MINISTERSTVO
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STATE ENERGY POLICY

OF THE CZECH REPUBLIC

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Contents:

1 Purpose and framework of the State Energy Policy

The main purpose of the State Energy Policy (SEP) is to ensure reliable, secure and environmentally-friendly supplies of energy to meet the needs of the populace and economy of the Czech Republic, at competitive and acceptable prices under standard conditions. It must also secure uninterrupted energy supplies in crisis situations to the extent necessary to ensure the functioning of the main components of the state and the survival of the population.

The **Czech Republic's long-term energy vision** is the provision of reliable, reasonably priced supplies of energy to households and the economy that are sustainable in the long term. This vision is summed up in the three top strategic energy objectives of the Czech Republic, which are **security – competitiveness – sustainability**.

One of the most significant characteristics of the current trend in energy on the global scale is the high degree of uncertainty concerning future political and economic development, the development of technology and the requirements concerning environmental and climate protection. The strategic response to challenges in the energy sector is the efficient use of domestic energy sources and raw materials, the need to take a comprehensive view of supplies of all forms of energy and the entire chain from production/generation through to consumption and the adequate diversification of sources, raw materials and transport routes. Equally important is the Czech Republic's active involvement in the formulation of fundamental development energy strategies in the international context and the use of instruments enabling the effective promotion of the national energy policy and the application of the latest international scientific and technological know-how.

With its State Energy Policy the government of the Czech Republic has formulated a political, legislative and administrative framework for reliable and reasonably priced supplies of energy that are sustainable in the long term. In accordance with the law[1] the State Energy Policy is a strategic document that expresses the state's objectives in energy management in line with the needs of economic and social development, including environmental protection, which also serves as the basis for territorial energy policies.

To ensure the fulfilment of its long-term vision the State Energy Policy defines **the Czech Republic's strategic energy objectives** and sets out **strategic priorities** within the term specified by law and also for the period in which there is usually an economic return on investments in all types of sources and networks and in which the basic characteristics of future development can still be reasonably predicted. Investment in the construction of new sources is provided by energy companies and decisions are based entirely on the expected return on investment. The state may use its instruments to influence the behaviour of investors to a limited extent and an a manner that is compatible with competition law. The

[1] Act No. 406/2000 Coll., on Energy Management, as amended (the law)

State Energy Policy must provide not only a long-term focus, but also the necessary flexibility to promote new technical and economic development.

At present, energy supplies are based on market principles. The fundamental problems of the energy market are the high risks associated with rapid changes in European legislation and unstable market signals generated by a number of distortions in the market and the promotion of political objectives. Current development is leading to a situation where investors are only looking to construct sources with guaranteed (subsidised) prices. Investment in sources and networks is de facto controlled by state incentives and not by the market. Market development that is not corrected by the state under these conditions will result in an unbalanced source mix that poses a number of strategic and systemic risks for the future. For this reason many countries in the EU are adopting various interventionist measures aimed at ensuring sufficient regulation or ensuring the construction of new sources to cover consumption. These interventions, primarily in the form of capacity mechanisms related to offered capacity (MW), would supplement the wholesale market (MWh). If they are introduced unilaterally with no regional or Union-wide coordination, they will further hamper the operation of the internal market and may have serious consequences for interconnected national markets without these subsidies.

The European electricity market is currently at a crossroads. The existing model of the "energy-only market" assumes that the market will provide both short-term optimisation (efficient allocation of the necessary production amongst existing capacities), as well as long-term investment signals for the construction of new capacities. This model was definitely set up around 10 years ago, in 2003, following the codification of the model based on third-party access to networks – TPA (the previous framework from 1996 also allowed for the single buyer model). The high degree of market distortion in the sector, however, practically paralysed this second function of the market model. In contravention of the plan to complete the internal electricity market based on this model, various forms of state intervention are being advocated, aimed on the one hand at promoting political and strategic plans (support for RES, regulation of electricity prices, preferential access rights, bans on certain types of sources, etc.), while on the other at dealing with the consequences of this market distortion (capacity payments, Contract for Difference, strategic reserves, etc.).

The European Commission is thus pushing for the completion of a model that is prevented by the steps taken by member states. Further development will focus either on completion of the internal market and a return to the "Energy-Only Market" by eliminating market distortion, or on dividing the energy market and capacities and creating a separate a mechanism providing signals for investment. It is not currently clear what the future model will be like. If this change comes to pass, it will be the third market model implemented during the last 20 years and will not necessarily be definitive for the next 20 years. The state's energy strategy must therefore be formulated so as to objectively define strategic objectives, sub-strategies and the desired target situation (consumption, distribution, production, management, emergency procedures) regardless of the predominant market model. Instruments aimed at attaining the target situation will then be specified in relation to manner in which the sector is organised at the time. The strategy is based on the specific natural, economic and social conditions of the Czech Republic in the context of development in Europe and formulates basic strategic objectives in compliance with the European Union's long-term energy strategy focused on decarbonisation, high security of supply and competitive energy prices.

Permanent legislative changes at the European and national level are puzzling investors, who are currently circumspect about investing in energy. In order to improve the situation it is particularly essential to define and approve the substantive direction to be taken in the future development of power engineering, approve medium-term and long-term targets and stabilise the system through legislation aimed at achieving those targets. At the both the national and European level. The main objective is to ensure a stable and predictable business environment, efficient state administration and adequate and secure infrastructure. Direct financial aid and other fiscal stimuli are instruments which merely complement this and are limited in terms of fact and time, and must always be evaluated from the viewpoint of the impact on energy prices, the functioning of the market, the state budget and the stability of the sector as a whole.

During the preparation of this document a range of possible alternative scenarios were explored on the basis of a balance model in order to outline the future development of the energy sector in the Czech Republic. These scenarios are based on the change in the input parameters (although not axioms) of the balance model arising from the hierarchization of the top strategic priorities: security – sustainability – competitiveness. The result is the **specification corridors** that define the acceptable direction to be taken in the development of the mix of primary energy sources and gross electricity production in the Czech Republic. The corridor concept is therefore a means of quantifying the possible variability of the results of the model (i.e. primarily the structure and amount of primary energy sources (PES) and gross electricity production), depending on the predefined value of the input parameters in the variant.

2 Method used to create and implement SEP

The first phase of the creation of the SEP involved an **analysis of the existing energy system** and defined the main trends in the development of power engineering, demand for energy, the availability of the various PES, the energy mix and the potential for its development in the future, as well as the issue of energy infrastructure. In methodological terms this is a classic **SWOT analysis** of the strengths and weaknesses of the Czech energy industry, including the consequences of past decisions made within the framework of the energy policy (Section 3.1), as well as being designed to identify potential opportunities and threats resulting from prediction of the development of the internal and external conditions that influence the energy sector in the Czech Republic.

A comprehensive analysis of the **internal and external conditions that have an impact on the Czech energy industry** in the long term that have so far been identified is given in Section 3.2. External conditions particularly include global rivalry over primary energy sources, liberalisation of the energy market in the EU and the creation of a single market, the gradual transfer of competence from member states to the European level, globalisation connecting the national energy markets with the European and global markets, EU energy and climate policy, pressure on reducing emissions, integration of the energy markets throughout Europe and scientific and technological development. Internal conditions include the reliability of energy supplies, restoration of out-dated and the construction of new network infrastructure, the important role and tradition of power engineering, the dominant role of industry in the domestic economy, the waning stocks of available coal, the public's overwhelmingly positive view of nuclear energy, the limited potential of renewable energy sources, the well-developed thermal energy supply system, the need for the Czech Republic to meet its obligations as regards reducing greenhouse gas emissions, the unique transit position of the country, the ageing of the source base and energy infrastructure, and technical intelligence. Section 3.3 then presents a concise overview of the results of the SWOT analysis.

The second phase of the creation of the SEP, based on wide-ranging expert discussions held after 2007 following the establishment of the so-called "Pačes" Commission, **defined the state assignment for the energy sector**, which is contained in Section 4 – *Energy Policy of the Czech Republic until the year 2040*, i.e. the top strategic objectives for the entire energy sector, metrics and targets for their evaluation (Section 4.1). These resulted in the formulation of five key long-term priorities (Section 4.3) and **partial development strategies** for the various areas of the energy sector and related sectors. Section 5 – *Concept for the development of important areas of power engineering and areas relating to power engineering* thus contains the visions, main development focuses and supplementary objectives for a total of 8 areas.

The primary strategic assignment[2] for the SEP is based on the document entitled *Strategic Framework for Sustainable Development in the Czech Republic*, compiled by the Government Council for Sustainable Development and approved by the government of the Czech Republic through Government Resolution No. 37 of 11 January 2010. Its main aim is to "improve the life of the present generation and future generations through the creation of sustainable communities able to make efficient use of resources and unlock the environmental and social innovation potential needed to ensure economic prosperity, environmental protection and social cohesion" (p. 11). The assignment for the SEP contains the individual priorities and objectives in the priority axes of the Czech Republic's strategic vision for sustainable development. These objectives include, amongst others, reducing the health risks associated with adverse environmental factors; supporting business and increasing competitiveness; increasing the energy efficiency and economic efficiency of transport, reducing dangerous emissions from transport; ensuring the energy security of the state and increasing the energy and raw material efficiency of the economy; supporting the development of human resources; supporting education, research and development; more effective promotion of strategic and land use planning and the aim of protecting the landscape to ensure the protection of species diversity and the national commitments relating to cutting greenhouse gas emissions (objective 4).

In the second step the assignment was based on specific existing sectoral strategies and concepts – *Czech Republic National Action Plan for Energy from Renewable resources for the Period 2010-2020, Czech Republic International Competitiveness Strategy (2012-2020), Czech Republic Export Strategy (2012-2020), Raw Materials Policy for Minerals and Their Sources, State Environmental Policy of the Czech Republic (2012-2020), Czech Republic Transport Policy for the Period 2014-2020 with a View to 2050* and *Czech Republic Security Strategy (2012-2020)*, while account is also taken of other strategic documents currently being prepared. The SEP should also form the basis for related strategic documents such as the *Territorial Development Policy* and *Transport Policy*.

The *State Environmental Policy of the Czech Republic (2012-2020)* resulted in several strategic assignments for SEP, primarily with regard to the protection and sustainable use of sources, including the protection of natural sources, the protection and sustainable use of the soil and rock environment; climate protection and improving air quality, reducing greenhouse gas emissions, supporting the efficient and environmentally-friendly use of RES and energy savings; the protection of nature and the landscape while enhancing the ecological role of the landscape.

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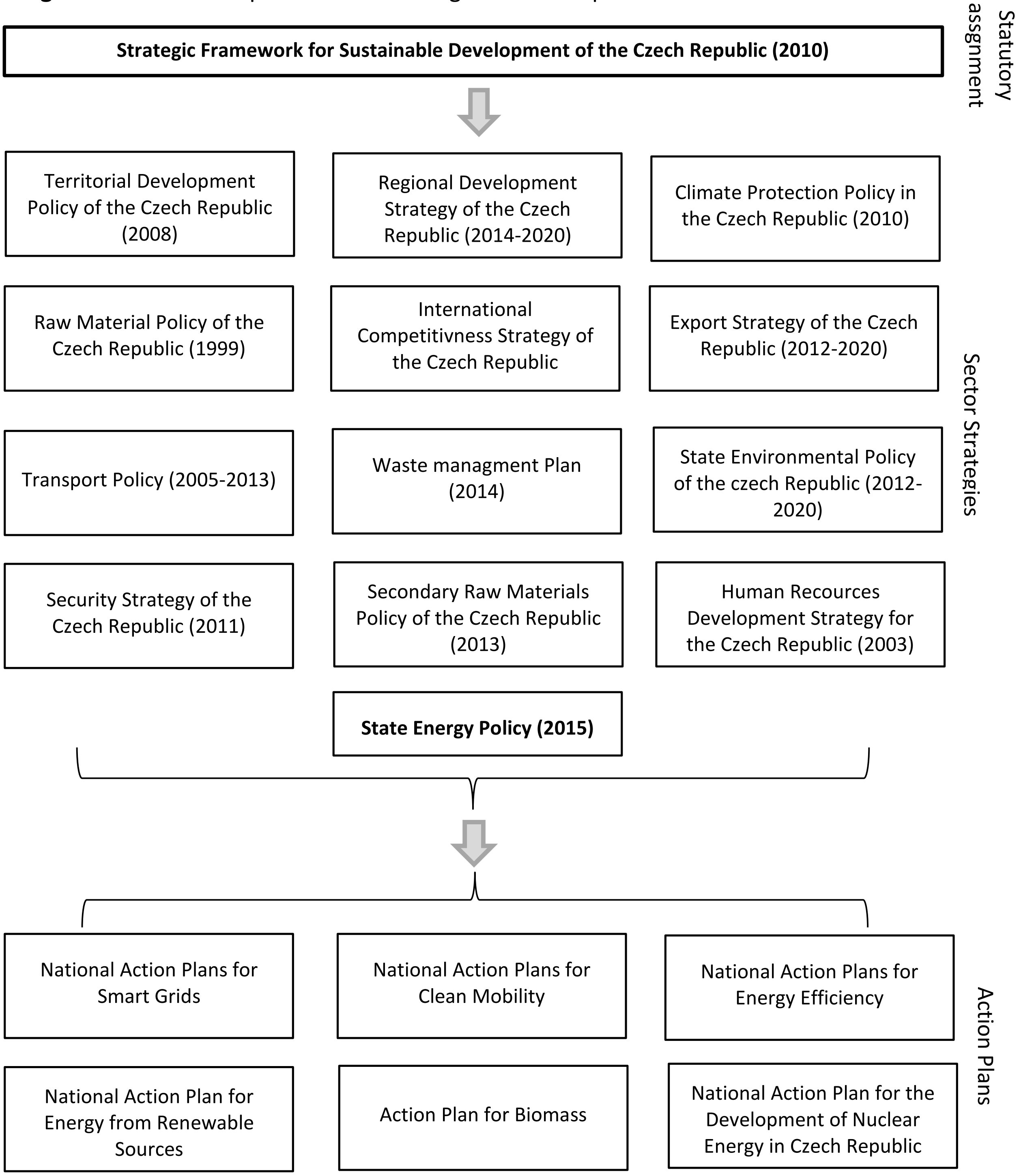
[2] In the case of the compilation and approval of the Economic Strategy of the Czech Republic, this document will naturally be taken into account in subsequent updates and evaluations of the State Energy Policy. Meanwhile, as this does not exist, the SEP will be based on partial sectoral strategies.

The interdependence of the individual strategic and conceptual materials at the Czech Republic level[3] can be seen in the following diagram.

Diagram No. 1: Interdependence of strategic and conceptual materials



[3] This is not a comprehensive list of all strategic documents and action plans at the Czech Republic level.

The SEP also respects commitments accepted by the Czech Republic in relation to international organisations and the EU (particularly the EU climate and energy targets by 2020).

The third phase of the creation of the SEP involved **energy modelling** focusing on the creation of internally consistent scenarios for the possible future development of the Czech energy industry with emphasis on energy savings, economic efficiency and maximum ecological acceptability and taking account of the defined framework strategic assignment from Sections 4 and 5. Three interrelated models were modelled – affecting the household sector, the total energy balance of the Czech Republic and the national economy in the context of the strategic assignment from Sections 4 and 5 while respecting the basic axioms (Section 4.2) defining the modelling constraints for the individual scenarios. The energy sector is extremely susceptible to the development of the external environment (the economy, the global political situation, changes in the legislative regulatory framework in the Czech Republic and the EU, advances in R&D&D, etc.). Therefore, a range of possible alternative scenarios which retained the basic axioms of the concept were explored during the preparation of the SEP in order to express the future intended development of the energy sector in the Czech Republic.

This analytical work led to the **definition of planned corridors** for the mix of primary energy sources and gross production of electrical energy (Section 4.2). During the preparation of the State Energy Policy a general look was also taken at extreme scenarios, although these were rejected as they grossly distort the three basic strategic objectives. These extreme scenarios are therefore not a realistic alternative to the State Energy Policy and as such are not contained in the corridors. These corridors are described in *Section* 4.2 *Axioms, indicative indicators and targets before 2040.* The framework of input parameters is defined by preserving a balance between the three strategic objectives of the Energy Policy - security, competitiveness, sustainability.

Thus, any mix of energy sources contained within the framework of corridors of primary energy sources and gross electricity production (see Section 4.2) is acceptable in the free energy market and given the uncertainties as regards developments in technology, EU energy legislation and market trends. If market development in the Czech energy industry is to deviate from the set corridors, state intervention could be considered in the implementation of the State Energy Policy. Using the corridor system for the State Energy Policy thus provides sufficient flexibility to respond to the dynamic development of internal and external conditions. As a result, the State Energy Policy is thus presented as a single variant, considering a balanced mix of sources prioritising the use of domestic primary sources and maintaining import dependence at an acceptable level. The target situation as regards proportions of the individual primary energy sources and sources for the production of electrical energy is defined in percentage corridors within a defined minimum and maximum for the various types of PES and of sources for the production of electrical energy. The proposed corridors express the variant nature of the policy and implicitly include the necessary flexibility with respect to the high level of uncertainty.

The modelling process also further defined what is referred to as an optimised scenario, which best corresponds to the balanced fulfilment of the three strategic objectives and the strategic aims of the state for the various sub-areas of the USEP. The optimised scenario is thus defined by the need to ensure reliable, safe, secure and environmentally-friendly energy supplies to meet the needs of the population and the economy of the Czech Republic, at competitive and acceptable prices under standard conditions, through a balanced mix of sources prioritising the use of domestic primary sources and maintaining import dependence at an acceptable level. It is based on precisely quantified input assumptions and the balanced fulfilment of the three strategic objectives given the anticipated development of the various forms of energy technology (including cost trends) and the focus of Czech and European climate-energy and industrial policy. It also assumes the implementation of all the partial strategic objectives and measures described in this document. Nevertheless, this is merely an illustrative scenario aimed at demonstrating the ideal (intended) direction that the Czech energy industry should take given this combination of input assumptions. The optimised scenario for the development of the Czech energy industry, including the individual input assumptions and key indicators, is contained in Section 7.

The last – fourth – phase defined the **procedure** and **instruments for the implementation of the State Energy Policy** (see Section 6).

3 Current state of the energy sector in the Czech Republic and main development trends in the coming decades

3.1 Current situation and state of the domestic energy sector

The domestic energy sector has undergone long-term development. In recent years the Czech Republic has made noticeable progress in the field of energy. The OECD has particularly praised the Czech state's efforts to improve its energy policy and climate protection policy, as well as its progress in ensuring oil and gas security, its steps forward in the liberalisation of the electricity market and the contribution it has made towards the development of the electricity market in the whole of the Central European region. However, at the same time Czech Republic is obliged to implement policies relating primarily to energy efficiency. The Czech transmission system is closely connected up with all neighbouring states. The sum total available transmission capacity in relation to the Czech Republic's maximum load is more than 35 % for exports and 30 % for imports, and there is increasing transit in the north-south direction, equivalent to up to 30 % of maximum load.

The Czech Republic has also made progress in reducing the impact the energy sector and industrial production have on the environment. It is, however, important to bear in mind that CO_2 emissions are not a key indicator for the environment of the Czech Republic and the health of its inhabitants. Reducing CO_2 emissions is primarily a political commitment of the EU and therefore also of the Czech Republic and has no direct impact on the health of the population of the Czech Republic. Critical factors here are local emissions of airborne dust, which absorb harmful chemicals and enter the body in concentrated form. Other factors are primarily SO_2 and NO_x emissions. These emissions are a significant burden on public health result mainly from (local) inefficient combustion of solid fuels, including parts of biomass, and from transport.

Almost 50 % of the consumption of primary energy sources in the Czech Republic is covered from domestic sources. The import energy dependence indicator of the Czech Republic (including nuclear fuel) is therefore roughly 50 %, one of the lowest in the whole of the EU. With the current global emphasis on energy security, this is one of the principal strengths of the domestic energy sector. The current EU average is approx. 60 %. The Czech Republic is fully self-sufficient in its production of **electricity and heat**. The structure of its electricity sources is stable. The most significant change in the last decade has been the construction of the Temelín nuclear power plant. As a result of support for renewable energy sources in the past there has been an increase in the proportion of renewable resources other than hydro power plants, yet so far, despite high subsidies, this has not succeeded in replacing a more significant proportion of fossil fuels. The proportion of **heat production** from domestic fuels is around 60 % and more than 80 % in heat supply systems. The Czech Republic has done well in introducing combined heat and power, while in the case of large and medium sources the proportion of cogeneration is almost 70 % of total gross heat production. The ratio of cogeneration heat production to overall heat production (including decentralised sources excluding households) is, however, less than half. The advantage of cogeneration production is that fuel energy use is high. Cogeneration also produces 12-13 % of gross electricity production. The priority for future development is to make more effective use of heat and electricity generated. Most heat supply systems use domestic brown and black coal as fuel. Besides low-power heating plants, heating plants with cogeneration production make the most efficient use of biomass and, in technical and economic terms, keep concentrations emission pollutants to an acceptable level.

A highly developed distribution network ensures secure electricity supplies with a high degree of reliability. However, the majority of the sources and networks are 35 or more years old and need extensive renovation and modernisation. This renovation must be carried out in the next 10-15 years. This renovation and modernisation will be coupled with adaptation to new technology and readiness for further technological development in sources and in consumption. Adaptation of the networks will be a costly and demanding process, particularly at the low-voltage level, enabling the further development of small production electricity sources.

The bulk of total primary sources is made up of currently constant domestic energy sources, due to the extensive use of domestic brown and black coal to generate electricity. The Czech energy sector is dominated by coal sources, which supply, as base load sources, almost 60 % of electrical energy and a large proportion of heat through district heating. In the Czech Republic coal is also used for individual heating. The decisive proportion of production heat and electricity sources using coal is approaching the end of its economic and physical useful lifetime. Despite certain ecological aspects of coal usage, this domestic raw material is not fully replaceable within the time frame of the SEP, for both safety and economic reasons. Therefore, another objective of the energy policy must particularly include securing modern, highly-efficient technology for using coal. The consumption of brown and black coal will gradually fall within the SEP time frame due to decreasing availability. The reduction in the proportion of coal used to produce electricity and heat in the Czech Republic should be a smooth process in the long term and should be implemented in a way that ensures that the remaining coal stocks are used in the most effective and environmentally-friendly manner possible. The priority will be sources with the highest possible efficiency, in both cogeneration and in condensation production. Inefficient coal combustion with extremely low efficiency is not desirable, which is why the aim is to put this process at a disadvantage.

The decline in the ratio of domestic energy sources to the consumption of primary energy sources will inevitably lead to the development of low-carbon base and peak load sources and also to a slight necessary rise in energy imports. The aim of the SEP in the long term is to maintain the Czech Republic's import energy dependence below 65 % before 2030 and 70 % before 2040.

The second important sources of energy in the Czech Republic, currently used primarily for the generation of electricity, are **nuclear sources**. These now supply over 33 % of all electricity produced. Nuclear sources as such are generally built outside densely-populated areas and generate electricity in base load. Regular peak operation, although technically feasible and used by certain countries (Germany, France), is not sensible from an economic viewpoint (low variable fuel costs and high fixed investment costs) and in many cases is also limited by operational parameters. Long service life, high utilisation factor, reliability, low cost and predictable operation are traits typical of nuclear sources. One significant strategic advantage is the high concentration of fuel, allowing, unlike all other sources, strategic stocks to be created to last for several years of operation. The output, volume of initial investment required and particularly the length of the investment horizon makes nuclear power plants suitable only for major and long-term investors. However, low fuel costs then give nuclear sources an indubitable advantage after amortization of the initial investment. The variability of fuel costs (especially the prices of uranium and enrichment) are reflected in the prices of the electricity generated far less than with fossil sources, which is also why the price of energy from nuclear sources is easier to predict. Nuclear sources use highly advanced technology. This means that they take longer to construct and need highly qualified staff for planning, construction and operation, and especially strong, independent state nuclear supervision. Nuclear safety, with risks stemming from the high concentration of energy in the nuclear source and the radiation hazards, must be ensured not only by the state of the technology itself, but also by skilled staff, at every instant of the operational process.

There are two nuclear power plants in the Czech Republic, in Dukovany and in Temelín. Nuclear sources are highly demanding in investment terms, as they are the most susceptible to political and economic stability, one of the priorities of the State Energy Policy. This is also a very sensitive area from the viewpoint of international relations. Within the time frame of the State Energy Policy what is important in terms of dependence on predicting the balance of production and consumption is the completion of the construction of additional nuclear power units to produce around 20 TWh by 2035, extending the lifetime of the existing four units in the Dukovany power plant (to 50 to 60 years) and later the possible construction of another unit to compensate for the decommissioning of the Dukovany nuclear power plant. In the long term, nuclear energy could provide in excess of 50% of the amount of electricity generated, thus replacing a large proportion of the coal sources. It is also advisable to start making greater use of heat energy from nuclear sources to heat larger urban agglomerations. If nuclear power were to continue to be used for a longer period of time, it would also be necessary to explore and prepare, as needed, sites for future additional nuclear power stations after 2040.

Another important source of energy in the Czech Republic is **natural gas**, used for the generation of electricity or for district and individual heating. Natural gas is used directly for heating purposes by approx. 27 % of households. Most heat supply systems based on natural gas are dependent on natural gas supplies with no option to switch to an alternative source. This proportion supplies heat to approx. 10 % of the populace. The current ratio of gas to electricity generation is roughly 2.5 %. During the last ten years gas consumption has fallen by 20 %, despite an increase of approx. 800 thousand in the number of consumers. This is primarily the result of building insulation and the use of more effective appliances, as well as the reduction in certain types of industrial production and, last but not least, the trend in household gas prices. Some gas sources are suitable for covering peak consumption times and also for bridging instability in certain renewable energy sources (photovoltaic and wind plants). Due to the ecological properties of gas and the technical aspects of gas combustion power stations, gas usage should be steered towards highly-efficient sources of combined heat and power (cogeneration and micro cogeneration) also for the provision of support services in the electricity sector. One of the principal sectors in which natural gas is used is transport, where it will partly replace liquid fuels in the medium term. The total proportion of gas in the energy mix should therefore rise.

The security and reliability of gas supplies are dependent on their stability, an adequately developed gas transport system and the capacity of gas storage facilities, the importance of which increases sharply if supplies are interrupted. The adequate capacity of domestic gas storage facilities means that a considerable proportion of total annual gas consumption can be stored directly within the Czech Republic. As regards gas supplies, domestic consumption is practically entirely dependent on imports of this energy commodity. The dominant supplier is still the Russian Federation, together with Norway, and in recent years there has also been an increase in the volume of gas obtained through trading on the spot markets in the EU. The Czech Republic has already adopted and continues to adopt a series of measures to ensure gas security – a considerable proportion of gas supplies is imported on the basis of long-term contracts, from diversified sources, with diversified transport routes also available, including supplies of natural gas from the Russian Federation.

Our gas supply system is technologically advanced, and primarily serves for the purposes of transit. It includes an extensive system of gas storage facilities and is connected up with systems in neighbouring countries (the Federal Republic of Germany, Slovakia, Poland), which proved beneficial when natural gas supplies from the Russian Federation through Ukraine were restricted and interrupted, meaning there was no need to impose any restrictions on supplies to end customers. For a long time now the prevailing direction taken by international gas transport has been east/west; the input capacity of gas pipelines from the east is 51 billion m^3/year, from the west a total of 29 billion m^3/year. Since the completion of the Gazela gas pipeline in 2012 (with a capacity of 30 billion m^3/year), gas is now transported through the Czech Republic primarily along the north/south axis, with gas transported from the Nord Stream and OPAL gas pipelines through the Gazela pipeline on into Germany and France. Of crucial importance to the security and reliability of gas supplies to domestic customers is principally the fact that at several nodes the Gazela gas pipeline is connected up to the Czech transport system, which may offer an alternative supply channel if there is any recurrence of the earlier problems with supplies through Ukraine. In 2011 work was also completed on the construction of the first Czech-Polish gas STORK I, with an annual capacity of 0.5 billion m^3. The priority is to expand the Czech-Polish connection with a second gas pipeline, STORK II, with a total annual capacity of up to 6.5 billion m^3, which is part of the north-south corridor in Central and Eastern Europe and has also been assigned the status of a project of common interest (PCI). Other alternative gas pipelines are Moravia, BACI and Oberkappel. Gas storage facilities currently have a capacity of 3.442 billion m^3 (approx. 35 – 40 % of domestic annual consumption) and an extraction capacity of between 55 mil. m^3/day (start of winter) and 33 mil. m^3 (end of winter). Considering the expected increase in the use of natural gas, secure and diversified transportation is essential.

Oil consumption, with the exception of use in transport, is not increasing (although its use in the chemical industry is important); in the Czech Republic it makes up only approx. 2 % of heat generation (heating oil). In contrast, in some western European countries the use of heating oil for household heating has been as high as 50 %. Due to the clampdown on emissions limits it is unlikely that there will be anything to stimulate a further increase in oil consumption. Nevertheless, oil will continue to dominate in the transport sector for the foreseeable future, which is why adequate and diversified import routes are essential. The Czech oil sector was fully liberalised before the Czech Republic joined the EU. Domestic oil companies were privatised and trade in oil products is entirely governed by the conditions of the market.[4] Through legislation the state may thus only influence certain aspects of the oil economy of the Czech Republic, e.g. the level and structure of emergency stocks of oil and oil products. It is, however, in the Czech Republic's strategic interests to permanently maintain a certain minimal level of oil processing in the Czech Republic.

The Czech state has retained ownership of two major companies in the sector. The first is MERO ČR, a.s., which owns and operates the Družba and Ingolstadt-Kralupy-Litvínov oil pipelines (and through its subsidiary also operates the Germany part of the IKL pipeline) within the Czech Republic and the central crude oil tanking station near Kralupy nad Vltavou, which is also where the Czech Republic's emergency oil stocks are stored. The second is ČEPRO, a.s., which owns and operates a domestic product pipeline system linking the ČEPRO warehouses and centres with refineries in Litvínov, Kralupy nad Vltavou and also with Slovakia, and also owns and operates significant motor fuel storage capacity. In terms of oil supplies the Czech Republic is also almost one hundred percent dependent on imports (domestic extraction comprises around 3 % of annual consumption); supplies from the Russian Federation continue to dominate. Imports were diversified in 1995, with the commissioning of the IKL pipeline, which links the Czech Republic to the TAL (Transalpine pipeline), transporting oil from the oil terminal in Trieste, Italy. The IKL pipeline supplies us with primarily low-sulphur, so-called sweet oils, which are processed in the Kralupy refinery. Recently, however, this oil pipeline has mostly been used to transport oil from the Russian Federation. This has meant that the two oil pipelines are now practically level in terms of supplies of oil to the Czech Republic. The import capacity of the Družba oil pipeline from the east is approx. 10 mil. t/year, while that of the IKL pipeline from the west is approx. 11 mil. t/year. The storage capacity of the Central Crude Oil Tank, used to store emergency oil stocks, is 1.55 mil. m^3 in real conditions. The volume of emergency oil stocks and oil products exceeds the prescribed 90 days according to both the previous methodology based on average daily consumption and also to the new methodology based on net imports (Council Directive 2009/119/EC).

Renewable energy sources (RES) in the conditions of the Czech Republic are non-fossil natural energy sources, i.e. hydro energy, wind energy, sunlight, solid biomass and biogas, environmental energy, geothermal energy and energy from liquid biofuels. In 2010 gross electricity production from renewable resources made up 8.3 % of domestic gross electricity consumption. The national indicative target for this proportion was set by the Czech Republic at 8 % in 2010. The ratio of gross heat energy generated from RES to total heat energy generated is around 8 %. The State Energy Policy is in compliance with the Czech National Action Plan for Energy from Renewable Sources and strives to ensure full

[4] Oil companies often use a reprocessing regime, which has its own certain specifics.

exploitation of the potential of biomass designated by the Action Plan for Biomass within the time frame in question and to assure compliance with the environmental protection and food security requirements.

Biomass is the only additional and widely available systemic renewable energy source in the Czech Republic for the heating industry. Other forms of renewable resources are limited for heating purposes for technical and other (socio-environmental) reasons. In the Czech Republic geothermal energy has as yet untested potential[5], although preliminary analyses have shown that this could be considerable. So far, geothermal energy has also been associated with high costs. Wind and hydro energy are not suitable for the heating industry and solar energy does not have adequate potential for centralised heat supplies. The importance of biogas is expected to increase, especially in agriculture. In general terms, support for biomass is a pro-growth measure from the viewpoint of Czech producers. With biomass savings on greenhouse gas emissions are made at the lowest cost per ton of CO_2 saved.

Some sources state that other types of emissions generated by the combustion of biomass (particularly airborne dust) are, in some cases, higher than with the combustion of natural gas, and even higher than coal combustion. It is therefore essential to ensure that biomass combustion is developed using technology that minimises this burden.

In the case of large combustion sources (P_{inst} in tens and hundreds of MW) biomass combustion is possible in order to save on domestic coal, or to reduce emissions while meeting the needs of the most modern and environmentally-friendly methods of combustion. With these large sources, emissions from biomass combustion are resolved on a systemic basis, as this production category already has the necessary technology for cleaning and dedusting discharged flue gas, etc. it would be advisable to specify the way in which biomass is used in order to prevent any further deepening of the direct competitive struggle of input raw materials between the energy sector and the woodworking, pulp and paper industries.

In the case of medium sources (P_{inst} in units of MW) the primary need is to support gas cogeneration of sources connected to the high-voltage grid (support for decentralised production for the high-voltage grid). This is the cleanest form of electricity generation and, given the current support for electricity generation, is also the most economically sustainable variant. Combustion of biomass for generating heat in this category of sources should be sited where there is no connection to the gas supply network or the electrification system or where adequate biomass potential and an existing heat supply system are nearby.

Small sources (P_{inst} in hundreds of kW) must be supported on a selective basis, as these existing coal sources have the lowest efficiency and the greatest influence on pollutant

[5] Assessing the potential for the exploitation of geothermal energy in the Czech Republic will be subject to a research study, which will define suitable locations for the use of this renewable resource.

emissions. An alternative solution is to use small gas cogeneration or pellet boiler plants wherever suitable. Sources at the household level should not, given the disproportionate administration involve, be supported on a systemic basis. More effective, however, is direct investment support for the populace, such as in replacing combustion sources, which may also enable control over the requisite technological standards of equipment and emissions.

The Czech Republic is committed to ensuring that 13 % of gross final energy consumption will be covered by from RES by 2020. This objective clashes with other requirements, such as environmental standards governing the protection of air, water and soil and maintaining the ratio of the state budget deficit to GDP below 3 %. The problem then is the EU's competitiveness with economically developed or dynamically developing states with low energy generation costs or lesser commitments and requirements relating to climate protection or air protection and the environment in general (USA, China, India, Brazil). Despite all the uncertainty over EU common policies after 2020, the Czech Republic is striving to meet the 13 % target for energy consumption from renewable resources under acceptable conditions. At present, this target cannot be achieved without support, which should be low, flexible, gradually downsized and in the future directed towards sources that are promising in economic and technological terms. RES are no exception in that development must be directed towards market mechanisms for mutual competition over different sources and technologies. There are also complementary solutions if the burden of meeting the targets for renewable sources proves too much of a burden on the economy, such as "statistical transfers" from other member states, possible joint projects abroad, etc. In a situation where, for example, sources in Germany place a disproportionate burden on our grid, such a solution would actually be a good example of international cooperation, with one state with better conditions for developing RES builds the source, while the other, which is in a favourable geographical position, enhances the infrastructure, so that the entire region functions reliably, while countries with excess sources installed could contribute towards the costs in regions where there are problems with network capacity.

For a long time now the Czech Republic has used hydro sources. However, these have now been considerably exhausted and their ratio, which is currently around 3 %, will not increase significantly in the future. What is important is that these sources are flexible, able to cover fluctuations in intermittent sources. Several of the pumping stations we have are the only accumulation type of source in the Czech Republic. Together with other hydro sources, provided that the water level is adequate, these are sources for peak consumption. There are certain options open in the form of small sources and several potential larger reservoirs that should gradually start to be used.

Owing to its geographic and climatic conditions the Czech Republic has somewhat limited options as regards the use of wind and solar energy. There are relatively few areas with regular, adequately strong and stable winds, and these tend to be situated in natural and protected mountain areas. There has been a sharp rise in the use of solar energy for electricity production due to the disproportionate amount of support available. This rise is pushing the networks and protection of farmland to the limits and has resulted in cutbacks in aid expenses. In the future it will be possible and appropriate to use solar energy primarily as a small power source in buildings.

The downside of disproportionate subsidies has recently been apparent in this country and in other European countries, and the situation is gradually being dealt with by the various governments. As regards the gradual phasing out of oil in favour of biofuels there is a need to carefully monitor the efficiency of the entire production cycle. It is also necessary to ensure that competition with foodstuffs does not cause biofuels to pose a threat to the food security of the Czech Republic and that biomass produced in the Czech Republic is used in the domestic energy sector.

In the Czech Republic geothermal energy has as yet unverified potential, for heating and air-conditioning as well as for electricity production. However, preliminary analyses have shown that this potential could be considerable. The economically justified use of geothermal energy on a broader scale in the conditions of Central Europe would be a matter for the more distant future.

The energy utilisation of waste also has unused potential for replacing coal. The energy utilisation of selected municipal waste would have a considerable effect. This would offer a potential replacement for primary energy sources (in terms of electricity and heat generation) and would also resolve the problem of getting rid of unused waste components. The world has access to advanced technology that meets all the technical and environmental conditions of the present day. Directive 1999/31/EC on waste landfills requires member states to reduce the quantity of biodegradable municipal waste ("BMW") that is landfilled. Of the total weight of BMW produced in 1995, the amount to be landfilled had to be reduced to 75 % (the amount of BMW produced in 1995) by 2006, to 50 % by 2009 and to 35 % of this figure by 2016. The Czech Republic took advantage of the option to defer these objectives by four years for those states that placed more than 80 % of municipal waste into landfills in 1995. Binding legislation defines the waste municipal handling hierarchy, while the main priority is to prevent waste generation in the first place, followed by reuse and recycling, followed by energy utilisation. So far the Czech Republic has not yet managed to completely meet this target, and achieving this is one of the aims of the State Energy Policy. Currently 500 kg of municipal waste is generated per inhabitant of the Czech Republic per year[6], while in the "old" EU countries the figure is 600-700 kg per year. The amount of waste generated rises as the population's purchasing power increases. Although efficient, tried and tested technology for the energy utilisation of mixed municipal waste does exist, there are only three waste energy utilisation facilities in the Czech Republic, with a processing capacity of 654 th. tons per year. In 2012 over 2.9 mil. tons of mixed municipal waste was produced, while most of this waste was placed on dumps." Approx. 60 % of municipal waste is dumped here[7], whereas there are countries in the EU which dump no waste, or almost none. There,

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[6] Statistical Environmental Yearbook of the Czech Republic (CENIA, MoE)

[7] In 2012 the percentage of municipal waste removed into landfills (D1, D5, D12) comprised 54 % of the total production of municipal waste.

waste is almost entirely used for material and energy. In terms of the European dumping rankings, the Czech Republic is in 17th place. In 2012 energy recovery facilities (ERF) converted 11.8 % of the total amount of mixed municipal waste to energy.[8]

The present state of technology and legislation guarantees highly efficient energy transformation (e.g. in combined generation) and controlled very low emissions of concentrations of a large number of pollutants. In the years to come renewable sources will play an increasingly greater role, yet according to a number of foreign studies (e.g. IEA) and also the energy strategies of prominent EU member countries, it is assumed that for at least the next two or three decades this will remain a supplementary source which will not cover the bulk of energy consumption but which is suitable for small and in some cases medium-sized customers. There is a need to see renewable energy sources as a diffused, decentralised source which reduces dependence on imports and in most cases is friendly to the environment. Nevertheless, the term renewable energy source does not automatically mean that it is an environmentally-friendly source.

Another **restriction is the budget capacity of the Czech Republic**. As part of its efforts to meet the targets set for the use of renewable energy sources our country has found itself in a difficult situation, where higher generation using these sources is partially “subsidised”. The finances to fund this must be acquired in a variety of ways, most of which place Czech (primarily energy-intensive) firms at a disadvantage from the viewpoint of competitiveness and has an impact on social stability. Programmes for supporting energy generation and savings cannot exceed the financial and hence the social capacity of the state.

Targeted support or sanctions should be used to enforce the basic objectives of the State Energy Policy. These include the aforementioned gradual transition from coal to other sources, improving environmental conditions by reducing emissions of airborne dust and aerosols, and achieving efficient energy savings. The state will strive to ensure that the subsidies and taxes system is as simple and comprehensible as possible and, especially is stable, balanced and financially viable in the long term. The principle should be to ensure that funds obtained through emission allowances or other financial burden on the environmentally adverse impact of energy sources will be used, wherever possible, to boost energy savings and reduce the environmental impact of energy generation, including the funding of costs associated with existing RES subsidies.

The **transport policy** is also important for electrical power engineering and the gas industry, particularly for the following reasons:

- Balance reasons. Increasing use of CNG for transport and later for electromobility must be ensured through imports of natural gas or the production of electricity.

[8]Statistical Environmental Yearbook of the Czech Republic (CENIA, MoE)

- Network reasons. This is not merely infrastructure for electrical vehicle charging stations and CNG filling stations, but also for accumulation management with respect to network stability.
- Security reasons. The EU views transport and power engineering as European critical infrastructure, which must be secured on a mutual basis.

One very suitable area seems to be suburban transport, both rail and the possible restoration of trolleybuses, or the partial replacement of motor diesel and petrol with natural gas. There are places that are suitable for this, and account must be taken in advance of future electricity and gas consumption.

In terms of **energy intensity** indicators the Czech Republic is currently above the EU27 average. This is due to the Czech Republic's traditional focus on industry and the status of the new member countries that joined the EU in 2004 and 2007. From the viewpoint of energy consumption per capita and electricity consumption per capita, the Czech Republic is roughly at the EU average. It still has a relatively high proportion of solid fuels in final consumption and low electricity use efficiency in final consumption particularly for electric heating and cooling. There is relatively significant potential for savings in reducing the energy intensity of buildings and the development of passive buildings. However, in this field it is important to take account of the considerable time and money that need to be invested in development. The structure of industry cannot be changed quickly or rashly and our exports are primarily based on engineering, which will always consume a lot of energy.[9]

Technological development, particularly in the field of renewable resources, is very fast, but estimating when new technology will be fully competitive and able to offer efficient energy accumulation, is still a highly speculative matter. At present, strong focus on those sources poses a considerable risk. Yet the active involvement of Czech industry in the development and production of these technologies (since they are mass produced) does not require that they be situated and directly supported in the Czech Republic. This, on the other hand, is necessary in the case of advanced conventional technologies (nuclear energy, high-efficiency coal, large cogeneration), where successful reference projects are a significant aspect of competitiveness. Know-how in the construction of complex technological units is enhanced over time and the competitive advantage in this field is sustainable in the long term. Moreover, the multiplier effects on the economy are considerably greater. What is of key importance to future technological development is the creation of an attractive environment, primarily through national applied research and development programmes, as indicated by the result of the review of the Czech energy policy by the OECD IEA. A suitable and effective way seems to be deeper and more comprehensive involvement of the Czech research and academic community in international energy research programmes currently

[9] Energy and electro-energy efficiency indicators may improve or deteriorate not only in relation to changes in energy or electricity consumption, but as as a result of changes in the total values to which they relate, i.e. GDP, GAV, and production, where applicable.

being refined both as part of the European Energy Research Alliance, as well as, for example, within the framework of the OECD Energy Technology Perspectives, or selected bilateral research programmes (with the USA, Japan, Korea, etc.), which requires a coherent government energy research programme. Czech scientists have been successful, for example, in the field of mobile electricity storage, the construction of vanadium redox flow batteries and in other fields of research. As regards **science and research** (S&R), there are individual programmes funded from grant schemes. Apart from security research, however, there is no comprehensive long-term strategy to support specific areas or the mechanism by which to implement it. There is also a lack of specialised research facilities in energy. So far universities have only played a limited role in energy research. the international dimension of S&R in the energy sector offers the Czech Republic effective access to the latest findings and research projects dealt with by the world economy's energy sector, while the effective involvement of Czech research and industrial energy partners opens up opportunities not only for research, but also for industry and Czech foreign trade.

It is important to bear in mind the fact that the energy sector and related sectors are important in terms of employment. This is particularly true in certain regions. The proportion of electrical power engineering, the gas industry, the heating industry and raw material extraction in relation to total employment in 2010 was 2 % (45 % in the production and distribution of electricity, heat and gas, 55 % in raw material extraction). More fundamental than the figures is the fact that both the mining and extraction industries and the energy sector have the ability to create multiple additional job and business opportunities in related sectors. The age structure of the workforce in the energy sector is less than favourable (the average age is 44). The demand for qualified professions in energy generation is increasing (the percentage of technical workers rose from 29 % in 2002 to 37 % in 2007). The proportion of university-educated specialists in relation to developed EU countries is relatively low (17 % vs. 31 %). The anticipated number of secondary school and university graduates between 2010 and 2016 will not ensure sufficient specialists to replace those of pensionable age. The energy sector is also threatened by the decline in teaching quality and the lack of multidisciplinary know-how.

Completion of the construction of network infrastructure is essential for the implementation and functioning of this market. Moreover, the integration of renewable, particularly intermittent sources will not be possible without the completion of the infrastructure. It is crucial that the Czech Republic is involved in this process, especially as regards its role as a transit nation. Due to the increasing installed capacity of decentralised intermittent sources and the falling prices of control and measuring elements there is a need to develop the use of smart grids and not focus solely on "smart measurement". It is important to avoid solutions that will allow cyber-attacks on energy systems.

There is a need for Czech research and development to be intensively involved in international cooperation in both of the above areas. Also important for the efficient use of smart grids is the development of the legal environment, which allows for the necessary shutdown and startup of sources and appliances connected to those sources.

The energy mix and energy systems need to be built systematically to enable the addition of new sources as required without the need for any fundamental reconstruction or redevelopment of the system. In order to ensure the **energy security and resilience of the** Czech Republic it is essential to have access to a robust transmission system with ample regulatory powers and a reasonable distribution system, which the Czech system is. At present, the structure of power and regulatory reserves is wholly adequate for maintaining reliable operation. If the European network were to collapse, as a surplus system the electricity grid of the Czech Republic is able to safely switch to temporary island operation and guarantee supplies to customers. The Czech Republic does not have adequate rapid reserves for long-term island operation. In the case of accumulated outages or attacks on multiple places and the subsequent disintegration of the transmission network the timely restoration of electricity supplies must be guaranteed for all major agglomerations. Territorial energy policies have not yet provided a comprehensive solution for keeping the region in question supplied with electricity and heat and ensuring that essential infrastructure remains operational in the case of long-term outages. There is a well-developed transport and distribution network for supplies of natural gas and considerable gas storage capacity. As regards oil, there are currently emergency stocks to meet in excess of 90 days of consumption. Coal-based heat supply systems are also operable in an emergency.

3.2 External and internal conditions affecting the Czech energy sector

In order to formulate a long-term energy strategy it is essential to estimate the trend in the external and internal conditions under which the Czech energy industry will develop during the time frame in question.

External conditions particularly include:

- Global rivalry over primary energy sources, enhanced by the long-term growth of dynamically developing economies and their energy needs, as well as the increasing import dependence of EU countries as a result of declining availability of their own resources and the extremely rapid closure of raw material deposits in the EU.
- Liberalisation of the energy market in the EU and creation of a single market, giving the state a more limited role in the energy sector, and thus also a raft of instruments that can be used by member states to promote their energy policies.
- Gradual shift of competence away from member states to the European Commission and bureaucratization of the decision-making process.
- Globalisation and liberalisation interconnecting the national energy markets with the European and international energy markets as well as the capital commodity markets. Specific local prices of commodities (electricity, gas, oil products) are now almost non-existent. Important aspects of competitiveness, however, are reliability of supplies and the non-commodity portion of the price (infrastructure costs, reliability management and market organisation, subsidies for RES and combined heat and power (CHP) as well as of course the tax burden), which in the case of electricity makes up more than 50 % of the final price, as compared to almost 30 % with gas.

