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# Assessment of the national Long-Term Strategies of the Visegrád Group Countries

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# Summary

The comparative analysis of the long-term strategies in Czechia, Hungary, Poland and Slovakia finds both commonalities as well as significant differences. The strategies in their current state represent an initial guide for each national transformation pathway towards a net zero economy in the EU, but will benefit from further specification along the way. They all include quantified targets, are based on dedicated technical analysis and most present an adequate level of detail on sectoral developments (without setting targets). There is clear room for improvement in analysing financing options for the necessary investment and in analysing the socioeconomic impacts of the paths charted in the strategies. Moreover, information on plans and procedures for implementation is low and the inclusion of the public in the development process could be improved for most strategies.

There is presently no evidence of cross-border thinking or a search for joint solutions in the strategies. Any integrated or at least coordinated planning between neighbouring countries is hampered by the fact that the documents did not have to follow a common structure and that they have been produced at different times, making the comparison more difficult. However, the resulting diversity also produces upsides in the form of national innovations.

In this exercise, **we focus on the identification of gaps, gathering good practices and presenting various approaches for the development of long-term strategies**, also in the context of time and changing political and regulatory conditions in which they were created.

Starting with the framework set out in Annex IV of the Governance Regulation as the basis, extending it and dividing it into categories, we assessed each strategy on a three-point scale. In addition, based on the findings of a cross-evaluation of the Visegrád Group strategies, we identified sensitive areas and prepared a set of cross-cutting practices, issues and recommendations ahead of upcoming updates:

- **Modelling:** In the case of the Visegrád Group, each country based its strategy (to lesser or greater extend) on an economy-wide model with different decarbonisation scenarios, which is an essential element of the strategy, greatly improving the quality of the strategy and providing additional data-based approach.
- **Targets:** Each country has specific targets: (i) an emission reduction target (ii) a renewable energy share target (iii) an energy efficiency improvement target for 2030 (which are set out in the NECP) and a climate neutrality target (or scenario) for 2050 (except Czech Republic, whose LTS is from before setting this goal at EU level). In terms of monitoring, governance, commitment to strategy and document transparency, it would be beneficial to set further interim goals for 2040 and other goals for 2050 (in the case of renewables and energy efficiency), or to at least define milestones resulting from modelling.
- **Sectoral approach:** Strategies should provide sector-specific sections containing a set of general indicators, emissions inventory and sector-specific indicators, presentation of different scenarios, description of the most important challenges and a strategy to address them, also reflected in policies and measures. Getting the highest mark for sector-specific categories in our assessment training, meant that the strategy provided a sufficient number of details regarding the abovementioned aspects. The horizontal problems that could not be reflected in the scoreboard are differences in structure, content and presentation of these sections, not only across the strategies but also within them. The documents would benefit from a more consistent, structured approach.

- **Visual presentation:** Long-term strategies for decarbonising the economy are based on models providing a considerable amount of data and indicators for different scenarios, describing policies and technologies for the different areas and sub-areas that also interact with each other – all happening over a 30-year time span. Authors need to input extra effort for presenting this data and the conclusions provided in the strategy – by using figures, highlighting the most important indicators, use of tables and summary tables etc.
- **Investment needs and financing:** One of the key parts of the strategies are the quantification of investment needs and their distribution across sub-sectors and time. Funds and other financing options should correspond to these needs, but take into account the characteristics of the sector and the negative impacts on vulnerable groups for just transition. Most strategies overlook the description of national measures and financial mechanisms that should be included in the strategy.
- **Research and Development**: The greatest innovation challenges defined throughout the document should be reflected in the strategy by identifying key priorities and funding distribution for R&D&I sectors. Countries should take advantage of their national intellectual capital and support the innovation of solutions that are crucial for decarbonising the economy. Innovation development can greatly benefit from regional and international cooperation that should also be reflected in the outlined policies and measures.
- **Socio-economic impacts:** Significant improvements should be made in addressing socio-economic impacts. Changes taking place in the economy at such a fast pace will have extensive consequences on societies, regions (in particular carbon-intensive, industrial regions) and the labour market. Distributive impacts, energy poverty issues, policies and measures to counteract these effects are vital elements of a LTS
- **Domestic governance:** Despite the fact that most countries have decided to implement some form of governance tools, further strengthening will add more weight to strategy implementation. Strategy should not be a figurative document, rather its main objective should be to serve as the key reference for the energy transition for policymakers, decisionmakers and investors.
- **EU-level governance:** Much can be done by improving the strategy development process and providing better guidelines and a framework for updating the strategy. More guidance from the EC in this regard would improve the quality, the impact and the comparability of the strategies, hence improve planning and monitoring at the regional and EU-level.
- **EU-level action:** A more active role from the European Commission could facilitate further improvements of national LTSs, for examples through the creation of a platform of knowledge exchange for the countries at the EU-level, organizing workshops / seminars to build the knowledge.

Due to the increasing know-how on modelling and strategic planning, which is also the result of the work on this strategy, the updated strategies should bring significant improvements at the national level. Importance and the usefulness of the strategy at the regional and EU level will depend on the regional cooperation of Member States and the involvement of the European Commission in improving the guidelines, communication and process. A more inclusive and collaborative nature for their development and implementation will be beneficial in the areas such as innovations, sector coupling, cross-border networks, transformation of carbon-intensive regions, transport, etc. Common knowledge platforms and better networking would provide

synergy effects and would positively affect domestic efforts and outcomes in terms of strategy creation and implementation, by establishing best practices, sharing experiences and know-how between the countries.

The elements that should be included in the strategy are laid out in Annex IV of Governance Regulation. Those guidelines were the starting point of the evaluation that were further extended and categorized into specific areas. The assessment's findings have been summarised in the form of a scoreboard, with each aspect scored on a three-point scale from 1 to 3 based on the following criteria. The highest score (3) was given if the category in the strategy can constitute a point of reference for future strategies, (2) means partial coverage of the category with moderate gaps and the lowest (1) means no coverage of the category or coverage with major gaps. More detailed guidelines on the methodology are presented in Annex I.

**Table 1. Scoreboard – Assessment of V4 countries by category**

| Category | Subcategory | Czechia | Hungar | Slovaki | Poland[1] |
|---|---|---|---|---|---|
| General information and targets | Adherence to Governance Regulation | 2 | 3 | 3 | 3 |
| | Up-to-date document | 2 | 3 | 3 | 3 |
| | Net-zero target | 1 | 3 | 3 | 2 |
| | GHG emissions reduction | 3 | 2 | 2 | 2 |
| | Renewable energy share | 1 | 2 | 1 | 2 |
| | Energy efficiency | 1 | 2 | 1 | 2 |
| Sectoral details | Energy | 2 | 3 | 2 | 3 |
| | Buildings | 2 | 3 | 2 | 3 |
| | Transport | 2 | 3 | 2 | 3 |
| | Industry | 2 | 3 | 2 | 3 |
| | Agriculture | 2 | 2 | 2 | 2 |
| | LULUCF | 2 | 2 | 2 | 2 |
| | Carbon removal technologies | 2 | 3 | 1 | 3 |
| Financing and enabling policies and measures | Investment needs assessment | 3 | 3 | 3 | 3 |
| | Financing | 2 | 3 | 2 | 3 |
| | R&D | 1 | 3 | 2 | 2 |
| Economic assessment | Socio-economics impacts | 1 | 2 | 3 | 2 |
| | Distributive impacts | 1 | 1 | 2 | 2 |
| Strategy preparation and implementation | Analytical tools | 2 | 3 | 3 | 3 |
| | Governance | 3 | 3 | 2 | N/A |
| | Public consultation | 2 | 3 | 2 | N/A |

[1] See disclaimer at the beginning of Section 1.

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# 1 Introduction and background

**Disclaimer:** *Polish long-term strategy is still in the making – the quantitative analysis for the strategy is completed, but qualitative analysis is still in the progress and is subjected to change, hence assigned score and references to Polish strategy can change significantly, once the strategy is completed and it cannot constitute a reference to the official position of Poland regarding the LTS.*

The creation of an adequate economy-wide strategy is crucial from the point of planning and governance of climate policy in individual countries over a longer period of time. Its objective is to demonstrate a holistic economic perspective, to bind detailed sectoral strategies exhibiting the state of the economy in relation to climate ambitions and to present the relative effort needed in individual sectors, sectoral interdependencies and the distribution of enabling policies and measures. The strategy also strengthens regulatory stability, which reduces investment uncertainty and enables a forward-looking perspective for addressing the impacts of the transformation.

One of the key laws in EU climate policy is Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action[2] (hereinafter referred to as the Governance Regulation). It obliges Member States to create two climate strategies: a National Energy and Climate Plan (NECP) – focusing on the energy sector, and on the next 10-20 years – and a long-term strategy (LTS) – which is a low-carbon strategy covering the entire economy over the period of the next 30 years.

The Governance Regulation puts significantly less emphasis on long-term strategies compared to NECPs, e.g. it has less precise guidelines as to the structure of the document, a much less intensive governance process involving scrutiny by the Commission side (in the case of NECPs there is an assessment and evaluation of implementation, which is not the case for LTS). The lower emphasis and respective perceived lower political importance has arguably translated into significant delays in adopting their strategies by Member States – some of which have not yet done so, despite the deadline for submitting them to the Commission on 1.1.2020. Due to the relatively large differences in the long-term strategy adoption dates and significant changes in climate policy in recent years, both the topicality and ambition of climate policies presented in the documents vary significantly. In addition, because of the lack of a strict framework provided by the Regulation, the details and scope of the strategies are also very diverse.

In this report, the focus is set on the four members of the so-called Visegrád Group – namely Czech Republic, Hungary, Slovakia, and Poland – which is a formal alliance formed in 1991. Its initial objective stood for mutual support on entering EU and NATO structures which has evolved into further cooperation. Today, it is a platform for sharing best practices regarding membership in the EU and debating current issues, as well as advancing cooperation in education, science, cultural, economic, and energy. Its activities embrace strengthening stability in the region through joint actions at the level of the ministers or in the form of expert teams. At the Polish Presidency in 2020-2021, V4 countries announced more intense collaboration within the energy sector including a common position at the EU level concerning the Just Transition in coal regions and a regulatory framework for the natural gas market[3]. Other

[2] The European Parliament and the European Council. (2018). Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action.
[3] Central Europe Energy Partners (CEEP). (2020). 'Back on track' – the Polish Presidency of the Visegrad Group (V4) 2020-2021.

goals are covered by the implementation of the "Clean Energy for all Europeans" package, which facilitates the common electricity energy market, supports innovative technologies, and extends research on low-carbon nuclear power[4], hence the comparative analysis of individual long-term strategies can be a good point of reference for further discussions in the Visegrád Group, in the region of Central and Eastern Europe and the entire European Union.

