil*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Area of cultivated soil	ha	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 162: *Production of solid municipal waste (and landfilled volume)*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Production of SMW	kt	5,621,883	N/A	N/A	N/A	N/A	5,534,126	N/A	5,630,000	5,300,000	5,250,000	5,190,000	5,140,000
Landfilled SMW	kt	3,444,748	N/A	N/A	N/A	N/A	2,758,736	N/A	1,910,000	850,300	78,700	0	0

Table 163: *Share of CH4 recovery in total CH4 production from landfills*

		2010	2011	2012	2013	2014	2015	2016	2020	2025	2030	2035	2040
Ratio of CH_4 recovery	%	*14*	N/A	N/A	N/A	N/A	*12*	N/A	*14*	*16*	*17*	*16*	*15*

152 Emissions are calculated according to the formula 11.6. (IPCC 2006) and therefore it is not possible to break down nitrogen directly to soil, plant nitrogen and nitrogen in crop residues returned to the soil

Annex 3 List of figures, tables and charts

Table 164: *Development of international prices of basic fuels, 2017 values with partial update of parameters (source: recommended parameters for preparation)*

	Constant 2016 prices (EUR/boe)			Constant 2016 prices (EUR/GJ)			Constant 2016 prices (EUR/toe)		
	EUR/boe	EUR/boe	EUR/boe	EUR/GJ	EUR/GJ	EUR/GJ	EUR/toe	EUR/toe	EUR/toe
	Oil	Gas (GCV)	Coal	Oil	Gas (GCV)	Coal	Oil	Gas (GCV)	Coal
2015	51.77	41.68	12.32	8.90	7.17	2.12	372.72	300.09	88.74
2016	60.36	43.72	12.95	10.38	7.52	2.23	434.60	314.75	93.25
2017	65.90	45.67	13.57	11.33	7.85	2.33	474.49	328.81	97.69
2018	71.66	47.66	14.18	12.32	8.20	2.44	515.95	343.15	102.07
2019	76.25	49.75	14.78	13.11	8.56	2.54	548.97	358.22	106.39
2020	80.58	51.84	15.37	13.86	8.91	2.64	580.18	373.23	110.65
2021	84.57	53.84	16.26	14.54	9.26	2.80	608.93	387.63	117.04
2022	85.95	54.01	16.75	14.78	9.29	2.88	618.85	388.89	120.58
2023	88.61	54.88	17.21	15.24	9.44	2.96	638.03	395.16	123.90
2024	90.45	55.57	17.78	15.56	9.56	3.06	651.26	400.12	128.01
2025	91.47	56.08	18.36	15.73	9.64	3.16	658.59	403.80	132.21
2026	93.75	56.97	19.07	16.12	9.80	3.28	675.04	410.19	137.28
2027	95.82	57.80	19.77	16.48	9.94	3.40	689.91	416.17	142.33
2028	97.23	58.72	20.50	16.72	10.10	3.52	700.02	422.81	147.57
2029	99.43	59.65	21.23	17.10	10.26	3.65	715.89	429.46	152.86
2030	100.77	60.99	22.04	17.33	10.49	3.79	725.51	439.13	158.67
2031	102.04	61.84	22.24	17.55	10.63	3.82	734.67	445.26	160.09
2032	102.66	62.81	22.52	17.65	10.80	3.87	739.17	452.25	162.14
2033	103.38	63.68	22.82	17.78	10.95	3.92	744.36	458.52	164.29
2034	104.20	64.47	23.09	17.92	11.09	3.97	750.22	464.20	166.27
2035	105.12	65.14	23.34	18.08	11.20	4.01	756.83	469.00	168.02
2036	106.15	65.77	23.49	18.25	11.31	4.04	764.30	473.52	169.14
2037	107.33	66.28	23.68	18.46	11.40	4.07	772.80	477.20	170.53
2038	108.62	66.77	23.91	18.68	11.48	4.11	782.03	480.78	172.12

2039	109.94	67.33	24.15	18.91	11.58	4.15	791.60	484.75	173.87
2040	111.30	67.34	24.32	19.14	11.58	4.18	801.36	484.81	175.13

Table 165: *Development of international prices of basic fuels with updated prices for the period 2015–2024*