- EU energy and climate policy with the aim of achieving a low-carbon economy and particularly low-carbon energy sector by 2050, accepted climate and energy policy commitments by 2020, including discussion on the future need for a framework for EU energy and climate policy 2030.[10]
- General pressure to reduce emissions generated by the energy sector and pressure to increase efficiency and savings in both production and consumption.
- Integration of the energy markets throughout Europe, relocation of sources to areas with suitable natural conditions (electrical power engineering) and diversification of supplies (gas and oil), resulting in the need to rebuild European transport routes, particularly in the north/south axis. The Czech Republic will continue to be a major transit route for all network energy sectors and its role will increase further (particularly in the electrical power engineering sector).
- Unilateral changes to the energy policies of all the large EU states, which, due to the interconnection of the markets, will inevitably influence the energy policies of other states, including the Czech Republic, primarily the so-called Energiewende of the Federal Republic of Germany.
- Tendency to separate electricity payments (MWh) and introduce separate payments for available capacity (MW) through various forms of capacity mechanism in certain EU countries.
- Technological development particularly in the field of renewable, generally distributed sources, network management systems, communications and information technology, as well as technological development on the consumption side, which cannot always be estimated precisely (e.g. the ever-expected progress in the field of transport and electromobility).

The most important internal conditions are as follows:

- Ensuring the reliability of energy supplies from the viewpoint of security and protection of the population.
- The need to renovate out-dated and build new network infrastructure and ensure diversification.
- The important role and tradition of the energy sector and power engineering with a high degree of know-how in classic technologies and nuclear technologies, including the great pro-export potential of power engineering.

[10] In October 2014 an agreement was reached concerning the level and binding nature of the targets for the climate and energy framework of European policy for the period 2020-2030. The package includes a Europe-wide binding target for reducing greenhouse gases to 40 % of the 1990 level, an indicative (non-binding) target to increase energy efficiency by at least 27 %, a binding target of at least 27 % for the ratio of energy from RES to final consumption, and a target to increase the cross-border interconnection of electricity grids.

- The dominant role of industry in the domestic economy. The proportion of industry (including the energy industry) with approx. 30 % of gross added value makes the Czech Republic a heavily industrial country (the EU average is approx. 19 %). This has a fundamental impact on the energy intensity of the Czech national economy as a whole.[11]
- Gradually waning stocks of coal and the gradual decline in coal mining, making coal still the most valuable raw material.
- Prevailing public support for nuclear energy.
- Limited availability of renewable energy in the Czech Republic and lower competitiveness of such energy in the existing conditions.
- Developed heat supply system with low costs based on brown coal, which so far has remained reasonably priced.
- Individual household heating using coal in villages and towns is harmful and unsustainable in terms of emissions, which are carcinogenic and mutagenic (PAH; PM10; PM 2.5; airborne dust).
- Geographic position predetermining the Czech Republic to serve as a transit country for all network commodities and ensuring high flexibility of supplies.
- Gradual ageing of existing technical intelligence and the need to replace it in an adequate and timely manner. Declining level of professionalism amongst graduates.

The Czech energy market is part of the European market, which is the biggest regional market and also the biggest energy importer in global terms. The challenges faced by the EU, i.e. climate change, reducing dependence on imported energy, technological development and energy efficiency, are also faced by other countries around the world. The Czech Republic's international energy policy is therefor also an important means of implementing the State Energy Policy. Relations with energy producer and transit countries and with major consumer nations are an integral part of this policy. The Czech energy policy is clearly determined by international/worldwide energy policy and the global market, on which for at least two crucial energy raw materials, gas and petroleum, the Czech economy is reliant solely on imports. The legislative framework of the Czech energy policy is delineated by the Czech Republic's membership of the EU and Czech membership of selected multilateral energy organisations (IEA, IEF, IRENA, ECT, Euratom, ENTSO-E, ENTSOG and others).

The multinational framework for the national energy policy is formed by European Union sectoral policies. A number of these policies in the fields of energy, the environment, competition and industrial policy, trade policy and external relations (including involvement in international institutions) have a fundamental effect on the future energy environment. All of the network energy sectors have seen a systematic increase in the mutual dependence

[11] The transfer of GAV within the Global Value Chain also has a fundamental impact on the energy sector, and hence electrical energy intensity in relation to total GDP or GAV.

of the various national subsystems. Of crucial importance is regulatory intervention at the European Union level aimed at promoting the EU's political aims. The State Energy Policy is in line with the basic aims of expected developments in the EU and within this framework also formulates priorities that will be advocated by the Czech Republic in cooperation with other nations at the Union level.

The electricity and gas market in the EU has seen liberalisation and partial integration during the last 15 years. Coupled with the changes initiated in the source mix and international commitments this has led to an environment of mutual dependence in which it is practically impossible for the energy sector of any member state to operate in isolation from the others in an effective and lasting manner. The electricity and gas market is currently a fundamental mechanism that ensures energy supplies to consumers under normal conditions.

The structure of production and the use of sources are determined by market signals, in which the state may or must (in compliance with binding EU legislation) intervene by imposing taxes and fees[12], supporting selected types of sources and imposing a mandatory payment for externality. This renders it able to influence the availability and prices of domestic primary energy sources and relative prices for final consumption. According to ENTSO-E forecasts, the next few decades will see reserve power fall in neighbouring countries and throughout Europe and it is likely that there will be a particular lack of stable sources of energy supplies in the future. In order to ensure energy security and self-sufficiency it is therefore sensible to establish certain electricity generation reserves and particularly adequate generation capacities and a suitable mix of sources.

The modernisation of developing, often very highly populated countries often leads to more intense international rivalry over mineral resources, and fuel and energy raw materials are no exception. During the last decade the global minerals market has undergone systemic changes caused by the fact that many former raw material producers or exporters are gradually becoming raw material consumers or even importers. Intense rivalry over the best access to mineral resources results in the formation of new alliances and a worldwide emphasis on energy security. Asian countries are very active in securing sufficient supplies of raw materials for their economies. The EU responded to these changes by adopting the *Raw Materials Initiative*, which, as a means of providing better access to mineral resources, offers three pillars – greater use of domestic (European) raw materials, the establishment of mutually beneficial economic relations with countries around the world with stocks of raw materials, and support for material-saving technologies. The EU is also striving to adapt its conceptual policy for the recycling and use of secondary raw materials.

[12] Act No. 280/2009 Coll., Tax Code, as amended

3.3 Key outcomes of the SWOT analysis

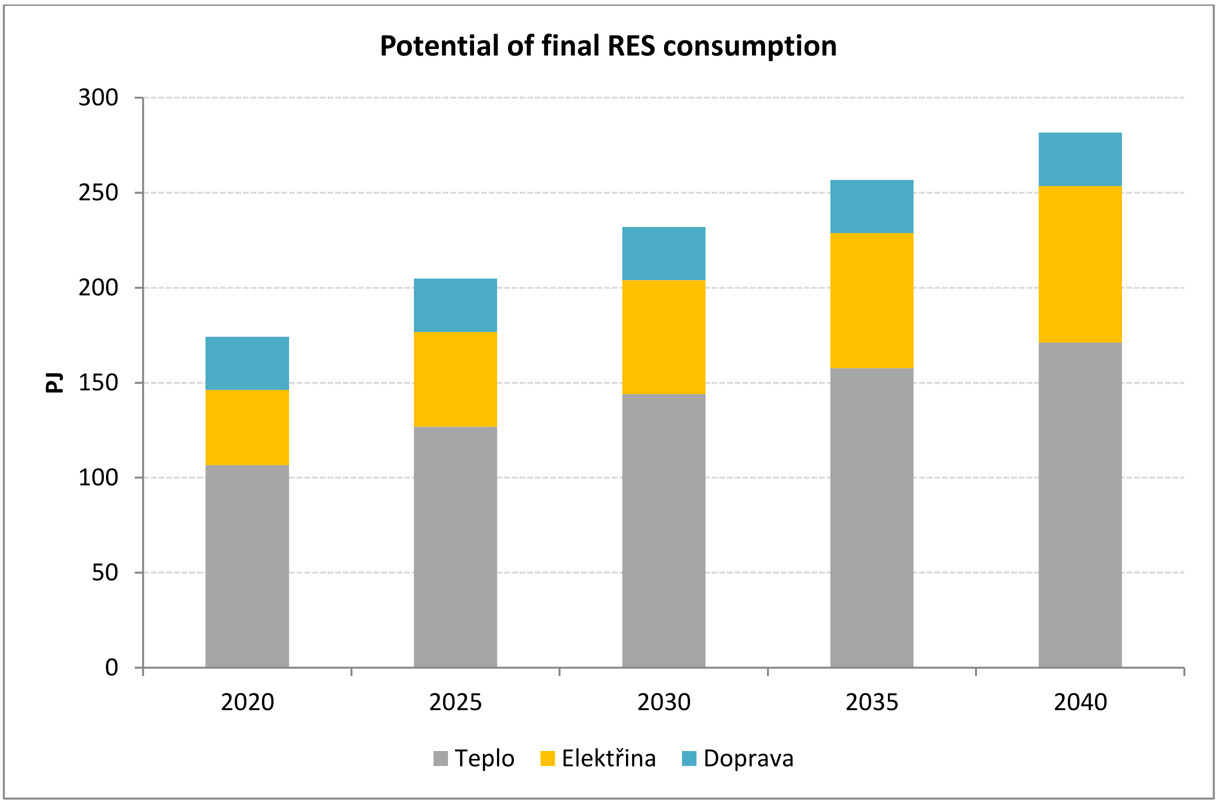
Strengths	**Weaknesses**
▪ High quality and reliability of energy supplies. ▪ Launch of the transformation of the production base in the electricity sector in order to maintain stability and adequate capacity. ▪ Public acceptance of nuclear energy. ▪ Developed heat energy supply system. ▪ Relatively positive import energy dependence indicator. ▪ Complete self-sufficiency in the production of electricity and heat. ▪ Know-how in the construction of complex technological units.	▪ Market distortion and distorted investment signals. ▪ Ageing source base and network infrastructure. ▪ Ageing highly-educated human resources. ▪ Limited potential for greater expansion of renewable resources. ▪ High proportion of local sources using poor-quality fuel with high air pollutant emissions, particularly in highly polluted regions. ▪ High proportion of landfilled municipal waste. ▪ High standards of quality and reliability are taken for granted. ▪ Enforced compliance with binding objectives of the EU climate-energy policy in violation of the principle of technological neutrality when meeting decarbonisation commitments, which would place a disproportionate financial burden on the state budget and the Czech economy.

Opportunities	Threats
▪ Transit role of network industries for energy commodities in Central and Eastern Europe. ▪ Conceptual recycling and use of secondary raw materials, including the energy utilisation of waste. ▪ Use of alternative fuels (electricity, CNG, etc.) in urban, suburban and rail transport. ▪ Reducing the energy intensity of buildings and increasing the energy efficiency of technological processes in industry. ▪ Involving the Czech research and academic community in international energy research programmes. ▪ Expanding technical education and opportunities for graduates in the field of energy, science and research. ▪ Development of smart grids. ▪ Restructuring of the source base to focus on modern highly-efficient technologies and fuels. ▪ Development of unconventional ways of extracting hydrocarbons around the world and in the EU (e.g. in Poland).	▪ Instability of the legal framework. ▪ Unilateral and uncoordinated introduction of capacity mechanisms within the EU, and primarily in countries neighbouring the Czech Republic. ▪ Limited available stocks of brown coal and the related supply of heat to the populace. ▪ Time-consuming process to build modern highly-efficient source capacities as a replacement for existing sources. ▪ Safe and reliable energy supplies in the gradual organisationally and economically demanding implementation of island operations to deal with emergencies. ▪ Deterioration of the operational reliability of the electricity system due to massive development of intermittent RES without the introduction of additional measures. ▪ Risk of failure to meet generation adequacy (Generation Adequacy) as a result of the decommissioning of ageing, high-emission sources and sources without secured coal supplies. ▪ Continuing dynamic development of intermittent RES in Europe uncoordinated with the relevant development of network infrastructure.

The possibility of using the various different energy sources is limited in the Czech Republic by the country’s natural potential and economic specifics, which naturally determine their comparative advantages and disadvantages.

The Czech Republic has naturally limited potential for developing and using renewable resources, as shown in Graph No. 1 below.

Graph No. 1: Potential of final RES consumption



Teplo = Heat
Elektřina = Electricity
Doprava = Transport

The potential of energy from renewable resources is limited by the natural conditions of the Czech Republic (climate, geology and soil) and the environmental protection requirements (soil, water, landscape character, flora and fauna). The most important limits for the various types of sources are as follows:

The potential of wind energy is most limited by the landscape relief, which predetermines the Krušné Mountains, Vysočina and the Jeseníky Mountains as the most important localities in terms of wind flow. Other limiting factors include residential complexes, protected natural areas such as national parks, Protected Landscape Areas and localities forming part of the Natura 2000 system, military radar zones, etc. Wind energy's realistic potential is determined by a study by the Institute of Atmospheric Physics compiled for the Czech Society for Wind Energy as being approx. 2 300 MW in a medium-case scenario. However, this potential is only feasible with the helpfulness of the local communities within the framework of permit processes and is therefore unlikely to be exploited in full.

The potential of solar energy is limited primarily by the climate of the Czech Republic, i.e. especially by its meteorological conditions and latitude. With a view to long-term sustainability the protection of agricultural land precludes the systematic use of agricultural land for photovoltaic sources. The potential thus depends on the expected efficiency of new forms of technology, the amount of roof area and brownfield land in the Czech Republic, the various roof usage parameters (determined by roof incline and the efficient placement of panels on flat roofs) and penetration arising from the manner in which energy is used (particularly in the case of recreational buildings with very low rates of usage penetration will be less than in buildings that are constantly occupied). According to the reference scenario of the National Action Plan for Smart Grids, in terms of generation the realistic potential is approx. 5 800 MW, part of which will gradually replace PPS in fields, with the temporary exclusion of agricultural land. Usage should rise slightly as the technology becomes more effective. Analyses by the Ministry of Industry and Trade show the potential of solar energy for the production of heat to be around 5 PJ.

The potential for using energy from biomass is based on the Action Plan for Biomass, according to which the total figure for biomass from the Czech Republic is approx. 160 to 217 PJ, with no risk to food security. Due to the long-term trend of reducing the size of agricultural plots we assume a conservative estimate towards the lower end in the basic scenario (nevertheless, the upper corridor for RES respects the maximum figure). Compared to the current use of biomass, at the rate of approx. 90 PJ per year, it is expected that there will be a significant increase in supplies of biomass for power engineering.

Potential use of geothermal energy stems mainly from the possibility of using low-potential heat, as neither the technical nor the economic capacity for using high-potential heat in the conditions of the Czech Republic has been tested yet, even though this potential may be considerable in the conditions of the Czech Republic. Although there are demonstration projects in various phases of development, the real possibility of mass expansion within the time frame of the USEP has not yet been tested. In contrast, the use of the low-potential heat technology offered by heat pumps is commercially mature and available and installed capacities are expected to increase at least four-fold. Total potential is limited particularly by the need for heat, the available options and economy of each individual construction project, and the options and economy of integrating heat pumps into heat supply systems.

Also, the individual sources have differing so-called full costs of electrical energy generation, which are what determine their appeal for investors and the manner and extent in which they are applied on the liberalised market, as shown in Graph No. 2 below.[13]

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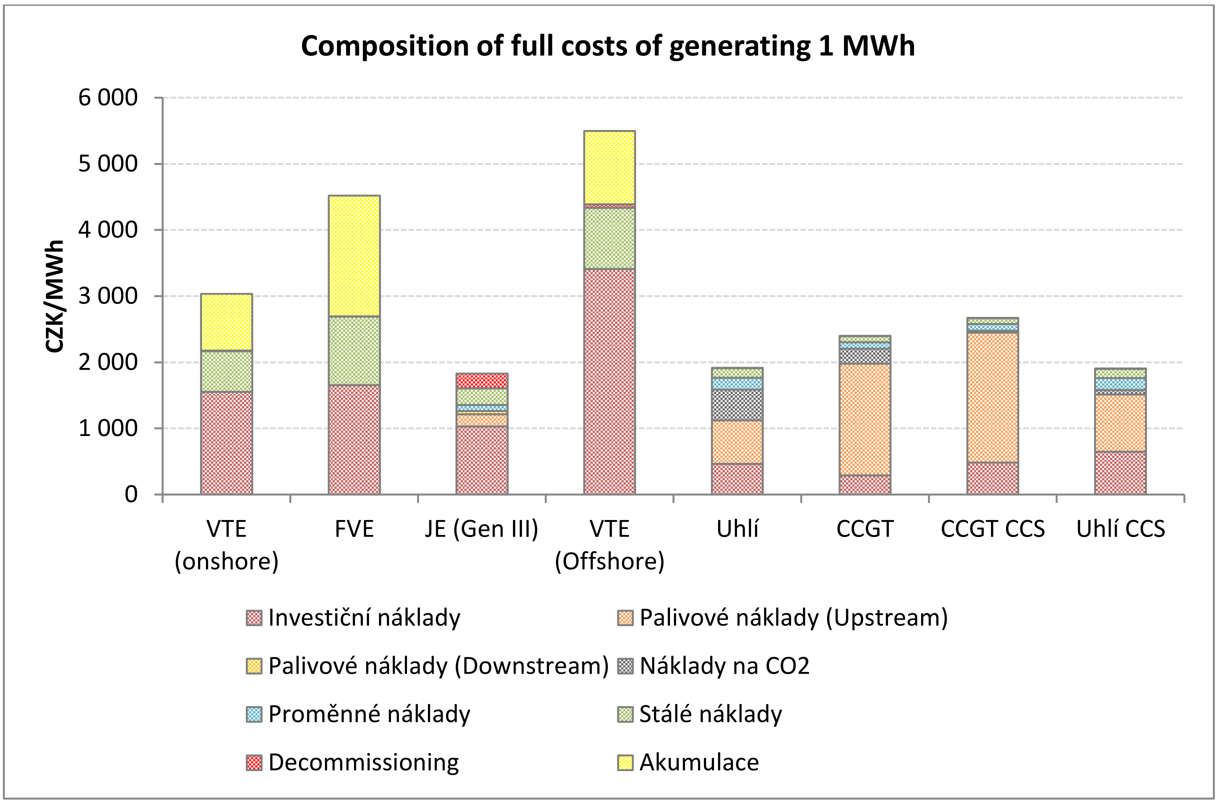
[13] This graph does not include so-called external expenses, which affect the fact that in this case the producer does not have to bear all the costs of its activities, even though it has revenues in full available (negative externality), which can lead to a sub-optimal balance in the market. It is the non-existence of the market that makes it difficult to quantify the external costs of the various technologies. As the calculations are burdened by a major error due to the various methodologies applied, no account was taken of costs for which no means of internalizing them are known (e.g. the emission allowances market allows for internalization). Account was also not taken of external costs for which methods of quantifying them do exist. The reason for this is that in order to objectively take account of externalities it is necessary to include all external costs (quantifiable as well as those for which no quantification yet exists). The analytical materials that supplement this document provide additional information concerning external and the quantification of such costs.

Graph No. 2: Full costs of electrical energy generation



Investiční náklady = Investment costs
Palivové náklady = Fuel costs
Proměnné náklady = Variable costs
Náklady na CO2 = Costs of CO2
Stálé náklady = Fixed costs
Akumulace = Storage

Diagram No. 2: Competitive advantages of the Czech energy sector

Technologie	Konkurenční pozice	Výhoda
Plyn	Dokud jsou kontrakty vyjednávány bilaterálně, slabší vyjednávací pozice než Německo či Polsko	◔
Černé uhlí	Dlouhá přepravní trasa od mořských přístavů, lokální černé uhlí není konkurenceschopné	○
Hnědé uhlí	Máme doly, ale zásoby budou postupně vyčerpány, ani uhlí za limity není dostatek pro pokrytí celé potřeby ČR	◕
Solární energie	Sluneční podmínky srovnatelné např. s Německem*, ale horší než v jižních zemích EU	◑
Větrná energie na pevnině	Větrné podmínky horší než v přímořských zemích (a průměrně čtyřikrát horší i než v sousedním Německu*)	◔
Větrná energie na moři	Nemáme moře	○
Biomasa, odpady	Stejné podmínky jako ostatní státy, v odpadu se můžeme dále rozvíjet, biomasa má potenciál v zemědělství	◕
Jádro	Máme zkušenost s provozováním, vhodné lokality pro výstavbu i funkční legislativu (oproti např. Polsku), ale máme nižší množství jaderných elektráren než např. Francie či USA	◕

○ Konkurenční nevýhoda
◑ Neutrální
◕ Konkurenční výhoda

* expertní odhady % pokrytí dané země s porovnatelnými podmínkami z údajů ČHMI, JRC EK, ECMFW.

Technologie = Technology; Konkurenční pozice = Competitive position
Výhoda = Advantage; Plyn = Gas
Dokud jsou kontrakty vyjednávány bilateralne, slabší vyjednávací pozice než Německo či Polsko = Until contracts are negotiated bilaterally, weaker negotiating position than Germany or Poland
Černé uhli = Black Coal
Máme doly, ale zasoby budou postupně vyčerpávány, ani uhli za limity není dostatek pro pokratí cele potřeby ČR = We have mines, but stocks will gradually depleted, with the carbon limits there is not enough coal to cover all the CR's needs
Solární energie = Solar energy
Slunečné podmínky srovnatelné např. S Německem, ale horší než v jižních zemích EU = Sunshine conditions comparable e.g. with Germany, but worse than in southern EU countries
Větrná energie na pevnině = Land-based wind energy
Větrné podmínky horší než v přímořských zemích (a průměrně čtyřikrát horší i než v sousedním Německu) = Wind conditions worse than in coastal countries (and also on average four times worse than in neighbouring Germany)
Větrná energie na mori = Sea-based wind energy
Nemáme moře = We have no sea
Biomasa, odpady = Biomass, waste
Stejné podmínky jako ostatní státy, v odpadu se můžeme dale rozvíjet, biomasa má potenciál v zemědělství = Same conditions as other states; we can develop further in terms of waste, biomass has potential in agriculture
Jádro = Nuclear Nuclear
Máme zkušenost s provozováním, vhodné lokality pro výstavbu i funkční legislativu (oproti např. Polsku), ale máme nižší množství jaderných elektráren než např. Francie či USA = We have operational experience, suitable construction sites and functional legislation (compared to e.g. Poland), but we have fewer nuclear power plants than e.g. France and USA
Konkurenční nevýhoda = Competitive disadvantage
Neutrální = Neutral
Konkurenční výhoda = Competitive advantage
Expertní odhady % pokrytí dane země s porovnatelnými podmínkami z údajů ČHMI, JRC EK, ECMFW = Expert estimates of % coverage in countries with comparable conditions, based on from CHMI, JRC EC, ECMFW data

4 Energy Policy of the Czech Republic until the year 2040

4.1 Strategic energy objectives of the Czech Republic

The strategic objectives are based on the EU energy strategy and are aimed at meeting the targets of the State Energy Policy and fulfilling the long-term vision for the energy sector in the Czech Republic.

The top strategic objectives are as follows:

- **Security** of energy supplies = ensuring essential energy supplies for consumers in normal operation and in the case of step changes in external conditions (outages in supplies of primary sources, price fluctuations on the markets, malfunctions and attacks) in the context of the EU; the aim is to guarantee the rapid restoration of supplies in the case of outages and also to guarantee full provision of supplies of all forms of energy to the extent necessary to keep the economy functioning in "emergency" mode and to keep the population supplied in any emergency situations
- **Competitiveness** (of the energy sector and social acceptability) = final energy prices (electricity, gas, oil products) for industrial consumers and for households that are comparable with prices in other countries in the region and those of other direct competitors + energy businesses able to create economic added value in the long term
- **Sustainability** (sustainable development) = energy structure that is sustainable in the long term from the viewpoint of the environment (no further damage to the environment), finance and the economy (financial stability of energy enterprises and the ability to provide the necessary investment in renovation and development), human resources (level of education), social impact (employment), and primary sources (availability)

Security of supplies measured using the following parameters:

a. Contingency supplies of primary energy sources:

Contingency supplies of primary energy sources in the year in question are determined as the sum total of immediately available PES stocks from liquid fuels and natural gas in storage facilities, from solid fuels in landfills of mining companies and manufacturers, from nuclear fuel and also from intermittent and non-intermittent renewable energy sources in the year in question according to the following equations:

$$AZ_{PEZ} = (Im_{KP} - Ex_{KP}) \cdot k_{KP} + PEZ_{ZP} \cdot k_{ZP} + PEZ_{TP} \cdot k_{TP} + PEZ_{JP} \cdot k_{JP} + PEZ_{iOZE} \cdot k_{iOZE} + PEZ_{nOZE} \cdot k_{nOZE}$$

$$RZ_{PEZ} = \frac{AZ_{PEZ}}{PEZ} \cdot 100\%$$

where:

AZ_{PEZ} absolute PES contingency supplies [PJ]

RZ_{PEZ} relative PES contingency supplies [%]

Im_{KP} imports of PES from liquid fuels including oil and oil products [PJ]

Ex_{KP} exports of PES from liquid fuels including oil and oil products [PJ]

k_{KP} coefficient of ratio of PES stocks from liquid fuels to net imports [-]

PEZ_{ZP} consumption of PES from natural gas [PJ]

k_{ZP} coefficient of ratio of PES stocks from natural gas to domestic consumption [-]

PEZ_{TP} consumption of PES from solid fuels including coal and coal derivatives [PJ]

k_{TP} coefficient of ratio of PES stocks from solid fuels to consumption [-]

PEZ_{JP} consumption of PES from nuclear fuel [PJ]

k_{JP} coefficient of ratio of PES stocks from nuclear fuel to consumption [-]

PEZ_{iOZE} consumption of PES from intermittent renewable resources [PJ]

k_{iOZE} coefficient of ratio of PES stocks from intermittent RES [-]

PEZ_{nOZE} consumption of PES from non-intermittent of renewable resources [PJ]

k_{nOZE} coefficient of ratio of PES stocks from non-intermittent RES [-]

PEZ total PES consumption [PJ]

Intermittent sources are sources whose supplies vary depending on the natural conditions at the time; in the case of RES these are particularly sources that directly convert wind and solar energy to electrical energy. Non-intermittent sources are those with stable supplies that are not dependent on the natural conditions at the time; in the case of RES these are particularly sources that use biomass, biogas and the biodegradable part of municipal waste.

The data for computing this indicator are sourced from statistics and future forecasts prepared at the Ministry of Industry and Trade (MIT) using its own methodology. The aim in terms of ensuring the energy security of the Czech Republic is to maintain or increase these emergency reserves.

b. Diversification of primary energy sources:

Diversification of primary energy sources in the year in question is determined as the sum total of the squares of the ratios of PES sub-types, with five different categories (gas fuels, liquid fuels, solid fuels, nuclear fuels, RES), to the total annual consumption of PES in the year in question on the basis of the Herfindahl-Hirschman Index[14] in the following manner:

$$H_{PEZ} = \sum_{i=1}^{N} \left(\frac{PEZ_i}{PEZ}\right)^2$$

where:

H_{PEZ} diversification of primary energy sources [-]

PEZ_i consumption of PES sub-type [PJ]

PEZ total PES consumption [PJ]

N number of PES sub-types [-]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. For the calculation using the aforementioned five PES categories the indicator is in the interval <1/5;1>. The aim is to reduce this indicator and keep it below 0.25 in the long term.

c. Diversification of gross electricity production:

Diversification of gross electricity production in the year in question is determined as the sum total of the squares of the ratios of electricity generated from PES sub-types, with seven different categories (black coal, brown coal, natural gas, other gases, renewable and secondary sources, nuclear fuels, other fuels) to the total gross electricity generated in the year in question on the basis of the Herfindahl-Hirschman Index as follows:

$$H_E = \sum_{i=1}^{N} \left(\frac{TBV_i}{TBV}\right)^2$$

where:

H_E diversification of gross electricity production [-]

TBV_i gross domestic electricity production from PES sub-type [GWh]

TBV gross domestic electricity production [GWh]

N number of PES sub-types [-]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. For the calculation using the

[14] The Herfindahl-Hirschman Index (HHI), which takes on values in the interval (1/N,1), measures, within the framework of economic theory in general, the size of firms relative to the size of the sector, and actually indicates the level of market competition in the sector in question.

aforementioned seven PES categories the indicator is in the interval <1/7;1>. The aim is to reduce this indicator and keep it below 0.35 in the long term.

d. Diversification of imports:

Diversification of imports in the year in question is determined as the sum total of the squares of the ratios of the import of PES sub-types, with four different categories (natural gas, oil and oil products, coal and coal derivatives, nuclear fuel) to total annual PES consumption in the year in question on the basis of the Herfindahl-Hirschman Index according to the following equation:

$$H_{Im} = \sum_{i=1}^{N} \left(\frac{Im_i}{PEZ} \right)^2$$

where:

H_{Im}	diversification of imports [-]
Im_i	size of import of PES sub-type [PJ]
PEZ	total PES consumption [PJ]
N	number of PES sub-types [-]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. For the calculation using the aforementioned four PES categories the indicator is in the interval <1/4;1>. The aim is to reduce this indicator and keep it below 0.30 in the long term.

e. Import dependence:

Import dependence in the year in question is determined based on the methodology used by the International Energy Agency (IEA) as the ratio of net PES imports to total PES consumption in the year in question, while it is determined variably, excluding primary heat from nuclear reaction and including it, according to the equation:

$$DoZ = \frac{\sum_{i=1}^{N} (Im_i - Ex_i)}{PEZ} \cdot 100\%$$

where:

DoZ	import dependence [%]
Im_i	size of import of PES sub-type [PJ]
Ex_i	size of export of PES sub-type [PJ]
PEZ	total PES consumption [PJ]
N	number of PES sub-types [-]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. The aim is to keep import dependence at or below the EU28 in the long term.

f. <u>Security of infrastructure operation:</u>

Security of infrastructure operation in the year in question is determined as the degree of compliance with criterion N-1, the basic criterion used to assess the reliability of the electrification system, which gives the ability to maintain normal system operational parameters even following the outage of any particular element (lines, transformer, unit, etc.) at the very high voltage (VHV) level, while supplies may be temporarily limited, in the year in question.

This indicator is evaluated retrospectively by the transmission system operator, ČEPS, a.s., on the basis of its own dynamic model of the transmission system.

g. <u>Self-sufficiency in electricity supplies:</u>

Self-sufficiency in electricity supplies in the year in question is determined as the ratio of gross electricity production and gross domestic electricity consumption in the year in question, as follows:

$$SEE = \frac{TBV}{TBS} \cdot 100\%$$

where:

SEE	self-sufficiency in electricity supplies [%]
TBV	gross domestic electricity production [GWh]
TBS	gross domestic electricity consumption [GWh]

The data for computing this indicator are sourced from statistics of the Energy Regulatory Office (ERO) and statistics and future forecasts prepared at MIT using its own methodology. The aim is to keep self-sufficiency at at least 90 %.

h. <u>Generation adequacy:</u>

Generation adequacy is defined as the medium- and long-term ability to balance the consumption and production of electrical energy, including adequate flexibility of the production portfolio and the ability to respond to sudden changes in output; it is set as the remaining capacity in the electrification system determined by the difference between reliable available capacity in the system in the year in question and the load at the reference point according to the following equation:

$$RC = RAC - (P_{Load} - P_{LoadM}) = NGC - UC - (P_{Load} - P_{LoadM})$$

where:

RC	remaining capacity [MW]
RAC	reliable available capacity [MW]
P_{Load}	load [MW]
P_{LoadM}	potential for reducing load [MW]
NGC	net generation capacity [MW]

UC unavailable capacity [MW]

This indicator is evaluated by the transmission system operator, ČEPS, a.s., based on the applicable ENTSO-E methodology defined for the Scenario Outlook and Adequacy Forecast, which is available on the ENTSO-E website.

The aim is keep remaining capacity within the corridor range -5 % to +15 % of load, including management on the consumption side.

Competitiveness measured by the following parameters:

a. Level of integration into international networks:

The level of integration into international networks is determined as the total available transmission capacity in proportion to maximum load, which is determined as the ratio of the sum total export or import capacity of the transmission system (TS) in the year in question and the perspective maximum load on the TS for the year in the following manner:

$$P_{Ex\%} = \frac{P_{sumEx}}{P_{maxLoad}} \cdot 100\%$$

$$P_{Im\%} = \frac{P_{sumIm}}{P_{maxLoad}} \cdot 100\%$$

where:

$P_{Ex\%}$ total available transmission capacity for export [%]

$P_{Im\%}$ total available transmission capacity for import [%]

P_{sumEx} TS sum total export capacity [MW]

P_{sumIm} TS sum total import capacity [MW]

$P_{maxLoad}$ TS maximum net load [MW]

This indicator is evaluated by the transmission system operator, ČEPS, a.s., based on its own methodology for planning the development of the TS over the next 7- and 15 year period. cross-border capacities are calculated using NTC methodology in accordance with ENTSO-E methods modified for the needs of transit systems such as the Czech TS. The procedure used to determine cross-border capacities is defined in ČEPS workflow procedure No. 03/2011/13100 - Procedure for Determining Available Tradable Capacity for Auction and is also available on the ČEPS website. The aim is to keep transmission capacity for export and import at the level of at least 30 % of the Czech ES load (which is triple the target of the Lisbon Strategy and in line with the transit energy role of the Czech Republic).

b. Discounted costs of ensuring energy:

The costs of ensuring energy in the year in question are determined as the sum total of funds invested in securing energy supplies in the year in question, i.e. fuel costs of electricity and heat generation, fixed and other variable costs of operating all electricity and heat sources, the investment costs in sources and infrastructure, the costs of energy-saving measures and the costs of importing PES. Discounted costs of ensuring energy are then determined on the basis of the following equation:

$$DCF = \sum_{j=1}^{N} \frac{CF_j}{(1 + DF)^j}$$

where:

DCF	Discounted cash flow [mil. CZK]
DF	Discounted factor corresponding to risk-free yield rate and risk premium [%]
CF_j	Costs (cash flow) in year in question [mil. CZK]
N	Total number of years for which discounted costs are quantified

The data for computing this indicator are sourced from statistics and future forecasts prepared at the Ministry of Industry and Trade using its own methodology. The aim is to optimise costs while meeting the requirements concerning energy security and supply sustainability.

c. Energy price ratios in the wholesale market to global competitor ratios:

Energy price ratios in the wholesale market to the OECD and BRICS average in the year in question are determined as the ratios of the prices of energy traded in the wholesale market to the average energy prices within the framework of defined groups of countries in that year:

$$p_{CE} = \frac{C_{EVO}}{C_{Epr}} \cdot 100\%$$

where:

p_{CE}	ratio of energy prices in wholesale market to EU average [%]
C_{EVO}	price of energy in wholesale market [CZK/MWh]
C_{Epr}	average price of energy within OECD or BRICS [CZK/MWh]

The input data for computing this indicator are sourced from statistics and future forecasts prepared at the International Energy Agency OECD (IEA) and statistics and future forecasts prepared at the Ministry of Industry and Trade using its own methodology. The aim is to keep the energy price level below 120 % of the OECD average.

d. Final price of electricity at LV and HV level and natural gas:

The final price of electrical energy at the low voltage (LV) level in the year in question is determined as the sum total of the prices of electricity, system services, electricity transmission and distribution, and also the contribution to RES and CHP in the year in question, including the MO fee.

The final price of electrical energy at the HV level in the year in question is determined as the sum total of prices for power electricity, system services, electricity transmission and distribution as well as the contribution towards RES and CHP in the year in question, including the MO fee.

The final price of natural gas in the year in question is determined as the sum total of the commodity price of natural gas, storage and service payments and the prices of transport and distribution in the year in question, including the MO fee.

The input data used to evaluate this indicator are sourced from statistics compiled by the Eurostat Statistical Office of the European Union, IEA forecasts and MIT outlooks creating using special methodology. The aim is to make and keep prices below the level of the EU28 average.

e. <u>Ratio of energy expenses to total household expenses:</u>

The ratio of energy expenses to total household expenses in the year in question is determined as the proportion of household expenses on all energy consumption in relation to the household's total expenses in the year in question according to the following equation:

$$p_{VDE} = \frac{VD_E}{VD} \cdot 100\%$$

where:

p_{VDE} ratio of energy expenses to household expenses [%]

VD_E household energy expenses [billion CZK]

VD total household expenses [billion CZK]

The input data used to evaluate this indicator are sourced from the Household Budget Survey (HBS), which is prepared and published by the Czech Statistical Office (CSO) and MIT outlooks compiled using its own methodology. The aim is to keep this indicator as far below 10 % as possible.

f. <u>Ratio of the energy sector to gross added value:</u>

The ratio of the energy sector to GAV in the year in question is determined as the ratio of the GAV of the energy sector (expressed as CZ-NACE 35 Production and Distribution of Electricity, Gas, Heat and Air Conditioning) to the total size of GAV in the year in question as follows:

$$p_{SE} = \frac{HPH_{SE}}{HPH} \cdot 100\%$$

where:

p_{SE} ratio of energy sector to GAV [%]

HPH_{SE} size of GAV of energy sector [billion CZK]

HPH total size of GAV [billion CZK]

The data for computing this indicator are sourced from statistics compiled by CSO and future forecasts prepared at MIT using its own methodology. The aim is to optimise the ratio.

g. Ratio of energy imports to gross added value:

The ratio of energy imports to GAV in the year in question is determined as the ratio of funds invested in energy imports at the PES level to the amount of GAV in the year in question according to the following equation:

$$p_{Im} = \frac{N_{Im}}{HPH} \cdot 100\%$$

where:

p_{Im}	ratio of energy imports to GAV [%]
N_{Im}	costs of energy imports [billion CZK]
HPH	total GAV [billion CZK]

The data for computing this indicator are sourced from statistics compiled by CSO and future forecasts prepared at MIT using its own methodology. The aim is to gradually bring the current level to below the 2010 figure.

h. Sum total economic added value (EVA) of the energy sector:

The sum total economic added value of the energy sector in the year in question is determined as the sum total of economic added values within the framework of individual business involved in the generation, conversion, transport and supply of energy (including coal, oil, natural gas and electricity) in the year in question.

The indicator is evaluated retrospectively and data for the evaluation are sourced from the financial statements of each different business. The aim is to keep this indicator positive.

i. trade balance of energy imports and exports:

The trade balance of energy imports and exports in the year in question is determined as the sum total of the foreign trade balances for each of the imported and exported primary energy sources in the year in question as follows:

$$OB_{PEZ} = \sum_{i=1}^{N} (Im_i - Ex_i) \cdot c_i$$

where:

OB_{PEZ}	trade balance of energy imports and exports [billion CZK]
Im_i	size of imports of PES sub-type [PJ]
Ex_i	size of exports of PES sub-type [PJ]
c_i	price of PES sub-type [CZK/MJ]

N number of PES sub-types [-]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. The aim is to quickly stabilise and then maintain the impact energy imports have on the balance of payments.

Sustainability measured by the following parameters:

a. Energy intensity of gross added value creation:

The energy intensity of GAV creation in the year in question is determined as the ratio of the total consumption of PES and the size of GAV in the year in question according to the following equation:

$$EN = \frac{PEZ}{HPH}$$

where:

EN energy intensity of GAV creation [MJ/CZK]

PEZ total PES consumption [PJ]

HPH gross added value [billion CZK]

The data for computing this indicator are sourced from statistics compiled by CSO and future forecasts prepared at MIT using its own methodology. The aim is to reduce energy intensity to half the current figure and attain the EU28 average.

b. Environmental impact:

Environmental impact in the year in question is determined as the quantity of emissions of CO_2, SO_2, NO_X and airborne dust in thousands of tons [th. t] and polycyclic aromatic hydrocarbons (PAH) in kilogrammes [kg] in the year in question.

Data determining this indicator are sourced from statistics and forecasts compiled by the Czech Hydrometeorological Institute (CHI) on the basis of a GAINS model using statistics and forecasts compiled at MIT using its own methodology. The aim is to ensure a long-term and permanent reduction in the summary environmental burden in all the relevant aspects.

c. Ratio of agricultural land used for energy purposes:

The ratio of agricultural land used for energy purposes in the year in question is determined as the ratio of the sum total of agricultural land used for the cultivation of energy crops and agricultural land used for other energy purposes to the aggregate area of agricultural land in the year in question, as follows:

$$p_{ZeP} = \frac{ZeP_E}{ZeP} \cdot 100\%$$

where:

p_{ZeP} ratio of agricultural land used for energy purposes [%]

ZeP_E area of agricultural land used for energy purposes [th. ha]

ZeP total area of agricultural land [th. ha]

The data for computing this indicator are sourced from statistics and future forecasts prepared at the Ministry of Agriculture (MoA). The aim is to optimise the energy utilisation of land while maintaining complete food security.

d. Ratio of fossil fuels to consumption of primary energy:

The ratio of fossil fuels to consumption of primary energy in the year in question is determined as the ration of PES consumption from fossil fuels to total PES consumption in the year in question as given by the equation:

$$p_{FP} = \frac{PEZ_{FP}}{PEZ} \cdot 100\%$$

where:

p_{FP} ratio of fossil fuels to consumption of primary energy [%]

PEZ_{FP} primary energy sources from fossil fuels [PJ]

PEZ total PES consumption [PJ]

The data for computing this indicator are sourced from statistics and future forecasts prepared at the Ministry of Industry and Trade using its own methodology. The aim is to ensure a permanent reduction in the proportion of fossil fuels.

e. Electricity intensity of gross added value creation:

The electricity intensity of GAV creation in the year in question is determined as the ratio of net domestic electricity consumption to GAV in the year in question, as follows:

$$EEN = \frac{TNS}{HPH}$$

where:

EEN electricity intensity of GAV creation [Wh/CZK]

TNS domestic net electricity consumption [GWh]

HPH gross added value [billion CZK]

The data for computing this indicator are sourced from statistics compiled at CSO, statistics compiled at ERO and statistics and future forecasts prepared at MIT using its own methodology. The aim is to ensure a permanent reduction in the electricity intensity of GAV creation and keep it below the EU28 average.

f. Ratio of renewable energy sources to gross final consumption:

The ratio of RES to gross final consumption in the year in question is determined as the ratio of final consumption of renewable energy sources to total gross final energy consumption in the year in question:

$$p_{OZE} = \frac{KS_{OZE}}{HKS} \cdot 100\%$$

where:

p_{OZE} ratio of RES in final consumption [%]

KS_{OZE} final consumption RES [PJ]

HKS gross final consumption [PJ]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. The aim is to gradually increase the ratio of RES to a figure which entails full use of the economically efficient potential of renewable energy sources in the Czech Republic.

g. Electricity consumption per capita:

Electricity consumption per capita in the year in question is determined as the ratio of net domestic electricity consumption and the number of inhabitants in the year in question, as follows:

$$SEO = \frac{TNS}{PO}$$

where:

SEO electricity consumption per capita [kWh/capita]

TNS domestic net electricity consumption [GWh]

PO number of inhabitants [million inhabitants]

The data for computing this indicator are sourced from statistics compiled at ERO, statistics and future forecasts prepared at MIT using its own methodology and the Population Projection prepared and published by CSO. The aim is to keep electricity consumption per capita consistently below the EU28 average.

h. Ratios of RES and CHP to heat supplies from HSS:

The ratios of RES and CHP to heat supplies from heat supply systems (HSS) in the year in question are determined as the ratio of heat supplies from HSS generated from RES or from CHP to total heat supplies from HSS in the year in question as follows:

$$p_{OZE} = \frac{SZT_{OZE}}{SZT} \cdot 100\%$$

$$p_{KVET} = \frac{SZT_{KVET}}{SZT} \cdot 100\%$$

where:

p_{OZE} ratio of RES to heat supplies from HSS [%]

p_{KVET} ratio of CHP to heat supplies from HSS [%]

SZT_{OZE} heat supplies from HSS generated from RES [PJ]

SZT_{KVET} heat supplies from HSS generated from CHP [PJ]

SZT total heat supplies from HSS [PJ]

The data for computing this indicator are sourced from statistics and future forecasts prepared at MIT using its own methodology. The aim is to ensure that at least 60 % of heat supplies from HSS are covered by CHP and at least 20 % of heat supplies from HSS are covered by RES.

4.2 Axioms, indicative indicators and targets before 2040

The basic input assumptions, or axioms, are conditions which are always upheld during the implementation of the State Energy Policy and during the actual modelling process constitute fixed input parameter values. Key axioms include:

- Emphasis on minimising the import dependence of the Czech Republic in the case of energy raw materials (primarily oil and natural gas) and thus on guaranteeing energy security.
- Making it a priority to preserve (economically and energy) efficient heat supply systems, shifting brown coal primarily to cogeneration and sources with the highest energy conversion efficiency.
- Protection and efficient use of agricultural land (with the exception of cultivating biomass, agricultural land should not be used for energy sources; these should use existing structures and industrial land, with the exception of critical infrastructure buildings. Where possible, advocate the return of temporarily excluded agricultural land back to the Agricultural Land Fund.
- Maintaining the food security of the Czech Republic at 100 %.
- When constructing energy sources, take full account of environmental (NP, Protected Landscape Areas, sites forming part of the Natura 2000 system) and socio-cultural restrictions, including landscape and settlement protection.
- Respecting protected areas, important centres of biodiversity, places with a high proportion of natural biotopes and the habitats of specially protected and endangered species.
- Maintaining the high standard of energy supplies and fulfilling generation adequacy parameters.
- Keeping generation adequacy within the range of -5 % to +15 % of free available capacity according to ENTSO-E methodology.
- Respecting the waste management hierarchy.

The indicative indicators and targets by 2040 set by the State Energy Policy are corridors for ensuring a balanced mix of sources for electricity generation and corridors for the composition of a diversified mix of primary energy sources prioritising the use of domestic primary sources and keeping import dependence at an acceptable level.

Targets include import dependence ratios and the percentage of the power balance covering domestic consumption.

The variant recommended by the SEP is a relatively broad corridor of various acceptable situations that are dependent on actual developments in society and the economy as well as developments in the EU and around the world, and therefore represents the direction it is hoped and expected that the energy sector will take while respecting fixed restrictions (axioms) and input assumptions arising from related sectors (food self-sufficiency, restricting coal-mining to existing mining areas, etc.).

The indicative indicators and targets by 2040 as defined by the strategic focus of the Czech energy industry are as follows:

a) Achieve a 40 % reduction in CO_2 emissions by 2030 in comparison with 1990 and a further reduction in emissions in compliance with EU strategies aimed at decarbonizing the economy by 2050 in accordance with the financial capacity of the Czech Republic.

b) Increase energy savings in 2020 by 20 % against the anticipated figure without the need for active measures ("business as usual"), with the target of achieving net final energy consumption of 1060 PJ (according to Eurostat methodology, or 1020 PJ according to IEA methodology) and continue increasing energy efficiency by 2040 in compliance with EU strategies with the aim of reducing energy intensity and average energy consumption per capita to below the EU28 average.

c) Ratio of annual electricity production from domestic primary sources to the total gross amount of electricity generated in the Czech Republic of at least 80 % (RES, secondary sources and waste, brown and black coal and nuclear fuel, assuming adequate supplies) with the target **electricity generation structure** (in proportion to the total gross annual amount of electricity generated) in corridors[15]:

1.	Nuclear fuel	46 – 58 %
2.	Renewable and secondary sources	18 – 25 %
3.	Natural gas	5 – 15 %
4.	Brown and black coal	11 – 21 %

d) Diversified **mix of primary sources** (in proportion to the total gross annual consumption of primary energy sources) with the target structure in corridors[16]:

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[15] In terms of absolute figures for the various options for the development of the Czech energy sector, the annual amount of electricity generated may range from 42 882.7 to 57 948.6 GWh for nuclear fuels, from 15 752.8 to 24 977.8 GWh for renewable and secondary sources, from 4 813.4 to 14 986.7 GWh for natural gas and from 9 626.7 to 20 981.4 GWh for brown and black coal.

[16] In terms of absolute figures for the various options for the development of the Czech energy sector, the annual consumption of the various types may range from 449.0 to 609.9 PJ for nuclear fuels, from 171.4 to 318.7 PJ for solid fuels, from 318.4 to 464.4 PJ for gas fuels, from 220.4 to 318.7 PJ for liquid fuels and from 269.4 to 409.8 PJ for renewable and secondary sources.

1.	Nuclear fuel	25 – 33 %
2.	Solid fuels	11 – 17 %
3.	Gas fuels	18 – 25 %
4.	liquid fuels	14 – 17 %
5.	Renewable and secondary sources	17 – 22 %

e) Maintain a positive electricity power balance and ensure the adequacy of power serves and regulation (provision of the necessary support services) and keeping generation adequacy within the range of -5 to +15 % of maximum load on the electrification system (free available capacity according to ENTSO-E methodology).

f) Import dependence not exceeding 65 % by 2030 and 70 % by 2040 (nuclear fuel as an imported source).

g) Final electricity prices (the market plus the regulated component) for the business sector that are comparable with trends in neighbouring countries (final electricity prices at the VHV and HV level) and below the EU28 average, while also remaining below 120 % of the OECD average.

h) Decline in the trend of the ratio of energy expenses to total household expenses, aiming to keep the figure below 10 %.

