

CHAPTER 1

CURRENT TRENDS IN ECONOMIC DEVELOPMENT

THE CZECH REPUBLIC'S NATIONAL ENERGY AND CLIMATE PLAN: PATHWAYS TO DECARBONIZATION, ENERGY SECURITY, AND INDUSTRIAL TRANSFORMATION

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Abstract. The energy transformation of Central European countries is becoming critically important in the context of achieving the EU's climate goals and ensuring energy security following the geopolitical upheavals of 2022. The Czech Republic, as one of the most carbon-intensive economies in the EU with a coal share of approximately 40% in its energy mix, faces unique challenges in balancing the needs of its energy-intensive industry with its environmental commitments to the European community. The approval of the updated National Energy and Climate Plan (NECP) in December 2024, after prolonged delays and the threat of sanctions from the European Commission, marked a key milestone in shaping the country's long-term energy transition strategy. The purpose of the study is to conduct a comprehensive analysis of the updated Czech NECP and assess its impact on the country's energy transformation by 2030, with a perspective toward 2050, including mechanisms for achieving European climate goals. The research object encompasses the strategic priorities, target indicators, and institutional mechanisms for implementing Czech energy policy in the context of the requirements of EU Regulation 2018/1999 on the Governance of the Energy Union. The research methodology is based on a systemic analysis of official Czech government documents, expert assessments by the European Commission, and statistical data from the Ministry of Industry and Trade, employing methods of structural analysis of energy strategies, comparative analysis of European energy planning practices, and evaluation of the compliance of national plans with European directives. The study findings indicate that the plan envisages a fundamental restructuring of the energy sector, increasing the share of renewable energy sources from the current 18% to over 30% by 2030 and a complete phase-out of coal-based generation by 2033. Consequently, in sectors covered by the EU Emissions Trading System, the Czech Republic plans to reduce emissions by 63% by 2030 compared to 1990 levels, surpassing the EU-wide target of 55%. For instance, total investments in the energy transformation are estimated at 2.8 trillion Czech crowns, with projected additional GDP growth of 2% and the creation of new jobs in the clean technology sector. As a result of the plan's implementation, the country's energy dependence on imports is expected to decrease from 40% to 26% by 2050, significantly enhancing national energy security. The practical value of the study lies in identifying effective mechanisms for coordinating industrial and environmental policies, tools for financing the green transition, and strategies for addressing socio-economic challenges in coal-dependent regions, which can serve as a practical model for other industrialized countries in Central and Eastern Europe during their energy transition.

Keywords: decarbonization; renewable energy; energy security; coal-based generation; nuclear energy; Central Europe; climate policy; energy transition; industrial transformation; European integration.

JEL Classification: Q42, Q48, Q54, Q58, L94

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Introduction. The energy transformation of European countries in the context of achieving climate neutrality by 2050 has become one of the most pressing challenges of contemporary European policy. These processes are of particular significance for Central and Eastern European countries with highly carbon-intensive economies. The Czech Republic, with a coal share of approximately 40% in its energy mix, faces the challenge of balancing ambitious European climate goals with the need to maintain the competitiveness of its energy-intensive industry. The approval of the updated National Energy and Climate Plan by the Czech government on December 18, 2024, provides opportunities for a scientific analysis of the mechanisms shaping the energy strategy of an industrially developed Central and Eastern European country.

Literature Review. Scientific research on national energy and climate plans as instruments of Czech energy policy is developing within several thematic directions, encompassing theoretical aspects of energy planning, empirical studies of energy transformation, and the specifics of regional approaches.

In the study of NECP (2019), an attempt was made to examine the transition of the Czech electricity sector by 2030 in accordance with the National Energy and Climate Plan (NECP). The research emphasizes the reorientation from coal to nuclear energy, bioenergy, as well as increasing the role of combined heat and power generation. It is shown that the Czech NECP defines gradual decarbonization, an increase in the share of renewable sources, and energy efficiency, but the pace of changes remains moderate compared to EU leaders.