This report presents the assessment and the abovementioned comparative analysis of the Visegrád Group countries LTSs, and aims at identifying best practices and weaknesses of these strategies[5]. Based on the findings, the analysis also provides the guidelines ahead of the upcoming update, which, in line with the Governance Regulation, should be done every 5 years, if necessary. However, after the regulation was adopted in 2018, European Council committed to the climate neutrality goal in 2050, increasing the ambition to reduce emissions by 55% until 2030 as part of the Fit for 55 package[6]. Tightening EU climate and energy policy, the COVID-19 pandemic and the creation of NextGenerationEU for green recovery means that most strategies will need to be updated.

The Visegrád Group presents moderately similar approaches to strategy development, creating a document based on quantitative economy-wide models, however, the documents differ in the degree of detail of the individual parts and in their structure. The quality of the document is also affected by the date of its adoption: Poland (still in the process of creating strategy) or Hungary may have benefited from a late adoption, had more time and feedback from earlier strategies. There is also growing need for a more extensive and far-reaching approach as a result of more stringent climate policy.

[4] Ibid.
[5] Detailed assessment of individual countries are presented in the Annex II.
[6] Council of the EU and the European Council. (2021). Fit for 55. The EU's plan for a green transition.

# 2 Assessment of the Visegrád Group's national long-term strategies

## 2.1 Overview of the key climate and energy indicators in the Visegrád Group countries.

Due to regional, political, historical and cultural connections, the countries of the Visegrád Group share a lot of similarities, also in economic matters – and as a result they face several similar challenges, also on the path to climate neutrality. The four countries have a number of common features relevant in this context. They share similar relative energy intensity[7], as all of them are also historically dependent on fossil fuels. All countries are net importers of energy, hence the issue of energy security is of great importance.[8] Each of the studied countries differ vastly in the size of their respective economies and populations[9], with Poland accounting for over half of the population and nominal GDP of the group, followed by the Czech Republic and then Slovakia and Hungary. To understand the similarities and differences between countries and their different starting point in decarbonisation process, this section provides an overview of key indicators: GHGs emissions and use of energy carriers.

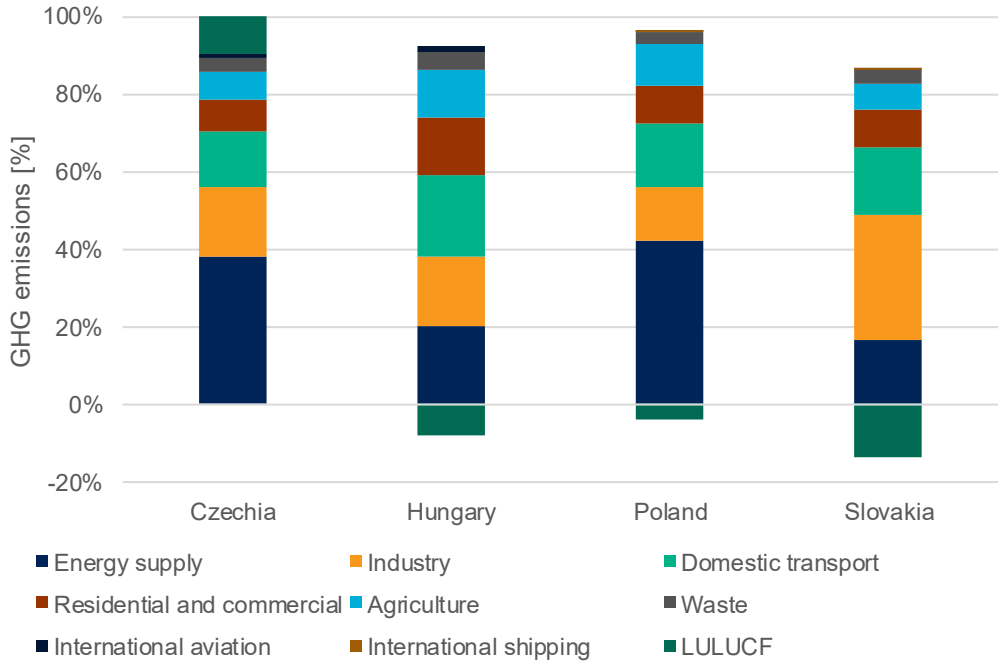
### 2.1.1 GHG emissions

The difference in size of economy translates into differences in absolute total greenhouse gas emissions[10]. According to European Environment Agency estimates, Poland emitted almost 380 Mt $CO_2$e net, followed by Czech Republic with around 140 Mt $CO_2$e, Hungary with 60 Mt $CO_2$e and Slovakia with 35 Mt $CO_2$e. Not surprisingly, the energy supply sector is the largest emitter in the V4 group (250 Mt $CO_2$e), constituting 40% of total GHG emissions, followed by transport and industry sectors with almost 110 Mt $CO_2$e of annual emissions (which translates into 18% of total emissions each).

Figure 1 presents the breakdown of the sectoral share in net emissions for each country in 2019, showing the diversity of these shares between the states. Poland and Czech Republic emits the most in energy supply sector and their overall structure is relatively similar, while Slovakian and Hungarian emissions are led by industry and transport respectively with significant less emissions from energy supply.

[7] Defined as Gross Inland Consumption/GDP.
[8] Kochanek E. (2021). The Energy Transition in the Visegrad Group Countries. *University of Szczecin*, Szczecin.
[9] The World Bank. (2020). GDP (current US$) - European Union.
[10] European Environment Agency (EEA). (2021). EEA greenhouse gases - data viewer.

**Figure 1. Share of total GHG emissions by sector in 2019**




Source: WiseEuropa based on EEA data

Figure 2 presents how GHG emissions changed in individual countries in the most emitting sectors between 2005 and 2019.

**Energy supply:** In each of the four countries, the main driver of emission reduction is currently the energy supply sector, which is a general global trend given its big share in total emissions and high economic feasibility of the emission reduction compared to other sectors. In Europe the emission reduction from power and heat conventional plants is strengthened by the economic impulse coming from the EU ETS, but also the rapid development and price drop of low-emission technologies supported by national and EU regulations and funds. The emission reduction which was achieved in this sector by all V4 countries resulted also from the increase in the efficiency of power plants (through modernisation, retrofitting and commissioning of new coal-fired units meeting the highest efficiency standards), modernisation of transmission and distribution systems and decrease in energy demand[11] (i.e. increase in the energy efficiency of buildings).

**Industry:** The Visegrád Group is a highly industrialized region, whereas the decarbonisation of the industry sector has been so far overlooked by the European Union compared to energy sector. However, as the decarbonisation process advances in other sectors, the industry will finally have to take over the burden of emission reduction – especially in Slovakia, where this sector is responsible for a large share of total emissions (see: Figure 1). Nevertheless, some progress has been already made in lowering industrial emissions in V4 countries (see: Figure 2): either a change in fuels used for combustion, i.e. a switch from coal to low-carbon natural gas has occurred (in Hungary and Poland) or there was a decline in industrial production (in Czechia and Slovakia).

[11] Poniatowska-Jaksch M. (2021). Energy Consumption in Central and Eastern Europe (CEE) Households in the Platform Economics. *Energies*, p. 11.

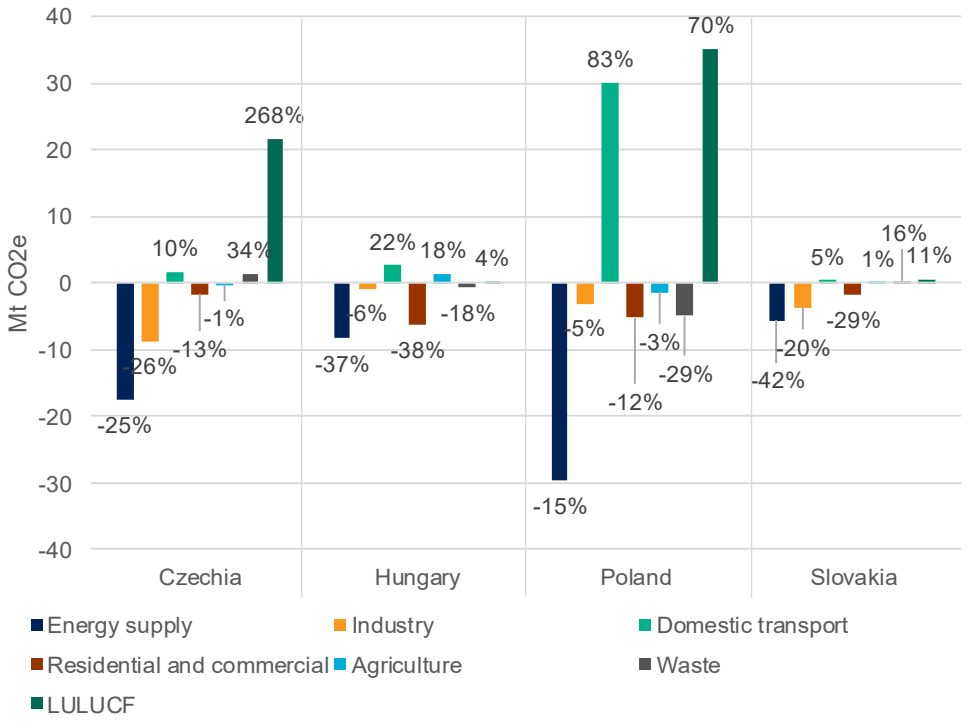
**Domestic transport:** sector emissions are also rising in each country (particularly in Poland), which is typical for developing economies[12], as a result of growing economic accessibility of personal transport, expanding trade and service sector.

**Residential and commercial:** since this sector encompasses individual heating, in all V4 countries a decrease in emission from this sector has been observed thanks to the ongoing renovation wave and exchange of heat sources (e.g. more efficient boilers, switching to heat pumps etc.)

**Agriculture:** this is the sector where slight changes in the level of emissions have been observed across V4 countries; When it comes to **waste**, the situation in V4 region is ambiguous, as some countries experienced quite significant emission reduction in this sector (Hungary and Poland), whereas some underwent the increase in emissions from waste (Czechia and Slovakia). As for now, however, the agriculture and waste sector was arguably of less importance due to the small share of this sector in total GHG emissions (see: Figure 1). Moreover, waste (and agriculture) have not been addressed with significant, dedicated national or EU decarbonization policies in 2005-2019 period. Therefore, a serious emission reduction process in these sectors is still to begin.

**LULUCF (Land use, land use change and forestry):** Recent years have also brought a major increase in GHG emissions in the LULUCF sector for Poland and Czech Republic (in CZ going from sink to source), mainly caused by felling of the forests due to outbreaks of the bark beetle[13].