4.3 Strategic priorities of the energy sector in the Czech Republic

In order to ensure reliable, secure and environmentally-friendly energy supplies for the people and the economy of the Czech Republic at competitive and acceptable prices, it is essential to focus particularly on the following key priorities:

I. Balanced energy mix: A balanced mix of primary energy sources and electricity generation sources based on a broad portfolio, efficient use of all available domestic energy sources and coverage of the consumption needs of the Czech Republic by guaranteed electricity generation to the ES with adequate reserves. Maintaining available strategic reserves of domestic forms of energy.

II. Savings and efficiency: Increasing energy efficiency and achieving energy savings throughout the energy chain in the economy and in households. Meeting EU strategic objectives for cutting consumption and achieving energy efficiency at least at the level of the EU28 average.

III. Infrastructure and international cooperation: Development of the Czech Republic’s network infrastructure in the context of the nations of Central Europe, strengthening international cooperation and integration of the electricity and gas markets in the region including support for the creation of an effective and operational joint EU energy policy.

IV. Research, development and innovation: Support research, development and innovation so as to ensure the competitiveness of the Czech energy industry and support education, with the aim of achieving generational exchange and improving the quality of technical intelligence in the field of energy.

V. Energy security: Increasing energy security and resilience of the Czech Republic and enhancing its ability to ensure essential energy supplies in cases of accumulated outages, multiple attacks against critical infrastructure and in cases of prolonged fuel supply crises.

4.3.1 Priority I – Balanced energy mix

Priority I: **Balanced mix of primary energy sources and electricity generation sources based on a broad portfolio, efficient use of all available domestic energy sources and maintaining the surplus power balance of the electrification system with adequate reserves. Maintaining strategic reserves of available domestic forms of energy.**

Motive

A balanced mix of sources with efficient use of all available domestic energy sources and a surplus power balance in the electrification system. Maintaining the maximum, economically viable number of heat supply systems with a significant proportion of high-efficiency domestic coal combusted and the gradual transition from combusting brown coal to other sources in the case of low-efficiency, obsolete sources. In the long term, electricity generation and imports should be a purely market opportunity, with no state intrusion. The current situation as regards market distortion and forced state intervention to ensure production and system adequacy, however, calls into question the market advantages of exports and thus an unconditional emphasis on surplus production balance. From the viewpoint of the state it is the basic paradigm for ensuring generation adequacy in terms of the make-up and adequate robustness of installed capacity and its structure as far as operation is concerned (system adequacy), especially with respect to the increasing volatility and short-term power deficits in neighbouring countries and the consequent deterioration in the stability of electrical grids. If either of these two parameters are not fulfilled based on decisions taken by commercial businesses on the basis of market signals, this may be seen as grounds for possible state intervention. Therefore, although short-term electricity generation deficits can be accepted, nevertheless, in order to maintain energy security the generation adequacy indicator must be within the corridor of -5 % to +15 % of available power according to ENTSO-E methodology, otherwise there is a need for state intervention to ensure secure coverage of domestic electricity demand. In the context of ensuring generation adequacy and discussion over energy security from the viewpoint of the State Energy Policy there is a need to clearly separate physical installed capacity (MW) and the amount actually used according to immediate economic expediency (MWh). Unlike the pervious approach, therefore, electricity exports are not the objective; the objective is to cover domestic consumption with an adequate degree of security. Electricity exports to the extent of short-term free capacity are merely a commercial opportunity, assuming that the externalities are adequately reflected.

Target situation

This situation will be achieved by renovating obsolete electricity generation sources, while respecting the need for efficiency and environmental protection. Also, by a gradual transition from a source mix focused particularly on coal towards a diversified source portfolio with a higher proportion of nuclear energy in electricity generation. Such a mix of primary energy sources will ensure the energy security and strategic flexibility of the Czech Republic based particularly on advanced technologies that can bridge the transition period until renewable resources become fully competitive and 4th-generation reactors and nuclear fusion are available. Heat must be supplied through the existing heat supply systems wherever economically suitable, provided that reasonable account is taken of the environmental impact and other externalities in the prices of inputs for central and decentralised sources. The priority as regards the use of domestic sources (RES, coal) must be to favour heat generation or combined heat and power over purely condensation generation, particularly in ensuring the availability of coal for central heat sources.

Strategy prior to 2040

PI.1st Ensure self-sufficiency in electricity generation, based primarily on advanced conventional technologies with high conversion efficiency and with an increasing proportion of renewable and secondary sources. Production from nuclear sources will gradually replace coal energy as the pillar of electricity generation. The transformation of infrastructure will also enable extensive integration of new forms of technology in production, transport and consumption and the renovation of the existing source base. There will be a shift from the prevailing orientation on coal to a more diversified primary source structure and a fall in the importance of liquid fuels and coal.

PI.2nd Maintain the size of heat supply systems with a significant proportion of domestic high-efficiency coal combustion and, in the case of low-efficiency obsolete sources, ensure the gradual transition from brown coal combustion to other fuels.

PI.3rd Enhance the role of nuclear sources in electricity generation and maximise the use of waste heat from nuclear energy (construction of 1-2 new nuclear power units depending on the forecast balance of production and consumption, long-term extension of the lifetimes of the current four units in the Dukovany nuclear power plant and the possible construction of an additional unit for when the Dukovany nuclear power plant is decommissioned, territorial delimitation of localities for the potential further development of nuclear power after 2040).

PI.4th Develop competitive RES with effective state support for network access, permit processes, support for technological development and pilot projects and the current public acceptability of the development of RES with the aim of ensuring that RES make up at least 18 % of total electricity generation, involvement of RES in balance management.

PI.5th Significantly increase the utilisation of waste in waste energy recovery facilities with the aim of achieving up to 100 % usage of combustible waste after sorting by 2024.

PI.6th Keep electricity generation using coal on the decrease (with the target of 9 - 14 TWh/year), partial restoration of coal sources with assured supplies; new and renovated sources must be exclusively high-efficiency using at least 60 % of heat not consumed in electricity generation.

PI.7th Develop natural gas sources in low-output sources and micro cogeneration, in high-end or back-up sources and also, to a limited extent, also in high-efficiency combined cycle power plants and with natural gas comprising up to 15 % of total installed capacity.

PI.8th Maintain the surplus power balance of the Czech Republic's electrification system at -5 to +15 % of available power (after deducting support services and other reserves), with potential fluctuations in dependence on source development, with the aim of ensuring stable electricity supplies, including in crisis situations.

PI.9th Ensure the renovation, transformation and stabilisation of heat supply systems critically based on domestic sources (nuclear, coal, RES, secondary sources) supplemented by natural gas. Utilisation of the storage capacity of heating systems, in combination with heat pumps where applicable. The gradual shift of heating plants to cogeneration production.

PI.10th Major role of natural gas in local consumption and rise in the use of natural gas for CHP and partially for efficient condensation generation in semi-peak operation. Overall increase in the proportion of natural gas used to generate electricity.

PI.11th A gradual fall in the consumption of liquid fuels, particularly due to increasing efficiency, the rise in the proportion of electrified systems in public transport (rail transport, or trolleybuses) and also the increased use of LNG and CNG in transport and, later, the gradual rise in electromobility.

PI.12th A gradual fall in electricity imports and maintaining the balance within the range of +/- 10 % of domestic consumption in compliance with the conditions of the internal market.

There is a need to facilitate or stimulate the broadest possible mix of competing energy sources. Instruments that can be applied here include a variety of administrative, tax, tariff, communication and financial measures which have an overall neutral impact on the state budget. This will also increase the security of energy supplies. It is also important to support the construction of new, primarily high-efficiency and decentralised energy sources, and monitor the proportion of the various different energy sources in the market to bring it in line with the proposed corridors, i.e. to ensure that the proportion remains within the limit, indicative parameters and targets specified in the SEP.

4.3.2 Priority II – Savings and efficiency

Priority II: **Increasing the energy efficiency of the national economy.**

Motive

Increasing energy efficiency and energy savings are the common denominator in all three pillars of the Czech Republic's energy policy, i.e. security, competitiveness and sustainability. Emphasis on increasing energy efficiency stems from needs related to the declining availability of own disposable primary sources and the continuing industrial focus on the economy. In this field the Czech Republic must maintain or increase the trend in the decline in the energy intensity of GDP and strive to ensure that after 2020 energy intensity in the various fields is at the same level as comparable economies within the EU.

Target situation

The aim is to implement energy-saving measures to ensure that net final energy consumption in 2020 is at the level of 1060 PJ (according to Eurostat methodology, or 1020 PJ according to the methodology used by IEA). These values are based on the Energy Efficiency Directive[17], which lays out a strategic framework for increasing energy efficiency by 2020. The reduction in final energy consumption, which may be achieved using conceptual and integrated solutions combining support from the energy sector and information and communication technology (e.g. Smart Cities), will be implemented in the industrial, transport and services sectors, the public sector and in households. After 2020 the plan is to continue striving to increase energy efficiency. Nevertheless, these efforts will be more complicated than prior to 2020 due to less available (or more costly) potential for increasing energy efficiency. It is assumed that the majority of less demanding measures will be performed by 2020 in addition to the preferred comprehensive measures. Moreover, there is no guaranteed that the Czech Republic will be able to draw on ESIF funds as it can prior to 2020. With regard to the evolving European legislation it is also therefore necessary to prepare a stable framework to support energy efficiency after 2020 in line with the financial capabilities of the Czech Republic.

The implementation of these objectives particularly includes measures such as replacing appliances with more effective ones, insulating and renovating buildings, increasing the energy efficiency of technological processes in industry, increasing the efficiency of energy conversions, as well as reducing losses in the transmission and distribution of energy. It is also necessary to bring about a change in consumer behaviour, particularly to increase the economic and energy literacy and awareness of the public. The main stimulation the Czech Republic is planning to use by 2020 will be the provision of public aid for energy-saving measures, which, in combination with legislation, create a suitable environment for increasing energy efficiency.

Strategy prior to 2040

Cross-cutting measures

PII.1st Ensure the implementation of the National Action Plan for Energy Efficiency (NAPEE), i.e. implement 47.94 PJ (13.32 TWh) of new savings in final energy consumption by 2020.

PII.2nd Maximise the efficient use of public aid (grants and financial engineering instruments) and ensure that such funds are drawn.

[17] Directive of the European Parliament and the Council 2012/27/EU dated 25 October 2012 on energy efficiency, on the amendment to Directives 2009/125/EC and 2010/30/EU and on the repealing of Directives 2004/8/EC and 2006/32/EC

Electrical power engineering and the heating industry

PII.3rd Increase the efficiency of energy conversion and usage using best available techniques (BAT) for all newly-constructed and reconstructed sources. Build new combustion sources as high-efficiency or cogeneration sources.

PII.4th Restrict low-efficient condensation electricity generation from coal using financial instruments.

PII.5th Switch most heating plants to high-efficiency cogeneration wherever economically viable, making efficient use of heat pumps and cutting heat distribution losses.

PII.6th Use electricity to generate heat in final consumption, particularly using heat pumps (gradually substituting direct heating systems).

Households, services and the public sector (buildings, building equipment and appliances)

PII.7th Promote greater efficiency of appliances by natural replacement and raise awareness of the advantages of energy-saving appliances by supporting an information campaign. Ensure that the state sets a good example by selecting the most energy-saving appliances (highest energy classes), buildings and means of transport available in the market when making bulk purchases. Reduce consumption in standby mode through the use of smart grids.

PII.8th Reduce building energy intensity, i.e. meet the building energy intensity requirements stipulated by the Energy Management Act.

PII.9th Renovate residential buildings at least in compliance with scenario no. 3 - Building Renovation Strategy.[18]

PII.10th Implement energy savings in central institution buildings pursuant to Article 5 of the Energy Efficiency Directive.[19]

PII.11th Maximise the use of EU subsidy programmes to achieve energy savings (level of energy savings achieved being one of the selection criteria in operating programmes).

PII.12th Support the use of energy services with a guaranteed result (EPC) in the non-residential sector.

PII.13th Support the introduction of energy management systems in the public sector (Energy Management System and its certification pursuant to ČSN EN ISO 50001 - Energy Management System).

Industry

PII.14th Reduce building energy intensity in industry.

[18] The Building Renovation Strategy is part of NAPEE (Annex No. 6) and describes 5 renovation development scenarios by 2050.

[19] Application of Art. 5 is elaborated in the document Energy-Saving Options in Central Institution Buildings (MIT).

PII.15th Support the reconstruction of facilities and technology in order to boost their efficiency and increase the overall energy efficiency of industrial operations.

PII.16th Support the introduction of an energy management system and its certification pursuant to ČSN EN ISO 50001 - Energy Management System.

Transport

PII.17th Increase the efficiency of energy conversion in internal combustion engines with simultaneous effect and reduce specific emissions from transport, using fiscal instruments (graded road tax, pay-to-use infrastructure/tolls).

PII.18th Reduce losses in the operation of power systems and equipment in electric traction.

PII.19th Increase conversion efficiency in traction vehicles in rail transport when renewing rolling stock, incl. use of recovery.

PII.20th Increase use of alternative fuels – CNG and electromobility.

4.3.3 Priority III – infrastructure and international cooperation

Priority III: **Development of the Czech Republic's network infrastructure in the context of the nations of Central Europe, strengthening international cooperation and integration of the electricity and gas markets in the region including support for the creation of an effective and operational joint EU energy policy.**

Motive

Due to the position and transit role of the Czech Republic, advanced and reliable network infrastructure is one of the main factors in ensuring the security of energy supplies and also the competitiveness of the energy sector as a whole.

Target situation

Modernisation and boosting of the transmission system to ensure capacity to cover increased consumption (Moravia and Silesia Region, Central and West Bohemia), connection of new sources (South, Northwest, West and Central Bohemia, South Moravia) and the transit needs for the Czech transmission system in the north-south direction, guaranteeing that operational security and reliability will remain at the current level. Full integration of the electricity market and regulation within the framework of the European market is planned by 2015. Maximizing the use of EU financial instruments to support the development of the transmission system, primarily the north-south transit corridor in the Czech Republic.

Renovation and boosting of distribution systems (DS) and the implementation of smart network control systems to connect and manage the operation of distributed sources, local accumulation, the development of heat pumps and efficient consumption management. Involvement in European programmes to support the development of smart grids.

Maintain the Czech Republic's transit role in the transport of natural gas and boost the cross-border connection of the gas system in the north-south direction. In the east, connections with systems in Poland (STORK II) and Austria (BACI) and national connections (MORAVIA), with the prospect of gas supplies from the LNG terminals in Poland and Croatia, from sources around the Caspian Sea, or from new sources of shale gas in Poland, or from new terminals for import if they are developed. Ensure the further connection of the domestic system with systems abroad (including the possibility of reverse operation) and the use of gas storage facilities, including increasing maximum daily extraction output.

Maintain the operational oil processing capacities in the Czech Republic at at least 50 % of normal domestic consumption in the long term. Support the development and enhancement of the existing system used to transport oil to the Czech Republic, with the aim of securing and maintaining adequate transport capacity for the needs of refineries in the Czech Republic. Support further projects aimed at increasing the diversification potential of oil and oil product supplies to the Czech Republic, e.g. boosting the capacity of the TAL oil pipeline, the construction of an oil pipeline to link the Litvínov - Leuna (Spergau) refineries and connection to the NATO Central European Pipeline System (CEPS). Also, create conditions for potentially providing (transit) supplies of oil and oil products to neighbouring countries with the aim of making the use of existing oil and product pipeline systems as efficient as possible.

Strategy prior to 2040

PIII.1st Maintain the import or export capacity of the transmission system at at least 30 % of maximum load, eliminate bottlenecks in the north-south transit of electrical energy and compliance with the reliability criteria in the operation of this system.

PIII.2nd Ensure that the transmission system is ready for the connection of new generation capacities by the deadlines agreed between investors and the transmission system operator. Boost 400/110 kV transformer power to cover both the rise in consumption and also the change in the structure of sources connected to the DS (replacing larger high-usage conventional sources with distributed low-usage sources and fluctuating generation).

PIII.3rd In distribution systems, by 2030 renovate and develop means of remotely controlling consumption, distributed production and energy storage on the basis of the principles of smart grids and smart measurement with the aim of making optimal use of distribution systems and ensuring operational reliability, in line with the outcomes of the National Action Plan for Smart Grids (NAP SG) project.

PIII.4th Renovate and develop distribution systems, including management instruments, to ensure that they:

- enable the connection and operation of all new distributed sources in line with investor requirements assuming compliance with the connection conditions and in accordance with the SEP,
- satisfy consumption needs, including support for the development of heat pumps, electromobility (charging for electric vehicles) and local accumulation as part of low-energy homes,
- guarantee long-term network sustainability and operability even when decentralised sources in DS make up more than 50 % of the total installed capacity in the Czech Republic.

PIII.5th Maintain the Czech Republic's transit role in the transport of natural gas and implement the north-south corridor through the territory of the Czech Republic (STORK II, MORAVIA, BACI, OBERKAPPEL).

PIII.6th Permanently enable reverse operation and renovate and develop the gas pipeline transport system. Ensure capacity to increase supplies of natural gas (increase the need for natural gas in heat supplies, electricity generation and in transport).

PIII.7th Support other projects aimed at increasing the diversification of oil and oil product supplies to the Czech Republic, e.g. increasing the capacity of the TAL oil pipeline, constructing a pipeline to connect the Litvínov - Leuna (Spergau) refineries and to connect to the NATO Central European Pipeline System (CEPS).

PIII.8th Strengthen and support the development of the existing system used to transport oil to the Czech Republic, with the aim of ensuring and maintaining adequate transport capacity for the needs of refineries in the Czech Republic and, in cooperation with other nations (Slovakia, Ukraine, Russia), keep the entire transport system, which cost so much to build in the past, operational.

PIII.9th Maintain two functional supply routes for the transportation of oil to the Czech Republic from two different directions as the basis of the Czech Republic's oil security.

PIII.10th After any change to EU methodology relating to the calculation of emergency stocks of oil and oil products, maintain those stocks above the minimum level of 90 days with the prospect of increasing the level of those stocks to 120 days of net imports, depending on the financial capacity of the state.

PIII.11th Specify a systematic solution for circular electricity flows and transit in terms of security and cost compensation.

PIII.12th Permanently keep operational oil-processing capacity within the Czech Republic at the level of at least 50 % of normal domestic consumption.

4.3.4 Priority IV – Research, development and innovation

Priority IV: **Support research, development and innovation so as to ensure the competitiveness of the Czech energy industry and support education, with the aim of achieving generational exchange and improving the quality of technical intelligence in the field of energy.**

Motive

In the long term, research, development, innovation and education are fundamental factors in the competitiveness of the energy economy and critical factors for success.

Target situation

Ensure efficient cooperation and links between industry and secondary school and university education, increase the number and quality of graduates entering technical professions. Provide systematic lifelong professional education and the restoration and development of "hard" skills. Increase support for research and development in the energy sector and power engineering, but also in materials engineering and construction for power engineering (especially in relation to nuclear energy) and ensure that it focuses on the priorities specified by the State Energy Policy and the economic/export strategy of the Czech Republic. Suitable instruments can also be used, without the need for exceptional use of public funding, to ensure access to information and technology, with the potential to accelerate the implementation of the strategic objectives cited in the SEP, including energy efficiency, RES, transmission networks, energy storage, the development of next-generation reactors, new energy materials, etc.

Strategy prior to 2040

- PIV.1st Ensure that there at least 18 thousand graduates specialised in the energy sectors between 2014 and 2019, and at least 1000 graduates a year in the apprenticeship system in energy- and engineering-related disciplines.
- PIV.2nd Provide quality lifelong education in "hard" skills. Support the involvement of secondary schools and universities in research projects and joint projects with businesses. Expand the existing technical disciplines to include other "soft" skills in the field of energy trading, IT systems, customer services, teamwork and communication.
- PIV.3rd Establish a system of certifying professional associations to guarantee quality tested through practice in the field and ensure that such a system is actually applicable.
- PIV.4th Increase the appeal of technical disciplines so that demand for study places exceeds supply in all the energy sectors and ensure that the age average in the energy sector is comparable with that across the economy as a whole.
- PIV.5th Strive to increase funding for research and development in the energy sectors and engineering. The science and research development strategy should emphasise the energy sectors. Within the framework of this, ensure effective coordination of research projects involving government authorities, including national oriented research, experimental development and innovation priorities. In terms of SEP priorities ensure maximum involvement in European projects within the framework of the SET plan.
- PIV.6th Raise general public awareness concerning energy and particularly energy efficiency and saving behaviour.

4.3.5 Priority V – Energy security

Priority V: **Increasing the energy security and resilience of the Czech Republic and enhancing its ability to ensure essential energy supplies in cases of accumulated outages, multiple attacks against critical infrastructure and in cases of prolonged fuel supply crises.**

Standard (normal) conditions from the viewpoint of the USEP are defined as normal (non-crisis) situations.

Crisis (extraordinary) conditions from the viewpoint of the USEP are defined as situations constituting an exceptional deviation from normal conditions, which results in or forces fundamental changes in the behaviour of businesses as well as citizens and households. These can be emergencies as defined by a special law, or also fundamental changes in external conditions of a continuous nature which cannot be classed as emergencies but whose impact on businesses and citizens is exceptional and bordering on a breakdown in standard economic relations (e.g. a very deep recession such as that in the nineteen twenties, exceptional and lasting turbulence on the commodity or capital markets, or the suspension of international energy supplies due to conflict, even though the Czech Republic is not directly involved in such conflict).

Motive

Create the requisite conditions for diversified supplies of strategic natural fuels, both by continuing to diversify source territories and also by further diversifying transport routes. In the domestic environment create the requisite conditions to ensure stable supplies of electricity, gas and heat. Maintain an efficient structure of state material reserves of strategic commodities. Ensure the resilience of the energy sector at minimum cost and ensure that it is capable of providing the energy supplies needed if a crisis situation or combination of crisis situations occurs.

Target situation

Ensure the maximum possible diversification of source territories and transport infrastructure used to import strategic natural fuels, with emphasis on maintaining the Czech Republic's transit role and keeping the Czech Republic's import dependence in the field of gas and liquid fuels at or below the current level. Make preferential and effective use of domestic natural fuel sources, including the creation of opportunities to seek them out, legislative and territorial protection, with the aim of preventing an adverse bias against the domestic energy mix in the favour of raw materials on whose import the Czech Republic is dependent or the use of which is uneconomical and uncompetitive. Maintain reserves of strategic fuel and energy commodities for which the Czech Republic has no or limited primary sources, including the creation of a system of long-term nuclear fuel stocks held by the operator, and possibly also the reservation of capacity for backup supplies or own fabrication. Ensure the protection of energy infrastructure and build such infrastructure with foresight and adequately in advance.

In the field of electrical power engineering ensure both source stability (robust, power-surplus system) and transmission robust, power-surplus system with emphasis on adequate and sustainable domestic production to cope with consumption demand. Also, focus attention on preparing island operations to deal with emergencies, maintaining adequate regulatory power and a quality legal framework for ensuring the security and continuity of elements of energy infrastructure. Increase the resilience of the electrification and gas system against malfunctions and outages and ensure that they are able, in an emergency, to function as island operations. Permanently ensure adequate emergency stocks of all the basic primary sources. Ensure the integration, regular inspection and testing of emergency procedures in supplies of all types of energy. With public heat supplies, focus on ensuring an adequate raw material base and support the possible switch to alternative types of fuels in these operations to cope with potential crisis situations. Do not reduce the state's influence and control in strategic companies operating in the field of energy, and also, in the energy sector as a whole, refrain from strengthening the influence of those entities, countries or regions on which the Czech Republic is already heavily dependent in the energy field.

As regards energy security, effectively cooperate with energy and mining companies, both private and state-owned enterprises. Ensure the resilience and cyber-security of energy systems, at the level of key sources and system management and also, in the future, particularly to protect smart grids against cyber-attacks, including the protection of personal data.

Strategy prior to 2040

PV.1st Within the framework of the Czech Republic's foreign policy create the necessary preconditions for the development of mutually beneficial economic relations with nations from territories of interest.

PV.2nd Support projects aimed to connect up critical infrastructure with emphasis on the north-south connection. Detailed specifications of the various projects are given in the relevant sections (electrical power engineering, gas, oil).

PV.3rd Ensure the long-term supply of the necessary volumes of coal for the heating industry despite waning recoverable reserves through the use of legislative and regulatory measures, while respecting the principles of economic competition and prioritising increased efficiency and savings.

PV.4th Increase the proportion of heat supply systems using multi-fuel systems and capable of rapid changes in fuel to at least 30 % for short-term changeovers.

PV.5th Maintain emergency stocks of oil and oil products in compliance with the new computation methodology specified by Council Directive 2009/119/EC, for a period of at least 90 days of net imports and verify their real availability for use in crisis situations. With the aim of increasing energy security beyond 90 days of net imports with the prospect of increasing the level of these stocks to 120 days of net imports depending on the economic capabilities of the state and also seek new ways of funding those stocks.

PV.6th Support projects aimed at maintaining gas storage facility capacity within the Czech Republic at 35 – 40 % of annual gas consumption and a guaranteed extraction output for two months of at least 70 % of peak daily consumption during the winter period. Put in place conditions to enable the transport system to flow in reverse and to maintain capacity for gas supplies from the north or west at the level of at least 40 mil. m^3/day.

PV.7th Complete the north-south natural gas transit corridor in the territory of the Czech Republic by 2020 and within the framework of foreign relations support the final completion of the Baltic - Adriatic connection by 2025.

PV.8th Ensure efficient access to transit capacities for natural gas supplies for Czech consumers.

PV.9th Ensure that nuclear power plant operators maintain stocks of fuel cells, guaranteeing that facilities can operate at full capacity for four years, or also using reserve capacity backup contracts for fuel supplies or by maintaining the corresponding stocks of enriched uranium and the country's own fuel fabrication within the Czech Republic. The accomplishment of this objective should be scheduled in line with increasing the proportion of nuclear energy to the target of 50-60 % of final consumption.

PV.10th Complete territorial energy policies so as to provide at least larger towns and cities with essential energy supplies in island operations in the case of emergencies and to respond rapidly and effectively to potential extensive failures or natural disasters.

PV.11th Put in place and regularly review instruments for the efficient coordination of states of emergency in the electricity sector, the heating industry and the gas industry at the central and regional level. Ensure full and unlimited energy supplies in the case of short- and medium-term outages with one supplier or the loss (failure) of one cross-border connection.

PV.12th Cover the minimal technological needs of the economy and essential public consumption in the case of medium- and long-term outages with one supplier or one cross-border connection, and in cases of short- and medium-term outages involving the complete cessation of supplies of energy commodities from abroad or if the relevant network system of the Czech Republic is put into island operation.

PV.13th Support and develop the ability to supply energy in local (island) subsystems should the system collapse as the result of extensive failures caused by a natural disaster or terrorist or cyber-attack to the extent necessary to ensure minimum supplies to the populace and to keep critical infrastructure operational.

PV.14th Ensure supplies of basic forms of energy and their substitutes at least at the minimal technological level and at a level enabling society to keep functioning in the case of long-term interruptions in supplies from abroad.

PV.15th In all areas of the energy sector attention should be paid to foreign investment, particularly into certain elements (entities) of critical infrastructure to ensure that they do not pose a threat if potentially misused when promoting economic or political interests to the detriment of the Czech Republic and also preserve the state's influence and control in strategic companies (retain the state's ownership interests in these companies at least at a level which does not reduce the state's current ability to promote its interests through the exercise of shareholder rights).

5 Concept for the development of important areas of power engineering and areas relating to power engineering

5.1 Electrical power engineering

Vision

As far as the generation and supply of electricity are concerned, by 2040 it is essential to bring about a transformation to change the generation structure and renovate obsolete plants with considerably greater efficiency, to partially switch from coal to nuclear power, natural gas and RES, and to meet increasing demand due to the rise in the use of electricity in transport and efficient heating.

Ensure a slight electrical energy surplus power balance (in compliance with generation adequacy parameters) for the next 20 to 30 years for future generations, using all reasonable sources. From the viewpoint of supply availability the situation in Europe somewhat uncertain; large-scale and stable imports from neighbouring countries are unlikely to be possible due to the expected balance deficit of those countries. If we have a slightly surplus balance, it does not have to be for export but can be used to ensure essential reserves. In an emergency, electricity can be used for heating purposes or for transporting cargo by rail if a problem should arise with oil. This is a strategic matter. It is also impossible to accurately predict the speed at which technological advances will accelerate in some areas, potentially leading to a surge in demand for electricity above and beyond the expected trend (e.g. developments in electromobility in transport).

Primary objectives

- A.1. Ensure a power-surplus production balance based on a diversified fuel mix and the efficient use of available domestic primary sources.
- A.2. Ensure a high level of security, reliability and energy resilience through suitably sized and structured reserve capacities, available regulatory power for the needs of the Czech Republic, energy storage facilities and the capacities of transmission and distribution networks, including control and protection elements.
- A.3. Ensure the development of systems and instruments for managing the electrification system which make effective use of both new technology (smart grids) as well as broadening regional cooperation in the area of system management and boosting reserves. Support the development of distributed and centralised accumulation systems.
- A.4. Maintain and enhance the high transit capacity of the network and the openness of the energy sector in the Czech Republic, ensure constant compliance with the reliability criteria and adequacy to meet future transmission needs.
- A.5. Due to the strategic importance of the energy sector, keep ČEPS, a.s. exclusively state-owned and retain the state's dominant influence in ČEZ, a.s.
- A.6. Ensure the protection of areas and corridors of public infrastructure and related development plans through land use planning instruments.
- A.7. Promote the rapid and full integration of the energy markets in Central Europe and the development of market mechanisms facilitating access to the market, as

well as changes in suppliers while at the same time controlling the market risks. Ensure an open and highly competitive environment with effective control over market dominance and abuse of the market. Support efforts to ensure a market environment in the European electricity market with minimal market distortion. If development in the internal electricity market cannot be returned to a fully liberalised environment that is free of market distortion, there is a need to promote the Europe-wide harmonization of capacity mechanisms on the basis of technological neutrality[20]. In an extreme case scenario, if not even this harmonized solution can be enforced, it will then be in the Czech Republic's interests to also implement a regional (or nationwide) solution that will meet the Czech Republic's needs for production and system adequacy.

Partial objectives and specification of these objectives in individual areas

Liberalisation and integration of the electricity market

Aa.1. Promote a highly competitive environment in the electricity market, the regional integration of the electricity market and regulatory power and energy, harmonization of the market rules, price-setting and tariff mechanisms and simplification of access to the market.

Aa.2. Promote market mechanisms that negate the significant influence that market distortion (subsidies, administrative restrictions and barriers) has on the price of electricity. If any form of capacity mechanism is introduced in Europe, promote a coordinated approach that minimises the final burden for the consumer and does not place the Czech energy sector at a disadvantage within the framework of the internal electricity market.

Aa.3. Keep final electrical energy prices below the EU28 in the long term, i.e. at a level compatible with the competitiveness of the Czech economy and social sustainability.

Aa.4. Revise network tariff systems with the aim of reflecting the network costs structure and enhancing elements of directness.

Renewable energy sources

Ab.1st Support the development and use of renewable resources in compliance with the economic capacity and natural geographic, geological and climatic conditions of the Czech Republic.

Ab.2nd Before 2040 exploit the potential of biomass (to an extent that is sustainable in terms of food security and the protection of land resources and the landscape), wind energy (respecting the principles of environmental and landscape

[20] Without discrimination as regards the type of technology and aspects of production and consumption, and not differentiating between existing and new sources of power.

protection) and solar energy on building roofs and structures (with respect to the principles of monument and urban protection).

Ab.3rd Work together with the Ministry of Agriculture to set up a mechanism to ensure the preferential use of purposefully cultivated biomass for domestic entities.

Ab.4th In justified cases further support for RES should be ensured through mechanisms that enable the strategic objective to be achieved at minimal cost, i.e. for example inverse auctions, tax breaks for investors, or net metering, and which will be compatible with the EU rules governing public aid. Put in place technical standards for new RES at the BAT level.

Ab.5th Funds to support RES and their further development should be obtained particularly from energy taxes and fees and mandatory externality payments (CO_2 allowances, carbon taxes) and the direct burden of electricity prices for the business sector and households should be gradually minimised/eliminated. In the long term, set up proportions aimed at returning specific energy taxes (this does not apply to excise duties) to the energy sector to support savings programmes and to increase the energy efficiency of the conversion and transport of energy.

Ab.6th By 2025 ensure adequate capacity and flexibility in distribution systems in order to meet the need for the connection of renewable resources in compliance with the targets set for the proportion of RES in PES and the electricity generation structure shown in Section 4.2, by developing the capacities of DS and particularly by efficient management of existing networks and by defining and meeting technical conditions stipulated for sources and networks. Guarantee that the needs of RES are taken into account in the DS as soon as possible and in the long term.

Ab.7th Do everything possible to simplify the administrative processes involved in connecting RES. Ensure that small sources are connected to the networks by the deadlines and under the technical conditions specified by the legislation.

Ab.8th Ensure the greatest possible integration of RES into ES balance management mechanisms, particularly using smart distribution networks and management of RES connected to the DS.

Nuclear energy industry

Ac.1st Support the development of nuclear energy as one of the pillars of electricity generation, with the target of nuclear energy comprising approximately 50 % of the amount of electricity generated and maximising heat supplies from nuclear power plants.

Ac.2nd Support and accelerate the process of negotiating, preparing and implementing new nuclear units at existing nuclear power plant sites with a total output of up to 2 500 MW, or annual production of approx. 20 TWh by the years 2030 – 2035, including the steps necessary for international discussion of the issue.

Ac.3rd Create conditions to extend the lifetime of the Dukovany plant to 50 years and, if possible, to 60 years (taking account of technology, safety and security, the economy and EU rules).

Ac.4th Schedule the potential construction of another new block at existing nuclear power plant sites in line with the expected decommissioning of the Dukovany plant, i.e. after 2035, depending on the predicted balance of production and consumption.

Ac.5th Put in place legislative, administrative and social conditions for the construction and long-term and safe operation of radioactive waste repositories and rules governing the handling of spent fuel as a potentially valuable secondary raw material.

Ac.6th Seek out and protect other suitable sites for the development of nuclear energy.

Ac.7th Make a decision concerning the storage of nuclear waste by 2025.

Coal-fired power generation (condensation production)

Ad.1st Put in place conditions enabling the conversion of existing large condensation coal sources solely to high-efficiency sources in line with BAT standards and enabling these to be put into operation within the SEP time frame with regard to the availability of brown coal and with no adverse impact on coal supplies for energy-efficient HSS systems.

Ad.2nd Any new coal sources should be used for high-efficiency or cogeneration production with a minimal annual conversion efficiency of 60 % or efficiency in line with BAT if higher, throughout the coal-based energy sector corresponding to the target range for solid fuels as specified in Section 4.2.

Ad.3rd Introduce effective penalties for low-efficiency condensation electricity generation from 2015 with increasing progression.

Ad.4th Within the framework of the Czech Republic's raw materials policy ensure adequate supplies of brown coal for heating needs with priority access to fuel given only to high-efficiency cogeneration rather than condensation sources.

Natural gas sources

Ae.1st Put conditions in place to increase the proportion of natural gas sources in the source mix; the ratio of gas sources should be up to 15 % of total installed source capacity and with BAT parameters; conditions enabling the construction of gas turbines as quickly accessible regulatory and backup capacity.

Ae.2nd Create conditions enabling the development of micro cogeneration sources and their integration where possible into networks that prioritise electricity use for own consumption.

Energy storage facilities

Af.1st Develop efficient mechanisms for managing energy grids and levelling out local and temporal imbalances, including energy storage facilities designed to match the size and structure of generation sources, particularly with regard to the high unit output of nuclear and coal-fired plants and the scope and structure of renewable resources whose supplies fluctuate and are difficult to predict.

Af.2nd Develop centralised (TS and DS) and decentralised (electric vehicles, local storage) electricity accumulation for the needs of regulation and for use in the management of distribution networks, particularly on a commercial basis; with intermittent sources with a total installed power exceeding 4000 MW, where necessary also introduce aspects of mandatory accumulation for certain types of sources.

Secondary energy sources and waste

Ag.1st Maximise the energy utilisation of secondary energy sources, including suitable industrial and municipal waste while respecting the waste management hierarchy after sorting recyclable constituents.

Ag.2nd Prioritise support for the direct (thermal) utilisation of non-recyclable waste without prior treatment for cogeneration heat supply systems in compliance with the principles of environmental protection, particularly air protection.

Ag.3rd Reduce the storage of biodegradable municipal waste in compliance with EU requirements and increase landfill fees. Revenues from increased fees should be put into recycling and supporting the energy utilisation of waste, and particularly to support the waste management hierarchy.

Ag.4th Support energy cogeneration from biogas stations using biodegradable waste from the exploitable components of municipal and agricultural waste and waste from the food industry.

Development of the transmission system

Ah.1st Ensure the high security and reliability of the Czech Republic's transmission system and its ability to meet customers' needs as regards the connection of new sources on both the generation and consumption side and enabling the transmission of growing trans-European transit flows in both the north/south and east/west direction. Renovate and modernise the TS and increase its resilience to cope with crisis situations.

Construction of new transmission elements (substations, lines) and renovation of the existing TS:

Ai.1st Minimise the aggregate amount of time taken in permission procedures for linear construction, ensure access to land for key infrastructure.

Ai.2nd Secure funding for the renovation and development of the TS motivational regulation for operators in compliance with the approved 10-year TS development plan, a stable and long-term regulatory framework, expand funding from the EU (CEF, ESIF). Fees for applicants requiring connection to the TS should be set as being motivational, and will serve as a location signal for connection to the TS according to their needs.

Ai.3rd Ensure regional cooperation and mechanisms for joint network planning and development in the region of Central Europe.

Ai.4th Ensure that the transmission system is well prepared for the reliable connection of new large sources (nuclear, steam/coal, combined cycle, RES) and their integration into the source structure, including regulatory services.

Ai.5th Ensure that the transmission system is well prepared for the increased demand for transformation power for the distribution system in connection with consumption trends in the various regions and with the change in the structure of sources connected to the DS.

Ai.6th Eliminate bottlenecks in north-south transit, integration of the Czech Republic TS into trans-European electricity highways.

Ai.7th Implement technology for effectively managing network reliability and utilisation (FACTS, monitoring and dynamic management of network flows and load capacity, dynamic maintenance management). Implement the outcomes from the NAP SG project and support smart DS (virtual power plants, etc.).

Ai.8th Implement facilities ensuring efficient flow management and security of operation in transmission systems (TS).

Ai.9th Ensure territorial protection of areas and corridors for the development of the TS according to the approved ten-year TS development plan through the Czech Republic's Spatial Policy and Territorial Development Principles for the individual regions.

Ai.10th Promote greater European coordination in planning and supporting the development of the transmission systems (new interstate and selected national lines) needed for the completion and efficient working of the internal electricity market, including granting central EU bodies the relevant competencies.

Ai.11th Support the involvement of smaller sources and consumption groups in the provision of support services.

System operational management and international cooperation:

Aj.1st High level of operational cooperation and the gradual integration of the activities of transmission system operators in the region of Central Europe (balance management and operational planning as well as flow management in networks). Joint emergency procedures and fully integrated procedures to deal with overloads at the regional level.

Aj.2nd Construct adequate technical means of preventing the occurrence and spread of network failures and controlling overload and optimal network operation.

Aj.3rd Active involvement in defining and planning the EU multinational transmission system focusing on the region of Central and Eastern Europe (Super Smart Grid).

Development of distribution systems

Ak.1st Ensure the high operational reliability of distribution systems in compliance with European standards, as well as the energy resilience of the Czech Republic. Develop the DS in line with the increase in final electricity consumption in households and develop distribution systems in the area of the decentralised management of local systems and the integration of distributed sources.

Ak.2nd Minimise the aggregate amount of time taken in permission procedures for the construction of distribution networks and ensure access to land while complying with the principles of nature and landscape protection.

Ak.3rd Secure funding for the renovation and development of the DS (motivational regulation for operators, stable and lasting regulatory framework). Fees for applicants requiring connection to the DS should be set as being motivational, and will serve as a location signal for connection to the DS according to their needs, covering a significant proportion of the related costs.

Ak.4th Stimulate the development of distribution systems and ensuring adequate capacity to meet increasing electricity consumption in households and services and also the demand for new connections as the regions develop. By 2020 ensure adequate network capacity and the technical conditions needed to connect new decentralised sources and meet the requisite electricity quality parameters.

Ak.5th Renovate and develop distribution networks in order to maintain security and reliability. Ensure network reserve capacity for situations resulting in a sudden surge in electricity consumption as a substitute energy source in cases of emergency.

Ak.6th Support and develop energy resilience and the ability of the DS to cope with multiple outages of critical elements of infrastructure, or the breakdown of the transmission network and ensure supplies of the minimal amount of electricity needed for the populace and critical infrastructure (by strengthening infrastructure and island operations in large agglomerations). In connection with this, update regional territorial energy policies to focus on using island operations in emergency situations particularly for large urban agglomerations, primarily in localities with the appropriate source and consumption structure.

Ak.7th Implement the National Action Plan for Smart Grids. Implement a raft of instruments enabling consumption and distributed electricity generation to be linked up to the decentralised management and regulation of the system (management of small domestic and local sources, selective management of groups of appliances, management of the storage capacity of electric vehicles, virtual power plants etc.). In connection with this, prepare a suitable system of technical management, regulation and price-setting and tariff mechanisms to stimulate the involvement of decentralised generation sources and local consumption in managing the balance of the electrification system.

Ak.8th Ensure territorial protection of areas and corridors for the development of the DS through the Czech Republic's Spatial Policy and Territorial Development Principles for the individual regions.

5.2 Gas industry

Vision

In the period up to 2040 natural gas will be an important source, enabling a gradual move away from the use of solid fuels in final consumption and small heat supply systems, the partial offsetting of outages in supplies from already obsolete coal-based energy and a partial departure from liquid fuels in transport. Security of supply will be maintained through the diversification of sources and transport routes and the development of storage capacities in compliance with priority PV.6. This will also make it easier for the Czech Republic to meet its declared emission reduction targets.

Due to the anticipated increase in the use of gas in the energy sector and transport, in the future we may expect a further rise in gas consumption. Gas power plants with rapid start are replacing the fluctuating electricity generation from RES. In relation to the construction of CNG filling stations it is expected that there will be a rise in the use of vehicles powered by CNG compressed natural gas in municipal public transport, municipal waste collection vehicles and others, including the acquisition of CNG-powered vehicles for the rolling stock of large enterprises.

In order to ensure the security and reliability of supplies it will be necessary to continue to comply with the requirements concerning the current infrastructure security standard (N-1) and also the need to ensure security standards for supplies. After the completion of the Gazela gas pipeline followed by the STORK II and BACI pipelines, the focal point of transit transport in the Czech Republic is shifting from the east-west axis towards the north-south. The existing route via Lanžhot will probably be used primarily to supply the domestic market, which is why we will be supporting the implementation of a gas pipeline connecting the Czech and Austrian systems, enabling gas to flow through the southern corridor. We will also be supporting the construction of the north-south gas-supply corridor, which should link the future Świnoujście LNG terminal in Poland and LNG in southern Europe (e.g. LNG Adria in Croatia) via Poland, the Czech Republic, Slovakia, Hungary and Croatia. This project should also include the construction of the Stork II gas pipeline to Poland, which should ensure natural gas supplies from the Świnoujście LNG terminal. The transport infrastructure between northern and southern Moravia should also be strengthened through the Moravia project, which is a response to the increased need for security of supplies from gas storage facilities and will cover the potential construction of new storage facilities, as well as to the transition of existing industrial facilities, power and heating sources to natural gas as a low-emission fuel. A project is also planned for connection to Oberkappel, which would be another direct connection between the Czech and Austrian transport systems.

Primary objectives:

B.1. Maintain the Czech Republic's transit role in the transport of natural gas and boost the cross-border connection of the gas supply system in the north-south direction and also to the west, partly using the Gazela gas pipeline and also with the Austrian system. In the east, connect up with systems in Poland and Austria through the north-south connection.

B.2. Support greater diversification of gas supplies from various sources and via various transport routes, which will boost the security and reliability of supplies, including in cases of emergency or in trade or political crises. This means the state making maximum use of legislative instruments and economic diplomacy with the aim of maintaining supply diversification at least at the current level.

B.3. Support the use of the existing capacities of gas storage facilities within the Czech Republic and increase extraction capacity guaranteed for two months to at least 70 % of peak daily consumption during the winter period.

B.4. Implement an infrastructure security standard to ensure the further connection of the domestic system with systems abroad (including the possibility of reverse flow) and make use of gas storage facilities (including increasing maximum daily withdrawal capacity). Impose and thoroughly check compliance with the obligation to keep emergency stocks to ensure the availability of gas supplies to protected customers, including in emergencies.

B.5. Put in place market mechanisms that mitigate the significant impact that market distortion (subsidies, administrative restrictions and barriers) has on the price of gas; integration of the gas market by 2020.

B.6. Minimise the aggregate amount of time taken in permission procedures for linear construction, ensure access to land for key infrastructure and secure funding for the renovation and development of the transport system while complying with the principles of environmental and landscape protection.

B.7. Ensure that the transport system is well prepared for the reliable connection of new gas sources.

B.8. Ensure a high level of operational cooperation and the gradual integration of the activities of transport system operators in the region of Central Europe. Create joint emergency procedures and fully integrated processes to deal with potential crisis situations at the regional level.

B.9. Ensure the renovation and development of distribution networks to maintain operational reliability.

Partial objectives and specification of these objectives in individual areas

Ba. Diversification of transport routes

Ba1. Monitor the prospects for gas supplies from LNG terminals in Poland and Croatia, from sources in the region of the Caspian Sea, or from shale gas sources in Poland, if used. Set up the north-south corridor within the Czech Republic and support the completion of the entire north-south connection.

Ba2. Support permanent capacity for reverse operation of the transport system.

Bb. **Diversification of supplies** - Support the diversification of natural gas supplies on an increasing scale (from the current 8 billion m^3 to approx. 11 billion m^3 by 2040) for additional use in industry, transport and electricity generation.

Bc. Gas storage facilities

Bc1. Support projects ensuring the capacity of gas storage facilities within the Czech Republic to cover 35 – 40 % of annual gas consumption and adequate connection to the transport system with guaranteed withdrawal capacity for two months at the level of at least 70 % of peak daily consumption in the Czech Republic during the winter period.

Bd. Security of supplies

Bd1. In potential states of emergency, use consumption regulation as a solution for minimising the impact on the national economy and on public health and lives.

Bd2. Maintain adequate mandatory gas reserves to supply end customers.

Be. Liberalisation and integration of the gas market

Be1. Highly competitive gas market environment, regional integration of the gas market, harmonisation of market rules, price-setting and tariff mechanisms and simplifying access to the market.

Be2. Support the integration of the markets in the V4 Central European region and Austria, later to be linked to market integration within the EU by 2020.

Bf. Renovation and development of the transport system

Bf1. Development of the transport system (TS) – Ensure the maximum possible operational reliability of the Czech Republic's transport system and its ability to meet capacity needs stemming from the rise in consumption as well as the transport of trans-European transit flows in both the north/south as well as the east/west axis. Renovate the TS and increase its resilience to cope with potential crisis situations.

Bf2. Ensure regional cooperation and mechanisms for the joint planning and development of transport systems in the region of Central Europe.

Bf3. If there are any changes in ownership of the transport system operator, it is in the Czech Republic's strategic interests to ensure that the transport system is owned by an entity with a transparent ownership structure and a long-term investment plan, the aims of which as regards the development of this system are in line with the strategic interests of the Czech Republic.

Bf4. Ensure long-term stable and predictable regulation of the sector.

Bf5. Ensure territorial protection of areas and corridors for the development of the TS through the Spatial Policy and Territorial Development Principles for the individual regions.

Bg. Development of distribution systems

Bg1. Ensure the high operational reliability of distribution systems in compliance with the European standards and develop them in line with the increase in final gas consumption, particularly through the connection of micro cogeneration and in small heat supply systems.

Bg2. Ensure territorial protection of areas and corridors for the development of distribution systems through the Spatial Policy and Territorial Development Principles for the individual regions.

5.3 Transport and processing of oil

Vision

Oil and oil products will continue to be an important source of primary energy, despite the desired gradual phasing out of oil consumption and restrictions on the proportion it makes up of the source mix. The transit of oil and capacity for self-sufficiency in oil processing remain crucial aspects of the energy sector in the Czech Republic. With a view to energy security, as regards oil supplies to the Czech Republic it is essential, wherever possible, to adhere to one fundamental principle, i.e. not to be dependent solely on one source. It is also important to monitor developments in all the related sectors, especially in the petrochemical industry in order to secure fuel for transport and raw materials for the chemical industry.