Specific aspects of Czech energy policy are considered in the works of Matúš Mišík, Veronika Oravcova (2018), which analyze the EU's political strategy in the energy sector from the perspective of Czech energy policy. Tomáš Vlček (2019) investigates the processes of energy market liberalization in the Czech Republic and their impact on the formation of the national energy strategy.

In the article by Hromada, P. (2024), changes in Czech energy security after Russia's invasion of Ukraine in 2022 are analyzed. It highlights the increased attention of the Czech Republic to reducing dependence on Russian energy resources, particularly gas and nuclear fuel, which became a critical topic after the start of the war. The country's strategic steps are examined, including the activation of renewable energy development and support for nuclear energy as the basis of energy security. The study reflects both the challenges caused by the geopolitical crisis and the Czech Republic's adaptation to the new reality of energy security, emphasizing the need for strategies of reliability and diversification of energy sources.

In the article by Keno Energy Group (2025), the revival of the solar energy market (photovoltaic systems) in the Czech Republic since 2020 is considered. In 2023, nearly 1 GW of new PV capacity was installed, mainly through private rooftop systems. The country's aspiration to achieve an installed solar capacity of 10 GW by 2030 is traced. The role of financial support from the European Union is emphasized, particularly for the expansion of energy storage systems (target – 1.5 GW). The application of feed-in tariffs and premium models as mechanisms for stimulating investments is noted.

Despite the significant number of studies on European energy policy, there is a lack of research that analyzes the impact of the geopolitical changes of 2022 on the reformatting of national energy priorities and their reflection in updated NECPs. This creates a niche for scientific analysis of the Czech experience as a representative case of energy transformation in the industrial economy of the Czech Republic.

Aims. The purpose of the study is to identify the main trends in the development of renewable energy sources in the Czech Republic and to assess the effectiveness of state incentives for accelerating their implementation by 2030.

To achieve the purpose, the following tasks are set:

- analyze the current state of the RES market in the Czech Republic;
- assess the impact of political and financial instruments on the development of solar and wind energy;
- identify the main obstacles to large-scale implementation of RES;
- propose recommendations for optimizing state support.

Methodology. The study employs a comprehensive analysis of statistical data from official sources on the state of RES in the Czech Republic, as well as content analysis of national strategic documents and policies. Comparative analysis methods are used to evaluate the impact of state incentives and regulatory changes. The theoretical basis consists of EU energy policy approaches and models of energy market liberalization. Well-known statistical methods (correlation analysis, time series) are applied for data processing.

Results. On December 18, 2024, the Czech government approved the updated National Energy and Climate Plan, which outlines the development of the energy sector by 2030 with a perspective to 2050. The plan was prepared based on the requirements of Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action. This document envisages the decarbonization of the economy while maintaining energy security, affordability, and environmental sustainability. The key goals and indicators of national energy were defined as follows by the Ministry of Industry and Trade of the Czech Republic (2024).

Renewable energy sources. Increasing the share of renewable energy sources in the national energy mix from the current 18% to over 30% by 2030. Decarbonization. In sectors covered by the EU ETS, the Czech Republic plans to reduce emissions by 63% by 2030 compared to 1990 levels. Reducing dependence on foreign energy imports from the current 40% to approximately 26% by 2050 Czech Government Approves National Climate and Energy Plan (2024).

Economic indicators. Total required investments are estimated at 2.8 trillion Czech crowns, with projected GDP growth of 2%. The Czech Republic will continue to develop electricity production from nuclear and renewable energy sources (RES) and thereby continue to reduce emissions. Gas will serve as a transitional energy source in the electricity and heat production sector.

Table 1. Investment needs and financial support for the Czech Republic's energy transition

Indicator	Value	Comment
Total volume of investments	2.8 trillion CZK	Expected GDP growth of 2%
State aid (guaranteed revenues)	7.74 billion euros	For the construction of a new nuclear unit
EU Modernization Fund (2021-2030)	≈20 billion euros	40% allocated to RES
Additional funding (December 2024)	130 million euros	Phased withdrawal from coal, development of gas and waste processing infrastructure

Source: Czech Government Approves National Climate and Energy Plan; Renewable energy in Czech Republic

The plan contains goals and policies in all five dimensions of the energy union for the period 2021-2030 with a perspective to 2050: mitigation of greenhouse gases; energy efficiency; internal energy market; energy security and research, innovation, and competitiveness.