	Constant 2016 prices (EUR/boe)			**Constant 2016 prices (EUR/GJ)**			**Constant 2016 prices (EUR/toe)**		
	EUR/boe	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**
	Oil	**Gas (GCV)**	**Coal**	**Oil**	**Gas (GCV)**	**Coal**	**Oil**	**Gas (GCV)**	**Coal**
2015	46.65	40.40	11.71	8.02	6.95	2.01	335.86	290.91	84.28
2016	39.52	27.12	12.54	6.80	4.66	2.16	284.54	195.24	90.31
2017	47.78	33.64	17.30	8.22	5.78	2.97	344.02	242.20	124.53
2018	57.68	37.46	15.70	9.92	6.44	2.70	415.29	269.69	113.03
2019	63.39	40.72	16.16	10.90	7.00	2.78	456.44	293.20	116.32
2020	69.17	44.15	16.58	11.90	7.59	2.85	498.05	317.85	119.39
2021	74.92	47.51	17.30	12.88	8.17	2.97	539.42	342.05	124.55
2022	78.53	49.35	17.56	13.51	8.49	3.02	565.45	355.32	126.47
2023	83.48	51.76	17.78	14.36	8.90	3.06	601.03	372.68	127.99
2024	87.81	54.02	18.08	15.10	9.29	3.11	632.23	388.93	130.16
2025	91.47	56.08	18.36	15.73	9.64	3.16	658.59	403.80	132.21
2026	93.75	56.97	19.07	16.12	9.80	3.28	675.04	410.19	137.28
2027	95.82	57.80	19.77	16.48	9.94	3.40	689.91	416.17	142.33
2028	97.23	58.72	20.50	16.72	10.10	3.52	700.02	422.81	147.57
2029	99.43	59.65	21.23	17.10	10.26	3.65	715.89	429.46	152.86
2030	100.77	60.99	22.04	17.33	10.49	3.79	725.51	439.13	158.67
2031	102.04	61.84	22.24	17.55	10.63	3.82	734.67	445.26	160.09
2032	102.66	62.81	22.52	17.65	10.80	3.87	739.17	452.25	162.14
2033	103.38	63.68	22.82	17.78	10.95	3.92	744.36	458.52	164.29
2034	104.20	64.47	23.09	17.92	11.09	3.97	750.22	464.20	166.27
2035	105.12	65.14	23.34	18.08	11.20	4.01	756.83	469.00	168.02
2036	106.15	65.77	23.49	18.25	11.31	4.04	764.30	473.52	169.14
2037	107.33	66.28	23.68	18.46	11.40	4.07	772.80	477.20	170.53
2038	108.62	66.77	23.91	18.68	11.48	4.11	782.03	480.78	172.12
2039	109.94	67.33	24.15	18.91	11.58	4.15	791.60	484.75	173.87

2040	111.30	67.34	24.32	19.14	11.58	4.18	801.36	484.81	175.13

Source: Recommended parameters for the preparation of the National Plan (August 2018)