Primary objectives:

C.1. Utilise the available capacity of the Družba (southern branch) and IKL oil pipelines.

C.2. Ensure, including after any change in EU methodology concerning the calculation of emergency stocks of oil and oil products, that stocks remain above the level of

90 days of net imports with the prospect of increasing those stocks to 120 days of net imports depending on the financial capacity of the state and keep those stocks at that level through storage, primarily with national oil and oil products transporters. Within the framework of emergency stocks, ensure a suitable ration between oil and oil products, and, with the gradual rise in the volume of emergency stocks up to 120 days, gradually create stocks of light crude oil suitable for processing in the refineries at Kralupy nad Vltavou. Due to the strategic nature of this sector, leave MERO ČR and ČEPRO wholly state-owned.

C.3. Continue to support domestic oil processing and the production of the necessary refinery products with the aim of reducing imports of these commodities into the Czech Republic and, instead, creating conditions to further develop oil exports, particularly to the countries of Central and Eastern Europe. Strengthen the state's influence in this sector and ensure tighter integration of the entire oil transport and processing chain.

C.4. Support the development and strengthening of the existing system used to transport oil to the Czech Republic, with the aim of ensuring and maintaining adequate transport capacity for the needs of refineries in the Czech Republic. As part of this, create conditions enabling potential (transit) oil supplies to neighbouring countries with the aim of making the most efficient possible use of existing oil pipeline systems and also in order to keep oil flowing into the Czech Republic from two different directions. Support the gradual increase in the efficient use of the existing domestic product pipeline system, which is one of the most important European product pipeline networks, particularly due to its logistics position and connection to the Slovak product pipeline, and hence also to the Hungarian product pipeline system.

Partial objectives and specification of these objectives:

Ca.1. Achieve a prospective gradual increase in the volume emergency stocks of oil and oil products above the current level, with a view to increasing those stocks to cover 120 days of net imports, depending on the financial capacities of the state, and ensure the availability of those stocks at the government authority level in cases of oil crises.

Ca.2. Ensure that emergency stocks of oil and oil products are stored within the Czech Republic wherever possible, with state-owned oil transport system operators.

Ca.3. Active cooperation between the national oil transporter and the operators of the pipelines that transport oil to the Czech Republic, particularly in order to gain early warning of any business or technical issues which could result in restrictions on or the temporary complete interruption of oil supplies to the Czech Republic.

Ca.4. Ensure that the sector plays a greater part in covering the costs of administering state material reserves.

Ca.5. Ensure territorial protection of areas and corridors for the transport of oil through the Spatial Policy and Territorial Development Principles for the individual regions.

5.4 Production and supply of heat

Vision

Heat supplies are crucial for households and for the economy. They are always local in character and are thus locally priced. Coal-based heat supply systems currently represent a considerable competitive advantage for industry and for the populace. This advantage must be maintained and strengthened by creating conditions enabling the transformation and long-term stability of these systems and also increasing the efficiency of local heat generation. The main dominant source base will continue to be domestic coal, together with natural gas, RES, secondary sources and waste, and the utilisation of heat from nuclear energy and electricity.

Primary objectives

D.1. Keep heat supply systems as economically sustainable as possible in terms of competitiveness in the long-term and compare the economic aspects of centralised and decentralised heat sources when paying emission fees and other externalities (carbon tax, allowances, emissions). Support high-efficiency cogeneration, particularly in plants using brown coal.

D.2. Ensure the lasting availability of coal for heating systems and prioritise coal supplies to high-efficiency heat supply systems throughout the entire production system (i.e. also including heat distribution systems) over low-efficiency sources, throughout the entire time frame of the SEP. Support the use of biomass, other renewable and secondary sources and the maximum utilisation of waste in combination with other fuels for heat supply systems, particularly in the case of medium-sized and small sources at a reasonable collection and distribution distance.

D.3. Ensure the gradual transition to cogeneration combined with the efficient use of heat pumps in all heating plants. Support the use of natural gas, biomass, heat pumps and solar systems to replace solid-fuel heating in households. By 2020, wherever possible, move away from the use of coal in final consumption in households. Increase the efficiency with which electricity is used for heating purposes (replace direct heating and storage systems with heat pumps).

D.4. Ensure the gradual transition from non-compliant lower emission class solid fuel sources (as defined by ČSN 303-5) to more effective low-emission sources in higher emission classes (non-conforming manually-stoked boilers with low efficiency and high emissions that can burn waste and poor-quality fuel replaced with modern wood gasification boilers or automatic pellet boilers) in compliance with the current wording of the Air Protection Act.

D.5. Support the restructuring of energy- and economically-inefficient heat supply systems wherever greater there is the potential for achieving greater energy efficiency, greater flexibility in fuel use and better parameters from the viewpoint of sustainable development. Limit low-efficiency condensation electricity generation.

D.6. Support the maximum possible use of heat from nuclear power plants to heat larger agglomerations near those sources. Localities for consideration include

Brno, Jihlava, Dukovany, České Budějovice, and others by 2030.

D.7. Ensure that territorial energy policies are fully consistent with the SEP, land use planning processes and building proceedings and permission processes in the energy sector.

D.8. Support the territorial development of heat supply systems wherever viable and efficient, with the aim of using surplus heat resulting from savings in buildings.

Partial objectives and specification of these objectives in individual areas:

Da. Fuel base for heat supply systems

Da.1. Use high-quality brown coal for heat supplies from cogeneration. Create a legislative and administrative environment, including economic instruments aimed at prioritising the use of this coal, particularly in large and medium-sized heat supply systems (combination of higher mining fees and support for CHP in the heating industry, putting efficient sources at an advantage and penalising low-efficiency condensation generation sources.

Da.2. Particularly in the case of smaller and medium-sized heat supply systems, support the transition to multi-fuel systems using locally available biomass, natural gas and other fuel, if available, with natural gas in particular playing a stabilising role and serving as a supplementary fuel.

Da.3. Focus the use of high-quality black coal particularly on large and medium-sized heat sources with combined heat and power.

Da.4. Focus the use of natural gas as a low-emission source of energy primarily on small and medium-sized heating systems, on households and on decentralised heat sources (micro cogeneration), especially in areas with a high pollution load, where the combustion of solid fuels is primarily a source of higher concentrations of airborne dust.

Db. Electrification system and heating industry

Db.1. Support the use of larger heating plants to supply regulatory services for the transmission system. Support the efficient development of heat pumps in heating systems.

Db.2. Create conditions to enable heating plants to participate in the creation of regional territorial policies and ensure their role in the island operations of the individual areas in emergency situations.

Db.3. Integrate smaller heating sources into smart grid and decentralised management systems.

Dc. Decentralised heat production

Dc.1. Transition from direct heat and heat storage systems to heat pumps.

Dc.2. Wherever possible, move away from the use of coal in final consumption and replace it with natural gas, biomass, electrical heat from heat pumps and solar systems by 2020.

Dc.3. Increase the efficiency of local natural gas heaters.

Dc.4. Increase the efficiency and emission parameters of local biomass sources (focusing particularly on pellets, automation of heating systems etc.), especially in highly-polluted areas, where the combustion of solid fuels generates high concentrations of pollutants, particularly airborne dust and polycyclic aromatic hydrocarbons.

Dc.5. Prioritise high-efficiency combined heat and power.

5.5 Transport

Vision

In the future there is a need to reduce our dependence on oil in transport, or on fuels made from oil, and increase the proportion of alternative fuels used in transport, build adequate infrastructure for vehicles with alternative drive systems (natural gas, electricity). This will reduce the environmental impact of this sector (emissions, migration permeability of the landscape, including watercourses). Maintain or improve public mobility, not only within the framework of large cities, but also at the regional, national and international level.

Primary objectives

E.1. Increase the competitiveness of the Czech Republic and also support the reduction in greenhouse gas emissions (the state is a leading player in technological development in the application of innovative propulsion systems).

E.2. For the transport sector, ensure adequate fuel or energy at reasonable prices in order to develop mobility and maintain the competitiveness of the Czech economy. The same principles apply to transport as apply to electrical energy for industry.

E.3. Support research and development aimed at increasing the efficiency of combustion engines, more environmentally-friendly means of transport (particularly CNG, LNG, alternative fuels from RES, hybrid systems), including the development of fuel cells, batteries and supercapacitors for electrically-powered vehicles.

E.4. Prepare, as a follow-up to the recommendations of the 2010 OECD IEA Policy Review, a National Action Plan for Sustainable Mobility aimed at boosting energy-efficiency in transport with a fixed implementation schedule.

E.5. Develop infrastructure for more environmentally-friendly forms of transport and telematic traffic control systems designed to automate and optimise traffic. Transport requires a comprehensive approach, encompassing all possible alternatives.

E.6. In public transport introduce proven technology to increase the proportion of electrical energy using electric traction (further electrification of rail transport, and trolleybuses where possible).

E.7. Increasing efficiency throughout the transport department.

<u>Partial objectives in transport as a whole:</u>

EI.1. Reduce dependence on oil imports and cut carbon emissions in transport by as much as 60 % by the year 2050.

EI.2. Aim to increase the proportion of renewable resources in overall energy consumption in transport to 10 % by 2020.

EI.3. Increase the proportion of energy-efficient public transport at the national, regional and municipal level. Increase the proportion of combined transport with efficient use of rail.

EI.4. Accelerate research and technical development in the form of new innovations and the use of those innovations in the transport system, resulting in more economical vehicles, lower emissions and the use of alternative fuels and drive systems.

EI.5. Reduce the consumption of motor petrol and diesel in transport and replace them with alternative fuels.

EI.6. With a view to the refinery process, support a suitable fiscal policy promoting balance in the consumption of motor petrol and diesel, including in relation to anticipated EU measures.

<u>Partial objectives and specification of these objectives in individual areas:</u>

Ea. Road transport

Ea.1. Support efforts to cut the use of vehicles powered by diesel fuel in municipal public transport before 2030 by half, and to gradually phase them out in cities by 2040.

Ea.2. By 2030 ensure that road cargo transport exceeding 300 km is switched to other forms of transport, such as rail or inland waterway transport.

Ea.3. Increase the proportion of alternative fuels (biofuels, compressed natural gas (CNG), electrical energy, experimental hydrogen fuel cells), including use in trolleybus transport in urban agglomerations.

Eb. Rail transport

Eb.1. Increase the competitiveness of rail cargo transport in relation to other forms of transport.

Eb.2. Reduce diesel consumption and bring about an increase in the consumption of alternative fuels, particularly electricity and CNG.

Eb.3. Increase the proportion of electrical energy by expanding the electrification of busy routes, making extra use of electricity in suburban transport and also developing high-speed routes (HSR).

Eb.4. Design completely new HSR including power supply systems in relation to the development of transmission and distribution systems.

Eb.5. Reduce losses in power supply systems and electrical traction equipment.

Eb.6. Increase conversion efficiency in drive vehicles in rail transport when renovating rolling stock, including the use of recovery.

Ec. Waterway transport

Ec.1. Support the development of waterway transport due to its lower energy intensity per ton of cargo shipped.

Ed. Air transport

Ed.1. In the outlook, prioritise high-speed electrified routes over air transport for shorter distances, including in Central Europe.

Ed.2. Modernise public airport technical infrastructure in order to boost capacity and quality. Expand the capacity of landing runways at Prague Ruzyně, connect the airport up to the electrified rail system and design a concept for the related logistics systems.

5.6 Energy efficiency

Vision

Increase energy efficiency to the EU average and ensure that energy savings are the main resource for covering additional energy needs resulting from an upswing in the economy and a rise in the population's standard of living.

Primary objectives

F.1. Greater efficiency in the acquisition, transmission and conversion of. Reduce technological losses in transmission and distribution (keep losses in the TS below 1.3 % and losses in the DS below 6 % in the long term).

F.2. Reduce building energy intensity and increase energy efficiency in technological processes in industry.

F.3. Efficient energy appliances and use of such appliances (education, replacement, supporting smart measurement systems by involving consumers in consumption management, reducing consumption in standby mode).

F.4. Efficient distribution systems.

F.5. Support innovation focusing on technology aimed at increasing energy efficiency.

F.6. Use public aid funds (including part of revenues from the auction of emission allowances) to cover measures aimed at increasing energy efficiency (e.g. in the reconstruction and development of HSS).

Partial objectives and specification of these objectives in individual areas:

Fa. Energy-saving appliances and products

Fa.1. Support the permanent transition to energy-saving products and efforts to increase the requirements governing the minimal efficiency of products on the market, provide consumers with quality information (information support, awareness of labelling and information in advertisements).

Fa.2. Enforce strict compliance with the requirements stipulated for selected products associated with energy consumption, allow the marketing only of products that meet the eco-design requirements, and ensure that the state sets a positive example by purchasing the most energy-saving appliances available on the market.

Fa.3. Support the switch from direct heating systems to heat pumps and the further expansion of heat pumps, including involvement in management in smart grids.

Fb. Efficiency of energy conversions

Fb.1. Specify minimum efficiency for new production equipment.

Fb.2. Comply with requirements concerning emission parameters and the efficiency of boilers, air-conditioning systems and local heating systems.

- Fb.3. Ensure the transition to high-efficiency electricity and heat cogeneration in all heat supply systems.
- Fb.4. Cut losses in heat distribution systems.
- Fb.5. Support the renovation of electrical traction rolling stock in rail and trolleybus transport using recovery systems.

Fc. Energy distribution efficiency and consumption management

- Fc.1. Ensure the development of infrastructure to enhance potential consumption management amongst customers at the low-voltage level as part of smart grid systems.
- Fc.2. Support the further development of distribution tariffs to stimulate consumption management amongst end customers.
- Fc.3. Utilise synergy by building a common measurement system to span supplies of the various energy commodities (electricity, gas, heat and water where possible).
- Fc.4. Reduce losses in fluid power systems and electric traction equipment in transport, primarily on railways, but also in municipal public transport systems (tram and trolleybus network).

Fd. Energy intensity of buildings

- Fd.1. As far as buildings are concerned, the main aim is to switch to the low energy standard for new buildings after 2020, or construct buildings with almost zero energy consumption.
- Fd.2. When constructing new buildings and reconstructing existing ones, ensure strict compliance with the energy intensity requirements stipulated by the applicable legislation (in a cost-efficient manner) and use public buildings to set a good example.
- Fd.3. Make economically efficient use of insulation technology and interior alterations in existing buildings with energy recovery while respecting the principles of heritage protection.
- Fd.4. Increase awareness of building energy consumption using building energy intensity certificates.
- Fd.5. Supplement the legislation covering the valuation of buildings to include assessment of the applicable low-energy standard and technical systems in buildings.

Fe. Support the use of energy audits and appraisals, energy management (monitoring and targeting) and Energy Intensity Contracting methods

- Fe.1. Ensure compliance with the duty to perform an energy audit on buildings and energy structures when applying for a subsidy (with the exception of family houses), including the implementation of recommendations specified in audits of public buildings.
- Fe.2. Support the expansion of entities qualified to perform energy audits and appraisals, including support for furthering their qualifications.
- Fe.3. Support the introduction of energy management and EPC methods in the public and business sector, including making the provision of aid for savings measures

conditional upon the applicant's certification in the public and private sector on the basis of ČSN EN ISO 50001 – Energy Management Systems – Requirements with Guidelines for Use.

Fe.4. Stimulate the implementation of energy audit recommendations

5.7 Research, development, innovation and education

Vision

Highly innovative research and development in the energy sector and power engineering oriented towards areas in which the Czech Republic has a competitive advantage will be key factors in the competitiveness of the Czech energy sector and industry in general. The main source of added value is the supply of innovative solutions, services and investment units rather than actual machinery and equipment. The educational system ensures the generational exchange of the workforce in the energy sector and power engineering, as well as adequate qualified manpower for the further development of these industries as well as for exporting know-how. Technical and technical-economic fields will be highly prestigious courses. What is crucial for the development of basic research is cooperation between Czech research institutions and universities with partners abroad who are at the forefront in their individual fields. The same applies for the relevant domestic research, development and innovation institutions.

Primary objectives

Research, development and innovation

G.1. Increase the involvement of domestic research capacities in current and future international activities and projects such as 4th-generation nuclear reactors, nuclear fusion, the development of new materials for use in the energy sector and power engineering and utilisation of other opportunities offered by science, research and innovation.

G.2. Improve and enhance cooperation between basic and applied research in the field of energy. Follow up on past results and focus maximum support on applied research and development for the limited number of human resources and limited science and research potential of the Czech Republic. In basic research, define and support areas in which the current standard is competitive on the European and global scale.

G.3. Support research and development projects focusing on new innovative materials, equipment, technology, information and control systems.

G.4. Support research and development projects focusing specifically on increasing the efficiency of energy sources, reducing losses in energy transmission, more sophisticated network management, the development of more energy-saving appliances and drive systems and energy storage. In this regard, also particularly projects focusing on the development of next-generation transport systems using domestic energy sources (electric vehicles, hydrogen systems) and on the development and construction of the necessary infrastructure, including pilot storage projects in transmission and distribution networks.

G.5. Strengthen the links between research, education, state administration and practice via a long-term strategy defining priority areas and objectives. Coordinate state programmes and support from public funds with private resources with the aim of achieving maximum efficiency. Support cooperation between research organisations and industry.

G.6. Develop the activities of technological platforms (e.g. Sustainable Energy of the Czech Republic). Focus on setting and achieving specific goals.

G.7. Create a list of S&R priorities in the energy sector for the period prior to 2020 and a list of long-term priorities within the time frame of the State Energy Policy.

School system and education

Within the framework of their autonomy and in cooperation with professional organisations and firms operating in the energy sector, universities will strive to:

G.7. Increase interest in courses suitable for future specialists in the energy sector and related sectors and support interest in working in these sectors amongst young people.

G.8. Improve the structure of graduate know-how and skills to better meet the changing needs of employers and develop new courses to cater to the needs of industry. Ensure that technical specialists have extensive multi-disciplinary knowledge.

G.9. Ensure adequate numbers of well-qualified experts for the energy sector to provide the necessary generational exchange of technical intelligence in the energy sector and industry by 2020.

G.10. Introduce lifelong education in sustainable energy, covering the entire energy mix, the needs of infrastructure and the efficient use of energy.

<u>Partial objectives and specification of these objectives in individual areas:</u>

Research, development and innovation

Prioritise areas of the energy sector and technology that increase the competitiveness of the Czech economy, have export potential with high added value and help to protect the environment. Focus support on areas in which research and development is already up to the European or worldwide standard or where we have a significant competitive advantage (tradition, know-how, geographic conditions, the existence of infrastructure, strong position on the international market, etc.). The basic priorities of energy research and innovation are assumed to be as follows:

G.a. Renewable (alternative) energy sources

Ga.1. Support for projects will be focused on more effective use of biomass, na development of advanced biofuels made from non-food biomass and waste, new photovoltaic systems, including control elements, geothermal sources in the geological conditions of the Czech Republic and also on the production and energy utilisation of hydrogen, including fuel cells. All categories of high-efficiency heat pumps.

G.b. Nuclear technology

Gb.1. Support for projects will be focused on research into prospective 3rd- and 4-th generation nuclear technology. It will also focus on increasing the efficiency, lifetime and safety of nuclear sources, including the handling of radioactive waste, spent nuclear fuel and the end of the fuel cycle. Involvement in broader international projects is expected in this field. Development will also focus on engineering or special construction technology for the nuclear energy sector in connection with materials engineering.

G.c. More effective utilisation of fossil sources of energy (coal, natural gas)

Gc.1. Support for projects will be focused on research into new and more effective technologies for the combustion of traditional fossil fuels, e.g. clean coal technology with parameters that comply with BAT or better, as well as future economic and environmental requirements. In connection with this they will also focus on the development of high-temperature materials and on applied research and innovation of gas and steam turbines, heat exchangers, cogeneration systems and the topic of geological carbon dioxide storage.

G.d. Increasing the efficiency and reliability of energy systems and distribution networks

Gd.1. Support for projects will be focused on increasing the efficiency and reliability of energy systems and energy media distribution networks, including the integration of decentralised energy sources and backup to cope with crisis situations. Special attention will focus on the development of control systems in transmission and distribution networks.

Gd.2. At the distribution network level, focus particularly on the development of smart grids and the use of decentralised management of networks, production and consumption, including the option to manage storage in central and local systems.

Gd.3. At the transmission network level, focus on reliability management systems and their regional integration, network maintenance and operation systems based on monitoring and risk management and on emergency island subsystem management mechanisms.

Gd.4. Special attention will be given to developing means of protecting against cyber-attacks and safeguarding telecommunications systems. Support will be given to pilot electricity storage projects.

G.e. Energy utilisation of waste

Ge.1. Support for projects will be focused on the research and development of new technology for the energy utilisation of secondary raw materials and waste which cannot be used as material.

G.f. Transport systems

Gf.1. Support for research and development focusing particularly on increasing the efficiency of systems and means of mass transport, electric traction vehicles and their drives; on the development of fuel cells and batteries to promote electromobility; on the development of infrastructure for electric vehicles and the hydrogen economy and on the development of telematic traffic management systems aimed at automating and optimising individual transport.

Gf.2. Support will also be given to projects aimed at cutting losses in power supply systems and electrical traction equipment used in transport

School system and education

G.g. Improve the structure and applicability of graduate skills and know-how

Within the framework of their autonomy and in cooperation with professional organisations and firms operating in the energy sector, secondary schools and universities will strive to:

Gg.1. Implement changes in study programmes at secondary and tertiary level in order to bring teaching quality in line with the current and future needs of the labour market. Establish a system for evaluating courses from a work experience viewpoint.

Gg.2. Increase the ratio of practical findings and skills in graduates' educational profiles. Increase the proportion of external lecturers and specialised practical subjects in all fields of study.

Gg.3. Ensure cooperation with energy and industrial forms in specifying topics for vocational and diploma theses and set up a guidance and opponency system that always reflects practical opinions and experience.

Gg.4. In accordance with developments in industry, combine educational programmes focused on engineering and electrical engineering, providing graduates with a suitable skill set for the energy sector and for the implementation of large investment units linked to the construction industry.

Gg.5. With study programmes preparing graduates for future careers operating production and distribution facilities in the energy sector, focus increasingly on automation, control equipment and information technology, as well as on developing so-called soft (personal) skills. Support study programmes and vocational training on the topic of the efficient use of renewable energy sources, energy management and energy savings.

Gg.6. Building construction study programmes should also include the principles of designing low-energy buildings and energy savings.

Gg.7. Increase emphasis on the quality of graduates in troubleshooting and interdisciplinary findings. Increase student involvement in team projects between fields of study and between universities.

Gg.8. Maintain the quality of technical skills while improving soft skills.

Gg.9. Implement educational and informative instruments encompassing sustainable energy at all levels of education.

G.h. Motivational educational programmes and promotion of the energy sectors

Within the framework of their autonomy and in cooperation with professional organisations and firms operating in the energy sector, universities will strive to:

Gh.1. Develop motivational programmes for training and education in "energy", including a system to support students during their studies. Use suitable instruments to support the further development of the system of corporate scholarships, temporary jobs and work experience and their inclusion in the evaluation system for those courses, including crediting results, know-how and certificates obtained during the course of that work experience. If study work experience is part of the study plan, it should also be part of the evaluation system.

Gh.2. Support the general promotion of technical education and the energy fields, both by raising awareness and increasing knowledge of the energy sector within the elementary and secondary school system, as well as by raising general awareness through educational television programmes. Find a suitable form of popularising the topic using all mass media and the internet. Motivate employers to participate in this promotion and to support mechanisms combining both public and private funds.

G.i. Requalification and development of professional training

Gi.1. Enhance the role of universities within the framework of lifelong education focused on the energy sector and support requalification courses relating to the energy sector and associated fields. Link requalification courses with recognised certification by professional unions, associations and chambers, and closely link requalification courses to the current needs of firms, including a high degree of practical involvement by experts.

5.8 Power engineering and industry

Vision

Constantly develop power engineering and related branches of industry in order to boost self-sufficiency in the production of energy components, thus enhancing the role of energy security and independence. At the same time, restore Czech power engineering to its position as a leading world supplier of energy complexes and make the most of the potential offered by extensive renovation and modernisation of the energy industry in all parts of the developed world, together with the sharp upswing in energy in developing countries, as a unique pro-export opportunity, including for the construction industry involvement in building large investment units.

Primary objectives

H.1. Boost domestic self-sufficiency in the production of energy components in order to limit the impact of the anticipated shortfall in the generation capacities of the leading world producers (within the framework of EU regulations and conditions prioritising domestic producers).

H.2. Restore the status of Czech power engineering on the international investment units market, particularly in traditional territories (Latin America, China, India, Southeast Asia, the Near and Middle East, Northern Europe, the Balkans).

H.3. Increase the proportion of high-tech energy and power engineering investment units and components with high added value in exports from the Czech Republic.

H.4. Restore potential in the development, design, construction and export of technologically advanced investment units.

Partial objectives and specification of these objectives in individual areas:

H.a. Supplies of energy components

Ha.1. In connection with systems aimed at supporting the development of RES, strive to get domestic suppliers more closely involved and increase the technological level of production processes.

Ha.2. Focus programmes designed to support research, development and innovation, investment incentives and efficient and internationally respected certification procedures towards developing the production of high-tech energy components.

Ha.3. Support the involvement of power engineering enterprises in international energy research programmes, both through membership of international agencies and associations and also by supporting the co-funding of research and development projects from EU structural funds. For this purpose, focus government consultancy particularly on businesses and efficient project administration.

H.b. Supplies of investment units and link to the construction industry

Hb.1. Support large and medium-sized engineering concerns - while maintaining market conditions relating to power engineering, particularly in public procurement. Define conditions and technical parameters within the framework of authorisation procedures for the construction of energy facilities.

Hb.2. Put in place conditions for the comprehensive support of domestic producers in the field of energy with the aim of facilitating the transfer of new research and technical know-how into practice.

Hb.3. Support the construction of demonstration units and pilot projects for new high-tech schemes, both within the framework of permission and authorisation procedures as well as by involving state funding in support for research, development and innovation and addressing finances from EU structural funds, e.g. the European Agricultural Fund for Rural Development (EAFRD) in the field of energy.

H.c. Export of energy facilities

Hc.1. Support the export of energy facilities and units abroad. Through government administration and economic and trade diplomacy, support exports of energy complexes to third countries and the inclusion of power engineering in offset programmes.

Hc.2. Support the export capacity of power engineering companies and seek out export opportunities for Czech power engineering. Provide support particularly in searching for suitable opportunities, export loans and guarantee instruments provided by the EGAP credit insurer and the Czech Export Bank.

Hc.3. Strengthen cooperation between individual producers-exporters, specialised universities and research institutions in the Czech Republic and abroad with the aim of increasing trade and technical skills in the workforce.

Hc.4. Within the framework of the development of EU legislation, support an open environment enabling the involvement of engineering companies in energy contracts in EU countries and also in supplies for development and demonstration projects financed by the EU.

5.9 External energy policy and international relations in the energy sector

Vision

An effective, stable, transparent and credible external energy policy as an important means of achieving the objectives of the Czech Republic’s energy policy, which are to secure supplies, competitiveness and sustainability, strengthening energy security in the Central Europe region and securing the energy interests of the Czech Republic within the framework of the nation’s foreign policy, including efficient involvement in multilateral strategic negotiations on topical matters relating to global energy policy (the Czech Republic’s membership of OECD and the EU obliges it to participate in these activities).

Primary objectives

I.1. Develop an international energy policy to cover the basic objectives, which are supply security, competitiveness and sustainability, and to support the Czech Republic’s role as an important transit country for energy.

I.2. Support the creation of an effective and operable joint EU energy policy based on member state equality with the aim of formulating a coherent, strategic and targeted external energy policy and the consistent promotion of that policy amongst third countries, both transit and supplier, as well as amongst major consumer nations and developing economies and countries.

I.3. Within the framework of the EU climate and energy policy defend member states’ right to choose the energy mix and to technological neutrality and cost efficiency for the implementation of decarbonisation targets in the context of the commitments binding the world’s major emitters. For long-term targets, support the reduction of CO_2 emissions.

I.4. Implement the Czech Republic’s energy policy in compliance with the EU energy policy and Treaty on the Functioning of the EU, taking account of the national interests and preferences of the Czech Republic, and develop foreign relations with the aim of securing energy supplies while retaining national sovereignty in relation to the energy mix and use of domestic raw materials and energy sources.

I.5. Fully integrate the Czech Republic’s energy objectives into its trade policy and also ensure support for those objectives through the EU trade policy.

I.6. Strengthen energy diplomacy, focusing, amongst other issues, on:

- I6.a. Improve the environment for Czech companies investing in third countries and opening up the production and import of energy sources for Czech industry.
- I6.b. Create an external EU energy policy to strengthen the energy security of the EU.
- I6.c. Ensure equal conditions and coordinated approaches between EU member states when resolving energy supply crises.

- I6.d. Promote the interests of industry and the energy sector in the Czech Republic in EU legislation (the development and financing of networks from EU funds, emission control, administrative burden on businesses).
- I6.e. Promote nuclear energy as a low-carbon form of technology contributing towards the transition to low-carbon energy systems within the EU.
- I6.f. Promote the targeted elimination of market distortion in EU countries. If various forms of supporting and compensatory mechanisms are introduced to resolve issues of generation adequacy or system adequacy, advocate the harmonisation of such mechanisms throughout Europe in compliance with the rules of economic competition, as well as state support in the energy sector with the aim of minimising any adverse impact on the Czech energy sector.
- I6.g. Eliminate barriers impeding access to the electricity and gas markets, including access to energy infrastructure for Czech entities.
- I6.h. Constant pressure to fully comply with internal market directives in all EU countries.
- I6.i. Implementation of the objectives of the EU energy policy using a single Europe-wide market instrument to stabilise the price of carbon, with long-term robust implementation by 2040.

I.7. Support the rapid integration of the internal electricity market, connection of the markets of Central and Eastern Europe through implicit auctions and equality in capacity allocation and network usage mechanisms.

I.8. Ensure the effective coordination and implementation of the foreign energy policy between government authorities and the creation and operation of a permanent coordination mechanism.

I.9. Profile the Czech Republic within the EU in matters relating to energy security, efficient energy usage, nuclear energy, the heating industry, the use of RES and cooperation with the regions of Eastern and south-eastern Europe and with countries in the Southern Corridor.

I.10. Ensure the coordinated and effective promotion of the Czech Republic’s energy interests in EU structures at the formal and informal level (e.g. in the preparation of reference documents on BAT), including the relevant impact analyses on the Czech energy sector and the economy in order to provide negotiating teams with quality argumentative support.

I.11. Identify and regularly update the areas of the Czech Republic’s priority interests and enhance the activity and expert competence of representatives in working groups, particularly in the early phases of preparing new policies and legislative documents.

I.12. Monitor negotiations over EU (European Commission) strategic, conceptual and legislative documents relating to the sector and energy subsectors as well as transport so as to avoid counterproductive approaches and the duplicate approval of legislative documents at the EU level. This should also include monitoring the activities of European associations for the sectors in question with the aim of bringing their work into line with this policy and other strategic documents of the Czech Republic.

Partial objectives and specification of these objectives:

Ia.1. Support the timely exchange of information and the coordination of the energy policies of the nations in the region, as well as within the EU, and their involvement in joint security analyses and the reliability of supplies of all forms of energy.

Ia.2. Create a regional electricity and gas market in the region of Central Europe, or in the EU, providing fully open, barrier-free access to the market for end customers. In compliance with the European Council conclusions, complete the integration of the internal energy market in the EU and eliminate all barriers between member states and regions.

Ia.3. Support the rapid integration of the electricity market on the principle of implicit auctions throughout the Central and Eastern Europe (CEE) region and its connection with north-western Europe; support the development of the electricity, services and financial instruments market to ensure the stability of the electricity market. Owing to its geostrategic position in the region, support the Czech Republic's role in market integration and the creation and coordination of market mechanisms and institutions.

Ia.4. Improve cooperation amongst member countries in the region in monitoring the electricity and gas markets, supporting economic competition and ensuring market transparency. Support the development of effective coordination mechanisms and institutions for the management and development of energy grids and regulation based on the principles of member state equality, designed to ensure supply security in all states.

Ia.5. Create an effective joint mechanism for planning the development of transmission networks in the CEE region, ensuring optimal network development in line with electrical power engineering trends throughout the region and also in relation to developments in other regions. Support the coordination of procedures (particularly permission procedures and access to land) to ensure the timely implementation of development plans in all states in the region.

Ia.6. Support the creation and effective operation of joint mechanisms for the coordination and management of energy networks and for ensuring reliability and joint management of overloads and other emergency situations.

Ia.7. Support the diversification of European transport routes for natural gas and LNG terminals relevant for potential supplies to the Czech Republic and their connection to the transport system in the Czech Republic.

Ia.8. When specifying any further binding targets for reducing greenhouse gas emissions, make decisions conditional on the involvement of the other leading global emitters, including economically developed nations.

Ia.9. Specify further EU administrative restrictions and measures in relation to the production, transport and final use of energy, provide support only on the basis of complete and high-quality analyses of the economic impact on the competitiveness of industry and household standard of living.

Ia.10. Develop Czech cooperation in the field of energy, including supplies of capital investment projects from domestic manufacturers and the export of energy facilities, with major supplier and transit countries from within and outside the

EU.

Ia.11. Utilise specialists from Czech industrial and energy companies with experience in energy legislation, international energy cooperation in active EU bodies.

Ia.12. Actively cooperate within the framework of regional energy associations and organisations. Maintain active cooperation within the framework of V4 and coordinate approaches in relation to common interests. Strengthen the role and eight of V4 within the EU.

Ia.13. Continue in strategic energy-related dialogue with nations outside the EU.

Ia.14. Support the efficient involvement of research and development in the Czech Republic in international cooperation.

6 Instruments for enforcing the SEP

6.1 Legislative instruments

a. Proposed amendment to the Energy Act

- Expansion of the obligations of MO concerning the implementation and publication of energy statistics and forecasts, and in relation to analyses of the development of the energy sector for the needs of the state. Expansion of MO authorisation for acquiring the necessary data for these analyses from market participants (traders, customers, DSO, TSO, etc.).
- Specify definitions of technical infrastructure.
- Review the scope and completeness of authorising provisions for secondary legislation.
- Modify the role of the ERO and the binding nature of the State Energy Policy for the purposes of regulation in the energy sectors. Set up independent control of ERO activities.
- Specify the conditions for the issue of authorisation as an effective means of implementing the objectives of the State Energy Policy.
- Simplify administration in the construction and connection of new sources.
- Specify the regulation legislative framework with the aim of ensuring the long-term legislative and regulatory stability of the sector.

Coordinated by: MIT, ERO

Deadline: 31. 12. 2015

b. Proposed amendment to the Act on Supported Energy Sources

- Establish a mechanism to secure funding to cover the costs of supporting RES other than the price of electricity (e.g. the application of fees and taxes in the energy sector).
- Support for new RES through auctions or tenders for new capacities, or through compensatory payments, or investment support for winners of tenders, or through net metering.
- Introduction of a correction mechanism to check the reasonableness of public aid provided in compliance with a European Union decision within the framework of the notification process.

Coordinated by: MIT

Deadline: 31. 12. 2015

c. Proposed amendment to the Energy Management Act

- Provide a more detailed description of the content and scope of the State Energy Policy and the means of ensuring it remains binding for government authorities in the field of the economy and energy. Description of update procedure.
- Obligation and deadlines for territorial energy policies (TEP) in connection with the

update of the SEP and binding procedure for coordinating compliance of TEP and SEP.

- Completion of secondary legislation governing the minimum efficiency of energy sources and penalties for failure to meet the standards.
- Maintain the link between the SEP, TDP and PTD and specify a method for incorporating TEP into land planning documentation.
- Introduce a malus system for low-efficiency condensation electricity generation from coal, as quickly as possible.
- Simplify and streamline administration and regulations relating to control of energy savings.

Coordinated by: MIT

Deadline: 31. 12. 2015

d. Proposed amendment to the Building Act and amendment to the Environmental Impact Assessment (EIA) Act

- Analysis and implementation of instruments enabling the process of updating the PTD in relation to changes in the TDP in the case of important infrastructure buildings and electricity and heat plants.
- Linking the State Energy Policy, territorial energy policies and land use plans.
- Analysing the possibility of issuing a planning decision or ruling that would replace it, directly on the basis of the TDP while not contesting EIA requirements.

Coordinated by: MRD and MoE according to competence, in cooperation with MIT

Deadline: 31. 12. 2015

e. Proposal for the new Atomic Act

- Update SONS activities and competencies in line with European legislation.

Coordinated by: MIT, SONS

Deadline: 31. 12. 2015

f. Proposed amendment to the Waste Act

- Increase landfill fees and direct revenues towards supporting waste management.
- Support the energy utilisation of waste while respecting the waste management hierarchy.

Coordinated by: MoE

Deadline: 31. 12. 2015

g. Proposed amendment to the Air Protection Act

- Limit the range of fuels that can be used in small stationary combustion sources operated at the household level.

Coordinated by: MoE, in conjunction with MIT

Deadline: 31. 12. 2015

h. Analysis of energy legislation

- Perform a comprehensive analysis of the applicable legislation (laws, government regulations, implementing decrees) relating to energy and propose measures to simplify administrative processes and increase the efficiency of state administration, eliminate non-systemic measures and reduce the administrative burden on entrepreneurs, employers and natural persons.

Coordinated by: MIT, in conjunction with ERO

Deadline: 31. 12. 2015

i. New investment into energy infrastructure

- Create a suitable legislative environment for new investment in the development of transmission, transport and distribution systems, modernisation of heat supply systems, gas storage facilities and storage facilities for oil and oil products, aiming to use funding from EU sources.

Coordinated by: MIT, ERO, MRD, MF, ASMR

Deadline: on a continuous basis

6.2 Instruments in the area of state administration

a. Regulation of the energy sectors

- Ensure regulation of the energy sectors in order to systematically meet the objectives of the State Energy Policy and Raw Materials Policy.
- Modify the system used to support RES in relation to meeting the objectives of the Czech National Action Plan for Energy from Renewable Sources in manner that places no significant burden on the Czech economy and households and also to ensure support for those types of RES for which the Czech Republic has suitable conditions.
- Set up a tariff system for transmission, distribution and system services (particularly the payment component ratio on the consumption and production side) in order to create suitable location signals and a non-discriminatory environment within the framework of the energy sector and to ensure the stability and long-term sustainability of network funding, even with the considerable expansion of small home electricity generation sources.
- Support investment in and the development of transmission and distribution networks (connection conditions, availability of network capacities for the connection of new sources and consumption as a quality parameter in motivational regulation).
- Revise tariffs and tariff structures for future regulation terms in relation to the development of smart grids, decentralised sources and passive homes, in order to maintain a non-discriminatory and fair means of participation for various network user groups at their expense.
- Revise gas tariffs in relation to possible developments in support services and the heating industry (motivation for smaller investors).
- Support combined power and heat and secondary sources to an extent which helps to main network stability, resilience to malfunctions and efficient use of the network.
- Revise and supplement the Rules for the Operation of Transmission, Transport and Distribution Systems with the aim of creating conditions to ensure preferential access to networks for supported sources and also technical conditions for new sources aimed at limiting any adverse retrospective impact decentralised sources might have on the quality of electricity supplies and the reliability of the network.
- The regulatory framework must be stable in the long term and, for the transmission of electricity, the transport of gas and the distribution of electricity and gas, regulated prices must cover the reasonably incurred costs of ensuring the reliability, security and efficiency of these activities, depreciation and reasonable profits to ensure a return on investments in equipment used for the proper performance of the licensed activity.

Coordinated by: ERO

Deadline: 31. 12. 2016

b. Regulation for brown coal

- Perform a functional analysis of the market and the competitive environment in relation to brown coal, particularly as regards the availability of coal in the market and the economic legitimacy price of formation, analysis of the potential and impact of any regulatory instruments (material price regulation, intervention purchases, etc.). Submit the analysis to the government of the Czech Republic together with recommendations for this field.

Coordinated by: OPC, in conjunction with MIT, MF, ERO

Deadline: 31. 12. 2015

c. Conceptual work (policies, analyses)

- Support the establishment of a permanent multidisciplinary team of experts – "think tank" (in cooperation with MoEYS and the Academy of Sciences of the Czech Republic) to discuss and evaluate analyses and statistics relating to trends in the energy sector, and also to formulate recommendations for the assessment and updating of the State Energy Policy, the formulation of the energy policy and the application of instruments for implementing the SEP.

Coordinated by: MIT, MoI, MoEYS, MoA, MoE

Deadline: 31. 12. 2015

d. Perform periodical evaluation of the fulfilment of the State Energy Policy

- Evaluate the impact that instruments for implementing the SEP have on the business environment, the public sector and households.
- Compile and present the government of the Czech Republic with a report on the development of the energy sector and fulfilment of the SEP, including any recommendations concerning instrument updates.

Coordinated by: MIT

Deadline: by 31. 12. 2019 at the latest

e. Compile and publish an annual report on the development of the energy sector (electricity, gas, oil, heat)

- Description of development characteristics, main trends and recent changes, as well as anticipated development of primary characteristics (production, supplies, consumption, foreign trade, supply security, prices) at least 15 years in advance.

Coordinated by: MIT

Deadline: every year by 30. 10. (in relation to updates to SEP)

f. Update TDP and then TPD in relation to the SEP and completed analyses

- After the mandatory discussion process and narrowing down the number of situational variants, the inclusion of new nuclear sites, sites for storing spent nuclear fuel.

- After the mandatory discussion process, the inclusion of new corridors for transmission and transport networks, the placement of remote hot-water mains and also the development/transformation of heat supply systems.

Coordinated by: MRD, in conjunction with MIT and the relevant regional and municipal authorities

Deadline: TDP within 2 years of the decision selecting the site and regional TPD or PTD within the next three years

g. Ensure coherence in the creation of SEP and Territorial Energy Policies

- Create methodical rules for TEP, SEP assignments for individual regional TEP.
- Prepare and set up a procedure for MIT and processors aimed at harmonising policies (focus on energy resilience, the heating industry, building authorisation, etc.).

Coordinated by: MIT

Deadline: by 31. 12. 2015

h. Update TEP in line with the SEP and the compliance of existing TEP and SEP and ensure consistency in conjunction with operators

Coordinated by: MIT

Deadline: by 31. 12. 2019 and then no later than within 2 years of future updates to the SEP

i. Update ten-year transmission and transport system development plans

- Ensure compliance with the aims of the State Energy Policy and Raw Materials Policy, including the inclusion of implemented investments in order to guarantee electricity and gas supply security.

Coordinated by: ERO, MIT

Deadline: every year

j. Prepare a concept for supplies of oil and oil products (transport, processing capacity, distribution of oil products, organisational and ownership structure of companies in the oil sector) in line with the SEP and submit it to the government of the Czech Republic for approval

Coordinated by: MIT, in conjunction with ASMR

Deadline: by 31. 12. 2015

k. Compile a research study of sites for the further development of nuclear power plants after 2040

Coordinated by: MIT, in conjunction with MoE and MRD

Deadline: by 31. 12. 2016

l. In accordance with the approved SEP and Raw Materials Policy of the Czech Republic prepare an Update to the RAW handling policy and submit to the government for approval

Coordinated by: RAWRA, MIT, in conjunction with SONS

Deadline: by 31. 12. 2015

m. Select sites for final repositories of spent nuclear fuel, submit to the government for a decision to be passed

Coordinated by: RAWRA, MIT, in conjunction with SONS

Deadline: by 31. 12. 2025

n. Once every two years update the Czech National Action Plan for Energy from Renewable Sources

- Analyse the actual development of RES, compliance with SEP objectives.
- Evaluate the economic impact within the framework of separate material.
- Update and extend the NAP to 2030 no later than by 2016.

Coordinated by: MIT

Deadline: by 31. 12. 2014 and then every two years

o. Compile a National Action Plan for the Implementation of Smart Grids

- Impact analysis, specification of instruments, time schedule and programme management and submission to the government for approval.

Coordinated by: MIT

Deadline: by 31. 12. 2014, then update every three years

p. Compile a National Energy Savings Action Plan by 2020

- Impact analysis, specification of instruments, time schedule and programme management and submission to the government for approval in line with NAPEE, definition of specific objectives and specific programmes generally based on the main targets for this area as defined in the SEP.

Coordinated by: MIT, in conjunction with MoE

Deadline: by 31. 12. 2014

q. Compile a National Action Plan for Clean Mobility (gas, electricity)

- Impact analysis, specification of instruments, time schedule and programme management and submission to the government for approval.

Coordinated by: MIT, in conjunction with MoT and MoE and other stakeholders

Deadline: by 31. 12. 2015

r. Support research and development in clean mobility

- Prepare a coordinated strategy to support research and development in this field.

Coordinated by: MIT, MoEYS, in conjunction with MoT, MoE, TA CR and other stakeholders

Deadline: on a continuous basis (as a follow-up to the National Action Plan for Clean Mobility)

s. Boost and improve the analytical and conceptual capacity of MIT and closer cooperation with MO when performing analyses

Coordinated by: MIT

Deadline: by 31. 12. 2014

t. Compile a National Energy Resilience Programme

- Impact analysis, specification of instruments, time schedule and programme management and submission to the government for approval.
- Focus the programme on energy resilience and the ability of large agglomerations to use island operations, protection of critical infrastructure, protection against cyber-attacks on key energy systems.

Coordinated by: MIT, in conjunction with MoI

Deadline: by 31. 12. 2015

u. Authorisation, licensing processes and normative activities

- Issue of authorisation for the construction or fundamental reconstruction of electricity plants and selected gas facilities in relation to the expediency and efficiency of the construction work and in compliance with the Building Act, the Energy Act and the implementing regulations, including notification and justification of negative certificates issued by the European Commission.
- Meeting the administrative deadlines and strict compliance with the SEP and NAP.

Coordinated by: MIT

Deadline: on a continuous basis

v. Ensure efficient licensing processes

- Minimise the total time required for permission processes for energy buildings through the sophisticated coordination of processes and control mechanisms at MRD, MIT, MoE so that the time from when the application for the planning ruling is filed to when the planning permit or its equivalent is issued is as short as possible.

Coordinated by: MRD, MIT, MoE

Deadline: on a continuous basis

w. Define mandatory security standards for gas supplies and stocks of nuclear fuel in compliance with the applicable legislation and in proportion to the expected supply security situation and the international situation

Coordinated by: MIT

Deadline: on a continuous basis

x. Define technical parameters and standards for the efficiency of end appliances

- Achieve considerable induced savings in final electricity and heat consumption.

Coordinated by: MIT, MoE

Deadline: on a continuous basis

y. Check implementation of the Waste Management Act and Act on Supported Energy Sources

- Improve inspections and increase efficiency in energy management and support for RES.
- Focus inspections on compliance with the efficiency standards for energy facilities and systems as well as electrical appliances.
- Modify the scope of inspections, increase professional standards and ensure that government authorities and the public are systematically kept informed of the situation in energy management and the development of RES, and the comprehensive results of inspections and the evaluation of those results.

Coordinated by: MIT

Deadline: by 31. 12. 2015

z. State material reserves

- Update Government Resolution No. 910 dated 23 July 2008 on analysis of the possibility of including nuclear fuel in the state material reserves system in relation to the changes to the Energy Act and the new duty of operators to hold stocks of nuclear fuel.
- Revise the state material reserves model for oil, including stocks structure.

Coordinated by: MIT, MF in conjunction with ASMR

Deadline: by 31. 12. 2015

aa. Transport

- Monitor trends in the use of alternative fuels in transport in the EU and provide timely support for the creation of the necessary infrastructure for use in the Czech Republic

Coordinated by: MIT, MoT, MoE

Deadline: on a continuous basis

bb. Check that the energy sectors are prepared for potential states of emergency

- Regular training and verification of the crisis management system in the network energy sectors (electricity, gas, heat, oil and their impact on one another).

Coordinated by: MIT, ASMR, MoI

Deadline: 31. 12. 2014 + once every 2 years

cc. Prepare a concept/strategy for external energy relations/policy

Coordinated by: MIT, in conjunction with MoFA and GO

Deadline: 31. 12. 2015

dd. Compile a research study assessing potential for the use of geothermal energy within the territory of the Czech Republic

Coordinated by: MIT

Deadline: 31. 12. 2017

ee. Prepare a coordinated strategy to support research and development in the production of advanced biofuels from non-food biomass and waste

Coordinated by: MIT, MoEYS, in conjunction with MoE and other stakeholders

Deadline: on a continuous basis

6.3 Fiscal and tax instruments

a. EU FUNDS

- Ensure conditions for the maximum possible drawing of CEF from the part of this fund allocated and approved for the support of infrastructure energy projects for investment in the Czech Republic.
- Fund the modernisation and development of the transmission system from ESIF funds. Fund the introduction of smart elements into distribution systems using ESIF funds.
- Ensure that operating programmes support investment in energy savings, increasing energy efficiency and projects to renovate heat supply systems (energy efficiency and energy savings criterion incorporated into all operating programmes).
- Provide funding for research and development in the energy sector.
- Raise awareness of support provided in the field of energy for ERO.