The document is based on a joint model of the SEEPIA consortium, led by the Center for Environmental Issues at Charles University. These calculations model the most cost-effective way to achieve climate goals and are based on climate commitments and existing measures.

The Czech Republic was one of 13 member states that the European Commission reprimanded for failing to submit an update to the document. As a result, the Commission decided to initiate infringement proceedings. Thanks to the government's approval of the update to the National Plan, the Czech Republic avoids significant fines for non-compliance with its obligations to the Commission.

The role of nuclear energy in the strategy. The Czech Republic plans to completely phase out coal by 2033 and increase the share of nuclear energy to 68% in the energy mix by 2040, compared to the current approximately 40%. By 2030, the share of nuclear energy should grow to 44%.

In July 2024, the government officially selected KHNP (Korea Hydro & Nuclear Power) as the supplier for the construction of two new units at the Dukovany NPP, with an option for up to 3 additional units. Specific characteristics. Two APR1400 reactors with a capacity of 1,055 MW each. Total cost: 400 billion crowns (\$18.2 billion or 8.85 billion dollars per unit). Construction permit - by 2029, commissioning works - by the end of 2036, commercial operation - 2038. It is expected that the first unit will cover about 10% of the country's electricity needs David Dalton (2025).

At the Temelín NPP, the construction of two more units is planned after the completion of construction at Dukovany. Originally, 4 units were planned at Temelín, but after the Velvet Revolution of 1989, the construction of the 3rd and 4th units was suspended. Current status of Temelín. Two operating VVER-1000 units with a net capacity of 1,026 MW and gross 1,080 MW each. Since 2023, the two reactors have produced 272 TWh of CO₂-free electricity. In 2022 alone, thanks to the energy crisis caused by the war in Ukraine, the station earned 80 billion crowns Country Nuclear Power Profiles (2022).

Table 2. Current and future energy balance of the Czech Republic regarding the share of nuclear energy in electricity production

Year	Share of Nuclear Energy in Electricity Production	Comments on Projects and Development	Total Share of RES and Role of Gas
2023	Approximately 40%	Operation of 6 reactors at Temelín and Dukovany NPPs	RES share around 16.5%, gas as a transitional fuel
2030	Target of 44%	Launch of two new reactors at Dukovany (2400 MW) by 2030	RES to increase to 28%, gas ensures system stability
2040	Ambitious target — 68%	Planned commissioning of new units and modular reactors	RES share to rise to 46%, gas begins to decline
2050	Planned increase from current 33% to 50%	Extension of Temelín's operation, expansion of small reactors	RES to 46% and beyond, gas gradually replaced

Notes: Plans include the launch of small modular reactors (up to 3 GW capacity), which will complement traditional NPPs; Natural gas is used as a "transitional fuel" for network stabilization alongside the buildup of RES and nuclear energy.

Source: compiled by the author

State financial support. The European Commission approved a state aid mechanism, which provides for a state loan of up to 7.74 billion euros for the construction of a new power unit with guaranteed revenues for 40 years.

The government of Petr Fiala has committed to phasing out coal in the energy sector by 2033. Currently, coal power plants produce almost 50% of the country's electricity. Modeling shows that the Czech Republic can phase out coal even by 2030 with ambitious but realistic actions. The EU Modernization Fund allocated about 20 billion euros to the Czech Republic from 2021 to 2030, of which about 8 billion euros have already been used. Approximately 40% of the funds are allocated to renewable energy projects of Renewable energy in Czech Republic (2024).

In December 2024, the Modernization Fund approved an additional 130 million euros for the phased withdrawal from coal in the Czech Republic, a significant portion of which will go to investments in natural gas and the development of waste utilization infrastructure.