Table 166: *Development of international prices of basic fuels (2017 values)*

	Constant 2016 prices (EUR/boe)			**Constant 2016 prices (EUR/GJ)**			**Constant 2016 prices (EUR/toe)**		
	EUR/boe	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**	**EUR/boe**
	Oil	**Gas (GCV)**	**Coal**	**Oil**	**Gas (GCV)**	**Coal**	**Oil**	**Gas (GCV)**	**Coal**
2015	48.19	38.80	11.47	7.46	6.00	1.78	353.28	284.44	84.11
2016	56.19	40.69	12.06	8.70	6.30	1.87	411.93	298.33	88.38
2017	61.35	42.51	12.63	9.49	6.58	1.95	449.74	311.66	92.59
2018	66.70	44.36	13.20	10.32	6.87	2.04	489.03	325.25	96.74
2019	70.97	46.31	13.75	10.98	7.17	2.13	520.33	339.54	100.84
2020	75.01	48.25	14.31	11.61	7.47	2.21	549.92	353.76	104.88
2021	78.73	50.12	15.13	12.18	7.76	2.34	577.17	367.42	110.94
2022	80.01	50.28	15.59	12.38	7.78	2.41	586.57	368.60	114.29
2023	82.49	51.09	16.02	12.77	7.91	2.48	604.75	374.54	117.44
2024	84.20	51.73	16.55	13.03	8.01	2.56	617.29	379.25	121.34
2025	85.15	52.21	17.09	13.18	8.08	2.65	624.24	382.74	125.32
2026	87.27	53.03	17.75	13.51	8.21	2.75	639.83	388.80	130.12
2027	89.19	53.81	18.40	13.81	8.33	2.85	653.92	394.47	134.91
2028	90.50	54.66	19.08	14.01	8.46	2.95	663.51	400.76	139.87
2029	92.55	55.52	19.76	14.33	8.59	3.06	678.55	407.06	144.88
2030	93.80	56.77	20.51	14.52	8.79	3.18	687.67	416.23	150.40
2031	94.98	57.57	20.70	14.70	8.91	3.20	696.35	422.03	151.74
2032	95.56	58.47	20.96	14.79	9.05	3.24	700.62	428.67	153.68
2033	96.23	59.28	21.24	14.89	9.18	3.29	705.53	434.60	155.72
2034	96.99	60.01	21.50	15.01	9.29	3.33	711.09	439.99	157.60
2035	97.85	60.63	21.72	15.14	9.38	3.36	717.35	444.53	159.25
2036	98.81	61.22	21.87	15.29	9.48	3.38	724.43	448.82	160.32
2037	99.91	61.69	22.05	15.46	9.55	3.41	732.49	452.31	161.64
2038	101.11	62.16	22.25	15.65	9.62	3.44	741.24	455.70	163.14
2039	102.34	62.67	22.48	15.84	9.70	3.48	750.31	459.47	164.80

2040	103.60	62.68	22.64	16.04	9.70	3.50	759.56	459.52	165.99

Source: Recommended parameters for the preparation of the National Plan (August 2018)

Annex 4 List of figures, tables and charts

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Annex 4 List of Abbreviations

4M MC Trading on the Czech-Slovak-Hungarian-Romanian coupled day-ahead market (4M market coupling)

ANO Political party

BACI Bidirectional Austrian-Czech Interconnection

BAT Best Available Technology

BAU Business as usual

BEV Battery Electric Vehicle

BP British Petroleum

BGS Biogas station

BREF Best Available Techniques reference documents (IPCC)

BMW Biodegradable municipal waste

BW Biodegradable waste

SSS Supply security standard (natural gas)

BM Block market (with electricity in the Czech Republic)

CACM Capacity Allocation and Congestion Management

CCS Carbon Capture and Storage

CCU Carbon Capture and Utilisation

CDD Cooling degree days

CEE GRIP Gas Regional Investment Plan for Central and Eastern Europe

CEF Connecting Europe Facility

CEGH Central European gas distributor – Baumgarten

CRP Central registration of projects

Ceteris paribus A condition or assumption where the result is valid only if the other conditions remain unchanged

CF Cohesion Fund

CIF Costs of Insurance and Freight

CNG Compressed natural gas

CO Carbon monoxide

CO_2 Carbon dioxide

COP 21 Conference of Parties

CORE flow-based common methodology for the calculation of intraday capacity developed by the regional transmission system operators

Coreso, TSC, SSC Coordination platforms to ensure operational coordination between dispatching sites of participating transmission network operators

CPI Czech-Polish Interconnection

CPO02 European target for energy efficiency improvement

ČEPS Czech Transmission System Operator (ČEPS, a.s.)

CGS Czech Geological Survey

CHMI Czech Hydrometeorological Institute

CNB Czech National Bank

CR Czech Republic

ČSSD Czech Social Democratic Party

CZSO Czech Statistical Office

SES Secondary energy sources

DS Distribution systems

DT day-ahead spot market (in electricity in the Czech Republic)

EBGL Commission Regulation (EU) establishing a guideline on electricity balancing