Coordinated by: relevant coordinators (MRD, MF, GOCR, MIT, MoA, MoE), ERO

Deadline: by 31. 12. 2015, then on a continuous basis

b. Direct support programmes

- Greatly increase funds to support savings (MIT Efekt programme) in the coming years.
- Focus support primarily on EPC projects for funding high-leverage guarantees, on type projects with high repeatability and the potential for savings. Focus particularly on the following areas:
    - Support for the introduction of energy management in the public and business sectors.
    - Support for the development of heat pumps and use of heat pumps to replace existing direct heating systems and the direct combustion of solid fuels.
    - Reconstruction of public lighting.
    - Investment support for the reconstruction of heat supply systems.
    - Investment support for the energy utilisation of waste in designated facilities.
    - Implementation of smart systems in households with a demonstrable effect on savings and optimisation of consumption distribution.
    - Support for reducing the energy intensity of buildings.

Coordinated by: MIT

Deadline: by 31. 12. 2014, then on a continuous basis

6.4 Foreign policy

a. Within the framework of foreign policy in the energy sector, ensure constant coordination between GOCR, MoFA, MIT and ERO in setting and promoting the priorities and key interests of the Czech Republic, coordination of involvement in international negotiations, membership of the Czech Republic in international organisations and their working groups and at important conferences and expert discussions.

Within the framework of foreign policy, ensure the following long-term priorities in particular in relation to the EU:

- Integrate the electricity and gas market in the CEE region and EU.
- Ensure the full implementation of directives and regulations on the internal market in all EU countries. Particularly as regards non-discriminatory access to cross-border capacities and respecting cross-border influences.
- Integrate network development (including involvement in planning the development of European transmission infrastructure and the construction of Electricity Highways).
- Strive to eliminate distortion in the electricity market and set up equal conditions for all energy sources in the market. Until subsidy schemes have been phased out completely, promote the harmonised introduction of regulatory mechanisms and subsidy schemes to ensure generation adequacy and system reliability, as well as regional solutions, so as not to endanger the interests of the Czech energy industry and Czech companies.
- Promote nuclear energy as an accepted carbon-free technology which may be supported in the policies of the various member countries.
- Develop legislation and regulation for nuclear safety, damage liability, international negotiations, the storage of spent nuclear fuel and other regulatory measures in nuclear energy on a purely professional basis, taking no account of ideological intentions and approaches.
- Promote reasonable changes in permission processes and EIA investment projects (including interstate projects) to ensure that such processes are as efficient as possible.
- Support the diversification of European transport routes and source territories, including support for boosting interconnectivity (oil, gas, electricity), including the appropriate financial involvement of European funds.
- Strengthen the energy cooperation of the V4 countries and strive to coordinate the approach to all important documents and decision-making processes in the energy sector within the EU; nevertheless, targeted use should be made of ad hoc coalitions throughout the EU in order to promote Czech interests.
- Within the European discussion framework defend national sovereignty over the choice of the energy mix and rigorous technological neutrality, cost efficiency when meeting European decarbonisation commitments in the context of involving other world greenhouse gas emitters in efforts to reduce carbon emissions.
- Support the development of crisis plans to deal with energy crises and exceptional

situations within the region of Central Europe.

Within the framework of foreign policy in relation to countries outside the EU:

- Ensure active participation in the IEF and IEA and promote the interests of the Czech Republic concerning stability in the oil market.
- Support contracts with new gas producers in relation to the use of the north-south corridor and future channels of access to LNG.
- Coordinate cooperation with major producer and transit nations.
- Support cooperation in securing supplies of oil and oil products and related emergency measures.
- Strengthen "energy diplomacy", particularly in producer and transit countries, and in the traditional target countries for our energy industry and in developing countries with high market potential for power engineering and particularly for energy engineering. Focus on information support for Czech businesses, actively seek out business opportunities and provide political support at the local level.

Coordinated by: GOCR, MoFA, MIT, MoE, MoI, ERO, ASMR

Deadline: on a continuous basis

6.5 Instruments in education and support for science and research

a. Within the framework of support for technical disciplines and the natural sciences, initiate discussion between entities operating in the energy sector and representatives of university technical faculties

- The topic of these discussions will be strengthening the role of technical education, with emphasis on energy consumption.

Coordinated by: MIT and MoEYS in conjunction with other stakeholders

Deadline: by 31. 12. 2015

b. Ensure support for joint research projects between Czech and foreign research institutions, universities and firms.

- Within the framework of R&D&I programmes provide support for joint research, development and innovation projects between research organisations and businesses in the CR and abroad within the framework of international cooperation programmes.

Coordinated by: MoEYS and other providers

Deadline: on a continuous basis

c. Ensure support for S&R pilot projects in the field of energy in relation to the SET plan

- Focus the new programme on strategically targeted support for research projects in the field of energy (smart grids, electricity accumulation, S&R in nuclear technology) in the context of the priority “Sustainable Energy” priority in accordance with Government Resolution No. 552 of the National Priority Oriented of Research, Experimental Development and Innovation and the needs arising from the State Energy Policy.

Coordinated by: TA CR, in conjunction with MIT and MoEYS

Deadline: pursuant to Government Resolution No. 552/12

6.6 Exercise state ownership rights in energy companies in which the Czech Republic has an ownership interest

a. <u>Strengthen the state's position in energy companies with significant state influence</u>

- Concentrate on the preparation of general meetings and the owner's specific assignments at GMs aimed at ensuring the strategic interests of the state as given in the SEP and Raw Materials Policy.
- Enhance the control powers of supervisory boards in checking implementation of GM measures.
- Ensure that supervisory boards are staffed by persons properly qualified for the position.
- Chance articles of association to ensure the following in all companies in which the state has a majority interest:
  - Approval of the company strategy by the SB and assurance of compliance with the SEP.
  - Approval of important investment decisions and ensure their compliance with the company's approved strategy, the SEP, the Raw Materials Policy, the Security Strategy of the Czech Republic and any other conceptual documents.

<u>Coordinated by:</u> MIT, MF

<u>Deadline:</u> by 31. 12. 2015

6.7 Communication and media promotion

a. Publication of the State Energy Policy, analysis of its economic impact and possible scenarios for the development of the Czech energy industry after discussion by the government

- Compile and publish interpretative documents containing a detailed description of the situation in the energy sector, current and future conditions and trends in the energy sector in the Czech Republic and boundary conditions for the creation of the State Energy Policy.
- Set up one point to provide access to analytical reports and long-term energy trend forecasts, or provide links to the relevant documents.
- Recommend that information about the energy sector and the energy strategy be included in the framework educational programmes of all technical secondary schools and at least in general form in the curriculum in grammar schools.
- Support the organisation of a series of specialised seminars for energy professionals focused on presenting the SEP and its various areas and contexts. Organise discussion within the framework of these seminars.

Coordinated by: MIT, MoEYS

Deadline: by 31. 12. 2017 (publication of SEP and all relevant documents immediately after government approval)

b. Contact the management of universities

- Recommend to the rectors of universities that information about the energy sector and the energy strategy be included in the study programmes of all technical universities and at least in basic form in the study programmes of universities specialising in the humanities.

Coordinated by: MIT

Deadline: by 31. 12. 2014

7 Expected development of the energy sector in the Czech Republic prior to 2040 according to the optimised scenario

This section presents a quantification of one possible scenario for the development of the Czech energy industry in the long term in compliance with the strategic assignment of the SEP under predetermined assumptions, as well as the anticipated development of technology (including costs), the national economy and Czech and European policy. This is therefore not a strategic assignment, but merely an outline of one scenario depicting suitable development within the framework of the recommended corridors.

Development forecasts are burdened by a high degree of uncertainty and are based on currently available information and expert estimates of input parameters. Any significant deviation in these input parameters over time would also potentially result in a deviation in these forecasts. Deviations in the forecast that differ from the actual state of affairs will be evaluated by MIT on a continuous basis and will be corrected, where necessary, during the periodic assessment and possible update of the document in accordance with the law.

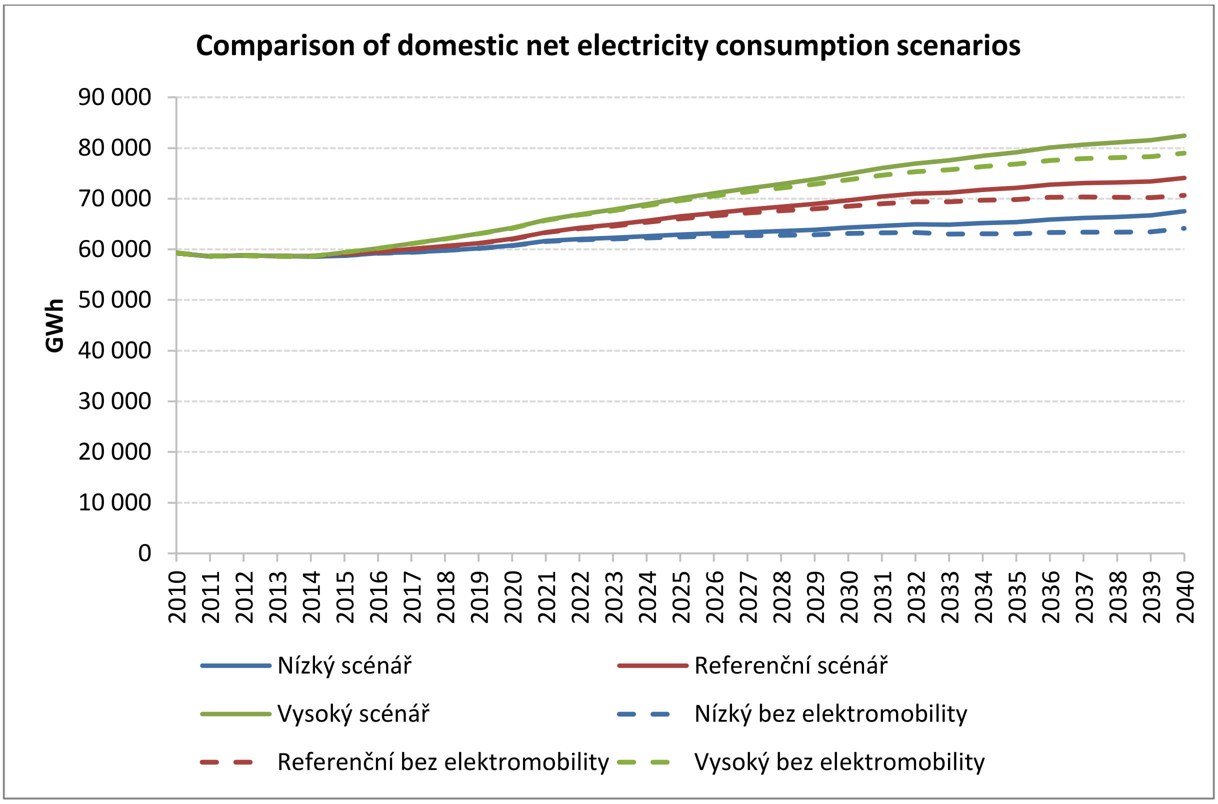
7.1 Basic inputs for model

The key inputs/prerequisites for the optimised scenario for the development of the energy balance of the Czech Republic include:

- Compliance with commitments previously adopted by the Czech Republic (including those to the EU), such as:
    - Climate and energy package,
    - Directive of the European Parliament and the Council 2012/27/EU of 25 October 2012 on energy efficiency, the amendment to Directives 2009/125/EC and 2010/30/EU and on the repeal of Directives 2004/8/EC and 2006/32/EC,
    - Directive of the European Parliament and the Council 2010/75/EU of 24 November 2010 on industrial emissions (integrated pollution prevention and control),
    - Action Plan for Biomass,
    - Czech National Action Plan for Energy from Renewable Sources,
    - National Action Plan for Energy Efficiency of the Czech Republic,
    - Waste Management Plan of the Czech Republic (2003).
- A total of 3 electricity consumption scenarios have been prepared - low, reference and high – based on an MIT macroeconomic model using input-output methodology. The development of net electricity consumption and electricity consumption excluding electromobility-related consumption is shown in Graph No. 3 below. The consumption scenarios were created using the anticipated trend in GDP (and thus GAV) on the basis of MIT and MF forecasts, while the MIT forecast is more conservative. The forecast is based on the reference electricity consumption in 2013 at the enterprise level after eliminating all possible fluctuations in that year. The trend in electricity consumption is then linked to the development of GAV in the sector in question taking account of the trend in electrical energy intensity of GAV

creation. The sectoral characteristics were consulted with various union associations grouped under the Confederation of Industry and Transport of the Czech Republic.

Graph No. 3: Comparison of domestic net electricity consumption scenarios



Source: MIT expert analysis, MF forecasts

Nízký scénář = Low scenario
Vysoký scénář = High scenario
Referenční bez elekromobility = Reference excl. electromobility
Referenční scénář = Reference scenario
Nízký bez elektromobility = Low excl. electromobility
Vysoký bez elektromobility = High excl. electromobility

- For the reference electricity consumption scenario the expected average growth in GDP at fixed 2005 prices between 2012 and 2040 is deemed to be 1.92 %.
- The operation of TNPP for 2040 and DNPP for the period between 2034 and 2036 and in relation to their gradual decommissioning as well as the construction of new sources with a capacity of approx. 30 TWh within the time frame of the USEP, while these sources should be connected up to the electrification system between 2033 and 2037, according to the forecasted generation and consumption balance.
- Trends in the prices of sources were based on MIT expert estimates, as well as estimates by the International Energy Agency and European Commission. The predictions of investment costs into energy infrastructure were based on own estimates compiled at MIT and figures supplied by energy infrastructure operators.

- Availability of RES in compliance with the National Action Plan for RES by 2020, as well as in compliance with the Action Plan for Biomass and the outcomes from the National Action Plan for Smart Grids.
- Availability of black coal and brown coal in the optimised scenario according to the latest mining forecasts, respecting existing mining areas.
- It is expected that available supplies of domestic brown coal will be prioritised for HSS and high-efficiency CHP systems.
- In relation to the potential of the energy utilisation of waste, and hence the potential for the construction of incineration plans, the optimised scenario includes:
    - Economic penalties for landfilling waste, followed by a ban on the landfilling of selected groups of waste.[21]
    - Respect for the waste management hierarchy pursuant to the current Waste Management Plan of the Czech Republic.
    - Introduction of adequate mechanisms restricting bulk exports of energy-utilisable waste abroad and ensuring that such waste is used within the Czech Republic where possible.
- There is currently great uncertainty over the future development of allowance prices. The SEP therefore works with various different trends in the price of CO_2 emissions. These include alternatives ranging from the possible abandonment of the EU ETS emissions trading system and a switch to differentiated national emission reduction instruments to the possible alternative of a global agreement on restricting greenhouse gas emissions.

The SEP optimised scenario assumes that the EU ETS emissions trading system will be left in place, including the structural reforms under way for the CO_2 emissions trading model, i.e. the introduction of a so-called stabilization reserve after 2020, together with backloading. The figures are based on materials prepared by the Ministry of the Environment as part of analysis of the impact the proposed climate and energy framework for the years 2020 – 2030 will have on the Czech Republic. Backloading is expected to result in a gradual rise in the prices of emission allowances prior to 2018 (to approx. 11.5 EUR/ton of CO_2), followed by a temporary decline until 2020 and then an increase up to 26 EUR/ton of CO_2 by 2030 due to the need to meet decarbonisation targets. After 2030 the nominal price of emission allowances is expected to rise slightly.

Due to the high degree of uncertainty in forecasting over a 25-year time frame, in which the Czech Republic has no control over many of the changes in the external environment, with the aim of ensuring the greatest possible flexibility for decisions by entities in the energy sector MIT has considered a series of alternative scenarios. These depict various combinations of input assumptions and changes in external conditions, while respecting the aforementioned strategic axioms. Within the framework of the process of creating these scenarios differing account has been taken of the relative importance of the three basic strategic objectives of the policy. The outcome of these analyses is the recommended range,

[21] It is assumed that these will be set in implementing legislation to the Waste Act.

or corridors, for the composition of the primary energy mix of the Czech Republic and the electricity generation of the Czech Republic, which are given in Section 4.2. These corridors will then be the assignment for the development of the Czech energy industry from the viewpoint of the SEP.

7.2 Optimised scenario for the development of the energy sector until 2040

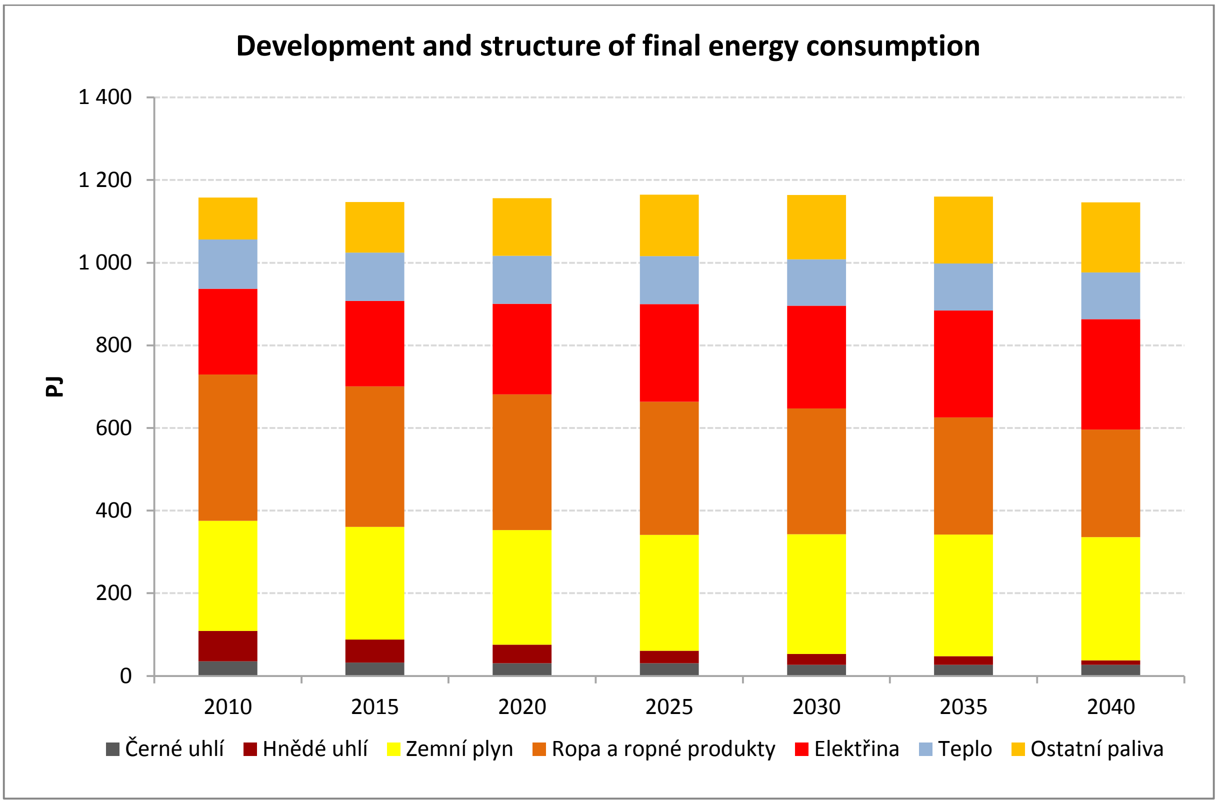
7.2.1 Development and structure of final energy consumption

Table No. 1: Development and structure of final energy consumption

Final energy consumption		2010	2015	2020	2025	2030	2035	2040
Black coal	PJ	35.0	31.8	30.9	30.8	26.7	27.1	26.7
Brown coal	PJ	73.8	56.0	44.8	29.6	26.2	20.2	11.3
Natural gas	PJ	266.1	272.9	276.9	280.7	289.7	294.6	298.0
Oil and oil products	PJ	354.1	339.9	329.1	322.6	304.8	283.4	260.5
Electricity	PJ	207.6	207.1	218.8	236.2	248.8	258.7	266.7
Heat	PJ	119.7	116.8	116.4	115.7	112.2	113.9	113.7
Other fuels	PJ	101.2	122.0	139.4	149.2	155.6	162.1	169.6
Total	PJ	**1 157.6**	**1 146.6**	**1 156.2**	**1 164.8**	**1 164.0**	**1 160.0**	**1 146.4**
Balance item *	PJ	25.8						
Total	PJ	**1 131.8**	**1 146.6**	**1 156.2**	**1 164.8**	**1 164.0**	**1 160.0**	**1 146.4**

** The calculation features different methodologies used by CSO and MIT. The balance item in 2010 serves to eliminate this difference.*

Graph No. 4: Development and structure of final energy consumption



Černé uhlí = Black coal
Hnědé uhlí = Brown coal
Zemní plyn = Natural gas
Ropa a Ropné produkty = Oil and oil products
Elektřina = Electricity
Teplo = Heat
Ostatní paliva = Other fuels

During the period in question the total amount of final energy consumption shows only a slight increase, which, respecting the anticipated GDP trend, indicates the implementation of the energy-saving policy. The structure of final consumption also shows an almost complete move away from brown coal, which is, especially in local heating plants, a source of harmful emissions.

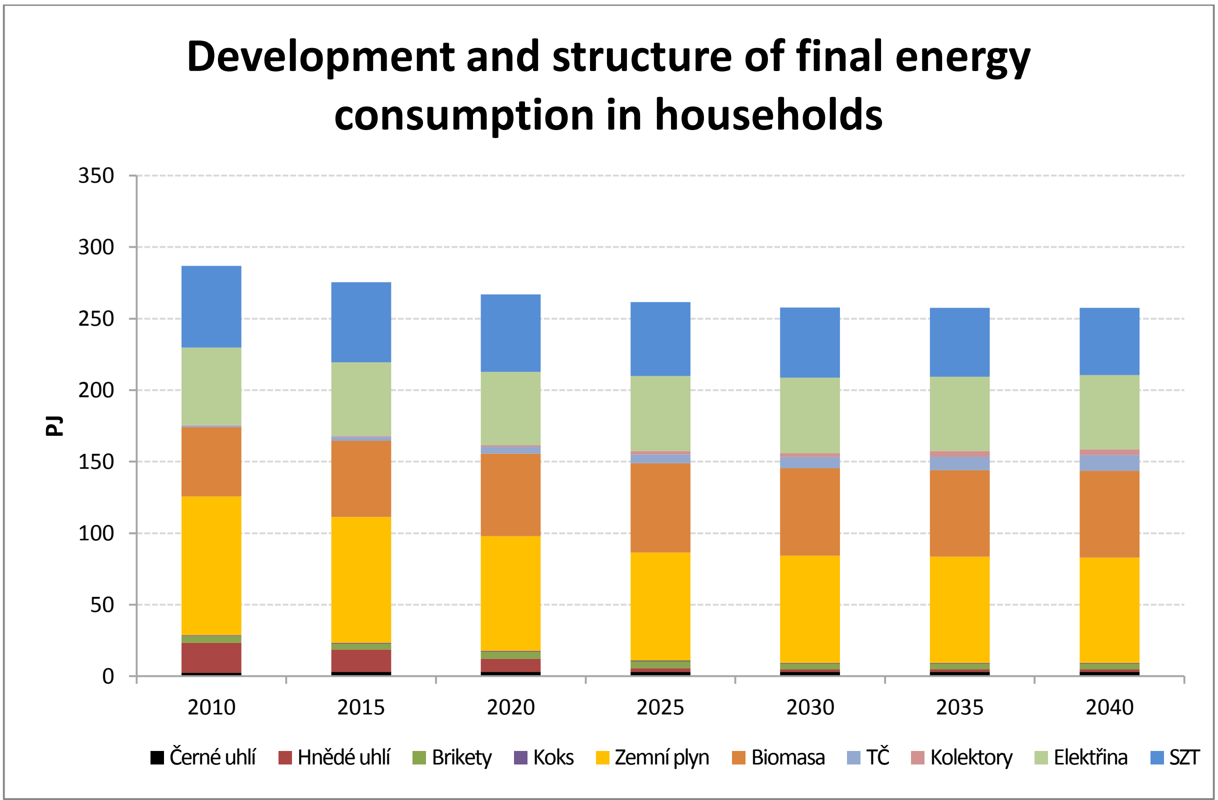
In the case of gas a slight rise in consumption is expected, together with a change in its internal structure (a fall in heat consumption in households and a slight increase in consumption in industry). An upswing in gas is also expected in the transport sector for the whole of the period in question (see Graph No. 6). Although in many cases solid fuels will be replaced by natural gas in households, consumption will not rise significantly due to higher building energy efficiency.

7.2.2 Development and structure of final energy consumption in households

Table No. 2: Development and structure of final energy consumption in households

Energy consumption in households		2010	2015	2020	2025	2030	2035	2040
Black coal	PJ	2.2	2.9	2.9	2.9	2.9	2.9	2.9
Brown coal	PJ	21.1	15.8	9.2	2.6	1.8	1.8	1.8
Briquettes	PJ	4.8	3.9	4.9	4.9	3.9	3.9	3.9
Coke	PJ	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Natural gas	PJ	96.9	88.0	80.1	75.4	75.0	74.4	73.7
Biomass	PJ	48.5	53.3	57.9	62.4	61.2	60.4	60.6
Heat pumps	PJ	1.2	2.6	4.6	6.2	7.8	9.4	11.0
Collectors	PJ	0.3	0.6	1.1	2.4	2.8	4.0	4.0
Electricity	PJ	54.1	51.5	51.4	52.4	52.8	52.1	51.9
HSS	PJ	50.1	49.2	47.3	44.7	42.0	41.1	40.1
Total	**PJ**	**279.9**	**268.5**	**260.0**	**254.7**	**250.7**	**250.6**	**250.6**

Graph No. 5: Development and structure of final energy consumption in households



Černé uhlí = Black coal
Hnědé uhlí = Brown coal
Brikety = Briquettes
Koks = Coke
Zemní plyn = Natural gas
Biomasa = Biomass
TČ = Heat pumps
Kolektory = Collectors
Elektřina = Electricity

SZT = HSS

Total electricity consumption at the household level will fall slightly throughout the entire SEP time frame. Purely electric heating and DHW will be replaced by heat pumps. The effect of further insulation will become apparent, particularly in the consumption of natural gas. The largest proportion of electricity consumption results from “large appliances”. The number of these per household will increase until saturation level. At the same time, their specific consumption will be reduced. Electricity consumption for lighting will decrease. There will be a rise in consumption for equipment that is less often used (ventilation, air conditioning, etc.). Specific energy consumption per household will fall, primarily as a result of the increasing efficiency of appliances.

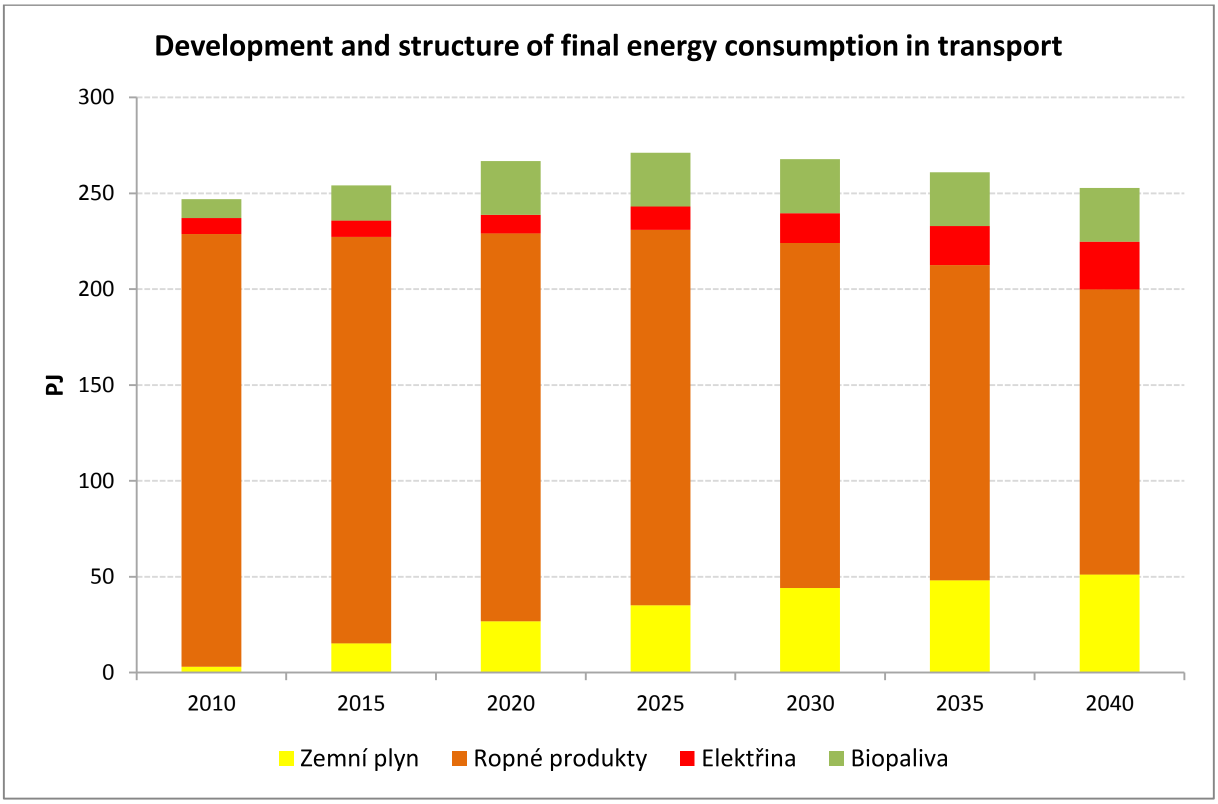
The optimised scenario does not anticipate the dramatic collapse of the HSS. However, the disconnection of flats in systems will continue, where heat supplies will not be provided to customers under competitive conditions, and there will be a gradual transition to the use of smaller, decentralised sources (block and home natural gas boilers and heat pumps).

7.2.3 Development and structure of final energy consumption in transport

Table No. 3: Development and structure of final energy consumption in transport

Energy consumption in transport		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Natural gas	PJ	3.1	15.3	26.8	35.1	44.1	48.1	51.1
Oil products	PJ	225.6	212.0	202.2	195.9	180.0	164.4	148.8
Electricity	PJ	8.5	8.6	9.7	12.1	15.6	20.4	24.9
Biofuels	PJ	9.8	18.3	28.1	28.1	28.1	28.1	28.1
Total	**PJ**	**246.9**	**254.2**	**266.9**	**271.1**	**267.8**	**261.0**	**252.9**

Graph No. 6: Development and structure of final energy consumption in transport



Zemní plyn = Natural gas
Ropné produkty = Oil products
Elektřina = Electricity
Biopaliva = Biofuels

The key trend in transport will be a reduction in vehicle consumption and the rise of alternative drive systems, with a gradual increase in the use of compressed natural gas in the form of CNG, as well as of electricity. Even so, it is expected that oil products will dominate this segment in 2040, even though their ratio will gradually fall to approx. 66 % of the total energy consumption in this sector. It is expected that there will be an increase in rolling stock in the Czech Republic by 2020 - 2025, particularly in the passenger car category. In subsequent years, however, the number of vehicles is expected to stagnate or decrease slightly. Total transport volumes will continue to rise, with saturation expected after 2030. With electrical energy it is expected that consumption will rise steadily as electromobility increases.

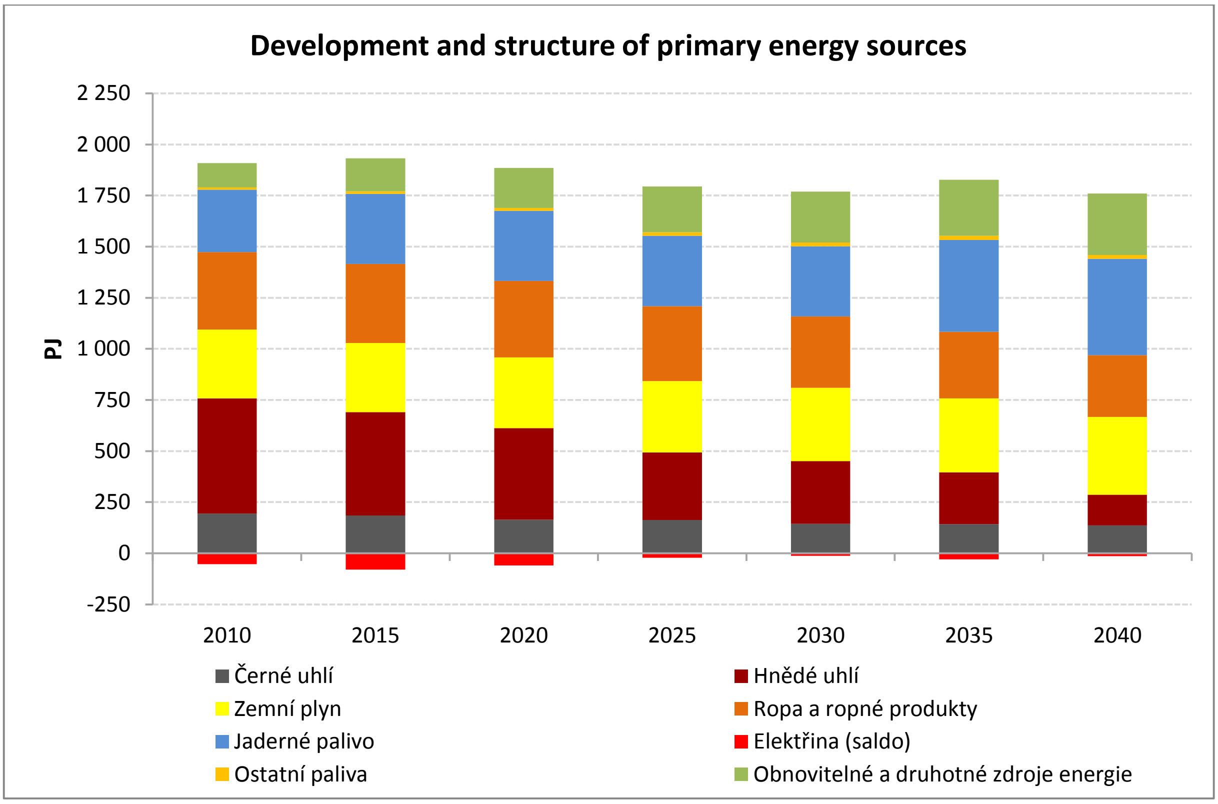
7.2.4 Development and structure of primary energy sources (PES)

Table No. 4: Development and structure of primary energy sources

PES		2010	2015	2020	2025	2030	2035	2040
Black coal	PJ	194.3	184.6	164.2	163.2	143.9	143.0	136.3
Brown coal	PJ	564.3	505.2	448.8	330.2	307.4	253.5	150.0
Natural gas	PJ	336.1	338.9	344.5	348.6	357.9	361.4	381.2
Oil and oil products	PJ	378.4	385.8	374.2	366.8	348.7	326.2	301.5
Nuclear fuel	PJ	305.4	343.6	343.6	343.6	343.6	449.2	471.3
Electricity (balance)	PJ	-53.8	-80.1	-58.9	-22.3	-11.9	-29.9	-13.3
Other fuels	PJ	10.5	12.9	13.8	17.2	19.5	19.5	19.5
RES and secondary sources	PJ	119.1	161.4	195.6	223.9	247.5	273.7	299.8
Total	**PJ**	**1 854.3**	**1 852.3**	**1 825.7**	**1 771.1**	**1 756.5**	**1 796.6**	**1 746.36**

Note: other fuels: degassing gas, industrial waste and alternative fuels, municipal solid waste (non-renewable)

Graph No. 7: Development and structure of primary energy sources



Černé uhlí = Black coal
Zemní plyn = Natural gas
Jaderné palivo = Nuclear fuel
Ostatní paliva = Other fuels
Hnědé uhlí = Brown coal
Ropa a Ropné produkty = Oil and oil products
Elektřina (saldo) = Electricity (balance)
Obnovitelné a druhotné zdroje energie = Renewable and secondary energy sources

Between 2010 and 2040 it is expected that there will be a significant decrease in unit heat consumption both in heat supply systems and in decentralised generation, primarily due to energy savings. This trend will be offset by a slight increase in the amount of space heated, both in households (increasing comfort and living space per capita), as well as particularly in the services sector (new shopping, sports and cultural centres). The overall fall in consumption will therefore be milder. In terms of electricity consumption, however, a slight increase is expected, as a number of rationalization measures affecting energy consumption will be accompanied by a switch to electricity (e.g. heat pumps and electromobility). In the household sector we can then expect a slight decrease in electricity consumption, due to energy savings resulting primarily from the use of more energy-efficient appliances. This decline will be partially compensated for by greater household comfort and a rise in the number of households. The development of GDP is an important factor in electricity consumption in the industrial sectors. Although increased consumption associated with economic growth can be compensated for by reducing energy intensity, the total volume of consumption will actually stagnate. A reduction in electricity consumption could only be expected as a result of economic stagnation or a decline in the economy, or following any significant de-industrialization of the Czech economy.

The PES structure will see a rise in the proportion of renewable and secondary sources of energy, primarily biomass and waste, as these as significant domestic energy sources. In contrast, the proportion of another, currently decisive domestic source, i.e. high-quality brown coal, will fall considerably by 2025, as shown in Graph No. 7**,** primarily as a result of the transformation and modernisation of the energy sector. The decline after 2025 is also caused by a reduction in mining operations. There will then be a further significant decline in the use of brown coal between 2035 and 2040, after which consumption should stabilise to a level which should be maintained in the long term for strategic reasons, i.e. after 2040. Brown coal will partially be replaced by natural gas, so this source is expected to see an increase. A relatively marked decline in the mining of black coal can be predicted. After 2023 the amount of black coal mined within the Czech Republic should not exceed 2 million tons a year, including black coking coal. The fuel demands of domestic power plants, heating plants and coking plants will have to be covered from abroad, at least until the switch to other fuel has been completed, or until heat supplies are covered from decentralised sources. As expected, the only firm mining black coal in the Czech Republic concentrates more on mining high-quality coking coal. In this respect we may expect that only coking coal will be mined after 2023, while coal for energy utilisation in combustion sources will have to be purchased abroad.

Changes in the PES structure between 2030 and 2035 are caused mainly by the construction and subsequent commissioning of new nuclear units, which will partially replace the existing blocks that are gradually being decommissioned. According to the forecasts, there will again be a fall in primary energy sources after 2035.

In the case of fossil sources, which can be used with various technologies and to varying degrees of efficiency (not only in the energy sector), monitoring PES consumption together with final consumption indicates efficiency with which these PES are used. With nuclear energy, PES (as with fossil fuels) includes the energy content of the fuel, which is currently used almost exclusively to generate electricity, while the technologies do not differ from each other much in terms of efficiency (around 33 %).

What has greater predicative value in the context of energy savings and source efficiency is the difference (or ratio) between primary energy sources and gross final consumption. This ratio falls in the time frame in question, due to the increasing energy efficiency of the fuel mix and the efficiency of energy conversion in specific power plants.

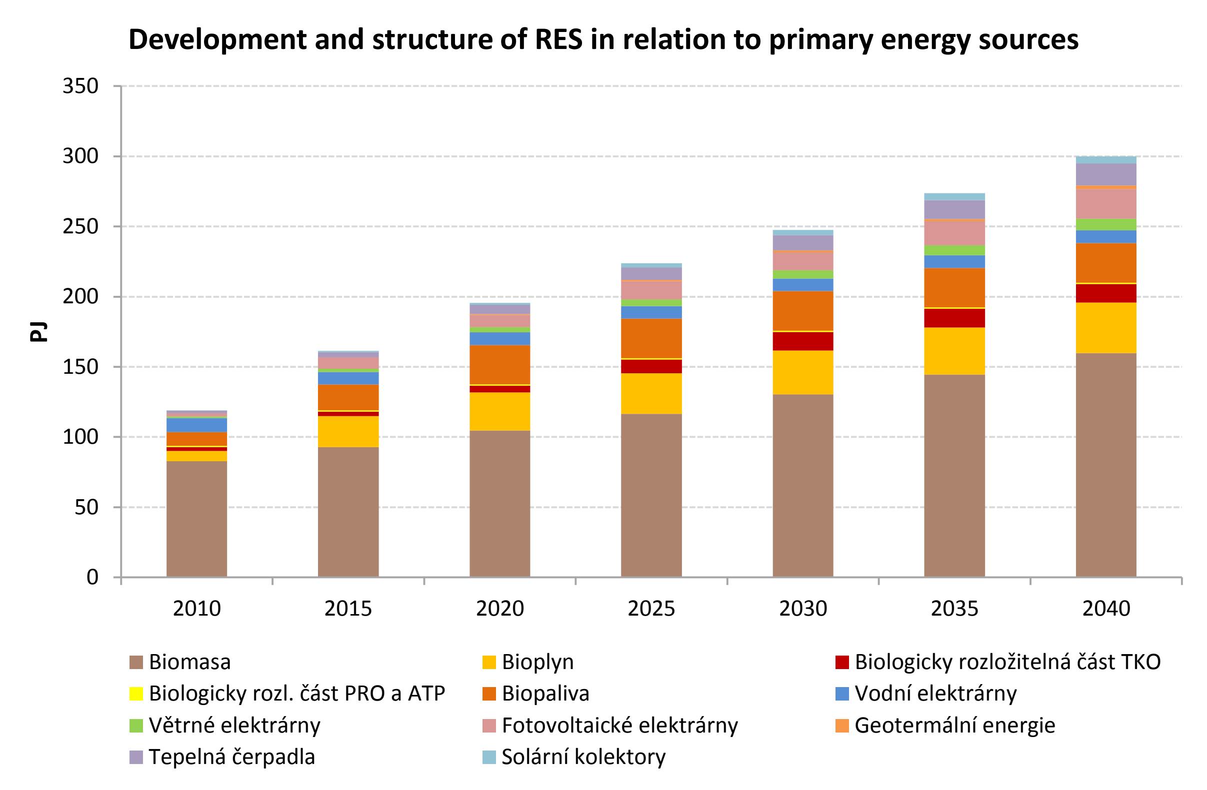
7.2.5 Development and structure of RES in relation to primary energy sources

Table No. 5: Development and structure of RES in relation to primary energy sources

Renewable and secondary energy sources		**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Biomass	PJ	82.7	92.7	104.7	116.6	130.4	144.6	159.9
Biogas	PJ	7.4	22.1	27.1	28.8	31.1	33.5	35.9
Biodegradable part of MSW	PJ	2.6	3.3	4.7	9.9	13.3	13.3	13.3
Biodegradable part of IW and AF	PJ	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Biofuels	PJ	9.8	18.3	28.1	28.1	28.1	28.1	28.1
Hydroelectric power plants	PJ	10.0	8.9	9.1	9.1	9.1	9.1	9.1
Wind power plants	PJ	1.2	2.3	3.6	4.8	5.8	7.0	8.2
Photovoltaic power plants	PJ	2.2	8.2	8.7	12.8	12.8	17.0	21.2
Geothermal energy	PJ	0.0	0.0	0.7	1.0	1.2	1.7	2.5
Heat pumps	PJ	1.8	3.7	6.6	8.9	11.2	13.4	15.7
Solar collectors	PJ	0.4	0.8	1.4	3.0	3.5	5.0	5.0
Total	**PJ**	**119.1**	**161.4**	**195.6**	**223.9**	**247.5**	**273.7**	**299.8**

Note: MSW – municipal solid waste, IW – industrial waste, AF – alternative fuels

Graph No. 8: Development and structure of RES in relation to primary energy sources



Biomasa = Biomass
Biologicky rozl. Část PRO a ATP = Biodegradable part of IW and AF
Větrné elektrárny = Wind power plants
Tepelná čerpadla = Heat pumps
Bioplyn = Biogas
Biopaliva = Biofuels
Fotovoltarické elektrárny = Photovoltaic power plants
Solární kolektory = Solar collectors
Biologicky rozložitelná část TKO = Biodegradable part of MSW
Vodní elektrárny = Hydro power plants
Gotermální energie = Geothermal energy

During the period in question there is a rising trend in the total proportion of renewable energy sources. This trend partly reflects efforts to make the maximum possible use of this domestic energy source assuming its economic return, and also the effort to minimise the impact on the state budget and the populace. Development in this field will be primarily due to the gradual increase in competitiveness as compared with conventional sources of energy.

The source with the greatest development potential, including for the future, is still biomass, particularly purposefully cultivated biomass, and it is expected that full use will be made of all available sources while keeping restrictions in place, such as food security. The overall potential is considered in compliance with the Action Plan for Biomass (APB). The lower limit of the range stated in the APB has been conservatively selected for use, while if the upper limit were reached we would be at the upper limit of the corridor for the RES ratio assumed by this policy.

In the case of other sources there is again a marked rise in photovoltaics after 2025 once they have become fully competitive, adjusting for a significant volume of accumulation. However, between 2025 and 2030 there will be no absolute increase in installed capacity in photovoltaics (see Graph No. 11), as during this period newly-built sources will be replacing previously installed photovoltaic power stations (PPS) that by then will have been fully amortized. The existing base will be renovated by 2030, and the increasing trend in electricity generation using photovoltaics will continue as a result. In connection with this it is expected that photovoltaics will be used solely on the roofs and other fixed structures of buildings, heritage protection restrictions and other technical limitations permitting. The expected output of PPS means that the majority of available roof space on residential houses (> 50%) and industrial buildings (> 70%) will be used. This does not take account of the increasing use of PPS on agricultural land, but rather the return of farm land that has only temporarily been excluded from the Agricultural Land Resources system.

The gradual increase in production is also significant in waste utilisation, with the expectation being that 100 % of combustible waste unsuitable for recycling will be utilised. In the case of wind energy it is assumed that full use will gradually be made of this source's potential while respecting all the factual limitations, including landscape protection. The use of environmental heat energy (heat pumps) also makes up a considerable proportion.

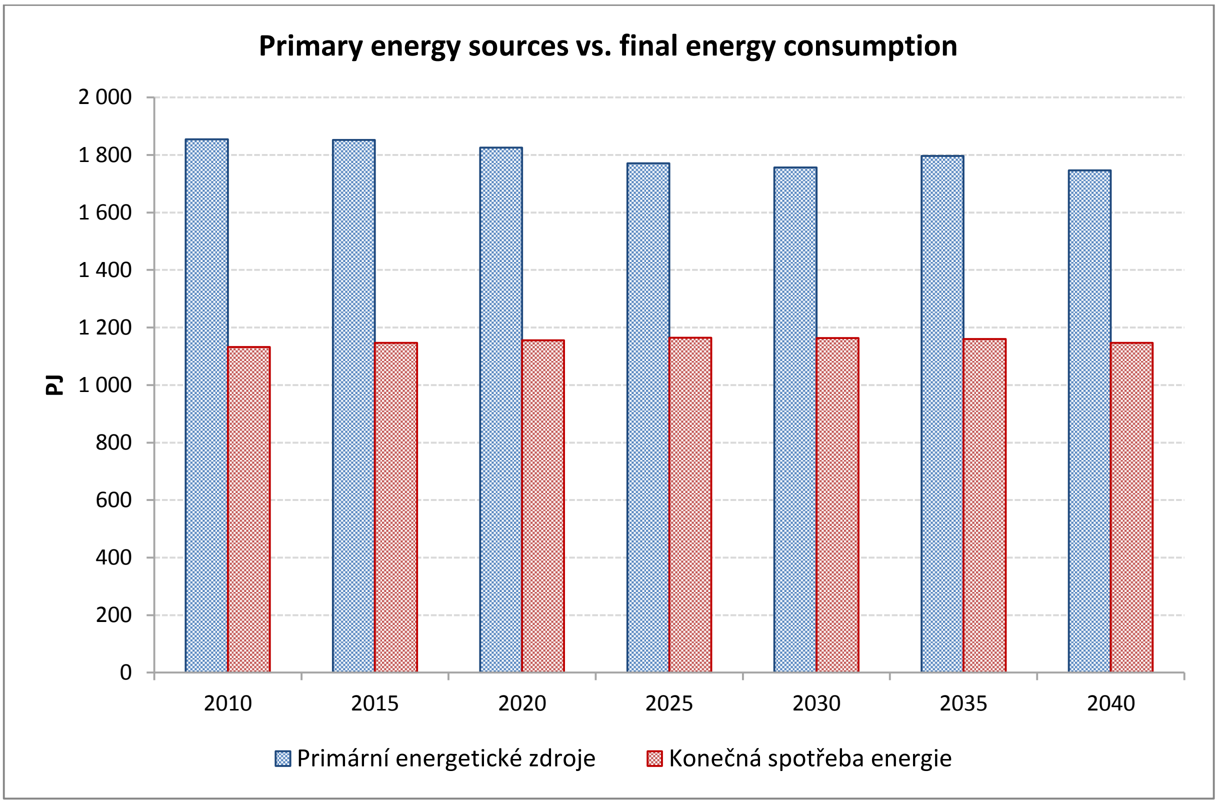
7.2.6 Primary energy sources vs. final energy consumption

Table No. 6: Primary energy sources vs. final energy consumption

		2010	2015	2020	2025	2030	2035	2040
Primary energy sources	PJ	1 854.3	1 852.3	1 825.7	1 771.1	1 756.5	1 796.6	1 746.4
Final energy consumption	PJ	1 131.8	1 146.6	1 156.2	1 164.8	1 164.0	1 160.0	1 146.4
of which non-energy*	PJ	113.2	113.1	113.1	113.1	113.1	113.1	113.1

** Non-energy substances are products that result directly from non-energy production processes for improved fuels, the nature of which means they are used for purposes other than energy (they are generated, for example, in high-temperature coal carbonisation in coking plants, pressure gasification and liquid fuel production). There are currently not enough relevant data to forecast non-energy consumption, and so the situation is expected to stagnate and remain at the 2012 level.*

Graph No. 9: Primary energy sources vs. final energy consumption



Note: It is assumed that savings will be made in primary energy sources and final consumption based on the balance model given in this document, in compliance with Directive 2012/27/EU on energy efficiency.