**Figure 2. GHG emissions change 2005-2019 in selected sectors**



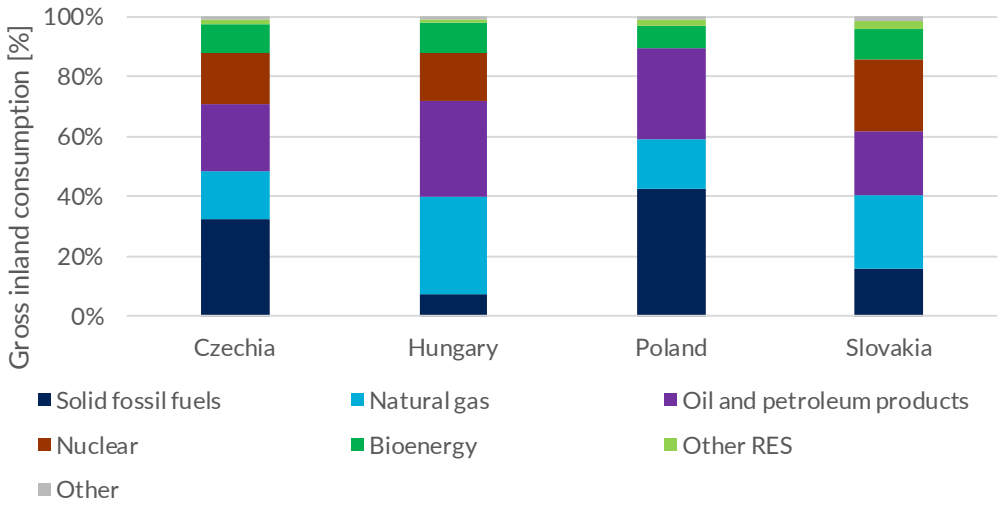

Source: WiseEuropa based on EEA data

[12] Sims R., Schaeffer R. et al. Intergovernmental Panel on Climate Change (IPCC). (2014). Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. *IPCC*, Cambridge / New York, p. 5.
[13] Ministry of Agriculture of Czech Republic. (2018). National forest accounting plan of the Czech Republic. p. 7.

### 2.1.2 Energy mix

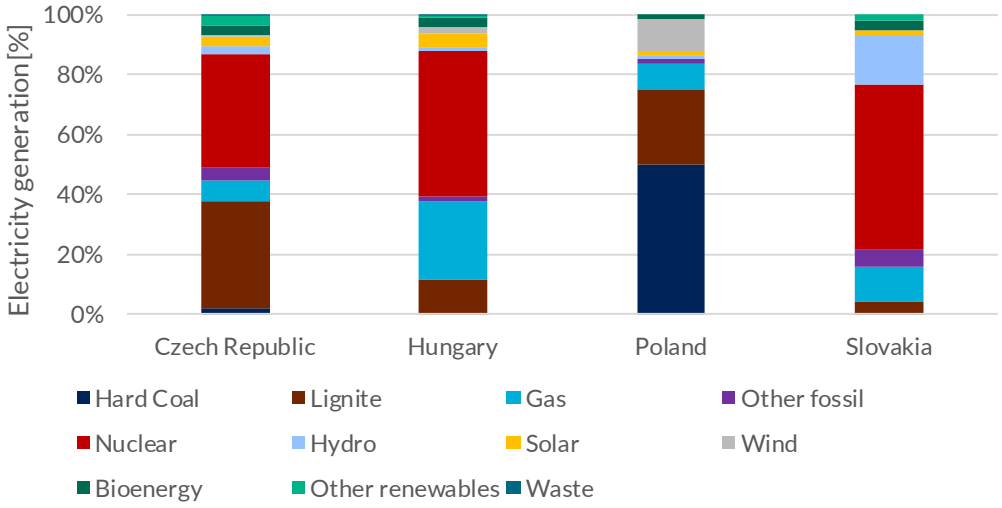
Similarities are also visible in fuel consumption structure. The Visegrád Group countries are highly dependent on fossil fuels for their energy consumption, especially gas and oil. However, one of the main differences in energy mix profiles is the lack of nuclear energy in Poland and high consumption of hard coal instead (see Figure 3). As a result, Poland has a much more carbon-intensive power generation mix in comparison to the other countries (see Figure 4). For this reason, in terms of solid fossil fuel dependence, Poland, followed by Czech Republic with its high dependence on lignite in power and heating, seems to be in a more difficult starting point with regard to reducing emissions in the energy sector. However, many of these coal-fired capacities are already obsolete and re-investment in the coming years would have been necessary regardless[14].

**Figure 3. Gross inland consumption of energy carriers in 2019**




Source: WiseEuropa based on EEA data

**Figure 4. Electricity generation by source in 2020**




Source: WiseEuropa based on Ember data

[14] Climate Analytics (2017). A stress test for coal in Europe under the Paris Agreement, p.11, figure 4.

## 2.2 General information and targets

**Table 2. Scoreboard on general information and targets**

| Subcategory | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Adherence to Governance Regulation | 2 | 3 | 3 | 3 |
| Up-to-date document | 2 | 3 | 3 | 3 |
| Net-zero target | 1 | 3 | 3 | 2 |
| GHG emissions reduction | 3 | 2 | 2 | 2 |
| Renewable energy share | 1 | 2 | 1 | 2 |
| Energy efficiency | 1 | 2 | 1 | 2 |

The general scope of long-term strategies was laid out in Article 15(4) of the Governance Regulation and Annex IV. In this section we assess if the strategy follow these framework and check the strategies for general alignment with current climate policy of European Union, manifested in (1) date of adoption of the document, and (2) three climate targets: namely GHG emission reduction, RES share and energy efficiency improvement.

Among the evaluated strategies, three (HU, SK, PL) are mostly in line with the abovementioned framework. Nonetheless, the Annex IV is only one page long (compared to 11 pages for NECP) being rather unspecific and leaving a lot of flexibility on Member State side, thus complying with it was not so difficult.

The Czech strategy was adopted long before the regulation entered into force, so unsurprisingly it differs the most from the framework and missing an important part of economic assessment. However, it contains most of these elements and scores 2, which is arguably evidence of the lack of specification in the guidelines in the regulation.

Due to the lack of organization and systematization in terms of the time of adoption of documents, in the entire European Union there is a spectrum of strategies relating to the different state of climate policies and goals that have been dynamically changing in recent years. Even in such a small group of countries as the Visegrád Group, the time span between the adoption of these documents is almost 5 years, which hinders the integration of regional efforts and cooperation within the LTSs framework, which at the moment is mostly incompatible with current activities in the field of climate protection.

**Table 3. Year of adoption or draft release of LTS**

| Country | Date of adoption | Responsible administration unit |
|---|---|---|
| Czech Republic | 22nd March 2017 | Ministry of the Environment |
| Hungary | 5th September 2021 | Ministry of Innovation and Technology |
| Poland | Still in progress | Ministry of Economic Development and Technology |
| Slovakia | 5th March 2020 | Ministry of the Environment |

The date of adoption translates into the goals set out in the documents: HU sets the goal of achieving climate neutrality, PL presents scenarios for achieving climate neutrality, whereas SK sets the goal, but the model does not cover this commitment (as the modelling took place before committing to the goal) and only presents a set of additional measures for filling the gap between modelling and climate neutrality. CZ falls short of the goal by 20% (see more in Annex II).

All strategies did not provide high-level targets beyond the 2030 targets defined in the NECP and the 2050 greenhouse gas reduction target. In none of the strategies were there interim or 2050 targets for two key indicators, energy efficiency improvement and renewable energy share.

None of the long-term strategies provide goals for renewable share and energy efficiency in 2050. However, Poland and Hungary presented possible indicative targets based on modelled scenarios.

**Table 4. High-level targets for 2050 and 2030**

| | **Targets for 2030 (based on NECP)** | | | | **Targets for 2050** | | |
|---|---|---|---|---|---|---|---|
| | **GHG emission reduction** | **RES share** | **Energy efficiency [Mtoe]** | | **GHG emission reduction** | **RES share** | **Energy efficiency** |
| | | | **Primary energy consumption** | **Final energy consumption** | | | |
| Czech Republic | -14% | 22% | 41.45 | 23.65 | -80% | - | - |
| Hungary | -7% | 21% | Not set | 18.7 | Climate neutrality | - | - |
| Poland | -7% | 21-23%* | 91.3 | 67.1 | Range of indicative targets | - | - |
| Slovakia | -12% | 19.2% | 15.7 | 10.3 | Climate neutrality | - | - |

*23% target is conditional, depending on whether the European Union decides to allocate additional funds to achieve this goal (as of 30th December 2019)

## General information and targets – cross-cutting issues

- Different adoption times make it difficult to integrate the actions taken by individual countries and to benefit from possible synergies at the regional and EU level within the framework of national strategies being developed, consequently reducing the importance and impact of the LTSs in this regard.
- The Governance Regulation framework requires indicative values for projections of RES share and energy efficiency (final consumption) by 2050, to the extent feasible. Lack of these targets is one of the most frequent major discrepancies among the strategies. In the case of quantitative economy-wide model results these values are easily accessible, and both the interim values as well as the 2050 values which would provide greater impact for the national climate policy beyond European obligations. RES share and energy efficiency indicators can serve to measure progress of the implementation of the strategy.

## 2.3 Sectoral pathways and measures

**Table 5. Scoreboard on sectoral details**

| Subcategory | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Energy | 2 | 3 | 2 | 3 |
| Buildings | 2 | 3 | 2 | 3 |
| Transport | 2 | 3 | 2 | 3 |
| Industry | 2 | 3 | 2 | 3 |
| Agriculture | 2 | 2 | 2 | 2 |
| LULUCF | 2 | 2 | 2 | 2 |
| Carbon removal technologies | 2 | 3 | 1 | 3 |

The general framework of long-term strategies set out in Annex IV of Governance Regulation requires inclusion of sector-specific related content. Providing a sectoral context is of crucial importance, which gives meaning to the planned transformation; background should include the presentation of various sector indicators, the presentation of policies and measures, and the various factors influencing the current state of affairs. While all the countries sectoral subsections contain historical emissions data and specify policies and measures with a long-term perspective, the level of detail, amount of information, structure and presentation vary significantly between sectors and countries.

Generally, the newer strategies (HU and PL) have better sectoral coverage than the older ones (CZ and SK). Modelling results are well incorporated in the text and are supplemented with qualitative analysis which makes the content easier to understand with a stronger narrative. The legibility of the document is manifested in a large amount of visual presentation of data and appropriate division into sectors (although in the case of Hungary, the buildings and transport

do not have a dedicated section, which can be seen as notable omission, due to the specificity of these sectors; nonetheless they were broadly discussed in the energy section).

The Czech Republic strategy does not provide visual representations of the data and it provides limited insight into the historical and future trends as well as policies and measures required to be implemented. Slovakia, on the other hand, focuses its visual data presentation and discussion on reducing greenhouse gas emissions and lacks more insight on modelling results regarding other sector specific indicators that detail the path to achieving neutrality in each of the sectors. Including more indicators allows an understanding of the sector's characteristics and emissions reduction potential, thus arguing for the proposed policies and measures.