NPD Nuclear Power Plant Dukovany

EEPR European Energy Programme for Recovery

EEX European Energy Exchange

EFEKT State Programme to Support Energy Savings

EIA Environmental Impact Assessment

ECIC   Energy Consultation and Information Centres

ENERGO   Statistical survey in the household sector

ENS   Energy not served

ENTSO-E   European Network of Transmission System Operators for Electricity

EPC   Energy Performance Contracting

ERD   Entity–Relationship Diagram

ERDF   European Regional Development Fund

ERO   Energy Regulatory Office

ES CR   Electricity system of the Czech Republic

ESF   European Social Fund

ESIF   European Structural and Investment Funds

ESR   Effort Sharing Regulation

ETP   Energy Technology Perspectives (IEA)

EU ETS   European Union Emission Trading Scheme

EU   European Union

EUA   European Emission Allowances

EUPHEMIA   EU Pan-European Hybrid Electricity Market Integration Algorithm

EURACOAL European Association for Coal and Lignite

Eurostat   Statistical Office of the European Union

EU-SILC   EU Survey on Income and Living Conditions

EA   Energy Act

FACTS   Flexible Alternating Current Transmission System

FCA   Regulation (EU) establishing a guideline on forward capacity allocation

FiD   Final investment decision

FSC   Forest Stewardship Council

PVPP   Photovoltaic power plant

GASPOOL German business zone

Gazela Gas pipeline

GHG Greenhouse gas

GWh Gigawatt hour

GWhe Gigawatt hour electricity equivalent

ha hectare

HDD Heating degree days

GDP Gross domestic product

GNI Gross national income

GVA Gross value added

BTS Border transfer station

IEA International Energy Agency

IGCC International Grid Control Cooperation

IPCC Intergovernmental Panel on Climate Change

IPI Industrial Production Index

IPPC Intergovernmental panel on climate change

IROP Integrated Regional Operational Programme

KDS Christian Democratic Party

KDU-ČSL Christian and Democratic Union - Czechoslovak People's Party

MW Municipal waste

KSČM Communist Party of Bohemia and Moravia

ktoe Kiloton of oil equivalent

CHP Combined heat and power generation

LČR Forests of the Czech Republic

LIP 15 Local implementation project, a joint cross-border trading project of the Czech Republic, Bulgaria, Austria, Germany, Hungary, Poland, Romania, Slovenia and Croatia

LOLE Loss of Load Expectation

LPG Liquified petroleum gas

LRF Linear reduction coefficient (emission allowances)

LULUCF Land use, land use change and forestry

M1 Vehicles with a maximum of eight passenger seats

M2 Vehicles with more than eight passenger seats (weight not exceeding 5 000 kg)

M3 Vehicles with more than eight passenger seats (weight exceeding 5 000 kg)

MAF Mid-Term Adequacy Forecast

MARI Manually Activated Reserves Initiative

MC market coupling

MCO Market Coupling Operator Plan

MERO, a.s. Czech company owning and operating the Druzhba and IKL oil pipelines on the Czech territory

FAME Fatty acid methyl ester

MoF Ministry of Finance of the Czech Republic

MoRD Ministry of Regional Development of the Czech Republic

PRIMES modelling tool for EU analysis (when assessing impacts and analysing policy options)

Mothballing Deactivation and storage of equipment or production equipment for future use

MIT Ministry of Industry and Trade

MRC Multi Regional Coupling

Mt Mega-tonne

Mtoe Million tonnes of oil equivalent

MoI Ministry of the Interior

MW megawatt

N Natrium

N1 Vehicles with a maximum permissible weight not exceeding 3 500 kg

N-1 Safety criterion

N2 Vehicles with a maximum permissible weight exceeding 3 500 kg but not exceeding 12 000 kg

N_2O Nitrous oxide

N3 Vehicles with a maximum permissible weight exceeding 12 000 kg

NAP CM National Action Plan for Clean Mobility

NAP NE National Action Plan for the Development of Nuclear Energy

NAP RES National Action Plan for Renewable Energy Sources

NAP SG National Action Plan for Smart Grids

NAPEE National Action Plan for Energy Efficiency

NATO Central European Pipeline System (CEPS)

NC CAM Network Code Capacity Allocation Management

NC ER Network Code for Emergency Restoration

NCG German business zone

NEMO Nominated Electricity Market Operator

NON-RES Non-Renewable Energy Sources

NET4GAS Transmission system operator in the Czech Republic

NH_3 Ammonia

NFI National forest inventory

NPISH Non-profit institutions serving households

NCS National Cohesion Strategy

LV Low voltage (low voltage networks)