Primární energetické zdroje = Primary energy sources
Konečná spotřeba energie = Final energy consumption

In practical terms, final energy consumption will stagnate. The significant fall in heat consumption (relative savings of over 25 %) will be offset by the slight rise in demand for heat comfort, the number of buildings heated, the increase in final electricity consumption (by both wholesalers and smaller customers in the business sector) and a slight rise in energy consumption in transport by 2025 (increased energy consumption will be compensated for by considerable savings resulting from conversion efficiency, meaning that after 2025 energy consumption in transport will stagnate and eventually fall slightly – see Graph No. 6). Final consumption is consumption determined before it reaches appliances, in which it is used for final overall equipment effectiveness, not for the production of other energy (with the exception of secondary energy sources).

The National Action Plan for Energy Efficiency of the Czech Republic states that the energy savings target of 47.94 PJ by 2020 corresponds to a final consumption excluding non-energy consumption of 1 020 PJ according to the methodology of the International Energy Agency. Graph No. 9 shows final consumption at the level of 1 156.2 PJ in 2020. This, however, also includes non-energy consumption, which has always been 110 PJ, and stagnation or a slight decrease can be expected. The figure of 1 156.2 PJ corresponds – taking account of historical balance differences (see Table No. 1) to the target stated in the National Action Plan for

Energy Efficiency of the Czech Republic.

Final consumption is based on a conservative estimate of the eventual effects of the implementation of all anticipated energy efficiency measures. It is also assumed that the comfort of the population will increase and there will be a rise in GDP with the Czech Republic's continuing focus on industry. Final consumption may be somewhat lower, as the result of more optimistic developments in the field of savings or due to a decline or stagnation in the economy.

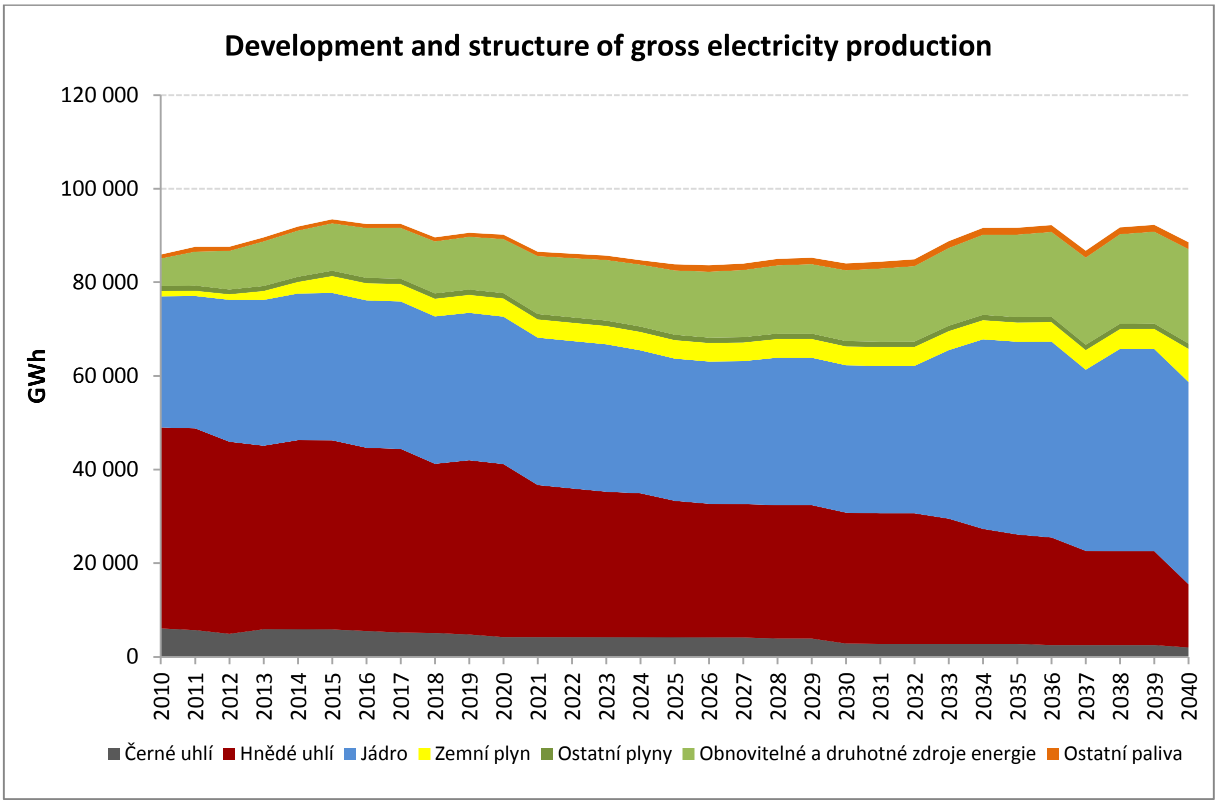
7.2.7 Development and structure of gross electricity production

Table No. 7: Development and structure of gross electricity production

Gross electricity production		2010	2015	2020	2025	2030	2035	2040
Black coal	GWh	6 052.0	5 832.4	4 198.4	4 134.3	2 824.0	2 745.0	1 989.1
Brown coal	GWh	42 936.1	40 389.6	36 951.3	29 167.5	27 947.7	23 366.2	13 497.2
Natural gas	GWh	1 125.7	3 624.6	3 914.4	3 973.4	4 043.5	4 126.6	7 101.1
Other gases	GWh	1 080.4	1 130.5	1 130.5	1 130.5	1 130.5	1 130.5	1 130.5
Nuclear	GWh	27 998.2	31 495.1	31 495.1	30 384.2	31 495.1	41 177.9	43 204.5
Other fuels	GWh	814.8	848.6	917.4	1 294.5	1 446.3	1 446.3	1 446.3
RES	GWh	5 902.8	10 122.3	11 548.8	13 742.0	15 125.6	17 638.7	20 173.0
Total	**GWh**	**85 910.0**	**93 443.2**	**90 156.0**	**83 826.4**	**84 012.7**	**91 631.2**	**88 541.7**

Note: other gases – coking, blast, degassing and other
other fuels – oil products, industrial waste and alternative fuels, municipal solid waste (non-renewable), waste heat

Graph No. 10: Development and structure of gross electricity production



** The jump in electricity production evident in 2037 is caused by the expectation that new nuclear sources will have a certain start-up curve and will not run at full power. Coupled with the predicted decommissioning of the Dukovany nuclear plant there will be an evident jump in the structure of gross electricity production.*

Černé uhlí = Black coal
Hnědé uhlí = Brown coal
Jádro = Nuclear
Zemní plyn = Natural gas
Ostatní plyny = Other gases
Obnovitelné a druhotné zdroje energie = Renewable and secondary energy sources
Ostatní paliva = Other fuels

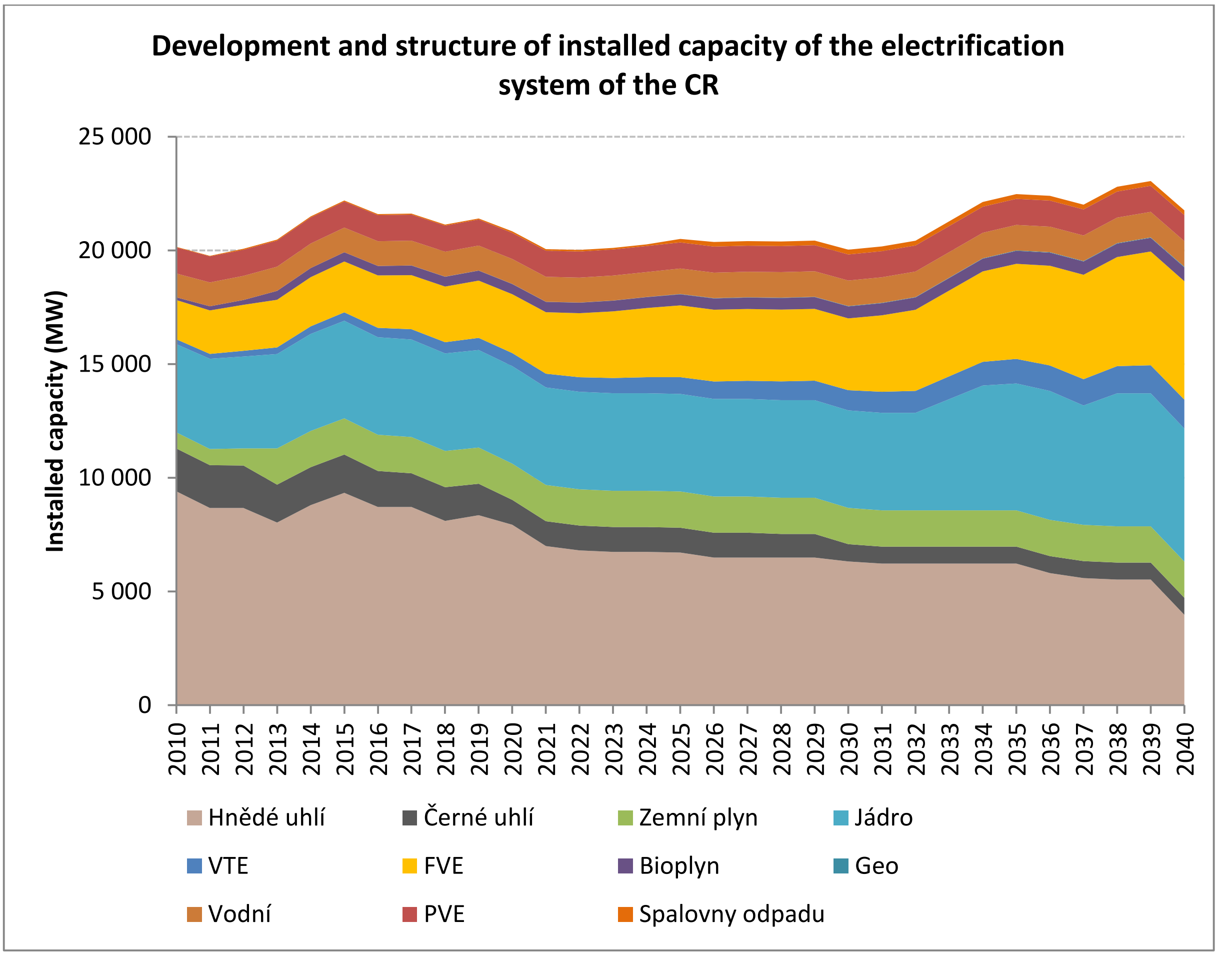
Total electricity production during the period in question will follow an upward trend. This will be in line with the expected gradual increase in electricity consumption in all sectors of the national economy, with the exception of household consumption (MOO). More marked deviations are then caused by the decommissioning of obsolete coal-fired power plants (in 2016 to 2025), the commissioning of new nuclear units and the replacement of the decommissioned units at DNPP with new nuclear sources (between 2033 and 2037). The main changes in the balance of electricity production include a gradual decline in energy generated from brown coal plants and an increase in energy generated by nuclear power plants. Electricity is expected to be generated from natural gas particularly in cogeneration[22]

[22] In line with the objectives and assumptions of this document, the optimised scenario also assumes the development of so-called micro cogeneration sources, primarily using natural gas. The category of these

and in peak sources operating at the top end of the semi-peak band. The main increase in electricity production from natural gas will occur by 2020, after which production will stabilise. In the corridor system, however, the installed capacity of natural gas sources will enable a certain increase in the volume produced (and therefore also exported), given suitable conditions in the electricity market.

Based on the expectations of the optimised scenario the output balance of the Czech ES remains consistently surplus; nevertheless, particularly between 2020 and 2025 it will fall considerably below the target (10 to 15 %). If there is a delay in the commissioning of new nuclear units, the Czech energy sector would fall into a slight deficit in capacity and especially in energy imports. After 2025, the potential of smart grids will offer other powers of regulation. This will particularly involve greater involvement of demand in system regulation and an increase in the extent of central and decentralised storage.

Graph No. 11: Development and structure of installed capacity of the electrification system of the CR



sources is not explicitly laid out, for the sake of conciseness, but the development of this source is taken into consideration in the predictions.

Hnědé uhlí = Brown coal
VTE = WPP
Vodní = Hydro
Černé uhlí = Black coal
FVE = FPP
PVE = PSP
Zemní plyn = Natural gas
Bioplyn = Biogas
Spalovny odpadu = Waste incinerator
Jádro = Nuclear
Geo = Geo

An important characteristic of the anticipated power balance trend is primarily the rise in installed capacity in sources of a variable supply nature, as shown in Graph No. 11. In sources of continuous power there is basically a slight decrease followed by stagnation. This means that due to the new capacities of RES the available capacity of sources will not increase any further. The regulation of energy sources must therefore entail higher and more effective involvement of consumption (i.e. demand) in the regulation process and an increase in storage system capacity with the completion of a management system for smart grids by 2025. The operability of energy sources is also almost entirely dependent on broad international cooperation between transmission system operators and a flexible cross-border trade mechanism.

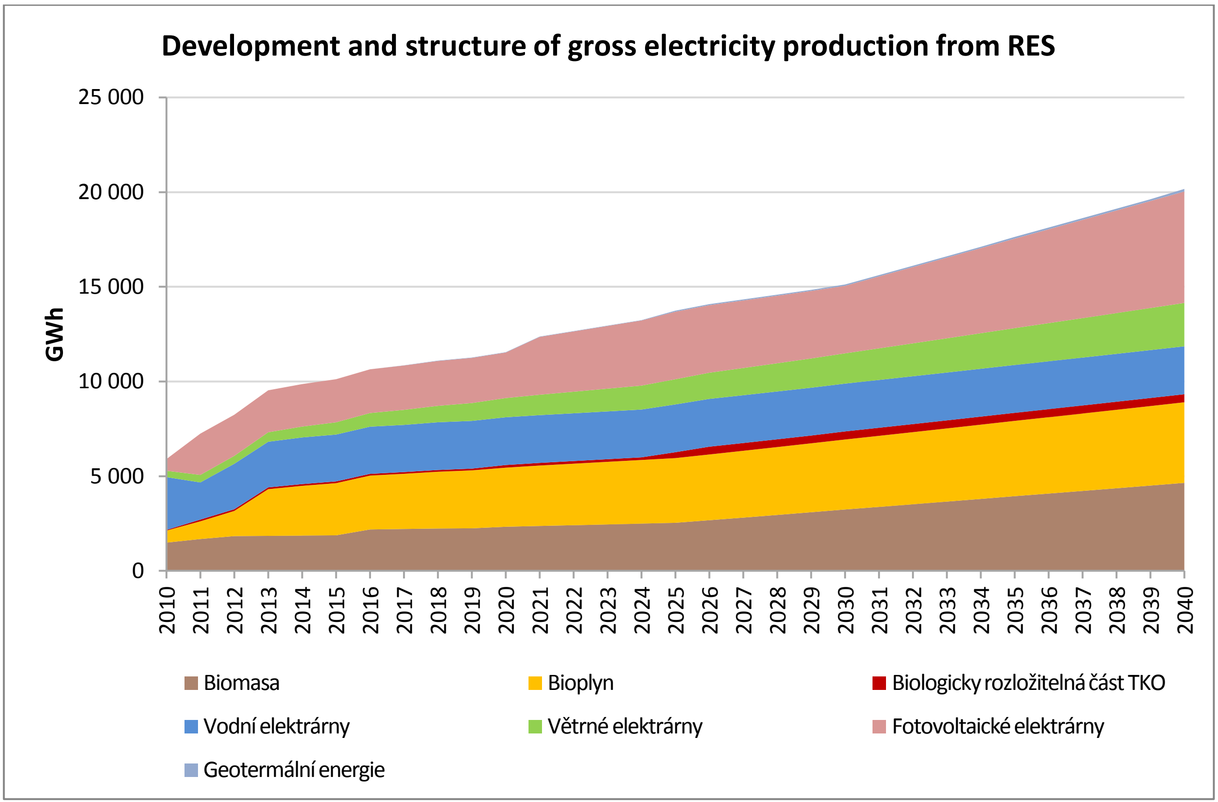
7.2.8 Development and structure of gross electricity production from RES

Table No. 8: Development and structure of gross electricity production from RES

RES		2010	2015	2020	2025	2030	2035	2040
Biomass	GWh	1 492.0	1 878.9	2 331.0	2 540.6	3 243.4	3 946.1	4 648.8
Biogas	GWh	634.6	2 754.0	3 121.2	3 416.0	3 696.0	3 976.0	4 256.0
Biodegradable part of MSW	GWh	35.6	91.2	138.1	310.0	425.2	425.2	425.2
Hydroelectric power plants*	GWh	2 789.5	2 475.6	2 522.7	2 524.5	2 526.2	2 528.0	2 529.7
Wind power plants	GWh	335.5	647.2	1 013.8	1 328.4	1 598.4	1 945.8	2 291.4
Photovoltaic power plants	GWh	615.7	2 275.5	2 403.6	3 567.4	3 567.4	4 725.7	5 883.9
Geothermal energy	GWh	0.0	0.0	18.4	55.2	69.0	92.0	138.0
Total	**GWh**	**5 902.8**	**10 122.3**	**11 548.8**	**13 742.0**	**15 125.6**	**17 638.7**	**20 173.0**

** In 2010 electricity production from hydro plants was exceptionally high due to the particularly favourable weather. The outlooks assume average rainfall, which causes a relative decline in production.*

Graph No. 12: Development and structure of gross electricity production from RES



Biomasa = Biomass
Vodní elektrárny = Hydro power plants
Geotermální energie = Geothermal energy
Bioplyn = Biogas
Větrné elektrárny = Wind power plants
Biologicky rozložitelná část TKO = Biodegradable part of MSW
Fotovoltaické elektrárny = Photovoltaic power plants

Total electricity production from renewable and secondary sources of energy will continue to rise between 2010 and 2040. This is motivated by an effort to make the maximum possible use of this domestic energy source, although on the assumption that it is competitive. Besides hydro energy, the potential for which has now been practically exhausted after more than a century of developing hydro power stations in this country, there is clear potential for the further development of biogas stations and PPS. Electricity generation from biomass and waste will continue to develop until domestic potential has been exhausted (according to the Action Plan for Biomass, statistics and forecasts concerning the production of waste and its fuel component).

A gradual fall in consumption is expected in oil and oil products. The reason for this will be the application of carbon taxes on heating oil, the trend for further reducing vehicle consumption and also the emergence of alternative vehicle propulsion systems.

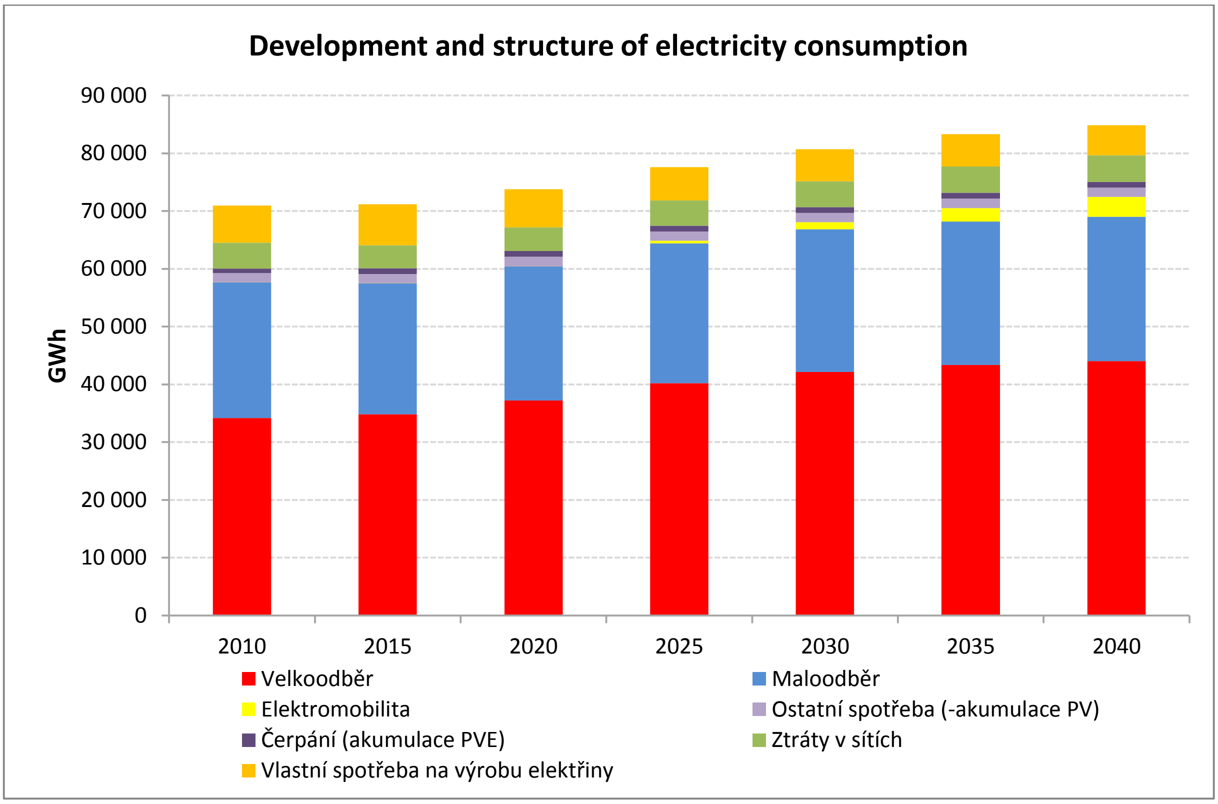
7.2.9 Development and structure of electricity consumption

Table No. 9: Structure of electricity consumption

Consumption		2010	2015	2020	2025	2030	2035	2040
Industrial customers	GWh	34 162.0	34 857.4	37 228.2	40 238.1	42 140.4	43 362.3	44 053.1
Small-scale customers	GWh	23 505.9	22 644.1	23 177.7	24 195.9	24 744.5	24 844.4	24 956.6
Entrepreneurs	GWh	8 478.4	8 342.2	8 909.6	9 629.9	10 085.2	10 377.6	10 543.0
Households	GWh	15 027.5	14 301.9	14 268.1	14 566.0	14 659.3	14 466.8	14 413.6
Other consumption	GWh	1 586.7	1 600.0	1 620.0	1 620.0	1 620.0	1 620.0	1 620.0
Net of mobility	GWh	**59 254.6**	**59 101.5**	**62 025.9**	**66 054.0**	**68 504.9**	**69 826.7**	**70 629.7**
Electromobility	GWh	0.9	6.8	50.9	438.1	1 189.6	2 328.5	3 442.2
Net consumption		**59 255.5**	**59 108.3**	**62 076.7**	**66 492.1**	**69 694.5**	**72 155.2**	**74 071.9**
PHP accumulation	GWh	795.0	1 000.0	1 000.0	1 000.0	1 000.0	1 000.0	1 000.0
Network losses	GWh	4 467.0	3 960.4	4 120.4	4 358.5	4 490.2	4 547.8	4 572.2
Own consumption	GWh	6 446.0	7 126.7	6 604.3	5 773.0	5 523.3	5 612.8	5 191.9
Gross consumption	GWh	**70 963.5**	**71 195.4**	**73 801.5**	**77 623.6**	**80 708.0**	**83 315.8**	**84 836.0**
electricity accumulation*	GWh	0.0	20.0	307.6	734.4	1 033.2	1 334.3	1 635.1

** As expected, a proportion of consumption will be covered by accumulation. Due to the specific nature of this item accumulation has been explicitly separated from consumption.*

Graph No. 13: Development and structure of electricity consumption



Velkoodběr = Industrial customers
Elektromobility = Electromobility
Čerpání (akumulace PVE) = Pumping (PSP storage)
Vlastní spotřeba na výboru elektřiny = Own consumption on energy generation
Maloodběr = Small-scale customers
Ostatní spotřeba (- akumulace PV) = Other consumption (IP storage)
Ztráty v sítích = Network losses

During the entire period in question, from 2010 to 2040, total net electricity consumption is expected to rise. There will be an increase amongst industrial customers, small-scale consumers (with the exception of households) and also in other forms of electricity consumption. The *network losses* and *own consumption* categories are then expected to stagnate. Besides savings resulting from the reduction in the energy intensity of appliances, there will be an increase in the use of electricity for pumping heat from the environment (heat pumps), as well as the replacement of solid fuels in final consumption and the use of electricity in transport.

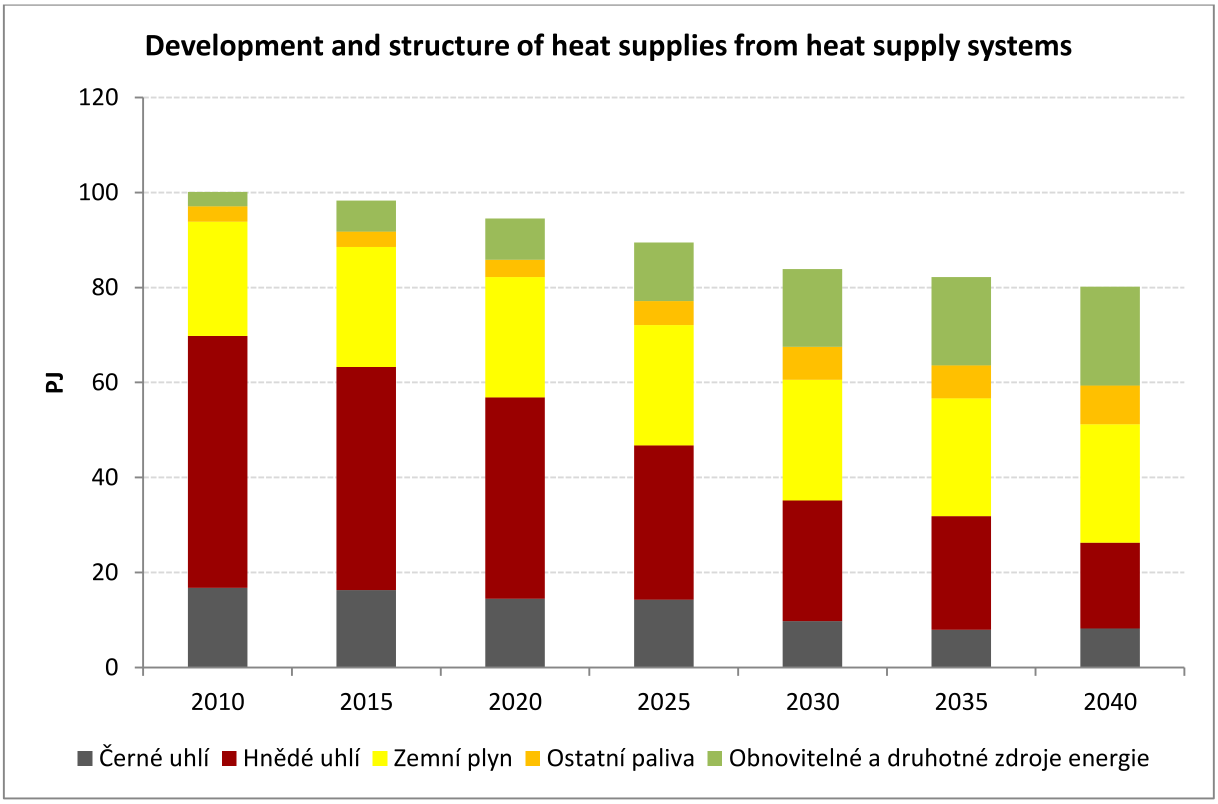
7.2.10 Development and structure of heat supplies from heat supply systems

Table No. 10: Development and structure of heat supplies from heat supply systems

HSS		2010	2015	2020	2025	2030	2035	2040
Black coal	PJ	16.8	16.3	14.5	14.3	9.8	7.9	8.2
Brown coal	PJ	53.0	47.0	42.4	32.4	25.4	23.9	18.1
Natural gas	PJ	24.0	25.3	25.3	25.4	25.4	24.8	25.0
Other fuels	PJ	3.2	3.2	3.7	5.1	7.0	7.0	8.1
RES	PJ	3.0	6.6	8.7	12.3	16.4	18.6	20.8
Total	PJ	**100.1**	**98.3**	**94.5**	**89.5**	**83.9**	**82.2**	**80.2**

Note: other fuels – coking, blast and other gases, industrial waste, alternative fuels, municipal solid waste (non-renewable), primary heat

Graph No. 14: Development and structure of heat supplies from heat supply systems

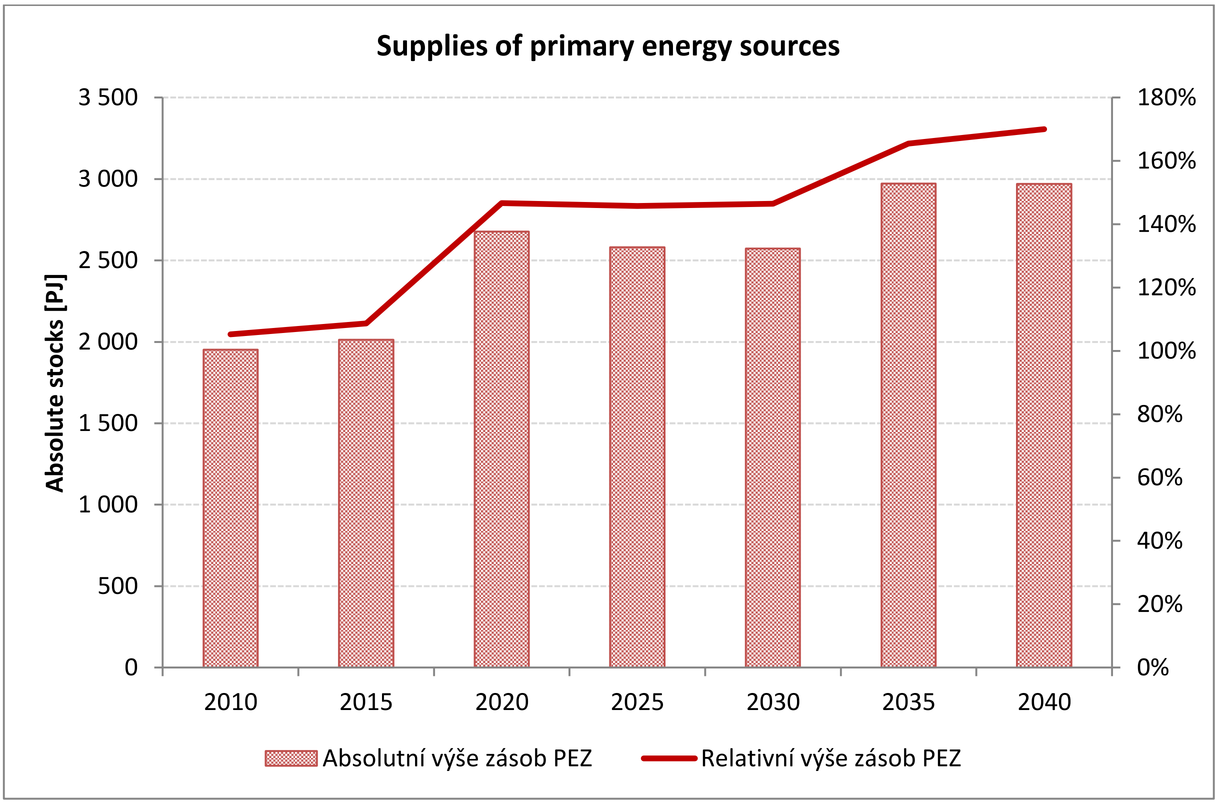


Černé uhlí = Black coal
Hnědé uhlí = Brown coal
Zemní plyn = Natural gas
Ostatní paliva = Other fuels
Obnovitelné a druhotné zdroje energie = Renewable and secondary energy sources

A considerable fall in consumption is expected in heat supply systems between 2010 and 2040, primarily due to savings measures in final consumption as well as in heat distribution. There will be a rise in the ratio of renewable and secondary sources of energy, primarily biomass and waste as important domestic energy sources. In contrast, the proportion of another, currently decisive domestic course, i.e. high-quality brown coal, will gradually fall during the period in question, with a sharp decline between 2035 and 2040. In the case of natural gas 2010 was an exceptional year due to the long-lasting extremely low temperatures. In the coming years gas consumption for the production of heat in heat supply systems is expected to return to the level it was at prior to that date, with a slight annual increase in consumption. This is the start of a longer-term trend seeing greater use of natural gas primarily in small and medium-sized heating systems.

7.2.11 Security indicators

Graph No. 15: PES contingency supplies

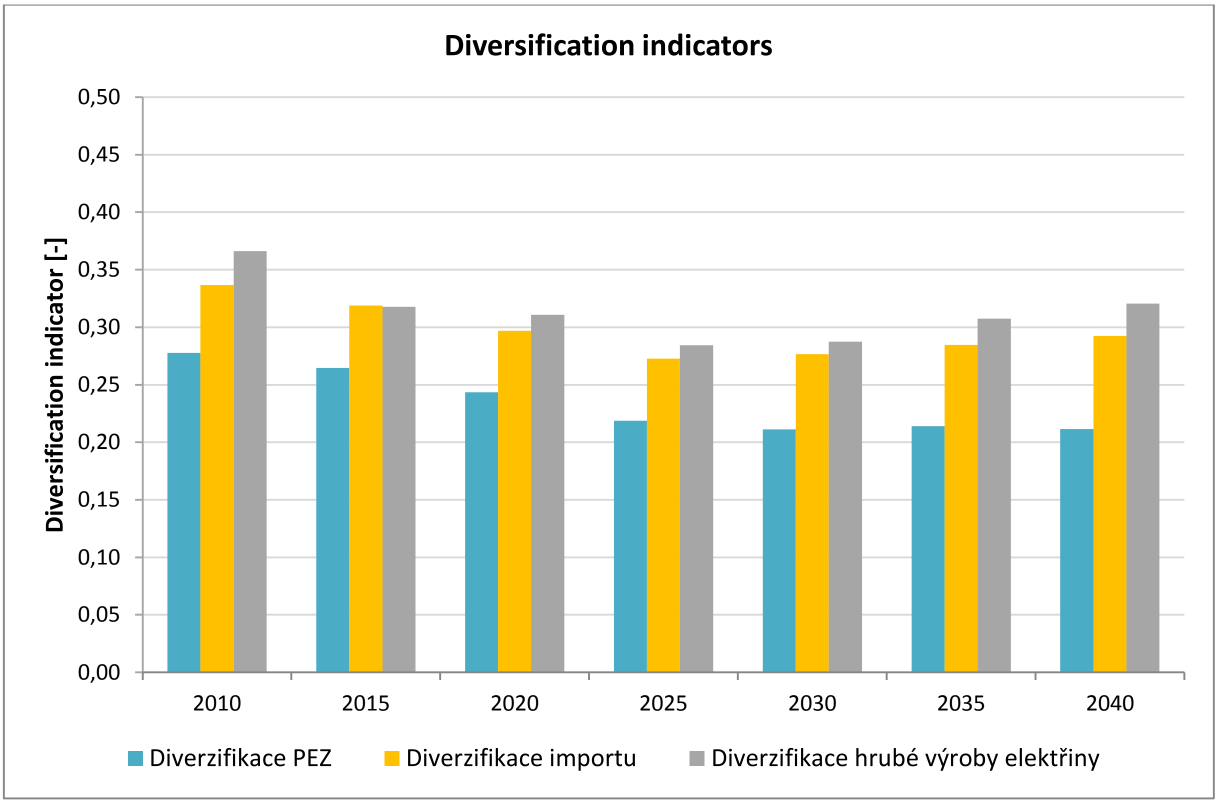


Absolutní výše zásob PEZ = Absolute PES reserves
Relativní výše zásob PEZ = Relative PES reserves

Contingency supplies of primary energy are determined according to the equations given in Section 4.1, while the coefficient k_{KP} is considered as 100/360, i.e. 100 days of net annual imports of liquid fuels; coefficient k_{ZP} has the value 0.35, i.e. 35 % of annual domestic natural gas consumption; coefficient k_{TP} is considered as 1.25, which takes account of the quantity of coal and coal derivatives in the landfills of mining companies and producers, estimated at 1.25 times annual domestic consumption; coefficient k_{JP} has the historical value of 2 and in the future (after 2020), after the implementation of all the necessary measures, of 4, which will represent stocks to cover one four-year nuclear source fuel cycle; coefficient k_{iOZE} is considered as 1, and coefficient k_{nOZE} is 1.5.

Depending on the development and structure of the use of the various forms of energy prior to 2030, contingency supplies of primary energy sources will tend to stagnate, with a subsequent increase caused by the rise in the use of nuclear fuel, which due to the high fuel concentration and assuming the relevant costs are invested, can be stored in the Czech Republic in quantities to cover at least one fuel cycle to meet the needs of domestic nuclear plants (the length of one fuel cycle is considered to be four years). This case scenario enables diversification over a longer period of time.

Graph No. 16: Diversification indicators



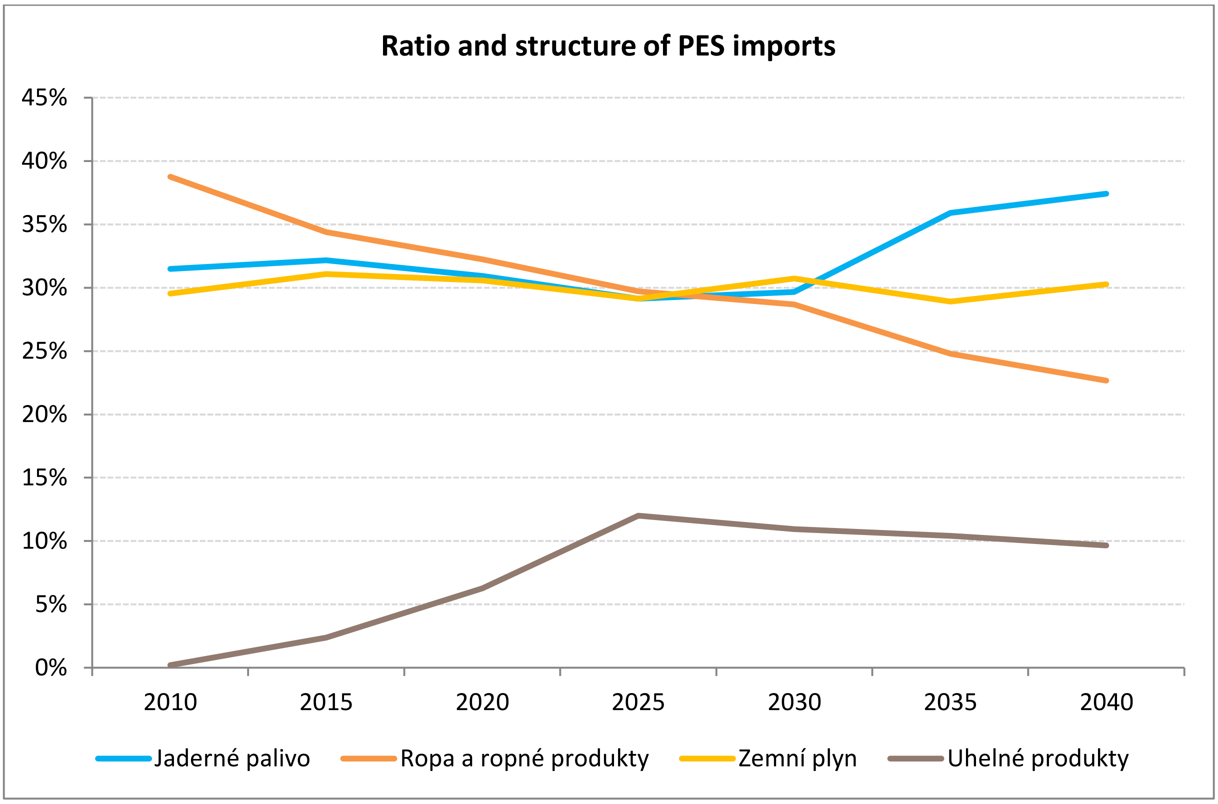
Diverzifikace PEZ = Diversification of PES
Diverzifikace importu = Diversification of imports
Diverzifikace hrubé výroby elektřiny = Diversification of gross electricity generation

The diversification indicators of primary energy sources, gross electricity generation and imports represent the uniformity of the ratios of the individual types of PES to their total consumption, domestic electricity generation and total imports. In general, the lower the value of this dimensionless indicator, the higher the level of diversification. In the case of PES diversification the indicator is in the interval <1/5;1>, while the one represents the proportion of a single type of fuel in the energy mix, while 1/5 indicates the equal distribution of the various PES in the mix (the number five in the denominator corresponds to the five categories from which the diversification indicator was calculated, these being gas, liquid and solid fuels, nuclear fuel and RES). Graph No. 16 shows that the gradual phasing out of the majority fuel, i.e. brown coal, will gradually improve diversification of the fuel mix, which from 2025 will be only slightly above the minimum value of 0.2, and in the target year 2040 will be at 0.2, indicating the best possible diversification.

The import diversification indicator has values in the interval <1/4;1>, and includes imports divided up into four categories, these being natural gas, oil and oil products, coal and coal derivatives, and nuclear fuel. It is abstracted from imports of other fuels. As expected, import diversification, as with PES diversification, is also most strongly affected by the fall in demand for brown coal, while the figure will drop by 2025 to a value that is only slightly more than the theoretical minimum of 0.25 and, due to the increasing use of nuclear fuel, will rise to a level which is still far lower and thus more favourable than in the base year of 2010.

Diversification of gross electricity production is determined using seven categories of PES, divided up as black coal, brown coal, natural gas, other gases, renewable and secondary sources, nuclear fuels and other fuels, and thus has values in the interval <1/7;1>. From the following forecasts for the diversification trends in gross electricity production as shown in Graph No. 16 it is clear that the size is most influenced by the ratio of stable sources, i.e. coal and nuclear power plants. In this respect the value of this indicator will first improve gradually due to the loss of dominance of domestic coal, and after 2030 will then deteriorate again as a result of this dominance being assumed by nuclear fuel. However, due to the increase in the use of renewable and secondary sources of energy, despite the distribution of electricity production in the context of the individual fuels and therefore also the diversification of gross electricity production, the situation will be more favourable in the target year 2040 as compared to the base year of 2010.

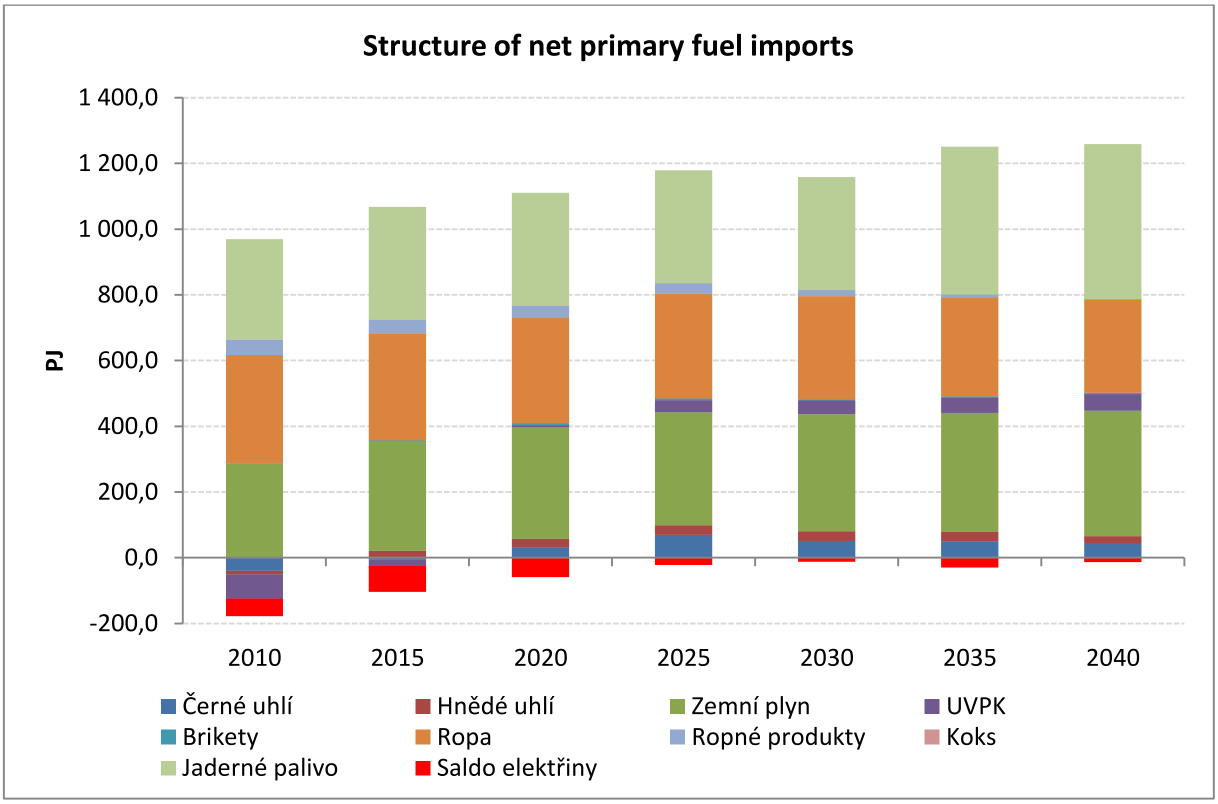
Graph No. 17: Ratio of imports of the individual primary fuels



Jaderné palivo = Nuclear fuel
Ropa a Ropné produkty = Oil and oil products
Zemní plyn = Natural gas
Uhelné produkty = Coal products

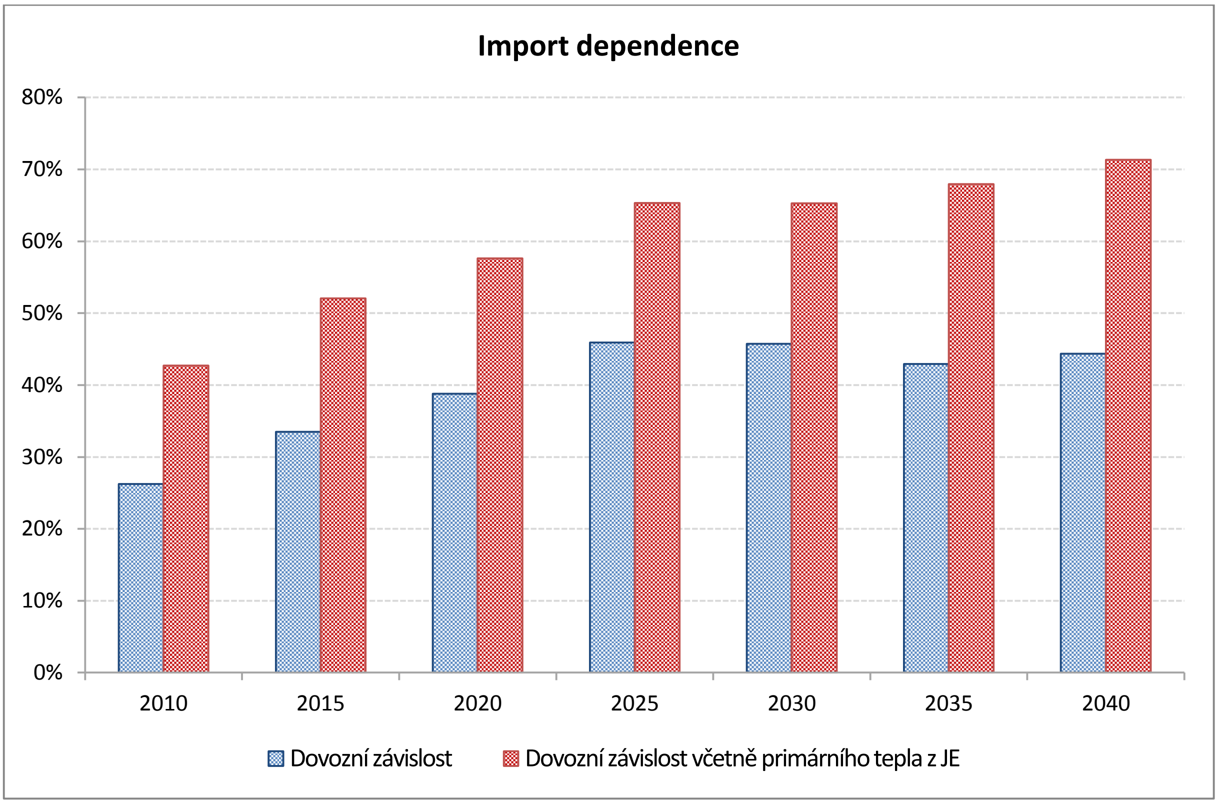
The ratio of primary fuel imports is computed as the ration of imports of primary energy from a particular fuel to total imports of primary energy sources. Between 2030 and 2035 there is an evident increase in imports of primary energy contained in imported nuclear fuel, at the level of 36 %, with the ratio then stagnating until 2040. The ratio of natural gas imports to primary energy sources will remain at around 30 %, while in absolute terms natural gas imports will increase gradually throughout the period. The consumption of oil products, depending primarily on changes in the transport sector, will fall steadily, both in absolute terms and also in proportion to total imports of primary fuels. The Czech Republic will also gradually become a net importer of black coal, both steam coal and coking coal. It is estimated that coal imports will peak in around 2025, followed by a gradual slight decline caused by the decommissioning of certain domestic black coal sources. The composition of imports, particularly after 2025, will contribute to a certain deterioration in import diversification - see Graph No. 16.