Specific replacement projects. The Opatovice power plant plans to stop using coal by 2030 and switch to natural gas. Ember modeling shows that by 2030, the Czech Republic can add 3.7 GW of onshore wind energy and 7.9 GW of solar energy, achieving 4 GW of wind and 10 GW of solar capacity without limiting generation Chris Rosslowe (2024).

Renewable energy goals. The government has set a goal to increase the share of renewable energy sources to 30% by 2030 (compared to about 18% in 2021). The Ministry of the Environment specified that this means 10 GW of installed capacity for solar power plants and 1.5 GW for wind by 2030. In 2024, the government planned to support wind energy with up to 130 MW, and in 2025 - 210 MW of new capacities and 30 MW of modernized wind power plants. The government plans to triple the installed wind energy capacity by 2030 from the current 350 MW to 1 GW.

The Ministry of the Environment allocated almost 500 million crowns (about 19.8 million euros) for the creation of new biogas plants in seven locations in the Ústí, Olomouc, South Bohemian, and Liberec regions. The biogas plant at the Litovel wastewater treatment plant will process about 7,000 tons of biodegradable waste

annually, producing almost 5,000 MWh of energy - enough to heat over 500 households.

The AGRISPOL cooperative will build a biogas plant near Mnřžice for processing about 29,000 tons of biodegradable waste. Czech Republic advances biogas production to enhance energy independence (2024).

Table 3. Czech Republic's decarbonization and renewable energy goals

Direction	Current State	Target (2030)	Target (2050)	Comment
Share of RES in the energy balance	18% (2021)	over 30%	over 40%	Priority – solar and wind energy
Emissions (ETS sectors)	Base level 1990	reduction by 63%	reduction by 50%	In accordance with EU requirements
Dependence on energy imports	40%	30%	≈26%	Reduction due to own generation and diversification of imports
Share of nuclear energy	≈40% (2023)	44%	68% (2040)	Expansion of Dukovany and Temelín NPPs, construction of new units

Source: Ministry of Industry and Trade of the Czech Republic (2024), Czech Government Approves National Climate and Energy Plan (2024)

Challenges in RES development. The Czech Republic has launched auctions only for biogas plants, small hydropower plants, and wind farms on a small scale, but the total capacity of power plants that can participate in auctions is strictly limited, and there are no auctions for solar power plants.

Energy Security and Independence. Withdrawal from Russian Energy Carriers. In January 2025, the Czech Republic achieved full independence from Russian oil supplies for the first time in its history, ending over 60 years of dependence. This was made possible by the completion of the modernization of the Transalpine (TAL) oil pipeline. Pipeline gas imports from Russia ceased at the beginning of January, and pipeline oil imports will end in the summer of 2025 (“Czech Republic Fully Independent from Russian Oil for the First Time in History”. European Pravda. April 17, 2025).

For gas, the country has signed contracts for the supply of Norwegian gas through Germany and Algerian gas through Italy. The Algerian contract, which covers 2% of Czech consumption, can be quickly increased to 20%.

Energy Balance and Prospects. Growth in Electricity Consumption. The plan anticipates an increase in electricity consumption by approximately one-tenth by 2030 due to decarbonization and the replacement of other fuels with electricity. Annual electricity production is expected to grow at a CAGR of 0.6% from 2024-2035 to 76.4 TWh.

Electricity Imports. As electricity replaces other fuels and consumption grows, there will be a partial need for electricity imports from abroad. However, the fully liberalized European electricity market allows for optimizing supply and demand.

The Czech Republic is forming a comprehensive energy strategy, which includes the following. Nuclear energy as the foundation - growth to 68% by 2040. Rapid phase-out of coal - by 2033 instead of the previously planned 2038. Moderate growth in RES

- to 30% by 2030. Energy independence - completion of the withdrawal from Russian energy carriers. Gas as a transitional fuel - to replace coal until the full transition to clean sources.