North Sea Brent FOB World-renowned oil price index (free on board)

NO_x Nitrogen oxides

NPOR National Priorities of Oriented Research

NRP National Reform Programme of the Czech Republic

NTC Net transmission capacity

GD Government decree

ODA Civic Democratic Alliance (political party)

ODS Civic Democratic Party (political party)

OECD Organisation for Economic Cooperation and Development

OLTC On-Load Tap Changer

OP EIC Operational Programme Enterprise and Innovation for Competitiveness

OPT Operational Programme Transport

OPEC Organisation of the Petroleum Exporting Countries

OP Off-take point

OP EI Operational Programme Enterprise and Innovation

OPE Operational Programme Environment

UN United Nations

OTE, a.s. Electricity and gas market operator

RES Renewable Energy Sources

P Phosphorus

PCIs Projects of Common Interest

PCR Price Coupling of Regions

PEFC Program for the Endorsement of Forest Certification

PES Primary energy sources

PFCs Perfluorocarbons

PHEV Plug-in hybrid electric vehicles (plug-in hybrid electric vehicles)

PICASSO Platform for the International Coordination of Automated Frequency Restoration and Stable System Operation

PJ Petajoule (power unit)

PLEXOS Integrated energy model for energy market modelling

PM 10 Particulate matter in microns

WMP Waste Management Plan of the Czech Republic

CP Climate Policy in the Czech Republic

CGP Cross-border gas pipeline

TSO Transmission system operator

C4G Capacity for Grid

RDP Rural Development Programme

TS Czech Republic's Transmission System

PST Phase-shifting transformers

LFF Land intended to fulfil forest functions

SES Supported Energy Sources

RDE Real Driving Emissions

RIA Regulatory Impact Assessment

RIS3 Strategy National Research and Innovation Strategy for Smart Specialisation of the Czech Republic

RSC Regional Security Coordinator

rTPA Regulated third party access

SDAC Single day-ahead coupling

SEA Strategic Environment Assessment

SEP State Energy Policy

SET Plan European Strategic Energy Technology Plan

SDIC Single intraday coupling

SO GL System Operation Guidelines

SO_2 Sulphur dioxide

SOAF ENTSO-E report

SoS Security of Supply

SPD Freedom and Direct Democracy (political party)

RDS Regional Development Strategy of the Czech Republic

STAN Mayors and Independents (political party)

SZ Green Party (political party)

BRP Balance responsible parties

HSS Heat Supply System

TACR Technological Agency of the Czech Republic

TAL Transalpine Pipeline

SAF Solid alternative fuels

TCEP Tracking Clean Energy Progress (IEA publication)

TEN-E Trans-European Energy Networks

TEN-T Trans-European Transport Networks

TERRE Trans-European Replacement Reserves Exchange

THÉTA A programme to support applied research, experimental development and innovation

TJ Terajoule (energy unit)

SMW Solid municipal waste

DNC Domestic net consumption

TOP 09 – Centre-right political party

TriHyBus Czech hybrid hydrogen-powered bus fuel using fuel cells

TRU Trading Region Upgrade

TSO Transmission System Operator

TYNDP Ten-Year Network Development Plan of the Czech Republic

FMI Forest Management Institute

USD PPP USD in purchasing power parity

USD/bbl USD per barrel

US-DEU Political party

R&D Research and development

R&D&I Research, development and innovation

IM Intraday market (with electricity in the Czech Republic)

VIP Virtual interconnection point

HV High voltage (or high voltage networks)

VTP Virtual trading point (gas)

VOC   Volatile organic compound

VoLL Value of Loss Load

NTS National transmission system

LFS   Labour Force Survey

WPP Wind power plant

HP, MP, LP   System of high-pressure, medium-pressure and low-pressure gas pipelines

VV Věci Veřejné (political party)

VHP Very high pressure long-range gas pipelines

VGS Virtual gas storage

WEO   World Energy Outlook (IEA)

XBID   Czech–Polish and Bulgarian–Romanian cross-border intraday market project

DN   nomination of obligation to deliver (natural gas)

ON   nomination of obligation to off-take (natural gas)

NG natural gas