Backing up qualitative analysis with modelling results is important for going beyond generic recommendations for sectors such as energy renewables deployment, energy efficiency improvement, alternative fuels development etc. The results should give at least a general impression of efforts needed in each sector and presenting the reliable paths to meet them.

All strategies have a modest coverage of agriculture and LULUCF sectors compared to the others. Their characteristics are exceptionally different from other sectors, but their role, in particular in the context of the potential of e.g. afforestation or other types of sequestration, is significant.

## Sector pathways and measures – cross-cutting issues

- Hungary, Slovakia and Poland provide detailed sectoral approaches with historical data on GHG emissions, description of policies, measures and technologies, but also provide quantitative analysis on future emissions pathways and, in the case of Poland and Hungary, also other indicators. Visual presentation of trends and forecasts (based on model's results) give a better sense of current and future dynamics.
- Ideally, the strategy should provide a set of sectoral targets and a reference to specific sectoral strategies (if applicable). Similarly to general indicators mentioned in section 2.2, sectoral indicators would allow measuring the progress of implementation of the strategy and a better understanding of the dynamics of the changes to come.
- In future updates, countries should also focus on more detailed sectoral discussions for agriculture and LULUCF, which have been poorly addressed in comparison with other sectors.
- When discussing sectors, the presentation and establishment of consistent structure across the sectors is also important. It helps to understand the content and the contribution of individual sectors in the wider decarbonisation context. The Slovak LTS is a good example of this.

## 2.4 Financing and enabling policies and measures

**Table 6. Scoreboard on financing and enabling policies and measures**

| Subcategory | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Investment needs assessment | 3 | 3 | 3 | 3 |
| Financing | 2 | 3 | 2 | 3 |
| R&D | 1 | 3 | 2 | 2 |

### 2.4.1 Investment needs assessment and financing

All V4 countries provide quantitative estimates of the investment needs for the transition scenarios. Furthermore, details on cost distribution between the particular sectors are also provided. The estimates made by Czech Republic may be, however, more of rough estimation, since they are not based on complex modelling; rather they were made with the use of a simplified tool, i.e. a *2050 Energy Calculator*[15] developed by the UK's Department of Energy and Climate Change and (for details see: Analytical tools).

These investment needs are to be financed by EU financial instruments, state budgets and/or private capital. Available EU funds are extensively described in the LTSs submitted by Hungary, Slovakia and Poland; the Czechian strategy covers only the EU ETS revenues to the state budget which are to be spent on the transition. An overview of state financial schemes (with the funds that are to be provided by these schemes) is provided only by Poland. Private finance flows were not covered in any of the LTSs submitted by V4 countries. As a result, financial resources identified in the strategies are not sufficient to satisfy the estimated investment needs.

In their documents, Hungary, Slovakia and Poland point out the presence of a funding gap – Hungary and Poland outline measures and policies (e.g. green bonds) to stimulate public and private investments needed for the transition, whereas Slovakia only declares to analyse whether and to what extent state and public authorities are ready to use increased funding for decarbonisation projects in the long term during the update of its strategy.

Additional elements which were included in some strategies were international climate finance and EU taxonomy for sustainable activities: Czech Republic's strategy reached beyond domestic decarbonization and delivered a separate, extensive chapter on supporting climate finance in developing countries, and Poland has assessed investments and technologies outlined in the LTS in terms of their compatibility with the EU taxonomy for sustainable activities, which allows an evaluation of the extent to which they can be financed with EU funds.

[15] Department of Energy and Climate Change of the United Kingdom. (2022). DEEC 2050 Calculator.

**Table 7. Investment needs for the transition vs. available financial resources identified in the LTSs** (in EUR billion; maximum values were taken).

| | | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|---|
| Investment needs[16] | | 334.7[17] | 70.5[18] | 196[19] | N/A |
| Identified financial resources | EU funds | X | 10[20] | 45[21] | N/A |
| | State budget | 5.8[22] | X | X | N/A |
| | Private capital | X | X | X | N/A |
| Funding gap[23] (**% of investment needs**) | | 328.9 (**98%**) | 60.5 (**86%**) | 151 (**77%**) | N/A |

### 2.4.2 R&D and innovation

While R&D and innovation are described in all strategies, the details provided by each country, as in the case of other sectors, vary significantly.

In general, the V4 LTSs lack a strategical approach towards R&D: no detailed and comprehensive roadmap is provided for the majority of them, except for the Hungarian case, where measures to promote both finance and R&D are described. Hungary is also the only state that overviewed, in detail, all available low and zero carbon technologies in all sectors, assessing their maturity and accessibility.

In contrast, Czechia just summarized R&D activities to date. Poland and Slovakia strive to develop the policy towards R&D since they indicate areas which are to be covered by R&D activities and they give a gist to how this sector will be financed (SK presents the 2020-2029 timeline
of expenditure for R&D). Nevertheless, it is not known how the funds will be shared between the particular areas. Moreover, no strategic goals or implementation tools have been identified.

[16] Defined as additional investment needs compared to the reference scenario.
[17] Summary table prepared by a team led by the consultancy Ricardo, as part of a contract to support DG CLIMA with the assessment of the Long-Term Strategies of EU Member States (value based on Table 11 of the Czechian LTS where the costs were expressed in CZK; they were converted by Ricardo to EUR using EUR/CZK=1/25.5).
[18] I.e. HUF 24 709 billion (Ministry for Innovation and Technology of Hungary. (2021). National Clean Development Strategy 2020-2050, p.15); converted to EUR using the exchange rate adopted by the consultancy Ricardo in the summary table prepared as part of a contract to support DG CLIMA with the assessment of the Long-Term Strategies of EU Member States, i.e. 1 EUR = 350 HUF.
[19] Government of the Slovak Republic. (2019). Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050, p. 66.
[20] I.e. HUF 3 500 billion (Ministry for Innovation and Technology of Hungary. (2021). National Clean Development Strategy 2020-2050, p.104); converted to EUR using the exchange rate adopted by the consultancy Ricardo in the summary table prepared as part of a contract to support DG CLIMA with the assessment of the Long-Term Strategies of EU Member States, i.e. 1 EUR = 350 HUF.
[21] Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050, p. 67.
[22] I.e. CZK 148 billion (Ministry of the Environment of the Czech Republic. (2017). Politika ochrany klimatu v ČR [Climate protection policy in the Czech Republic], p. 88); converted to EUR using the exchange rate adopted by the consultancy Ricardo in the summary table prepared as part of a contract to support DG CLIMA with the assessment of the Long-Term Strategies of EU Member States, i.e. EUR/CZK=1/25.5).
[23] I.e. the investment needs which financing was not adequately addressed in LTS; own calculations based on the LTSs.

## Financing and enabling policies and measures – cross-cutting

- An assessment of investment needs and the identification of available financial resources is essential for enabling and planning the implementation of the LTS.
- Given the estimated investment needs and identified financial resources, there is
  a significant financing gap that is not covered sufficiently in any of LTS submitted by V4 countries; this gap should be filled in the updates of the LTSs with extended estimates of available EU funds (the use of revenues from the sale of $CO_2$ emission allowances, funds from the Modernization Fund and cohesion funds, etc. At country level should be further specified), declarations on how much finance could be provided by the state and how it will be distributed, and, last but not least, measures to mobilise private finance flows (with modelled quantitative results of applying these measures), since states cannot rely on public finance only – notable share of financial burden linked to the transition requires some support from the private sector.
- An update of the assessment of investment needs is especially relatable in Czechia and Slovakia, where the scenarios for which the costs were calculated do not allow to achieve climate neutrality in 2050, hence aligning the scenario and investment needs with climate targets is needed. This also implies that the cost of decarbonisation would be considerably higher in these countries.
- Countries should consider bindingly earmarking appropriate shares of public funds identified in the LTSs for the transition in order to provide stable funding to the process.
- An emphasis should be put not only on cost distribution between the sectors, but also between particular periods until 2050 (more detailed forecast has been already provided by Poland and, to some extent, by Czechia and Hungary). By knowing the investment needs in particular sectors and knowing how much money is available in a particular moment, one can efficiently plan the implementation of the LTS.
- The assessment of investment needs should take into account the socio-economic consequences (for details see: Socio-economic impacts) of the scenario for which the costs were calculated.
- R&D and innovation should be discussed more broadly in the LTSs: strategies, policies and measures for related research, development and innovation are required by the Governance Regulation (especially in terms of financing them). An advancement of low and zero emission technologies could also lower the investment needs. An added value, therefore, would be setting the priorities of R&D in the context of decarbonisation.
- In the R&D chapters there is significant potential for future updates (except for HU, which stands out from other V4 countries), especially since, for example, SK and PL do not describe the financing of R&D activities beyond 2030.

## 2.5 Economic assessment

**Table 8. Scoreboard on economic assessment**

| Subcategory | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Socio-economics impacts | 1 | 2 | 3 | 2 |
| Distributive impacts | 1 | 1 | 2 | 2 |

### 2.5.1 Socio-economic impacts

Based on the LTSs submitted by V4 countries, several key economic factors prone to be affected by the policies presented in the strategies were identified (see Table 9.)

**Table 9. Issues included by V4 countries in the assessment of socio-economic impacts**

| Economic issue | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Gross Domestic Product | | | | |
| Employment | X | | | |
| Salaries | X | X | | |
| Government revenues | | | | X |
| International trade | X | | | X |
| Energy security | | | | |
| Impact on households* | X | X | | |
| Energy poverty | X | X | | X |

X – a given factor was not included in the LTS

* the situation of households (e.g. in terms of disposable income and private consumption, excl. energy poverty) under the measures proposed by particular countries is discussed in the chapter on distributive impacts

The degree to which particular factors have been discussed varies significantly depending on the country, with Czechia being the only country which did not provide a separate chapter on socio-economic impacts (a separate document refers to several studies assessing the impact of achieving 80% GHG emission reductions by 2050 on energy poverty, income distribution and taxation).

**GDP growth projections** have been presented in all strategies, but while Hungary, Slovakia and Poland provided projections for all scenarios being considered, the Czech Republic just referred to the GDP growth assumptions developed in another state document, which does not exactly reflect the measures encompassed by any of the scenarios outlined in the LTS.

The approaches chosen to assess and present **employment impacts** are also quite different depending on the country. Hungary and Slovakia provided numerical estimates of jobs under all scenarios (based on modelling), whereas Poland only forecasts, in percent, the possible negative impact of the transition jointly on employment and salaries.

When it comes to **salaries**, only Slovakia has assessed how real wages might change, in percent, under the transition scenario compared to the reference scenario.

For **government revenues**, only Hungary provided numerical estimates under each scenario and Slovakia mentions that the transformation towards a low-carbon economy will lead to lower collection of revenue from taxation. In contrast, Czechia refers to the EU ETS revenues only (for details see: Investment needs assessment and financing).