Graph No. 18: Structure of net primary fuel imports



Černé uhlí = Black coal
Brikety = Briquettes
Jaderné palivo = Nuclear fuel
Hnědé uhlí = Brown coal
Ropa = Oil
Saldo elektřiny = Electricity balance
Zemní plyn = Natural gas
Ropné produkty = Oil products
UVPK = Black coking coal
Koks = Coke

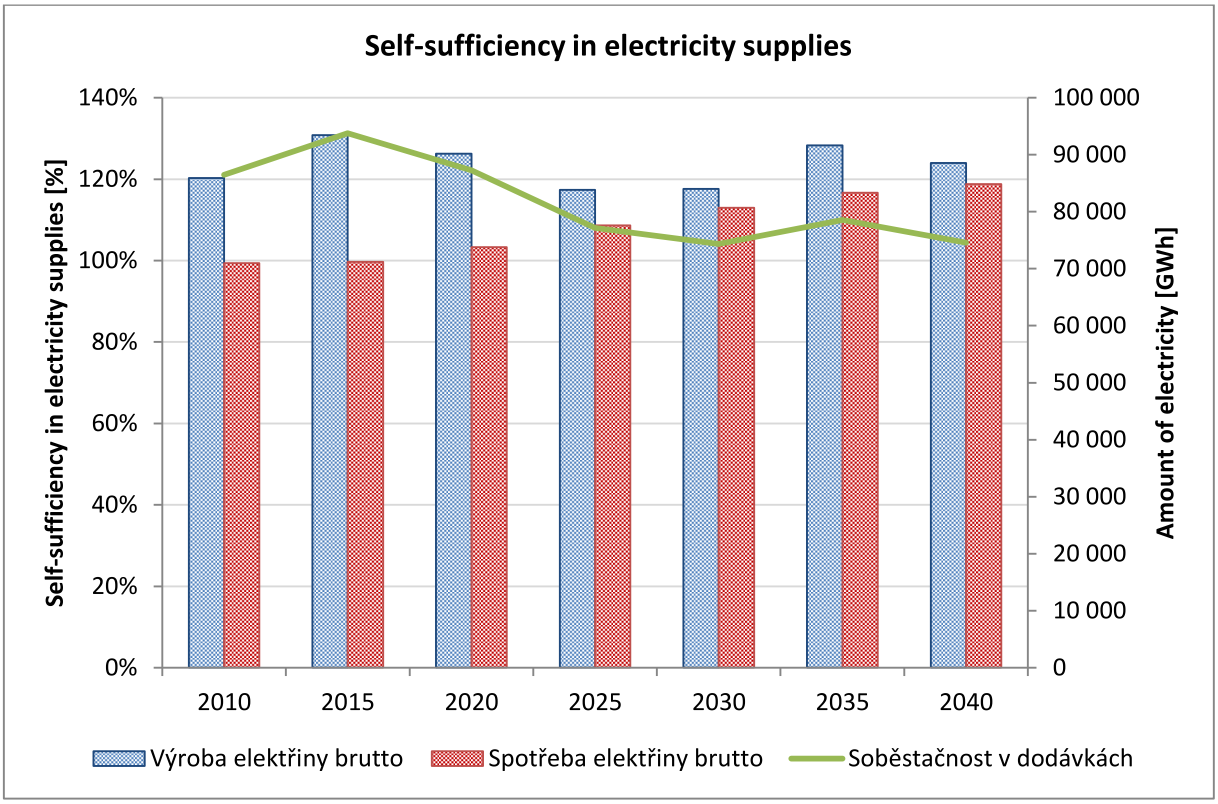
Graph No. 19: Import dependence



Dovozní závislost = Import dependence
Dovozní závislost včetně primárního tepla z JE = Import dependence including primary heat from NE

Despite the strong emphasis on the use of domestic energy sources, we may expect a gradual increase in energy imports accompanied by a rise in the import dependence indicator, expressed as the ratio between imported and total primary energy sources. This is primarily down to the anticipated increase in imports of coal products, due to the gradual shortage of domestic coal, and also of nuclear fuel as a source which the Czech Republic does not have at its disposal. The development of import dependence excluding primary heat from nuclear power plants, which indicates the ratio of fossil fuel imports, is primarily down to a combination of the falling trend in oil consumption, primarily in transport, the contradictory trend in the import of coal products and, last but not least, the total consumption of primary energy sources in the year in question. The result is therefore a fall in import dependence for fossil fuels in the period between 2025 and 2035 with a rise in subsequent years, as demonstrated by Graph No. 18.

Graph No. 20: Self-sufficiency in electricity supplies

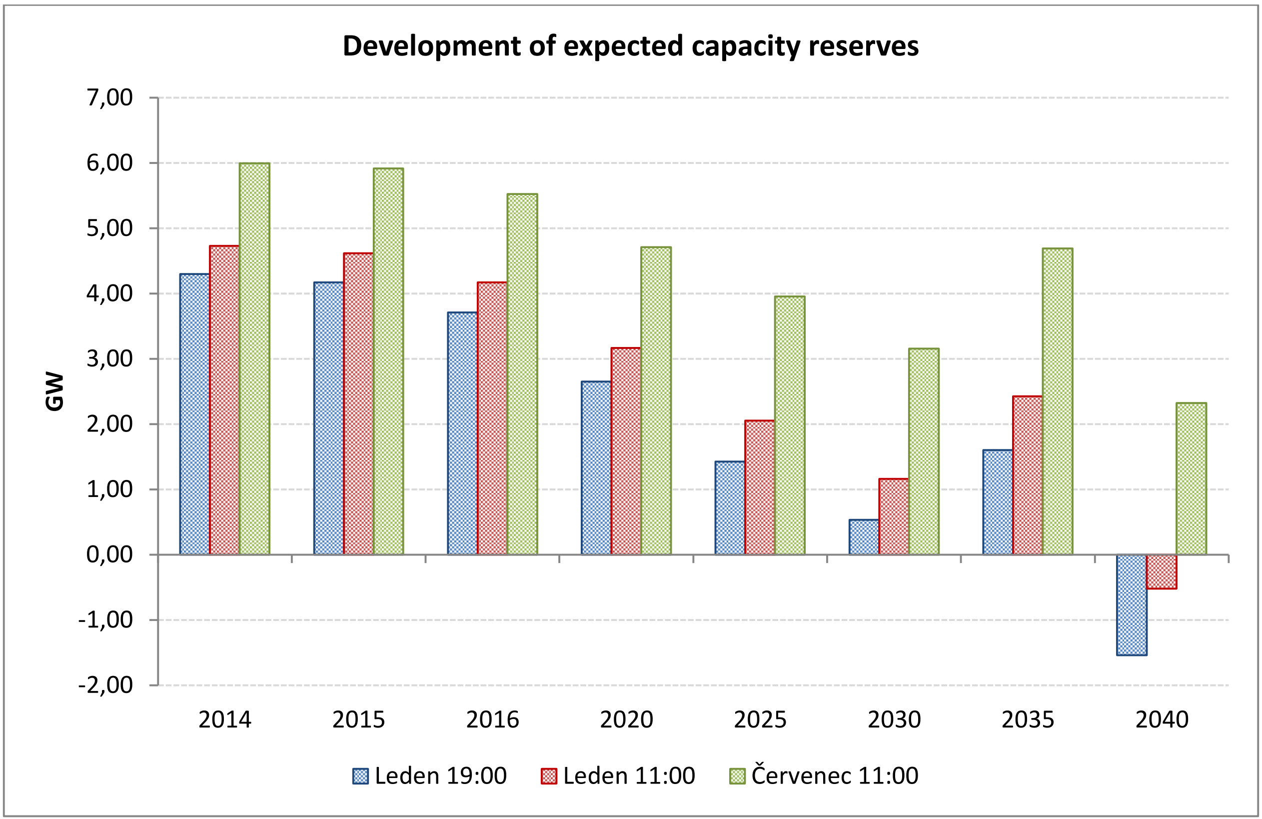


Výroba elektřiny brutto = Gross electricity generation
Spotřeba elektřiny brutto = Gross electricity consumption
Soběstačnost v dodávkách = Supply self-sufficiency

Due to the gradual rise in final electricity consumption, particularly amongst large industrial customers, the size of surplus production will fall to a practically balanced level in around 2030, after which the trend will essentially copy that of domestic electricity production, where the rate of self-sufficiency in supplying electricity through domestic generation will be around 100 %, although it may temporarily fall below that level. If the source mix and electricity consumption trends go as predicted, there should be moderate electricity imports in the target year within the framework of the State Energy Policy.

In order to guarantee the state's energy security under all circumstances it is essential to ensure that the source base meets the security requirements set by the ENTSO-E international system and generation adequacy standards.

Graph No. 21: Development of expected capacity reserves



Note: The calculation of the generation adequacy indicator does not take account of the potential for reducing the load on consumption management systems, due to the high level of uncertainty over the development and use of smart grid technology.

Source: Underlying data (MIT); ČEPS a.s.

Leden 19:00 = January 19:00
Leden 11:00 = January 11:00
Červenec 11:00 = July 11:00

Graph No. 21 demonstrates significant limitations on free available reliable capacity that could be used to meet unexpected outages in the system at the Czech Republic level in around 2030. The lack of base load sources is due to the decommissioning of old high-emission sources and the shortage of brown coal, particularly due to the closure of the mine at the ČSA quarry coupled with the later construction of new low-emission base load sources (new nuclear sources). Graph No. 21 also indicates that at the end of the time frame in question reliable free capacity, especially at the start of the year, might not be enough to cover the system load.

In the short term, this problem can be resolved by importing electrical energy from abroad. However, a problem may arise, as pointed out by ENTSO-E[23] in its generation adequacy

[23] ENTSO-E (2013) Scenario Outlook and Adequacy Forecast 2013 – 2030, s. 53-54

outlook for 2013-2030 with the implementation of the EU2020 scenario[24], when during the winter period the Central European region simultaneously faces a deficit, i.e. it might be that there is nowhere additional power can be imported from. The ENTSO-E report warns that only a scenario that reflects the settlement of the energy market and the economic meaningfulness of constructing new sources can lead to a surplus power balance in compliance with the SOAF requirements.

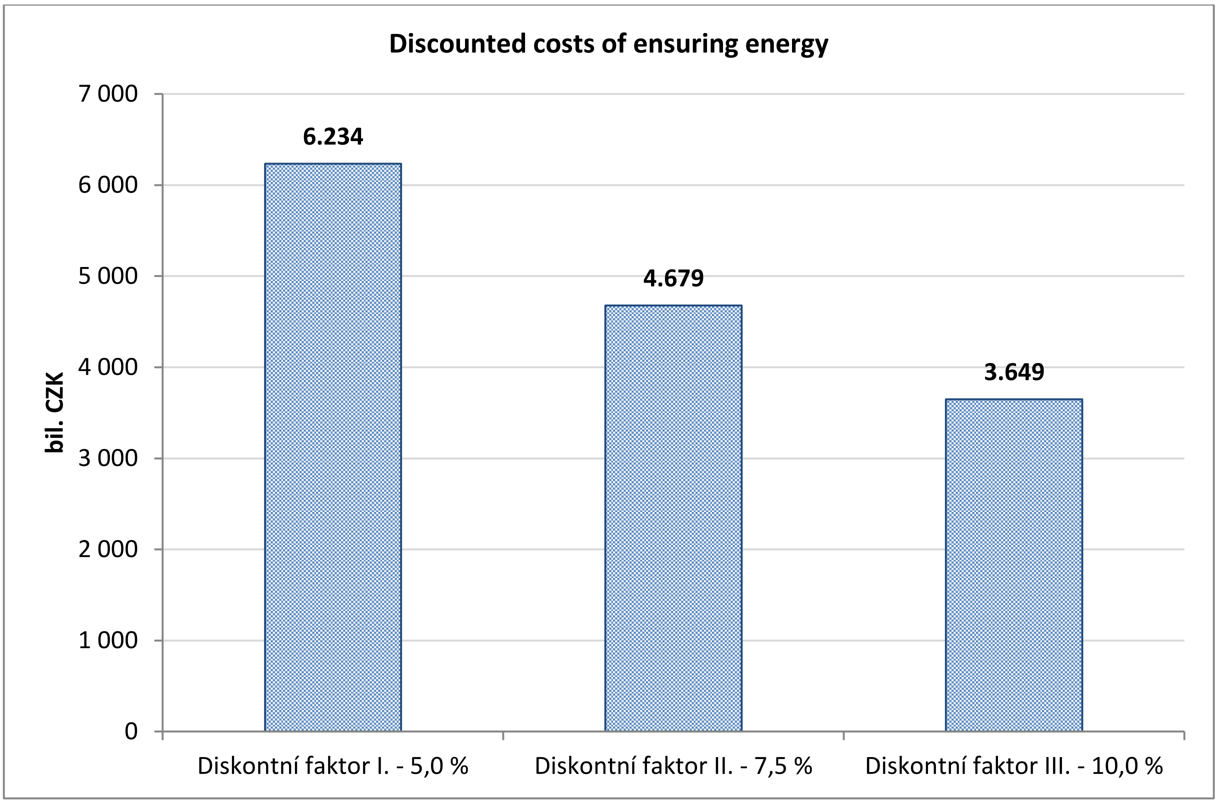
If no new system base load sources were to be built beyond those now under construction, after 2030 the Czech Republic would lose its ability to cover domestic consumption through domestic generation. For the higher rate of consumption used in the optimised scenario the import balance would be approx. 6 % (as a percentage of anticipated domestic consumption in the year in question) in 2033, with a gradual rise to approx. 17 % in 2040. If electricity consumption were to develop according to the high MO scenario, the Czech Republic's import balance would be at the level of around 5 % in 2025, with a gradual increase to approx. 25 % by 2040.

With regard to ensuring the reliability and high quality of electricity supplies, a problem could arise if units of the Dukovany nuclear power plant had to be decommissioned for whatever reason before the reach the end of their useful life. In such a case they would need to be replaced by a new nuclear source with equivalent capacity.

[24] Basic assumptions of this scenario include: meeting EU targets for electricity generation from renewable sources by 2020, meeting the targets of the National Action Plans for RES in the individual member states or similar governmental documents, individual national policies taken into account for phasing out the proportion of power generated from fossil fuels, and estimates from national TS operators if there is a lack of the relevant data.

7.2.12 Competitiveness indicators

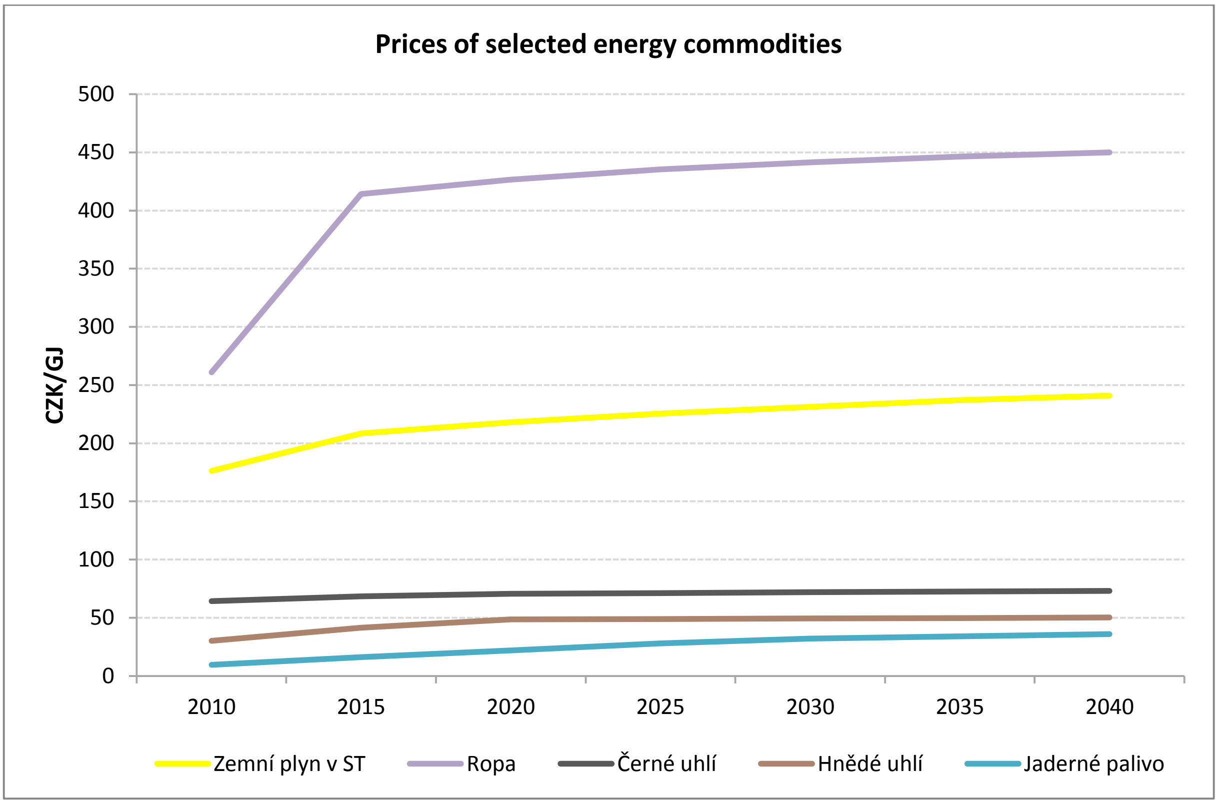
Graph No. 22: Discounted costs of ensuring energy



Diskontní faktor I. – 5,0 % = Discount factor I. – 5.0 %
Diskontní faktor II. – 7,5 % = Discount factor II. – 7.5 %
Diskontní factor III. – 10,0 % = Discount factor III. – 10.0 %

Discounted costs include the costs of operating the fuel mix, both variable costs (particularly fuel and other operating costs) and fixed operating costs and investment costs. They also include investment in the infrastructure of transmission and distribution networks, the costs of energy savings, costs associated with the recertification of the Dukovany nuclear power plant and, last but not least, the costs of importing PES. Due to the high sensitivity of the discount factor used, three scenarios have been used to cover the development of discounted costs depending on the discount factor chosen. The costs are relative (discounted) to the reference year of 2010.

Graph No. 23: Prices of selected energy commodities

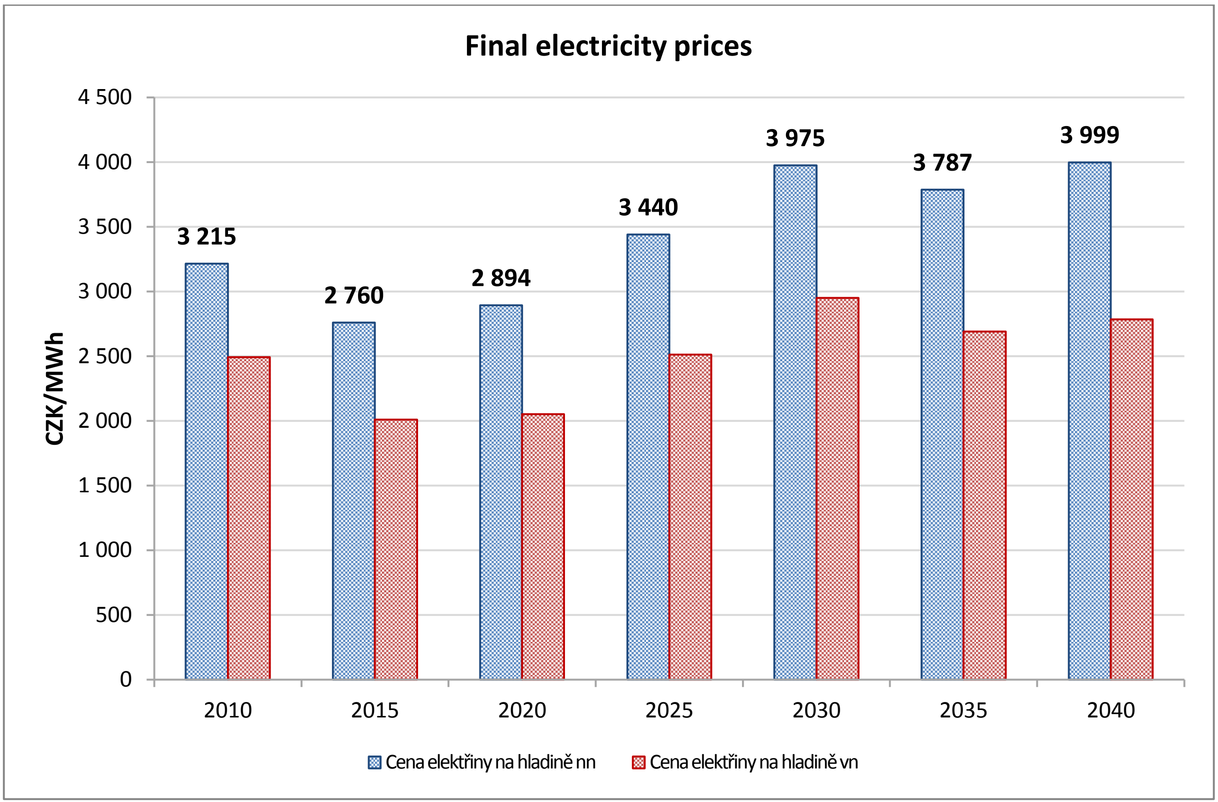


Note: These are nominal prices reduced by the level of inflation, with 2011 as reference

Zemní plyn v ST = Natural gas in ST
Ropa = Oil
Černé uhlí = Black coal
Hnědé uhlí = Brown coal
Jaderné palivo = Nuclear fuel

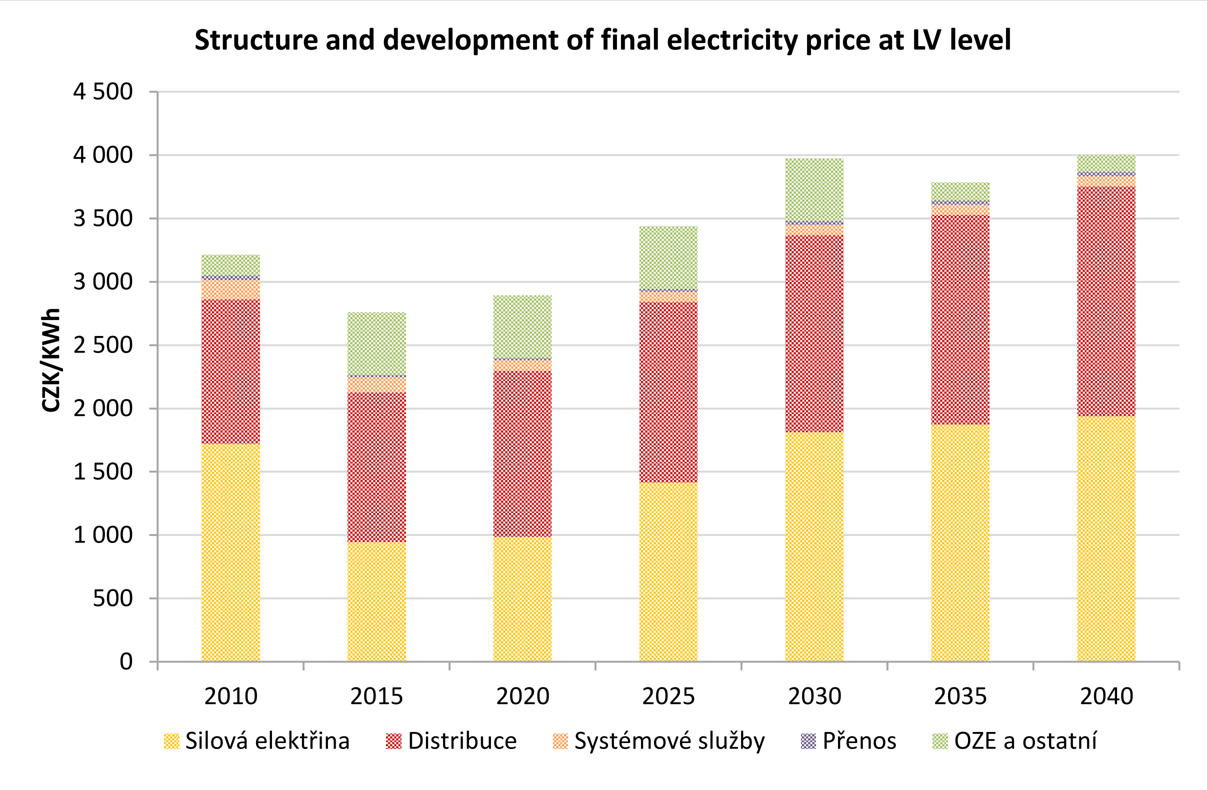
The trend in oil and gas prices is based on IEA (New Policies Scenario)/OECD analyses backed up by analyses performed within the framework of IEF. This trend is, however, burdened by a high degree of uncertainty. In the future we may expect a trend in separating the price of natural gas from the price of oil or oil products. Despite the influx of new sources of gas onto the world market, it will be the impact of the increasing demand of the populace and the influence of the increase in industry in large developing economies that will predominate. Rising prices will act as a certain stabilising force. Black coal is expected to see a more gradual increase, although the close link between the price of coal and the price of natural gas is expected to continue. The price of brown coal is more cost price, affected considerably by state legislation and indirect regulation. The reason for this is that this commodity is not particularly traded on the global or the European markets. The prices given in Graph No. 23 are quantified on the basis of real prices; specifically, the constant prices in 2011.

Graph No. 24: Final electricity prices



Cena elektřiny na hladině nn = LV electricity price
Cena elektřiny na hladině vn = HV electricity price

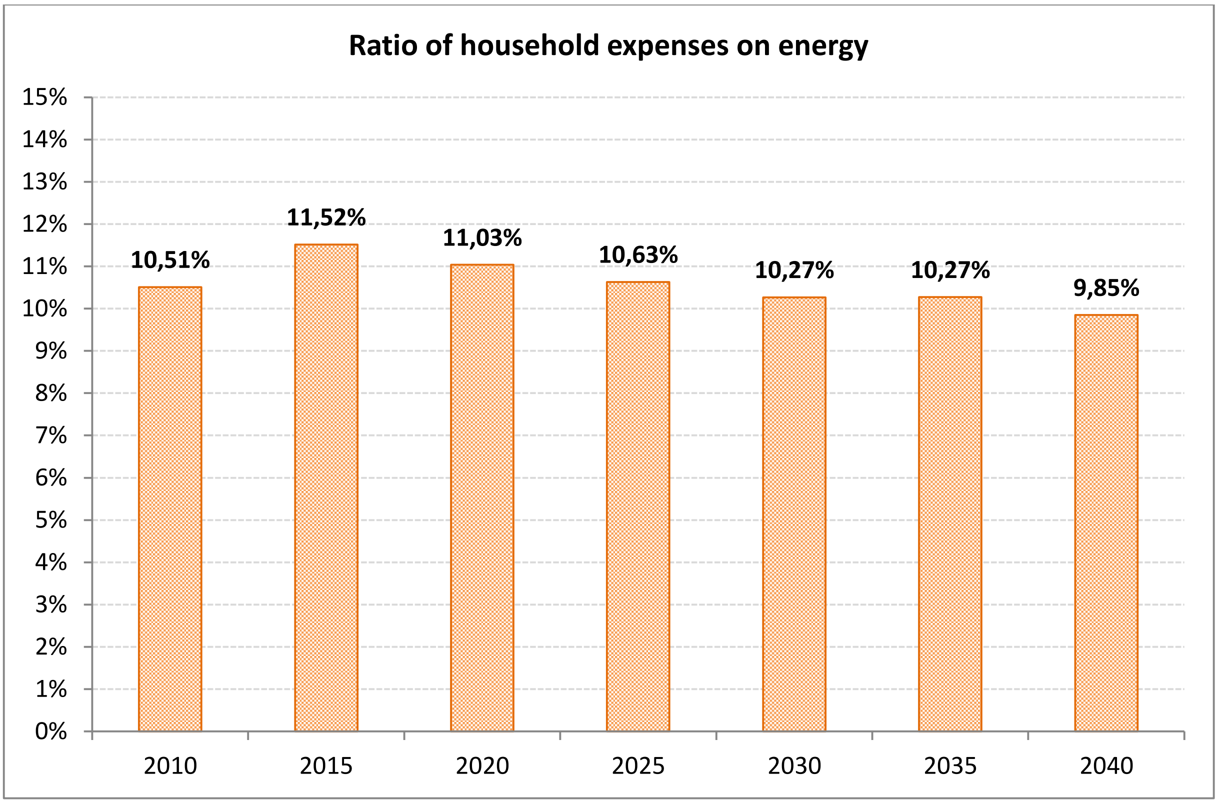
Graph No. 25: Structure and development of final electricity price at LV level



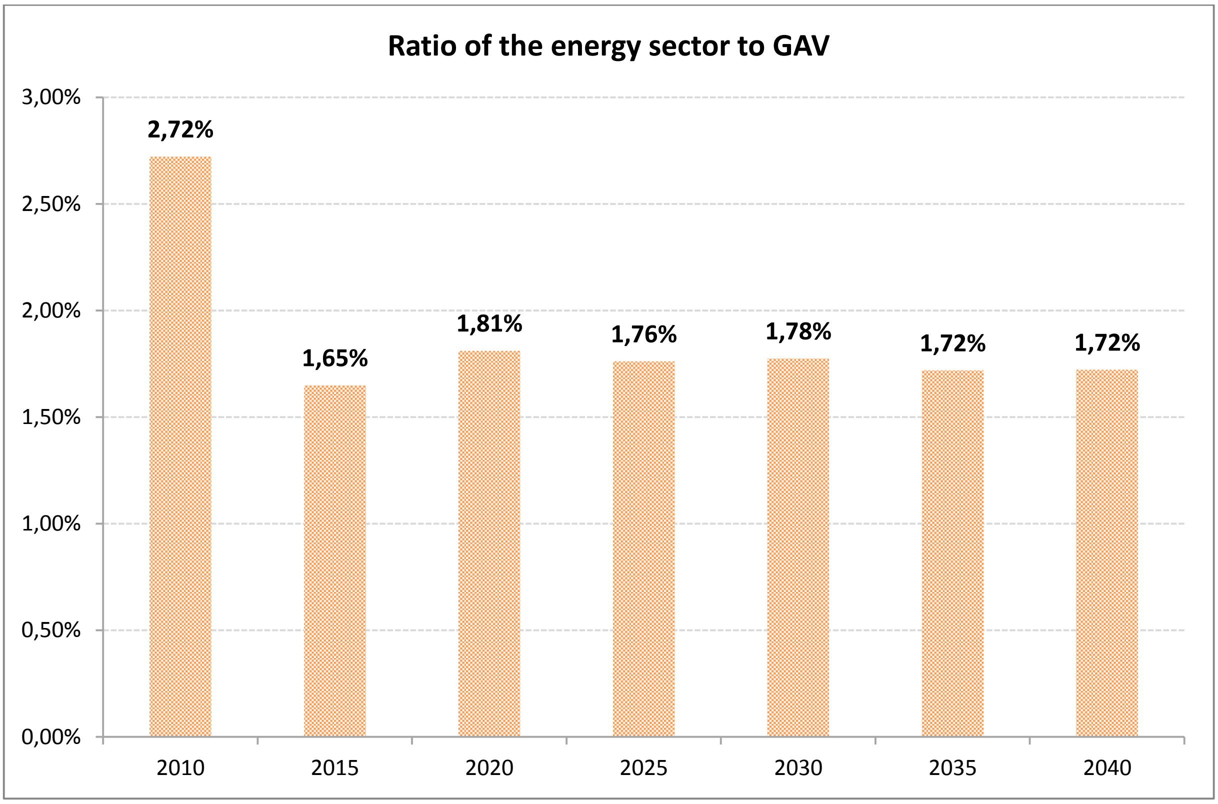
Silová elektřina = Power electricity
Distribuce = Distribution
Systémové služby = System services
Přenos = Transmission
OZE a ostatní = RES and others

Prior to 2030 the trend in final electricity prices for consumers will be affected particularly by the manner in which the obligatory costs of supporting RES are covered. After 2030 the impact of RES fees will be reduced significantly. Another factor that is reflected in prices is the renovation and development of the transmission system as well as the reduction and subsequent stabilisation of the costs of providing system services (SyS) in connection with the integration of system management and as the level of costs of SyS in the Czech Republic approaches that of countries with similar electrification systems. After 2020 there will be an increase in the regulated component of the price of electricity due to the implementation of smart grids, the development of distribution networks and accumulation. Key factors for the commodity component of the price in the future are the trend in the prices of emission allowances, with the optimised scenario taking account of the effect of backloading and of the introduction of the stabilisation reserve after 2020. Another important factor is the speed at which market distortion is eliminated, as thus currently exerts great pressure to reduce the price of electricity. This will not be apparent until at least the middle of this decade. The subsequent slight long-term increase is caused partly by the impact of more expensive emission allowances and partly by the necessary renewal of the production portfolio throughout Europe. This is manifested either directly in the price of electricity (i.e. the commodity component) or within the framework of the introduction of various forms of capacity mechanisms within the EU. The gradual increase in the price may be accompanied by short-term deviations (lasting several years) as a result of the degree of market distortion and the irregular development of the sector in relation to the stability of the legislation and the broader regulatory framework.

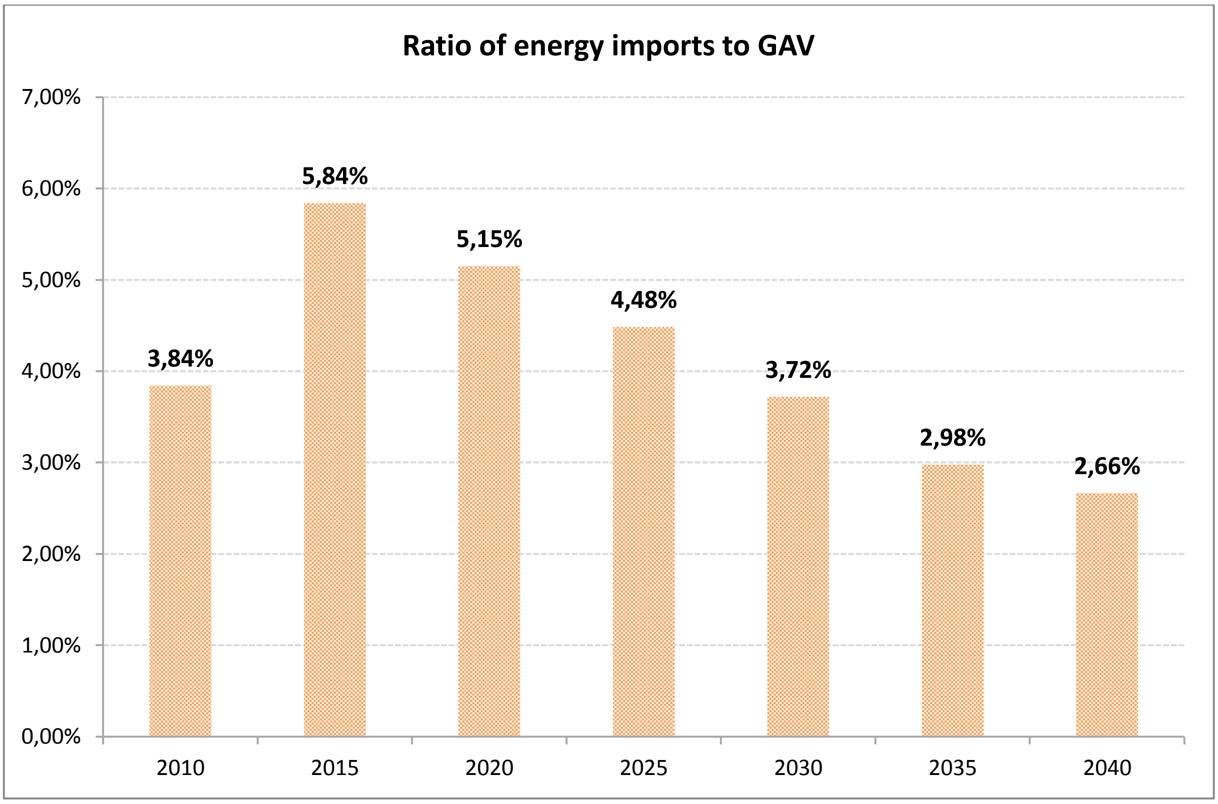
Graph No. 26: Ratio of household expenses on energy



Graph No. 27: Ratio of the energy sector to GAV at fixed 2005 prices

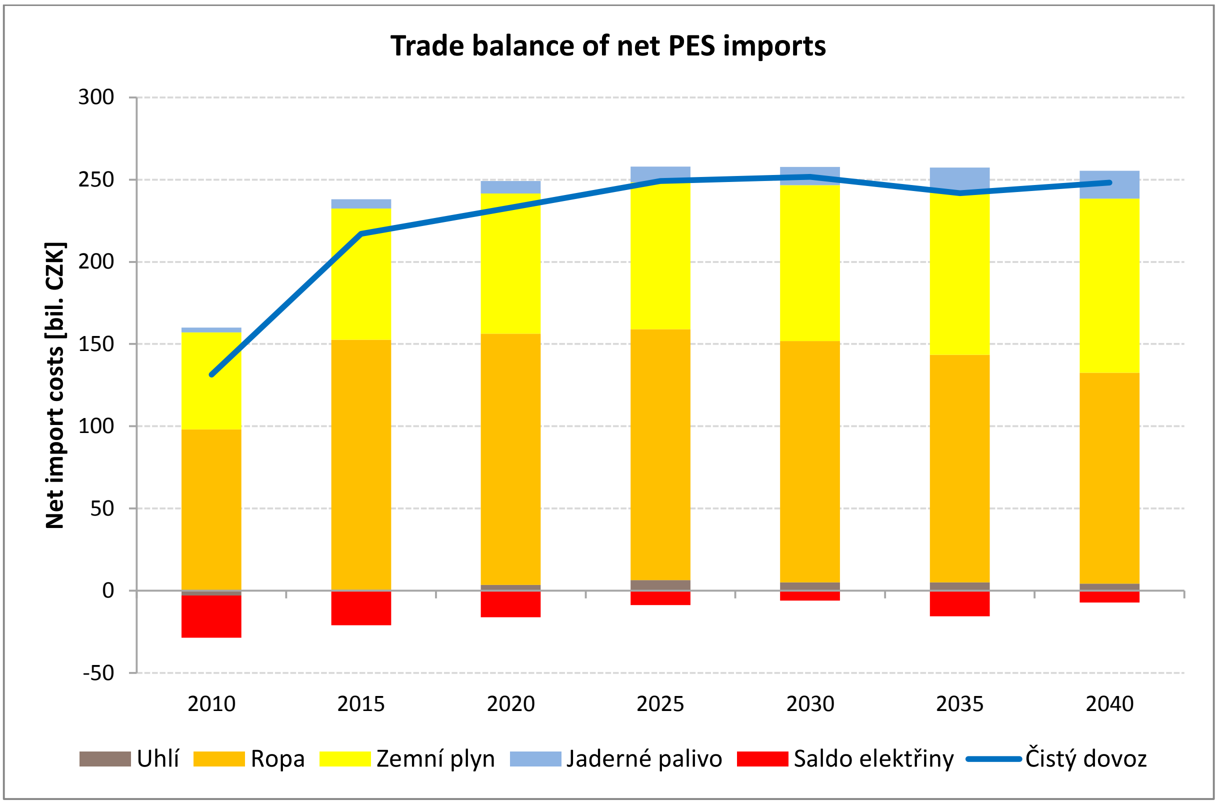


Graph No. 28: Ratio of energy imports to GAV at standard prices



The ratio of energy imports to GAV will rise sharply until around 2015, primarily due to the greater price dynamics of hydrocarbon fuels compared to the dynamics of GDP creation. The ratio of energy imports is then expected to fall to the 2010 level in 2040. The proportion the energy sector contributes towards GAV will fall significantly by 2015, which is caused by the increasing dynamism in the GDP trend as compared to the development dynamics in this sector. By 2040 this ratio is then expected to see a slight reduction.

Graph No. 29: Trade balance of net PES imports

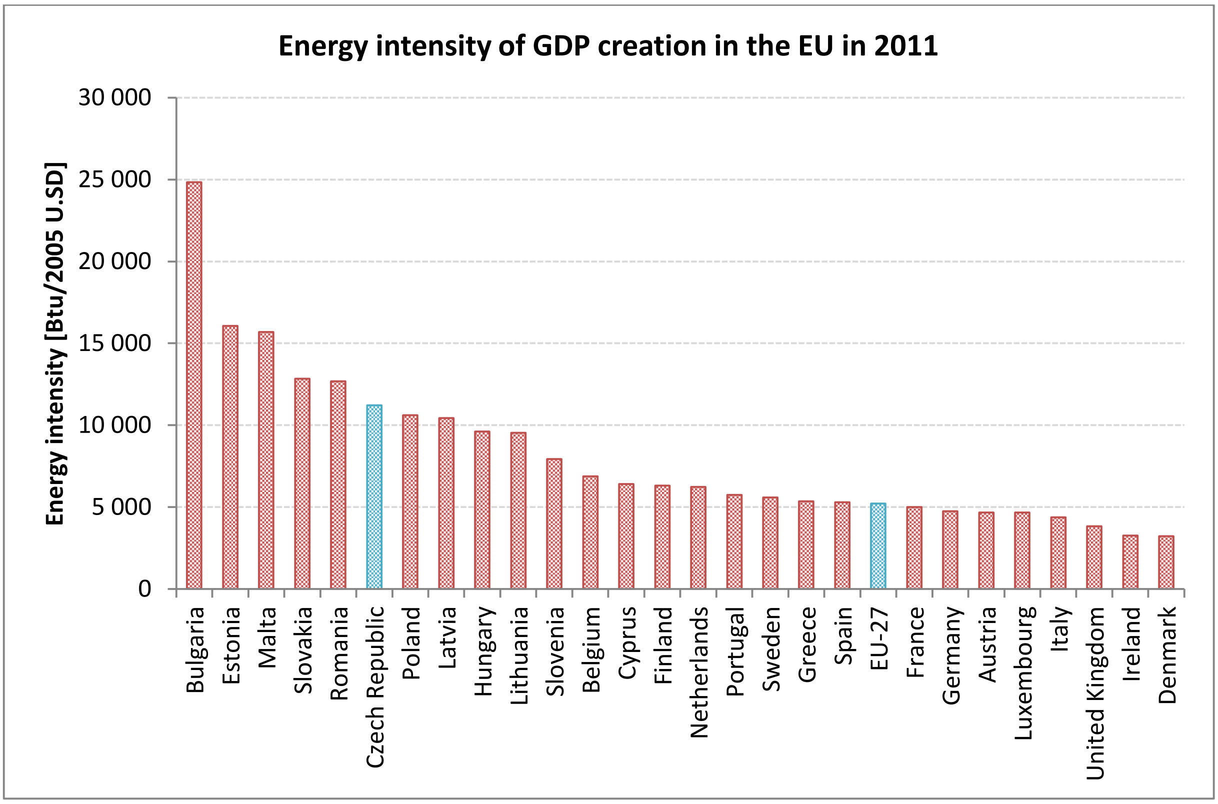


Uhlí = Coal
Ropa = Oil
Zemní plyn = Natural gas
Jaderné palivo = Nuclear fuel
Saldo elektřiny = Electricity balance
Čistý dovoz = Net imports

The expected costs of net imports of primary energy sources in monetary terms are demonstrated in Graph No. 29. In the context of the Czech Republic this primarily involves imports of oil, natural gas and nuclear fuel. In the case of all these fuels the Czech Republic is almost 100 % dependent on imports. Import costs are then calculated as the product of net imports of primary sources in physical units (specifically GJ) and the price of the fuel (commodity) in question in CZK/GJ. Increasing import costs are then the result of increasing import dependence (with the exception of oil products, imports of which are expected to fall by 2040), associated with the change in the fuel mix and the pricing trends for fuels (commodities) expected to see a gradual increase in the long term. With oil products we may expect an increase in the costs of net imports due to price rises, although imports will naturally be lower. The electricity balance has a positive impact on this indicator, and will play an important role particularly up to 2020 and then in around 2035, depending on the trend in electricity generation in relation to consumption. The costs of net imports of primary sources from abroad are expected to almost double, resulting in an increase in payments for net energy imports to almost 250 billion CZK.