The strategy is aimed at ensuring energy security, decarbonization, and compliance with European obligations while maintaining economic competitiveness.

Discussion. The updated Czech National Energy and Climate Plan (NECP) reflects a complex balancing act between the ambitious decarbonization goals of the European Union and the structural constraints of a carbon-intensive, industrially oriented economy. On the one hand, the Czech Republic has committed to phasing out coal by 2033 – an accelerated timeline compared to previous strategies—and to expanding the role of nuclear energy to nearly 70% of the electricity mix by 2040. On the other hand, renewable energy sources (RES) are set to grow only moderately, from 18% in 2021 to around 30% by 2030, which places the country below the EU frontrunners in solar and wind deployment.

This dual-track approach – massive investment in nuclear alongside incremental RES growth – has generated debate regarding the sustainability, flexibility, and cost-efficiency of the Czech transition. Advocates argue that nuclear energy ensures a stable, low-carbon baseload, enhancing security of supply and reducing import dependence. Critics emphasize that slower deployment of wind and solar risks locking the energy system into high-cost pathways and limiting innovation spillovers from decentralized green technologies. Moreover, the reliance on natural gas as a transitional fuel raises concerns about medium-term price volatility and exposure to external suppliers, even though contracts with Norway and Algeria have diversified import routes.

The plan also reveals structural challenges. While financial commitments are substantial – 2.8 trillion CZK by 2050 – the effective mobilization of EU funds, state aid mechanisms, and private capital will be decisive. The allocation of resources toward nuclear development, while necessary, could constrain available financing for small-scale renewables, storage, and demand-side flexibility, which are essential for grid stability in a decarbonized system. Another challenge is regulatory: limited auction volumes for solar and wind projects, together with bureaucratic hurdles in permitting, may delay project implementation and prevent full exploitation of renewable potential.

Socio-economic implications must also be considered. Coal-dependent regions face profound structural change, and while modernization funds provide compensation, questions remain regarding the speed and inclusiveness of just transition policies. Job creation in clean energy technologies is a positive trend, yet regional disparities risk intensifying if local labor markets are not fully integrated into the green transformation. Finally, geopolitical shifts after 2022, including the complete withdrawal from Russian oil and gas, underline the urgency of energy independence but also test the resilience of new supply arrangements.

Overall, the Czech NECP represents a pragmatic compromise: it secures alignment with EU climate commitments, strengthens energy independence, and ensures continuity for an energy-intensive economy. However, its heavy reliance on nuclear power, moderate RES targets, and unresolved socio-economic challenges raise

questions about the long-term adaptability and competitiveness of the Czech energy model.

Conclusions. The Czech Republic has approved an ambitious National Energy and Climate Plan aimed at reducing greenhouse gas emissions by 63% in ETS sectors by 2030 and a complete phase-out of coal by 2033, which aligns with commitments to the EU and the Union's climate policy. The country plans a significant increase in the share of nuclear generation from the current approximately 40% to 44% in 2030 and to 68% in 2040, including through the construction of new units at the Dukovany NPP and possible expansion of the Temelín NPP. An increase in the share of renewable energy sources to over 30% by 2030 is envisaged, with a focus on the development of solar energy (10 GW) and wind energy (up to 1.5 GW).

The Czech Republic is gradually reducing its dependence on energy imports, particularly Russian ones, achieving full independence from Russian oil and gas in 2025 through the modernization of import infrastructure and contracts with Norway and Algeria. To implement the NECP, investments of about 2.8 trillion CZK are required, with financial support from the state and the EU, including guaranteed revenues for the construction of new nuclear units and modernization funds for coal phase-out. Gas is defined as a transitional fuel during the coal phase-out and active development of nuclear energy and RES. Annual growth in electricity consumption is forecasted, necessitating the development of generation and import capacities while maintaining economic competitiveness.

Overall, the Czech NECP is a comprehensive strategy that integrates decarbonization, energy security, innovation development, and fulfillment of EU climate commitments, combining the development of nuclear generation with moderate RES growth and coal phase-out.

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