The impact of the transition on **international trade** is briefly described by Hungary and Slovakia without any numerical estimates and in-depth analytical approach.

**Energy security**, understood as an import-dependency of the country's energy system, is to a different extent referred to in every LTS submitted by V4 countries. Czechia, Poland, and, to some extent, Hungary provide an exact, numerical forecast of the number of imported fuels and electricity in the long term under each scenario. Slovakia only briefly refers to this issue.

**Energy poverty** risk, which is one of the most important issues when social costs of the transition are considered, is not covered in detail by any V4 country; Slovakia only defines social groups which are exposed to energy poverty risk.

However, although the socio-economic impacts are described to some extent (depending on the country), the LTSs delivered by V4 countries are, in general, short of measures and policies to prevent negative impacts of the strategy on the economy and society. This is especially applicable to Czech, Hungarian and Polish LTSs. While for a country like Hungary, the starting point and energy consumption characteristics make it relatively less vulnerable to suffering from negative impacts of the transition (nonetheless of great importance), this is especially relevant for the rest of the V4 countries. Severe negative socio-economic impacts might be expected in Poland and Czechia which are highly dependent on coal, (see: overviews of the key national climate and energy indicators in the Annex II: Country details).

Only Slovakia delivered a comprehensive assessment of the socio-economic impacts and broadly discussed expected negative impacts. As a result, this country mentions some measures aimed at mitigating a rise in unemployment, maintaining the competitiveness of industry and fighting dependence on imported primary energy sources. However, these policies could be better developed and there is lack of measures for some important impacts e.g., preventing an increase in energy poverty.

### 2.5.2 Distributive impacts

The assessment of distributive impacts should describe who and to what extent will bear the costs of the transition.

Czechia does not refer to distributive impacts at all, and Hungary only describes what might be done to prevent any negative distributive impacts.

Slovakia, however, has developed a relatively broad description of distributive impacts which includes **households and some industries**. Slovakia has analysed the impact the transition may have on households in terms of reduced consumption, the costs of electrification in the transport sector and higher prices transferred by businesses for the purposes of reimbursing the costs of energy efficiency investments. Estimates of how much households will invest until 2050 for thermal insulation, the purchase of more energy-efficient electrical appliances or the use of renewable energy sources have also been developed. Moreover, it has been assessed which sectors will be negatively impacted by decarbonisation (e.g. heavy industry), where production might increase (steel sector), what will happen with a very important branch of

Slovak industry, i.e. an automotive industry, and which sectors might benefit from the transition (e.g. construction).

When it comes to Poland, it states that the large amount of investments for decarbonising of the economy is needed in low-emission vehicles and buildings. Poland also recognizes that **coal and heavy industry regions** might experience a strong negative impact of the transition and that, for this reason, the transition of these regions will be extremely challenging.

However, although both countries, Slovakia and Poland, are aware of these negative distributional impacts, neither Slovakia nor Poland outline specific measures to mitigate them. They stress that some policies will be implemented, but to date nothing specific has been proposed.

## Economic assessment – cross-cutting issues

- The analysis of the impact of the transition towards climate neutrality on economy and society (including distributive impacts on social groups, specific regions and sectors) are essential components of climate and energy policy. However, a diagnosis of possible positive and, especially, negative impacts is not sufficient. A quantitative and qualitative **cost-benefit analysis** should be provided for each scenario in order to choose the optimal solutions: those which are not too harmful for the economy and the society, but allow for achieving climate targets.
- An exemplary assessment of avoided costs and added benefits is provided by Hungary. It includes both material and non-material factors. This model-based analysis is extensive since besides the increase in GDP and government revenues, improved labour productivity, energy costs and infrastructure it also covers avoided energy and fertilizer use, reduced transport-related externalities (including the cost of respiratory diseases due to air pollution, cost of noise pollution, cost of accidents, and value of time lost due to congestion) and the social cost of carbon. Providing analyses similar to that delivered by Hungary is highly recommended.
- In future updates, potential negative socio-economic and distributive impacts of the transition process, as well as preventative policies and measures, must be provided, especially by Czechia and Poland, which, as the countries highly dependent on coal, may be the most affected by a coal phase-out (both their economies and societies). Negative impacts identified by Slovakia should be reassessed in a climate neutrality scenario.
- Employment estimates should include both direct, newly created jobs in the green industries, and employment opportunities in other economic sectors, i.e. indirect jobs due to the spillover effect on the overall economy, as it is in the Hungarian LTS.
- When describing distributive impacts, vulnerable regions and social groups must be identified. Distributive impacts should be also assessed with respect to particular sectors. It is already partly done in the Slovakian LTS where impacts on different sectors are mentioned.

- Given recent developments, i.e. the "Fit for 55" legislative package (such as carbon pricing on buildings and transport), COVID-19 pandemic and, last but not least, volatility of natural gas and energy prices, there is a need to re-evaluate possible negative distributive and socio-economic impacts, and to develop comprehensive strategies to counteract them. This chapter of the LTSs should especially address coal regions and vulnerable societal groups and should include projections of energy bills and energy expenses for households. Possible implications of rising energy prices should be also discussed.

## 2.6 Strategy preparation and implementation

**Table 10. Scoreboard on strategy preparation and implementation**

| Subcategory | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Analytical tools | 2 | 3 | 3 | 3 |
| Governance | 3 | 3 | 2 | N/A |
| Public consultation | 2 | 3 | 2 | N/A |

### 2.6.1 Analytical tools

All V4 countries have taken a similar approach to exploring how the targets set in the LTSs could be achieved, as all the strategies have been prepared with the use of specific economic and energy models, which are extensively described in all the documents, as the initial assumptions.

Hungary, Poland and Slovakia adopted economy-wide, comprehensive models, whereas the Czech Republic used a simplified *2050 Energy Calculator*[24] developed by the UK's Department of Energy and Climate Change, but the results of the modelling conducted with the use of this calculator were incorporated into the strategy only to some extent as most of the analysis is provided in the annex to the Czechian strategy, which disrupts the narrative and hinders readability of the strategy (however, more extensive data sets of modelling results in the annex give more transparency). As part of the review currently underway of the strategy at the time of writing, a more sophisticated analysis is being used (personal communication).

Moreover, different pathways to achieve targets set in the strategies were considered, i.e. a scenario analysis was applied. In addition, these pathways were usually assessed in comparison to a (conservative) reference scenario (usually understood as a "business as usual" scenario).

### 2.6.2 Governance

Adequate governance mechanisms – i.e. progress monitoring, coordination, management, evaluation, reviewing and reports on the implementation – have proven to be essential to achieve climate objectives.[25] This idea lays behind the adoption of the Governance Regulation

[24] Department of Energy and Climate Change of the United Kingdom. (2022). DEEC 2050 Calculator.
[25] Ladegaard, P. (2001). Seminar on Regulatory Management and Reform: Good Governance and Regulatory Management. *Organisation for Economic Co-Operation and Development (OECD)*, Paris.

and the obligation to prepare national LTSs and NECPs. As a result, the European Commission provided a tool for monitoring the plans and progress made by the Member States, but its effectiveness depends ultimately on the quality of the domestic governance systems applied by individual countries.

Both the Czech Republic and Hungary provided a complex overview of domestic governance tools. The following table summarizes governance related information mentioned by Czechia, Hungary, Slovakia and Poland in their LTSs.

**Table 11. Governance tools included in the LTSs submitted by V4 countries**.

| Governance tool | Czechia | Hungary | Slovakia | Poland |
|---|---|---|---|---|
| Implementing body | The national system for policies, measures and projections | *Interministerial Committee on Climate Change* | *Governmental Council for the European Green Deal and Low-Carbon Transformation* | N/A |
| Implementation tools | Quantification of impacts and benefits of mitigation policies and measures | National short- and medium-term action plans and individual sectoral strategies | X | N/A |
| Monitoring | X | Already existing methods will be encouraged | X | N/A |
| Evaluation | Until December 31, 2021, delivered in September 2021[26] | Through the evaluation of the levels of GHG emissions | X | N/A |
| Update | Until December 31, 2023 | In 2026[27] at the latest where necessary | Within five years (i.e. in 2024) at the latest | N/A[28] |

X = a given tool was not included in the LTS

The need to update the strategy is expressed especially in the Czechian and Slovakian LTSs. Both countries understand that their strategies do not reflect EU climate targets, so the following revision is to include these targets in modelling.

[26] Czech Environmental Information Agency. (2021). Vyhodnocení politiky ochrany klimatu v ČR [Evaluation of the climate protection policy in the Czech Republic].
[27] Pursuant to the article 15 paragraph 1 of the Governance Regulation.
[28] Possibly every five years where necessary (pursuant to the article 15 paragraph 1 of the Governance Regulation).

### 2.6.3 Stakeholder participation and public consultation

The consultation process of all the LTSs submitted by V4 countries included public participation, except for the Polish one which has still not been released for public consultation; as it is still in progress. The extent of public involvement varied depending on the country.

Although Slovakia did provide an opportunity to share views on long-term decarbonization policy to all citizens, a broad public involvement was welcomed only at the initial stage of work on the LTS, when the Slovakian Ministry of Environment published a questionnaire through which everyone could submit the proposal of measures in the particular chapters proposed by the government. All responses have been assessed and processed. Following this stage, the government was arbitrarily choosing those with whom it wanted to cooperate and although public consultation was allowed in the official legislative procedure, it was of limited importance. Finally, the Slovakian strategy, although it was consulted, has not provided a feedback summary.

**Table 5. Public consultation process of the Slovakian LTS.**

| |
|---|
| Publicly available questionnaire |
| Consultations at governmental level |
| Working groups composed of the representatives of **state administration**, **academia** and **employers' associations** / Cooperation with relevant departments, the representatives of the general professional public and the relevant sections and organizations within the remit of the Ministry of Environment |
| Interdepartmental Comments Procedure process (public participation allowed) |
| Strategic environmental impact assessment, including human health impacts (public participation allowed) |

In contrast, Hungarian LTS refers to a wide stakeholder consultation process involving professional and civil society groups and organizations at each stage of work on the LTS.

**Table 6. Public consultation process of the Hungarian LTS.**

| | |
|---|---|
| Initial online public consultation (200 000 answers received) | |
| Draft (publicly available) | |
| Discussed during **online event series**, through which stakeholders from the private sector, financial institutions, and civil society groups including youth organizations provided contributions | **Three consultation workshops** (with different areas of expertise and the academia) have been organized to validate the modelling results and the low-carbon scenarios, and to discuss sectoral policies and priorities |

The Hungarian LTS provides a summary of the feedback received, but there is also evidence of public consultations in the strategy itself: some of the proposals outlined in the chapter on financing climate neutral transition and its economic policy instruments have been adopted after the consultation with representatives of the financial market and other financial organizations.[29] Moreover, Hungary already envisaged stakeholder consultations for the update of the LTS.