7.2.13 Sustainability indicators

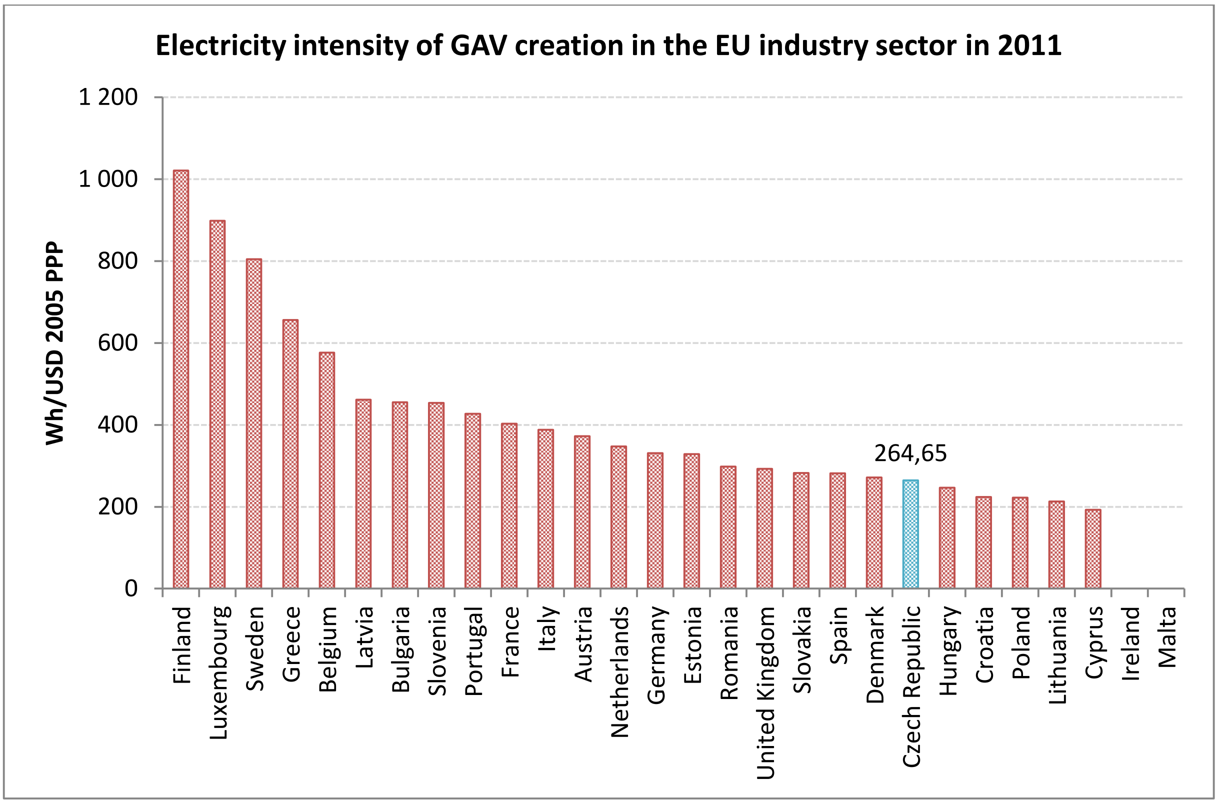
Graph No. 30: Energy intensity of GDP creation in the EU in 2011



Source: US EIA statistics (2011)

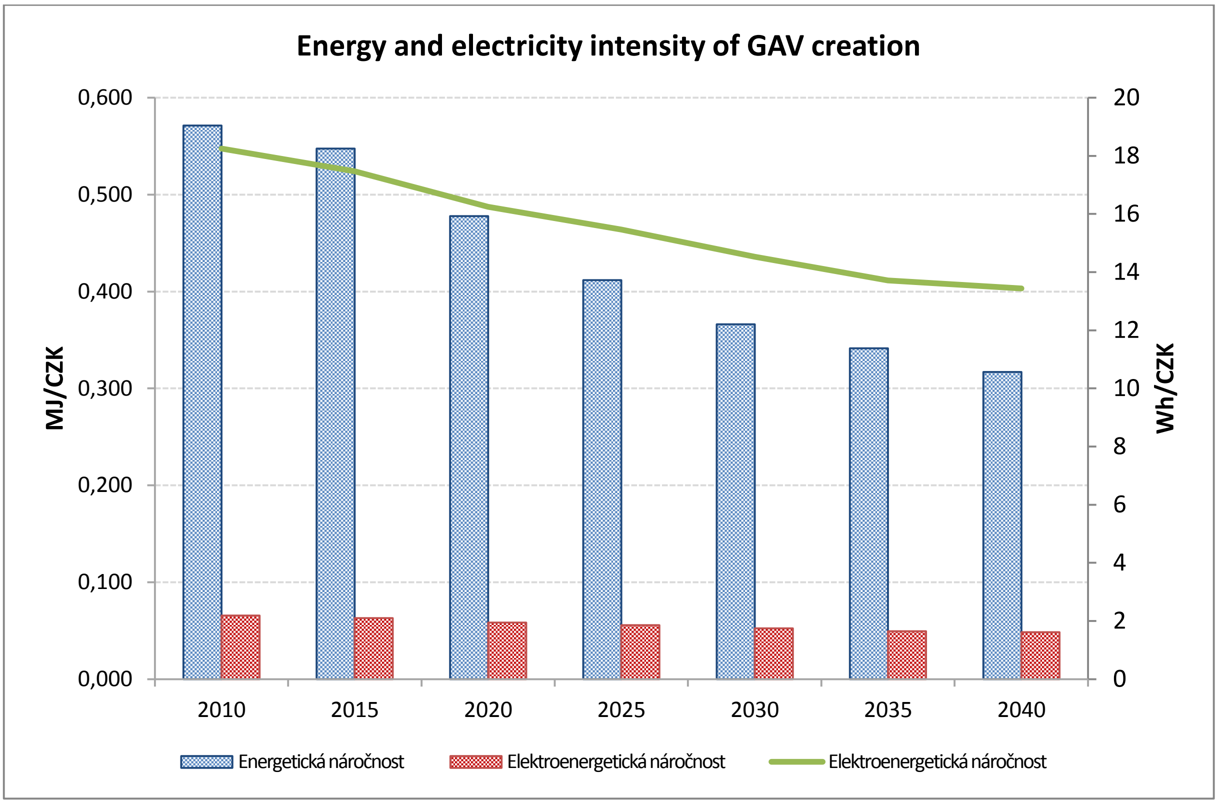
The legislative framework of current European policy aimed at reducing energy intensity is defined by Directive 2006/32/EC on final energy consumption and energy services, which was adopted in connection with the Europe 2020 strategy and the 2012/27/EU Energy Efficiency Directive. Based on these the various states set indicative energy saving targets for average final consumption or the consumption of primary energy sources. The Directive also requires implementation in the form of National Action Plans, which contain specific instruments for achieving the set (national) targets. Generally, the level of instruments selected varies in the different EU countries according to geographic position and the level of economic development. However, in reducing energy intensity essentially all European countries concentrate mainly on building energy management (in industry, services, the government sector and in headquarters), transport, increasing the efficiency of the energy sector itself (production and transmission of energy) and, last but not least, on reducing the energy intensity of domestic appliances. In the future it may be expected that the EU will place greater emphasis on reducing energy intensity by setting additional medium-term targets.

Graph No. 31: Electricity intensity of GAV creation in the EU industry sector in 2011



Source: IEA statistics (2011)

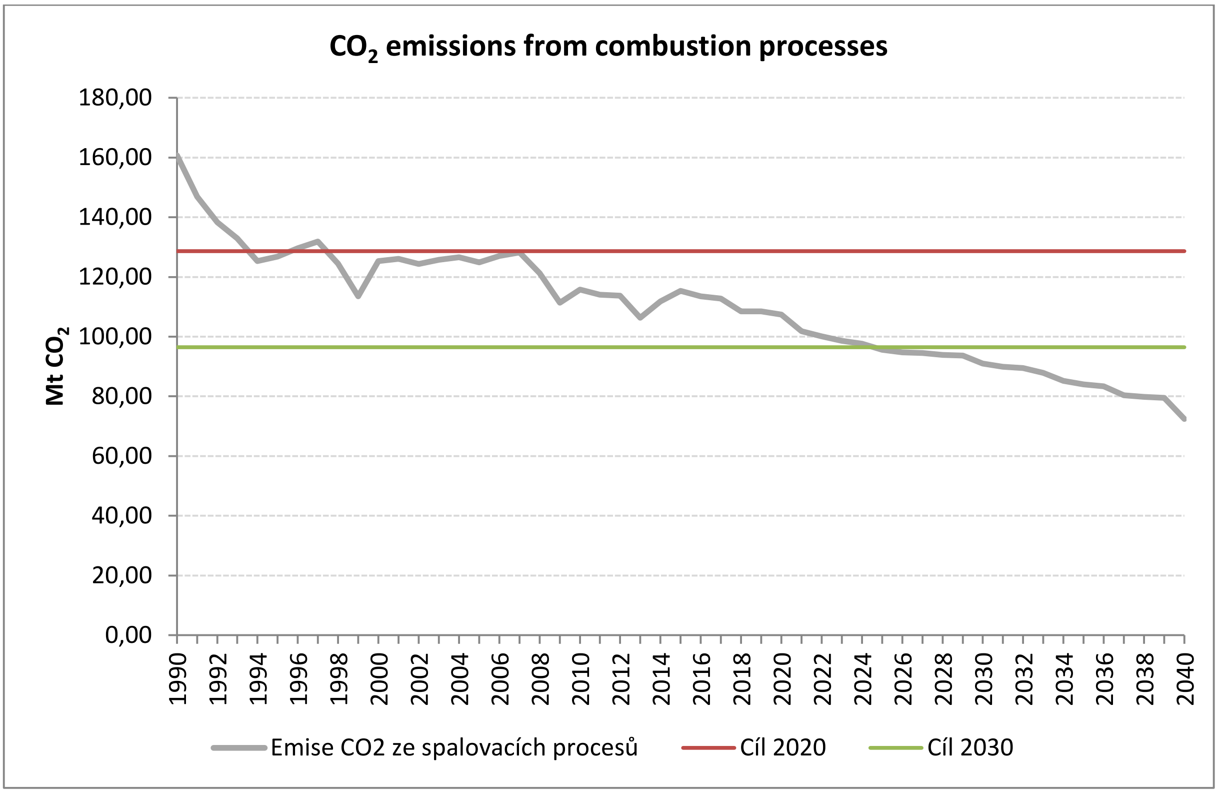
Graph No. 32: Energy and electricity intensity of GAV creation at fixed prices



Energetická náročnost = Energy intensity
Elektroenergetická náročnost = Electrical energy intensity
Elektroenergetická náročnost = Electrical energy intensity

Forecasts of the development of energy consumption and electricity consumption and the estimated trend in gross added value show that the energy intensity of GAV creation will gradually fall by 2040 to approx. 55 % of the figure in the base year, 2010, while the electricity intensity of GAV creation shows a somewhat slower decline to approx. 75 % of the figure for the base year, due to structural changes in the energy consumption mix.

Graph No. 33: CO_2 emissions from combustion processes



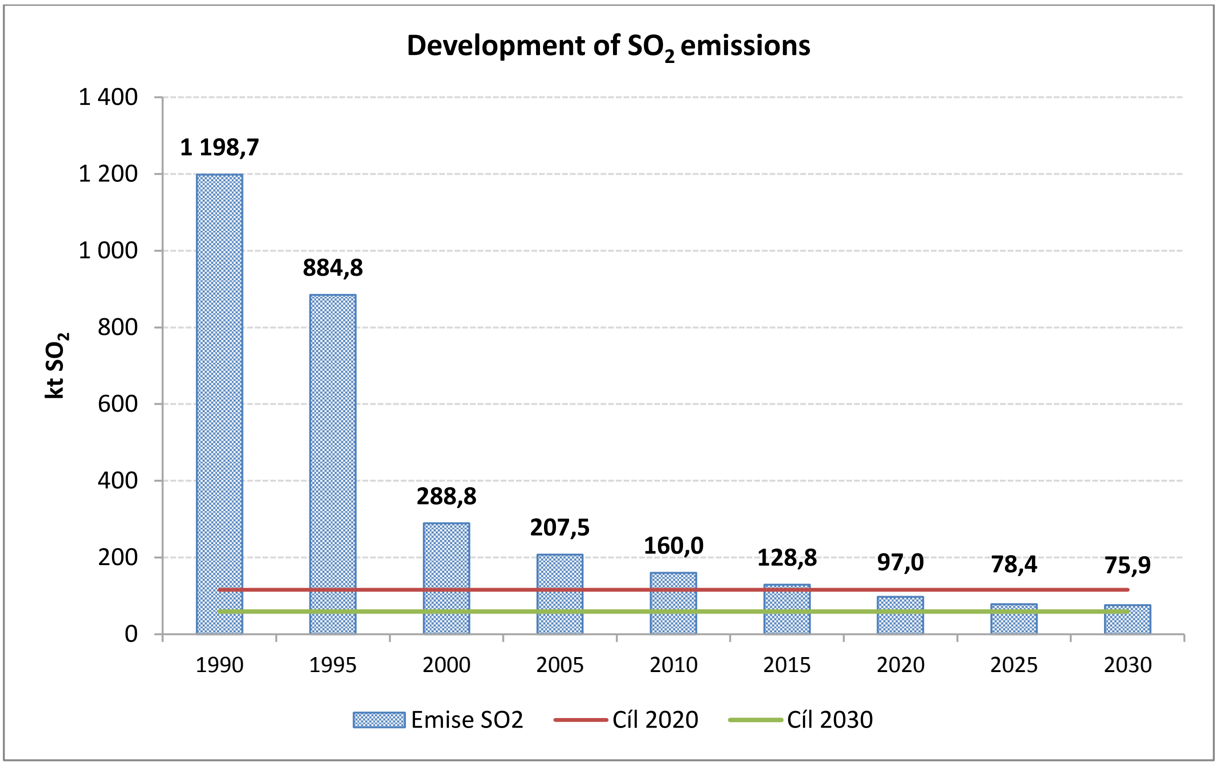
Note: No CO_2 emission targets are set for individual EU countries, but only for the EU as a whole. The lines here are computed from the EU emission reduction target of 20 % of the 1990 figure by 2020 and the EU emission reduction target of 40 % of the 1990 figure by a 2030 relative to the emission figures from combustion processes within the territory of the Czech Republic.

Emise CO2 ze spalovacích procesů = CO2 emissions from combustion processes
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

During the period in question CO_2 emissions in combustion processes will fall by 2040 to 62 % of the 2010 figure (thus 57 % of the 2000 emissions level), which is due to the effectiveness of the Industrial Emissions Directive, the reduction in electrical energy generation from coal and its replacement with other sources – natural gas, biomass, wind and photovoltaic sources. As a result of international EU climate protection commitments, after 2040 there may be a marked reduction in emissions due to the phasing out of coal, the introduction of CCS technology and a more widespread shift towards electromobility, and partially the use of vehicles running on CNG. However, a more rapid transition than that shown in Graph No. 33 is only possible at the price of significantly higher costs and greater impact on GDP.

The following graphs show the trend in SO_2, NO_x, NH_3, PM 2.5 and VOC emissions based on a GAINS model from CHI and which was computed on the basis of input data from MIT. Emissions are only calculated until 2030 and reflect the development of the energy sector and industry according to the optimised scenario presented in this document. The targets for 2030 depicted in the various graphs represent the relative emission ceilings applicable as of August 2014, proposed on the basis of current conversions of emissions figures for 2005, which may later be recalculated as a result of increasing knowledge of the emission inventory.

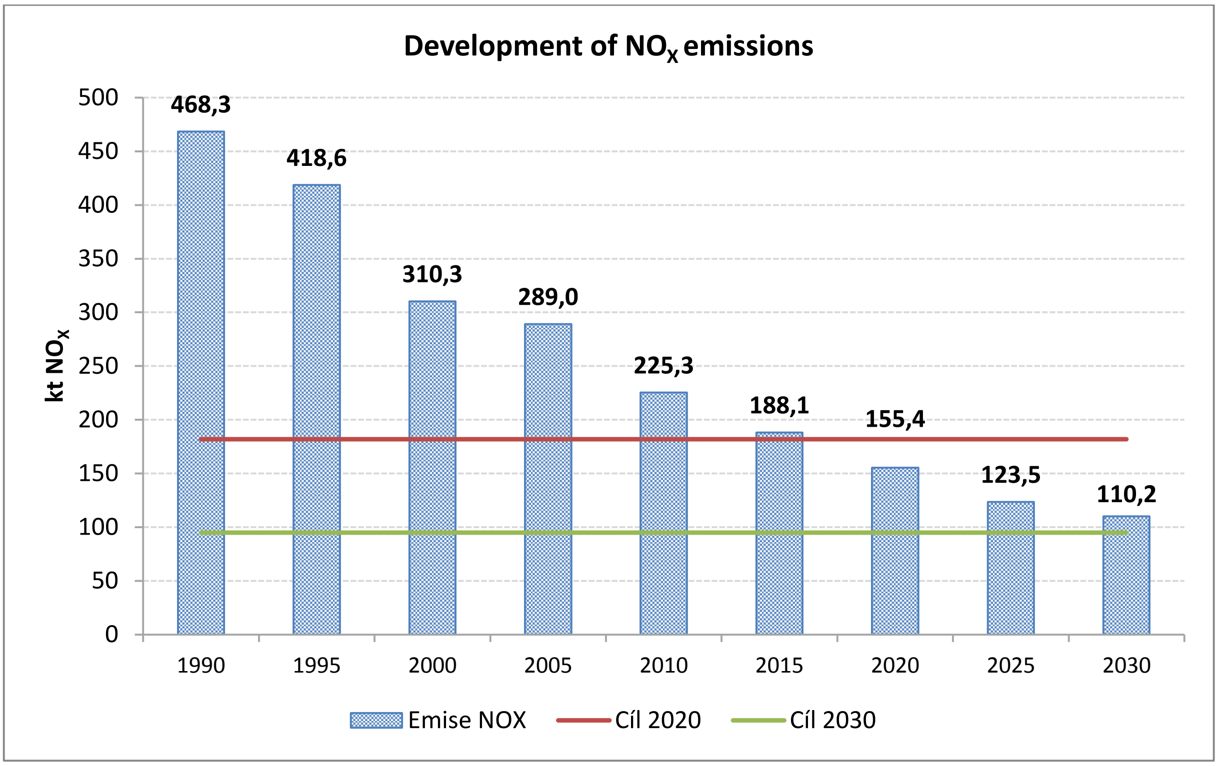
Graph No. 34: Development of SO_2 emissions



Source: GAINS model (CHI) based on MIT data

Emise SO2 = SO2 emissions
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

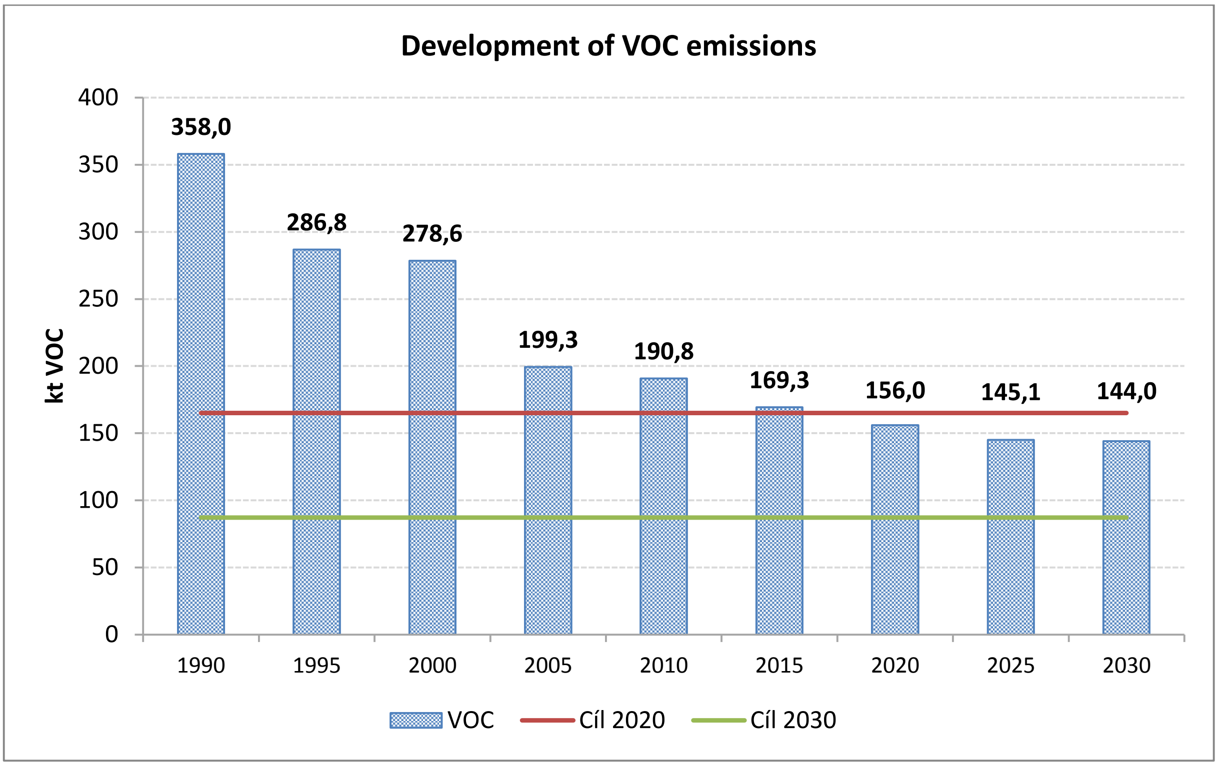
Graph No. 35: Development of NO_X emissions



Source: GAINS model (CHI) based on MIT data

Emise NOX = NOX emissions
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

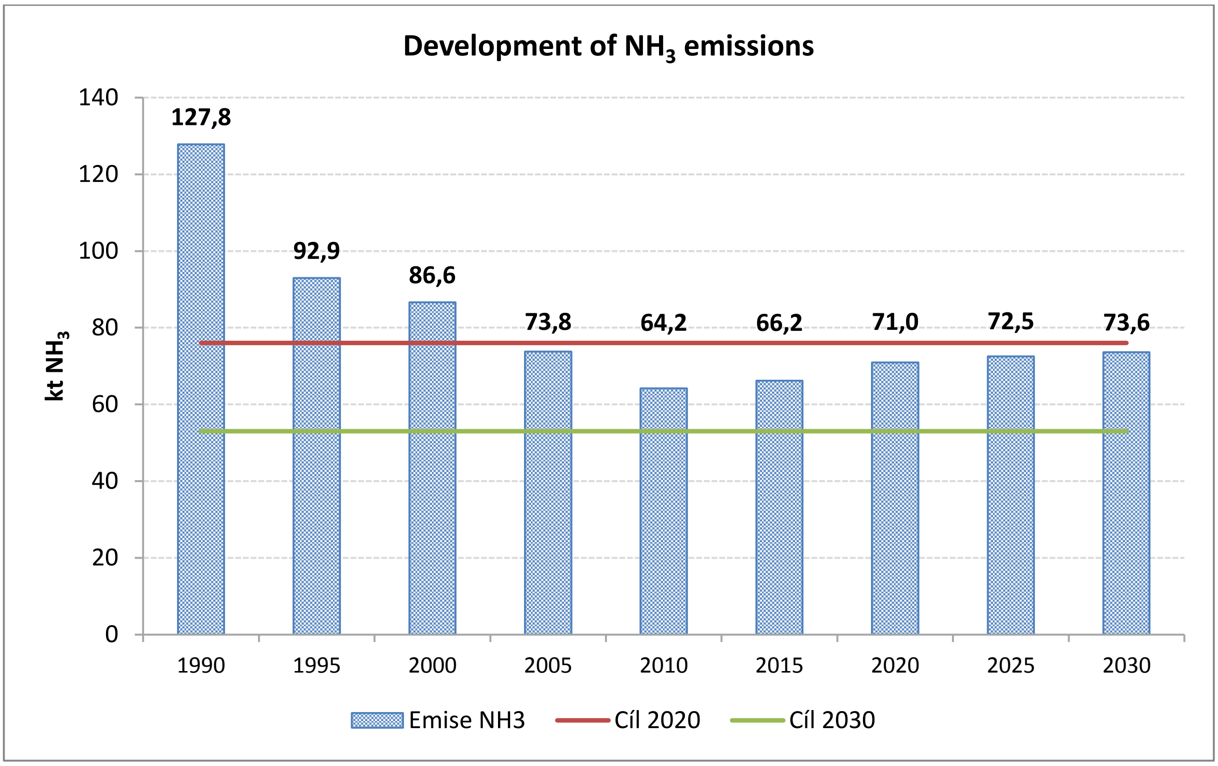
Graph No. 36: Development of VOC emissions



Source: GAINS model (CHI)based on MIT data

VOC = VOC
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

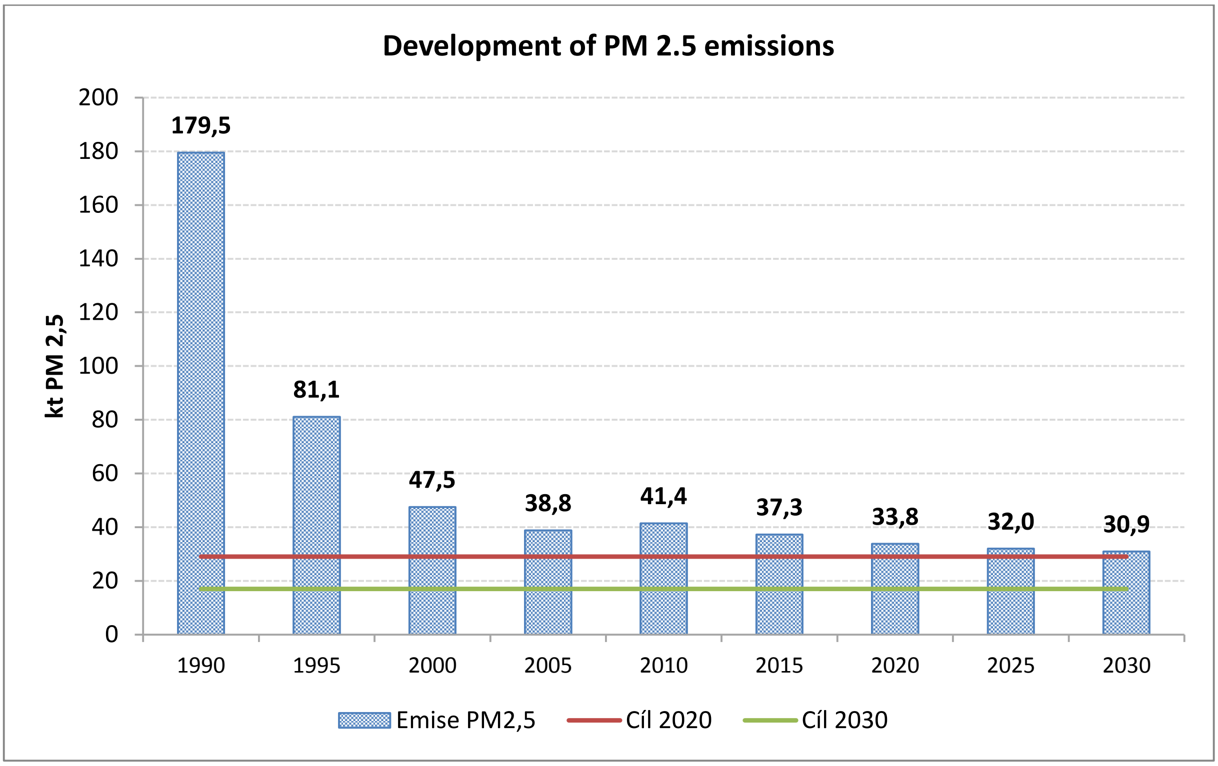
Graph No. 37: Development of NH_3 emissions



Source: GAINS model (CHI)based on MIT data

Emise NH3 = NH3 emissions
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

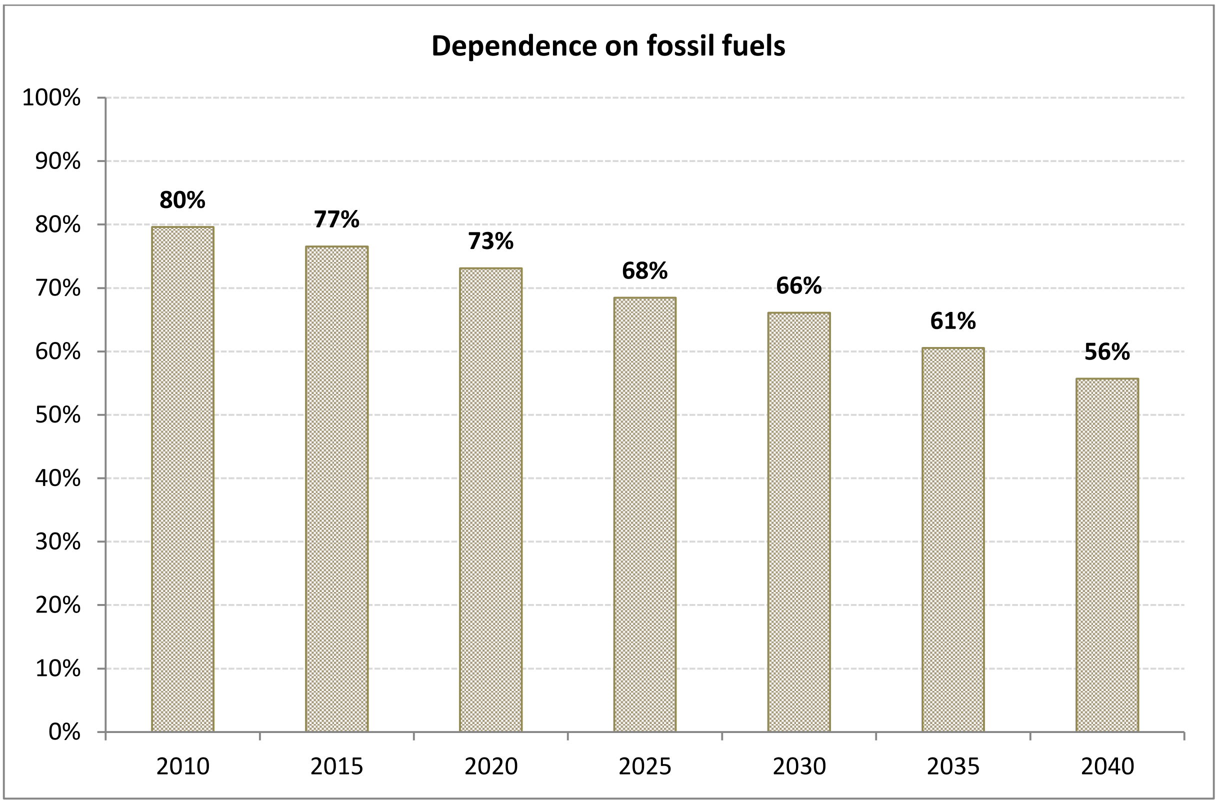
Graph No. 38: Development of PM 2.5 emissions



Source: GAINS model (CHI)based on MIT data

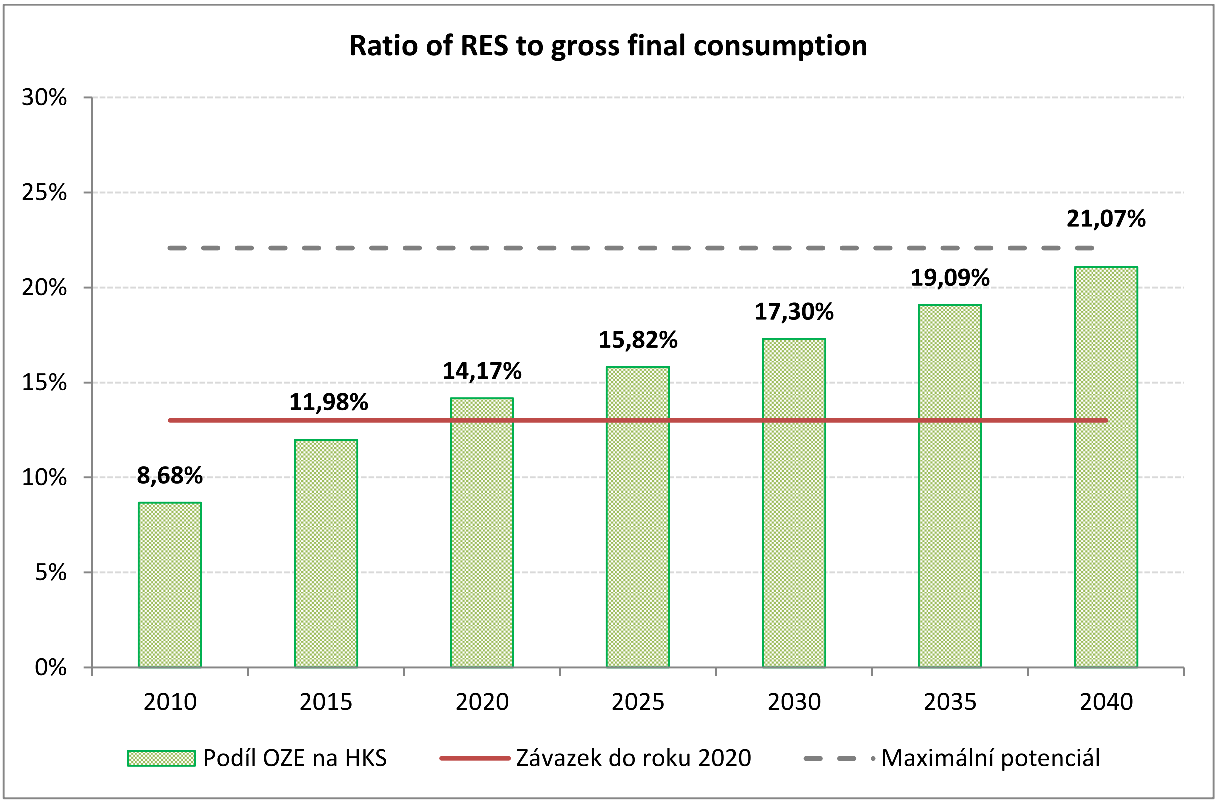
Emise PM2,5 = PM2.5 emissions
Cíl 2020 = 2020 target
Cíl 2030 = 2030 target

Graph No. 39: Dependence on fossil fuels



It is expected that the indicator showing dependence on fossil fuels, which is expressed as the ratio of total (domestic and imported) fossil fuels to primary energy sources, will gradually fall to 56 % in 2040. This trend is clearly down to the decline in the use of brown and black coal for the generation of electricity and heat.

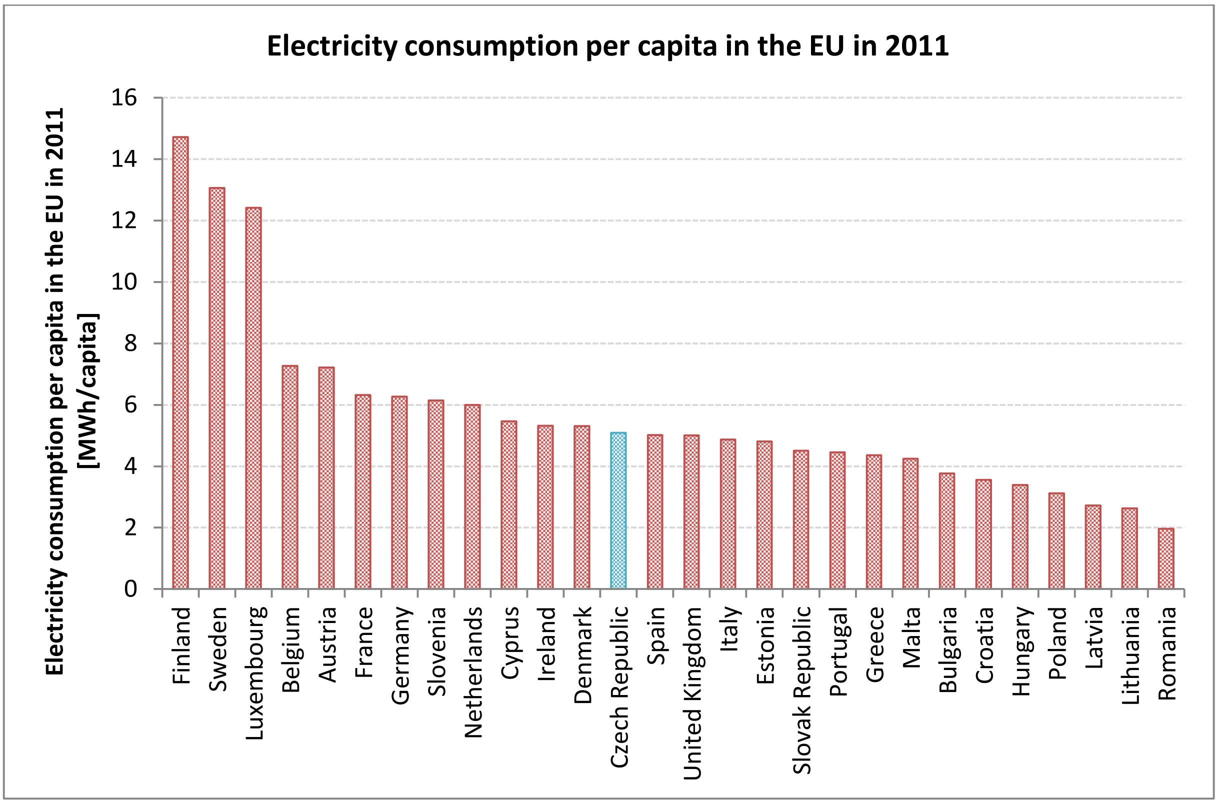
Graph No. 40: Ratio of RES to gross final consumption



Podíl OZE na HKS = Ratio of RES to GFC
Závazek do roku 2020 = Target by 2020
Maximální potenciál = Maximum potential

In final energy consumption fossil energy sources will be gradually replaced by renewable sources, the proportion of which will gradually rise in excess of 21 % of gross final consumption.

Graph No. 41: Electricity consumption per capita in the EU in 2011



Source: IEA statistics (2011)

All EU member states with the exception of Germany anticipate an increase in electricity consumption as a result of stringent environmental and decarbonisation requirements primarily of their energy sectors and also due to continuing economic development. In Germany specifically, electricity consumption rose at an average tempo by 0.7% per year in 2000-2011, even though the increase was faster before the recession. The German government predicts that total electricity consumption between 2012 and 2030 could fall by a total of 14.7 % (a drop in consumption in industry, the services sector and in households as a result of energy efficiency, while consumption is expected to increase by almost 100 % in transport).

In 2010 Italy's gross electrical generation was 346 TWh. According to forecasts, in 2020 this figure should be around 345-360 TWh. In this respect we may expect to see a significant rise in the use of electrical energy in the energy sector and today's electricity consumption to double by 2050.[25]

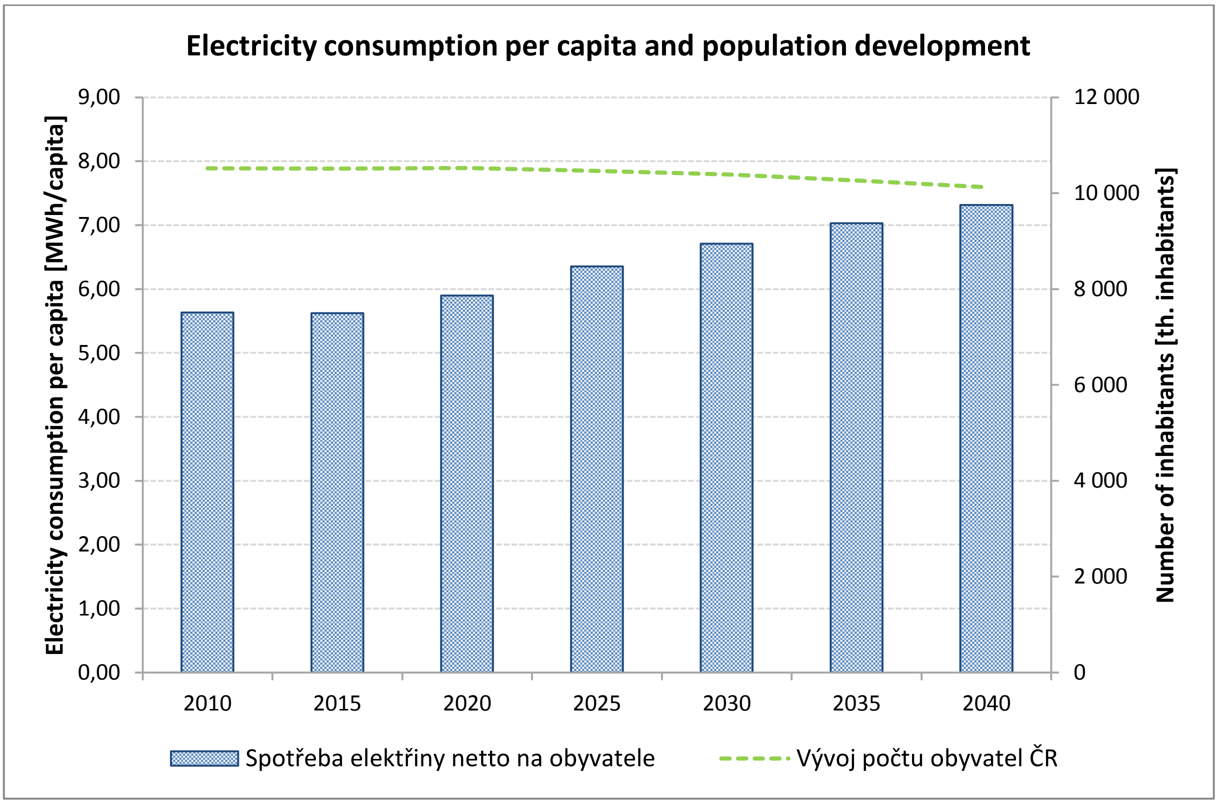
In its State Energy Policy, according to the reference scenario, Slovakia anticipates a rise in final energy consumption by 2035. Electricity consumption between the years 2014 and 2035 is covered in 3 scenarios, where *i)* the low scenario expects a considerable slowdown in economic development and GDP growth + a low 0.6%, annual increase in electricity

[25] Presentation by IT representative W. D´Innocenza at the SLT IEA, March 2013

consumption; *ii)* a reference scenario with a slight increase in economic dynamics and an annual increase in consumption at the level of 1.2 %; and *iii)* a high scenario with accelerated economic growth and a 1.4 % annual increase in electricity consumption.

According to the latest *Department of Energy & Climate Change* analyses, demand for electricity in Great Britain should increase by between 30 % and 100 % by 2050. [26]

Graph No. 42: Electricity consumption per capita and population development



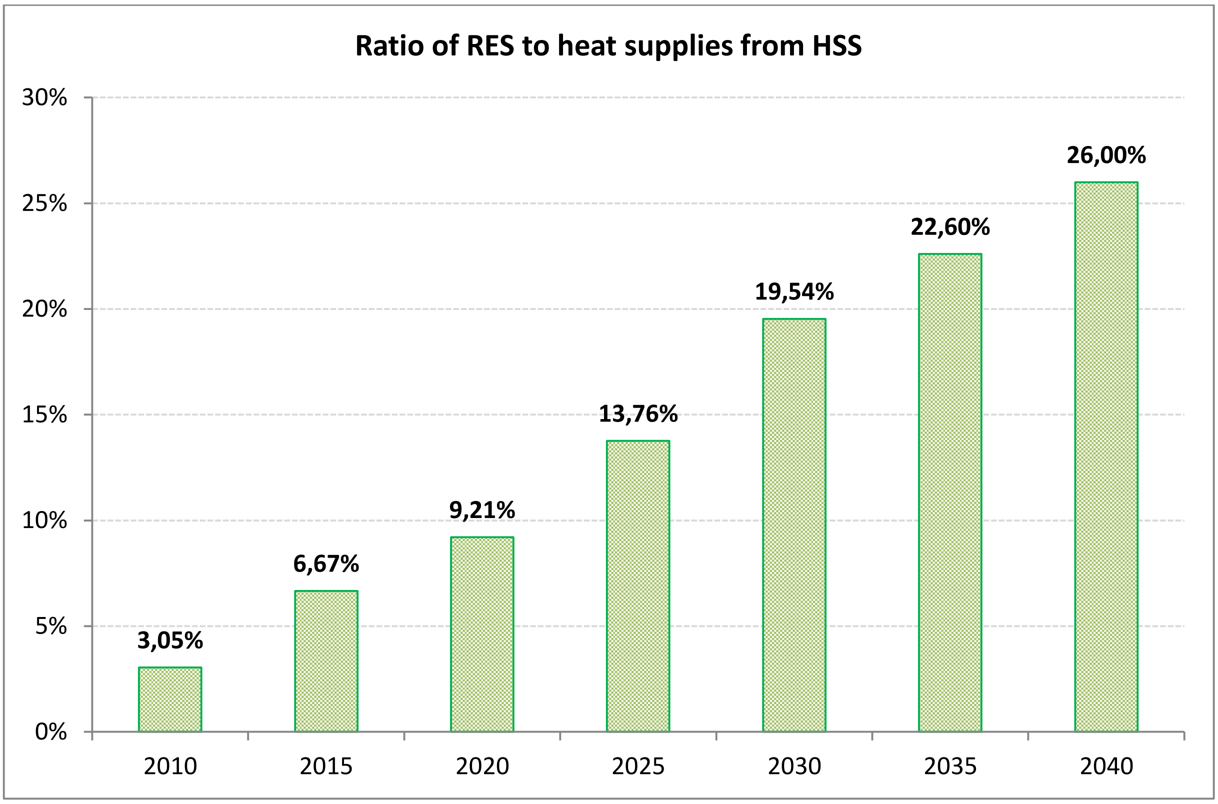
Spotřeba elektřiny netto na obyvatele = Net electricity consumption per capita
Vývoj počtu obyvatel ČR = Population trend in CR

In order to determine the trend for the electricity consumption per capita indicator historical figures were used, as well as data for the median variant of the forecasted trend in the number of inhabitants in 2011, 2021, 2031 and 2041, taken from the *Czech Population Projection by 2100* compiled by the Czech Statistical Office (CSO). The population development trend was then extrapolated based on the assumption that the number of inhabitants will follow a proportionate (linear) trend between the years for which estimates are available. Using the proportion of the total consumption of electrical energy (excluding own consumption for production, network losses and accumulation consumption) and the total number of inhabitants enabled us to quantify annual electricity consumption per capita in the Czech Republic in the individual years, see Graph No. 42. This trend shows that

[26] Electricity Market Reform – November 2012

electricity consumption per capita, despite the expected sluggish household consumption (MOO), see Table No. 2 and Graph No. 5, and the fall in the number of inhabitants, will rise by 2040, primarily due to the increase in electricity consumption at the industrial consumer level and business level, which currently available forecasts expect to rise, see Table No. 9 and Graph No. 13.

Graph No. 43: Ratio of RES to heat supplies from HSS



8 List of signs and abbreviations

USEP	Update to the State Energy Policy
AF	alternative fuels
BAT	best available techniques
Btu	British thermal unit
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CEE	Central and Eastern Europe
CEF	Connecting Europe Facility
CEPS	Central European Pipeline System
CNG	compressed natural gas
CZ-NACE	Classification of Economic Activities
CPPOP	Czech product pipelines and oil pipelines
CSO	Czech Statistical Office
SB	Supervisory Board
DS	distribution system
DHS	decentralised heat supply
ECT	Energy Charter
EIA	Environmental impact assessment
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
EPC	Energy intensity Contracting
ERO	Energy Regulatory Office
ES	electrification system
ESIF	European Structural and Investment Fund
EU	European Union
EU28	28 EU member states
Euratom	European Atomic Energy Community
FACTS	flexible alternating current transmission system
PPS	photovoltaic power station
GWh	gigawatt-hour
GDP	gross domestic product
GAV	gross added value
IEA	International Energy Agency
IED	Industrial Emissions Directive
IEF	International Energy Forum
IKL	Ingolstadt - Kralupy nad Vltavou – Litvínov oil pipeline
IRENA	International Renewable Energy Agency

IT	information technology
NPP	nuclear power plant
DNPP	Dukovany nuclear power plant
TNPP	Temelín nuclear power plant
CZK	Czech crown
FEC	final energy consumption
CHP	combined heat and power
kWh	kilowatt-hour
LNG	liquid natural gas
MoT	Ministry of Transport
MERO	international oil pipelines
MF	Ministry of Finance
PT	public transport
MJ	megajoule
MRD	Ministry for Regional Development
MIT	Ministry of Industry and Trade
MoEYS	Ministry of Education, Youth and Sports
Mt	megaton
MoI	Ministry of the Interior
MW	megawatt
MWh	megawatt-hour
MoE	Ministry of the Environment
NAP	National Action Plan
NAPEE	National Action Plan for Energy Efficiency
LV	low voltage
OECD	Organisation for Economic Co-operation and Development
MO	market operator
RES	renewable energy sources
PAH	polycyclic aromatic hydrocarbons
DSO	distribution system operator
SPP	steam (coal) power plant
PES	primary energy sources
PJ	petajoule
PM 10	solid dust particles (up to 10 µm in size)
PM 2.5	solid dust particles (up to 2.5 µm in size)
PPC	combined cycle
PPP	purchasing power parity
TSO	transmission system operator
IW	industrial waste

TS	transmission system (electrical power engineering), transport system (gas)
PST	phase-shifting transformer
TDP	Territorial Development Policy
PHP	pumped hydro plant
R&D&D	research, development and demonstration
RAO	radioactive waste
SEI	State Energy Inspectorate
SEP	State Energy Policy
SET plan	strategic energy technological plan
SOAF	Scenario Outlook & Adequacy Forecast
ASMR	Administration of State Material Reserves
SONS	State Office for Nuclear Safety
RAWRA	Radioactive Waste Repository Authority
HSS	heat supply system
TA CR	Technology Agency of the Czech Republic
TAL	Transalpine pipeline
MSW	municipal solid waste
TWh	terawatt-hour
US EIA	U. S. Energy Information Administration
USD	American dollar
TEP	territorial energy policy
TEL	territorial ecological limits
OPC	Office for the Protection of Competition
ZD	zoning decision
GOCR	Government Office of the Czech Republic
V4	Visegrád Four states
S&R	science and research
R&D&I	research, development and innovation
GM	general meeting
SNF	spent nuclear fuel
HV	high voltage
HSR	high-speed route
VHV	very high voltage
Wh	watt-hour
ERF	energy recovery facility
PTD	principles of territorial development

List of graphs, tables and images