Public consultation of the Czechian LTS was limited; the strategy does not provide information on the evidence collected, however, based on information from the Ministry of the Environment of the Czech Republic, a written public consultation of the draft LTS was carried out.

## Strategy preparation and implementation – cross-cutting issues

- The economy-wide modelling is a tool particularly useful in preparing complex development strategies (e.g. decarbonisation strategies), if economic, sectoral and social issues are intertwined and influence each other. Briefly, these models help understand and reflect complex cross-sector relationships.
- While domestic governance is not required by the Governance Regulation, it is important part of the strategy since it gives the ability to monitor the implementation progress and fulfilment of goals set in the strategy. Moreover, without domestic governance mechanisms a strategy could become a dead letter.
- The strategy should establish or indicate institutions tasked with governance and monitoring of the strategy implementation and should define appropriate framework for their operation.
- Targets mentioned in the previous chapters, relating to GHG emissions levels, share of RES in the energy mix and GDP growth can serve as indicators allow assessments on the extent to which the LTS has been successfully implemented.

[29] Ministry for Innovation and Technology of Hungary. (2021). National Clean Development Strategy 2020-2050, p. 92.

- Slovakian and Czechian LTS require an urgent update given their incompatibility with EU climate targets. Slovakia needs to include climate neutrality measures listed in the strategy in the modelling and Czechia must adapt GHG reduction scenarios to the 2050 climate neutrality target.

## 2.7 Conclusions

In summary, the first wave of national long-term strategies leave a lot to be desired in terms of their potential to guide national policy on a path in line with climate neutrality in the EU. Several factors have contributed to this outcome, ranging from insufficient legislation and management on the part of the European Union, through the dynamically changing regulatory environment in the context of climate policy, to the lack of experience of many countries in creating such a strategy. Some countries, despite a lack of EU commitment and guidelines, have provided comprehensive, far-reaching strategies that may themselves provide a good reference point for future updates.

The review and comparative analysis of the strategies (and their preparation process) have exposed weak points in our strategic approach to decarbonisation, but also allowed us to identify the best practices across the strategies. Based on our analysis, we provide our comments and recommendations which are presented in the tables of cross-cutting issues for each of the categories. Lessons learnt from this process should be taken into consideration ahead of preparing the updates of these strategies.

A lot depends on the background work that will be done by both the European Commission and individual countries. The European Commission should provide a better guideline for the creation of the LTS and monitor more the process of their creation, e.g. by forming a platform for administrative units involved. It should be remembered that the strategic process starts before modelling and actual writing of the strategy, and extends long after the strategy is created.
An inclusive process for its creation should be ensured, taking into account the interests of various sectors and social groups, so no one is left behind. Its assumptions should be based on a science-based and evidence-based approach, aimed at achieving the goal of climatic neutrality at the lowest possible social cost. It also seems that the key reason for the creation of the strategy is let slip, or not stressed enough, in the process of its preparation. The strategy should provide a relatively robust reference and facilitate the transformation process towards a low-carbon economy. To achieve this, an appropriate reporting process and monitoring the implementation of the strategy, along with the process of its updating must be planned.

Some countries have not yet adopted the final version of their strategy (Poland), and some are already preparing to update it (Czechia). The lack of synchronization makes it harder to compare these strategies and draw on their synergy, as they all relate to reality at the time of writing, and this, as already mentioned, has changed very dynamically in recent years. The next strategies should be in line with the new 2030 target and the climate neutrality target in 2050 (Slovakia and the Czech Republic need to be updated with outdated modelling or goals overall accordingly).

When it comes to regional cooperation, synergies can be obtained both in the process of creating a strategy as well as during its implementation, through the exchange of knowledge and best practices, technology transfer, running a joint agenda, creating new networks or strengthening cooperation at the borders.

# Annex I: Methodology

The General framework for long-term strategies, set out in Annex IV of the Governance Regulation as a template for content of national LTSs is much less detailed than for the NECP (essentially one page compared to eleven). Moreover its use is also not as binding – as Article 15(4) of the Regulation only says that "Member States' long-term strategies should contain the elements set out in Annex IV", which falls short of it being mandatory (which the template is for NECPs).
In combination, the lack of bindingness and the lower level of specificity have resulted in different approaches to strategy development for each country. Given the lack of precise structure and content guidelines, it is difficult to assess countries' LTSs in a comparative manner, as a wide range of strategies are compliant with the framework, but the outcomes differ in terms of quality and detail.

The assessment methodology used in this assessment follows the general logic of Annex IV of Governance Regulation in defining elements that should be included in the strategy divided in categories. It contains 21 subcategories that have been grouped into five main categories.

The rating is based on a simple indicative score on a three-point scale. The highest score (three) is usually defined such that either quality of a given strategy in a subcategory can be considered as fully meeting requirements or at least being able to serve as an adequate point of reference for future updates. The middle score (two) is given, when the category is included, but missing important parts. Lowest mark (one) is given when subcategory is not taken into account or has very modest coverage For types of subcategories such as: Adherence to the regulation, High-level targets etc. the assessment is straight-forward, for more descriptive categories such as the description of sectors it is important that the strategy includes individual elements, but does it in an understandable and exhaustive, comprehensive way. More specific guidelines are presented in Table 12.

It is important to highlight, that the analysis aims at assessing the general concept, content, scope, structure, incorporation of certain details, quality of presentation, preparation process and implementation of strategies rather than assessing the quality of individual policies and measures or qualitative and quantitative analysis.

**Table 12. Scoreboard guidelines (possible assessment values per individual subcategory)**

| Category | Subcategory | Score guidelines |
|---|---|---|
| General information and targets | Adherence to Governance Regulation | 1 - the document cannot be considered a strategy (e.g. different type of document - short declaration, study etc.),<br>2 - the strategy is broadly consistent with regulation, but has major discrepancies (e.g. only partial sectoral coverage),<br>3 - the strategy is consistent with the regulation, with potential minor deviations. |
| | Up-to-date document | 1 - the document was published before 2015,<br>2 - the document was published between 2015 and 2018,<br>3 - the document was published in 2019 or later. |

| | | |
|---|---|---|
| | Net zero target | 1 - the document does not consider net zero target,<br>2 - the document considers net zero target, but does not commit to it,<br>3 - the document commits to net zero target. |
| | GHG emissions reduction | 1 - the document has no high-level targets,<br>2 - the document presents a range of potential (indicative) targets by 2050 beyond already established NECP targets,<br>3 - the document sets specific targets for individual indicators along with interim targets. |
| | Renewable energy share | |
| | Energy efficiency | |
| Sectoral details | Energy | 1 - the document provides no sectoral detail,<br>2 - the document presents limited sectoral detail. It outlines historical and future trajectories of GHG emissions and discuss current state, policies and measures for decarbonisation,<br>3 - the document presents a comprehensive overview of the sector and its contribution to long-term decarbonisation. It provides quantitative and qualitative analysis beyond criteria for score 2. |
| | Buildings | |
| | Transport | |
| | Industry | |
| | Agriculture | |
| | LULUCF | |
| | Carbon removal technologies | |
| Financing and enabling policies and measures | Investment needs assessment | 1 - no assessment of investment needs,<br>2 - partial assessment of investment needs (e.g. only the energy sector),<br>3 - full assessment of investment needs (all sectors). |
| | Financing | 1 - no overview of financing instruments,<br>2 – partial or/and descriptive review of financing instruments,<br>3 - prescriptive provisions, linking investment needs with the necessary evolution of financing instruments. |
| | R&D | 1 - no overview of R&D state and role in decarbonisation,<br>2 - descriptive review of R&D state and role,<br>3 - prescriptive provisions, policies and measures for R&D sector. |
| Economic assessment | Socio-economic impacts | 1 - no overview of socio-economic impact,<br>2 - descriptive review of socio-economics impacts,<br>3 - prescriptive provisions, policies and measures for mitigating negative impacts. |

| | | |
|---|---|---|
| | Distributive impacts | 1 - no overview of distributive impact,<br>2 - descriptive review of distributive impact,<br>3 - prescriptive provisions, policies and measures for mitigating negative impacts. |
| Strategy preparation and implementation | Analytical tools | 1 - no analytical tools used,<br>2 - partial/qualitative assessment tools used,<br>3 - comprehensive modelling tools used to support qualitative analysis. |
| | Governance | 1 – the document does not provide information on governance,<br>2 – partial review of the governance mechanisms,<br>3 – prescriptive provisions, indicating or establishing institution governing and assessing the implementation of the strategy, defining framework for its action. |
| | Public consultation | 1 – the document was not subjected to public dialogue,<br>2 – the document was subjected to public consultations (comments on draft),<br>3 – the document was consulted on an ongoing basis with the public. |

# Annex II: Country details

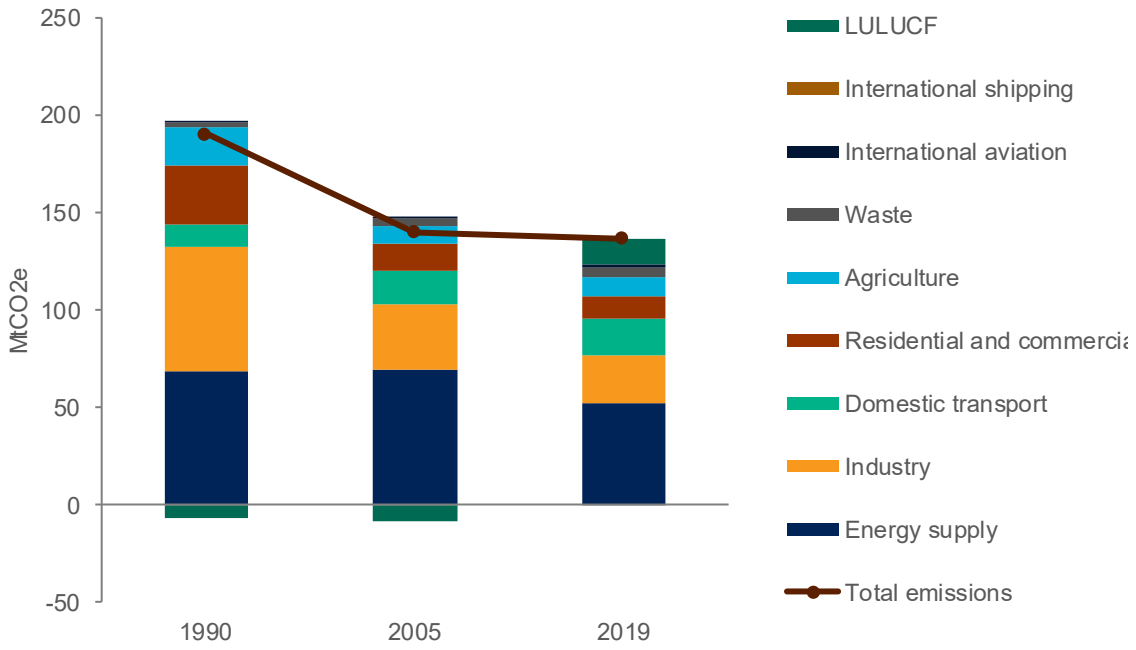
Country fiches provide better insight to key national indicators and a comment to the score given, indicating the pages corresponding to specific categories in the respective strategies.

## 1. Czech Republic

### 1.1. Overview of the key national climate and energy indicators

Czech Republic emitted almost 137 Mt $CO_2$e in 2019 which is a slight decrease in annual emissions compared to 140 Mt $CO_2$e emitted in year 2005. Most of the reduction was made in energy and industry sector, while transport, waste and LULUCF sectors all saw an increase in emissions. LULUCF sector in Czech Republic went from carbon sink (-8 Mt $CO_2$e in 2005) to net source (13.5 Mt $CO_2$e in 2019) – trees have been massively felled in recent years due to drought and the defeat of the bark beetle.

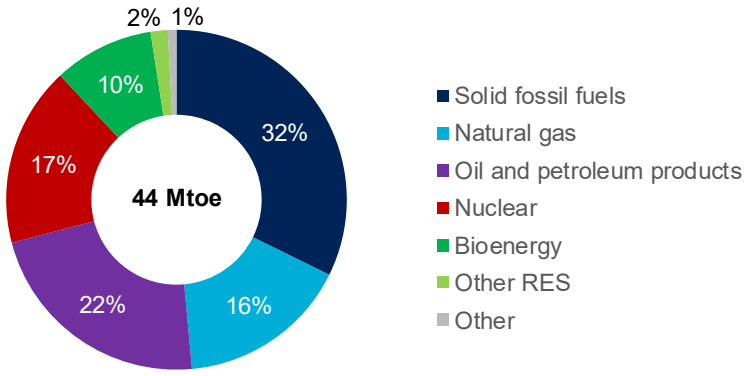
**Figure 5. Total GHG emissions by sector in the Czech Republic in 1990-2019**




Source: WiseEuropa based on EEA data

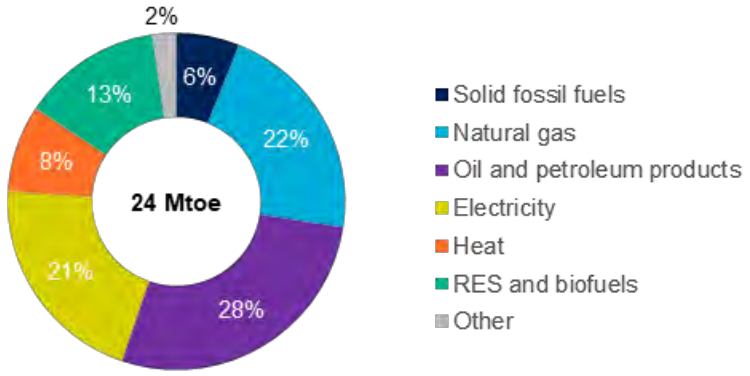
Czech Republic has extensive heating district networks powered predominantly by cogeneration units with lignite as a fuel, which is reflected in a big share of solid fossil fuels in gross inland consumption of the energy carriers. Electricity generation in Czech Republic is dominated by two sources: brown coal (lignite) (36%) and nuclear (38%), combining for 74% of generation.

**Figure 6. Gross inland consumption of energy carriers in the Czech Republic in 2019**



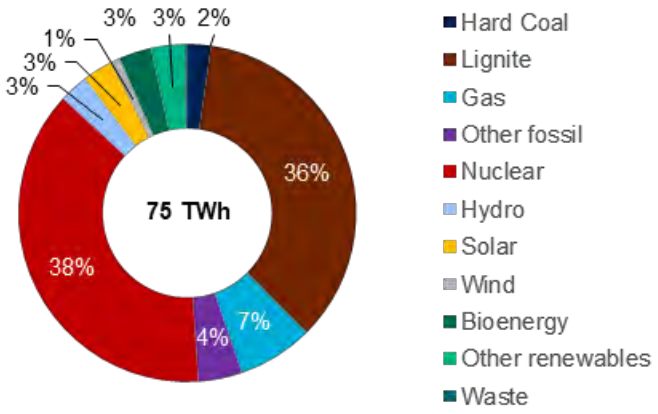

Source: WiseEuropa based on Eurostat data

**Figure 7. Final energy consumption (energy use) in the Czech Republic in 2019**




Source: WiseEuropa based on Eurostat data

**Figure 8. Electricity generation by source in the Czech Republic in 2020**




Source: WiseEuropa based on Ember data

## 1.2. Czech Republic assessment details

**Table 13. Country-specific assessment**

| Category | | Score | Comment |
|---|---|---|---|
| General information and targets | Adherence to Governance Regulation | 2 | The document was not prepared to comply with the Regulation (EU) 2018/1999 of European Parliament and of the Council on the Governance of Energy Union and Climate Action; nonetheless, it contains most of the elements set out in Annex 4 of the abovementioned regulation.<br>The document presents historical emission data and a set of policies and measures and discusses various emission reduction scenarios.[30] |
| | Up-to-date document | 2 | The document was adopted early in 2017, based on the obligation resulting from the national regulations.<br>It presents the climate and energy long-term strategy of the Czech Republic until 2030, with a perspective to 2050.<br>The implementation of the strategy is to be evaluated at the end of 2021. According to regulation, an update of the document should be prepared before the end of 2023.<br>The next update of the strategy (in 7 years after adopting the document, which is end of 2023[31]), is supposed to bring more accurate predictions on achieving Czech's climate objectives.[32] |
| | Net zero target | 1 | The document does not present net zero target. |
| | GHG emissions reduction | 3 | The document provides the following GHG reduction targets:<br>• reduce the Czech Republic's emissions by 2030 by at least 44 $MtCO_2e$ (by 30% when compared to 2005),<br>• aim at the indicative level of 70 $MtCO_2e$ emissions in 2040 (by 50% when compared to 2005),<br>• aim at the indicative level of 39 $MtCO_2e$ emissions in 2050 (by 80% when compared to 2005).[33]<br>In the LTS there are targets for GHGs reduction only, however, the National Energy and Climate Plan[34] sets the following targets for 2030:<br>• GHG emission reduction in non-ETS sectors: +9 %<br>• Share of RES: 21 %<br>• Energy efficiency target: energy consumption levels of 41.4 Mtoe (primary energy consumption) and 23.7 Mtoe (final energy consumption) in 2030. |
| | Renewable energy share | 1 | |
| | Energy efficiency | 1 | |

[30] Ministry of the Environment of the Czech Republic. (2017). Politika ochrany klimatu v ČR [Climate protection policy in the Czech Republic], p. 26-29.
[31] Ibid. p. 97.
[32] Ibid. p. 7.
[33] Ibid. p. 16.
[34] Government of the Czech Republic. (2019). National Energy and Climate Plan of the Czech Republic.

| | | | |
|---|---|---|---|
| Sectoral details | Energy | 2 | The document does not specify sectoral targets or milestones for the energy sector.<br><br>The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector.<br><br>State Energy Policy (SEP) is mentioned as the main relevant strategic document and sees the EU ETS as an important tool for emission reductions in this sector.[35][36] |
| | Buildings | 2 | The document does not specify sectoral targets or milestones for the buildings sector.<br><br>The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions included in the "Final energy consumption" section.[37]<br><br>Authors recognize big potential for emission reductions in this sector and are aiming at energy efficiency improvement of 25-40% by 2030. National Action Plan for Energy Efficiency is mentioned as main document addressing issues in the sector. |
| | Transport | 2 | The document does not specify sectoral reduction targets or milestones for the transport sector.<br><br>The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector.<br><br>Czech Republic recognizes the need to decrease transport emissions which have been on the rise in recent years: i.e. passenger cars doubled from 1990 to 2014. Measures to decrease these emissions include introducing standards for new vehicles, electrification and alternative fuels. It also plans to increase the share of rail and water transport whilst decreasing that of road freight.<br><br>Transport Policy of the Czech Republic and Action Plan for Clean Mobility is mentioned as the main strategy documents in transport.[38] |
| | Industry | 2 | The document does not specify sectoral targets or milestones for the industry sector. In the document, Czech Republic recognize the importance of reductions needed in this sector as it accounts for the second highest share of emissions.<br><br>EU ETS and IED directive were identified as key policies for reduction in this sector. The State Environmental Policy of the Czech Republic is also mentioned as a main relevant domestic document. |

[35] Ministry of Industry and Trade of the Czech Republic. (2014). State Energy Policy of Czech Republic.
[36] Ministry of the Environment of the Czech Republic. (2017). Politika ochrany klimatu v ČR [Climate protection policy in the Czech Republic], p. 45-46.
[37] Ibid. p. 46-55.
[38] Ibid. p. 55-62.

| | | | |
|---|---|---|---|
| | | | The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector.[39] |
| | Agriculture | 2 | The document does not specify sectoral reduction targets or milestones for the agriculture sector.<br>The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector.<br>The strategy mentions Action Plan for Biomass in the Czech Republic for the period 2012-2020 which aimed at increasing biomass generation capacity. [40] |
| | LULUCF | 2 | The document does not specify sectoral reduction targets or milestones for the LULUCF sector.<br>The document mentions the Rural Development Programme as a tool supporting afforestation of agricultural land.<br>The document gives limited sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector.[41] |
| | Carbon removal technologies | 2 | Carbon removal technologies does not have a dedicated section, however one of the scenarios is based on significant CCS technologies development and is highlighted as one of three scenarios that met reduction objectives set out in the document – this is also the only scenario where these technologies show up.<br>Besides the mentioned scenario, wide use of these technologies is not envisaged nor discussed in the document. |
| Financing and enabling policies and measures | Investment needs assessment | 3 | Czech Republic provides estimates of each scenario cost expressed in net present value (NPV) based on the 2050 calculator.<br>The document also refers to other documents for cost estimation (such as McKinsey “Costs and Potential for Reducing Greenhouse Emissions gases in the Czech Republic” report).[42] |
| | Financing | 2 | The document gives descriptions and estimates on budgets available for investment support from EU ETS revenues. It does not refer to any domestic financial instruments nor it refers to other documents[43].<br>Czech Republic goes beyond domestic decarbonization by providing a separate section on financing climate protection in less developed countries, however, it is not covered in the methodology, hence it does not affect the score. [44] |

[39] Ibid. p. 37-40.
[40] Ibid. p. 62-69.
[41] Ibid. p. 62-69.
[42] Ibid. p. 86.
[43] Ibid. p. 87-88.
[44] Ibid. p.89-93.

| | | | |
|---|---|---|---|
| | R&D | 1 | The R&D chapter in the Czechian LTS mentions a governmental R&D programme until 2030 (*National priorities of oriented research, experimental development and innovations*[45]) which includes issues related to climate protection. It is however not embedded in the Czechian LTS, which just summarizes to date R&D activities. The only R&D objective set in the document is that Czech Republic will support those applying to EU (LIFE and Horizon programmes) for finance for R&D projects related to climate protection. Therefore, the LTS itself does not provide enough measures aimed at fostering R&D activities in the area of zero and low carbon technologies.[46] |
| Economic assessment | Socio-economic impacts | 1 | The document does not discuss socio-economic impacts – only few policies and measures mentioned throughout the document refer to social issues. |
| | Distributive impacts | 1 | |
| Strategy preparation and implementation | Analytical tools | 2 | The document's analysis is based on the 2050 calculator developed by the UK's Department of Energy and Climate Change (now Department for Business, Energy and Industrial Strategy) adapted and calibrated for the Czech Republic.<br>The authors modelled 8 scenarios: 1 BAU, 4 scenarios that do meet the 80% reduction climate goal, and 3 scenarios that don't. Description, assumptions and scenario results are presented in more detail in the annex to the document.<br>The documents highlight that scenarios do not present specific visions but are to show that a mix of solutions has to be applied to achieve GHGs emission reduction objectives. Scenarios are not incorporated in the strategy and rather constitute separate parts. |
| | Governance | 3 | Czech Republic provides a separate section on international reporting and monitoring. It also gives the guidelines for evaluation and update of the strategy and establishes an institution responsible for its coordination.<br>The evaluation of the document will take place every 5 years and will assess not only meeting the targets for reducing greenhouse gas emissions compared to European ones and international goals, but also evaluation of the implementation of individual policies and measures in various sectors.[47] |
| | Public consultation | 2 | The draft strategy was consulted with the public by written comments, however, there was no public involvement during the preparation of the draft. |

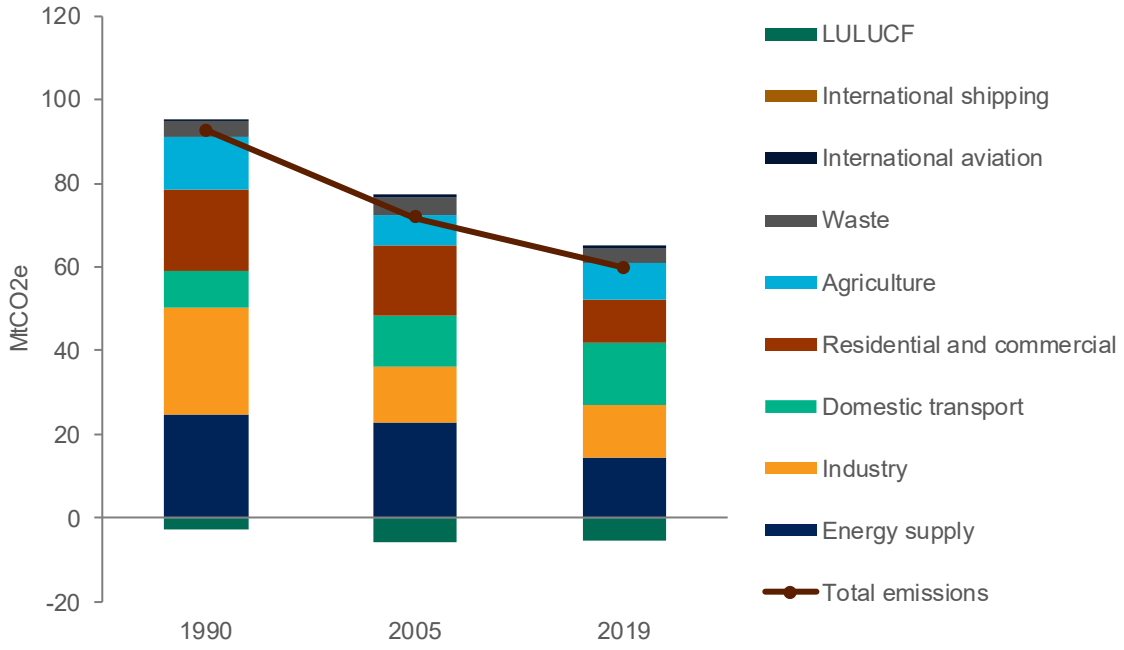
[45] Council for Research, Development and Innovations. (2012). National priorities of oriented research, experimental development and innovations.
[46] Ministry of the Environment of the Czech Republic. (2017). Politika ochrany klimatu v ČR [Climate protection policy in the Czech Republic], p. 76-78.
[47] Ibid. p. 96-97.

# 2. Hungary

## 2.1. Overview of the key national climate and energy indicators

Hungary cut its GHG emissions from 93 Mt $CO_2e$ in 1990 to 60 Mt $CO_2e$ in 2019, initially driven by political and economic changes in 1990 the first democratic government of Hungary was elected, which caused a wave of bankruptcies of industrial companies shrinking emissions in the sector, but also declining consumption of coal and oil. Since 2005, the biggest decline in emissions has occurred in the energy and residential sectors. In contrast, the domestic transport and agriculture sectors increased their emissions respectively by 22 and 18%.

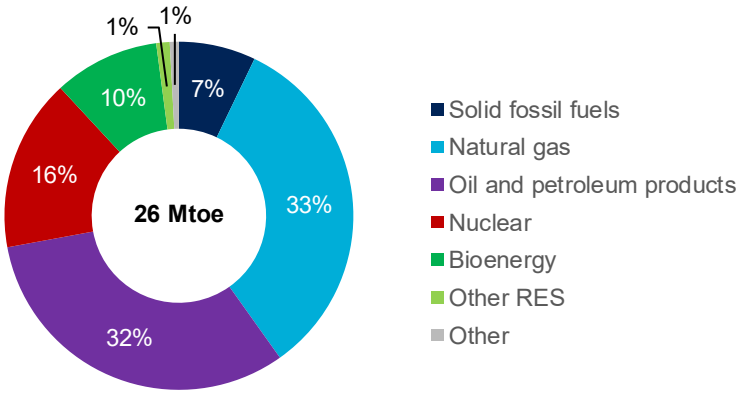
**Figure 9. Total GHG emissions by sector in Hungary in 1990-2019**




Source: WiseEuropa based on EEA data

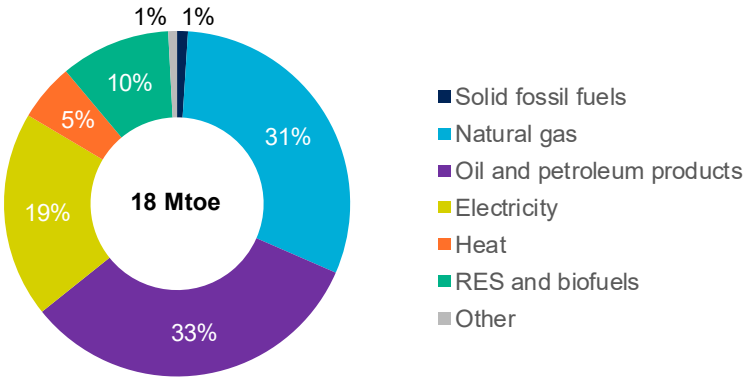
Gross inland consumption of energy carriers is dominated by natural gas, oil and nuclear. In electricity generation, a combination of new renewables and nuclear energy is slowly leading the transition, replacing high-emission fossil fuel sources which constituted 60% of generation in 2019.

**Figure 10. Gross inland consumption of energy carriers in Hungary in 2019**



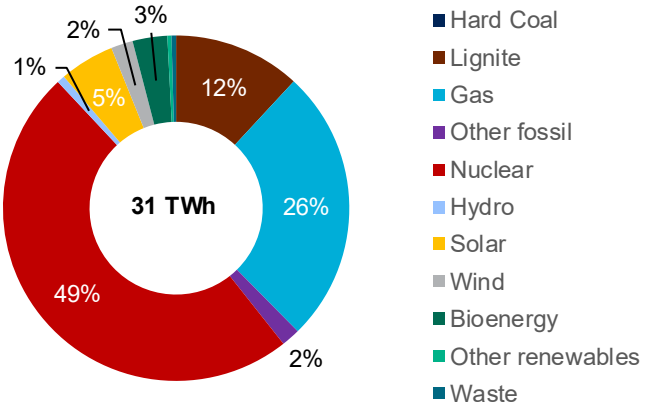

Source: WiseEuropa based on Eurostat data

**Figure 11. Final energy consumption (energy use) in Hungary in 2019**




Source: WiseEuropa based on Eurostat data

**Figure 12. Electricity generation by source in Hungary in 2020**




Source: WiseEuropa based on Ember data

## 2.2. Hungary assessment details

**Table 14. Country-specific assessment**

<table>
<tr><th colspan="2">Category</th><th>Score</th><th>Comment</th></tr>
<tr><td rowspan="6">General information and targets</td><td>Adherence to Governance Regulation</td><td>3</td><td>The document is prepared in line with the general framework of the document set out in Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action. It contains the elements set out in Annex 4 of the abovementioned regulation.</td></tr>
<tr><td>Up-to-date document</td><td>3</td><td>HU has adopted LTS in 2021 and its NECP[48] in 2020.</td></tr>
<tr><td>Net zero target</td><td>3</td><td>LTS presents an up-to-date perspective of the climate neutrality goal.<br>The document provides quantitative analysis with three different scenarios assessed, two of which present climate neutrality target:<br>- BAU scenario – following current trend and existing policies and measures<br>- LA scenario – path to climate neutrality with slower reduction rate until 2045 and then increased effort<br>- EA scenario – path to climate neutrality with effort evenly distributed in time<br>The document sets out target of climate neutrality for 2050.[49]</td></tr>
<tr><td>GHG emissions reduction</td><td>2</td><td rowspan="3">For 2030 targets the document refers to NECP and National Energy Strategy.[50]<br>The targets set in NECP are as follows:<br>• GHGs emission reduction in non-ETS: -7% (compared to 2005)<br>• GHGs emission reduction: -40%<br>• Share of RES: 21%<br>• Energy efficiency: final energy consumption lower than 785 PJ (2005 level)<br>The document specifies indicative milestones based on modelling of both neutrality scenarios:<br><table><tr><td>Scenario</td><td colspan="3">LA scenario</td><td colspan="3">EA scenario</td></tr><tr><td>Year</td><td>2030</td><td>2040</td><td>2050</td><td>2030</td><td>2040</td><td>2050</td></tr></table></td></tr>
<tr><td>Renewable energy share</td><td>2</td></tr>
<tr><td>Energy efficiency</td><td>2</td></tr>
</table>

[48] Ministry for Innovation and Technology of Hungary. (2020). National Energy and Climate Plan of Hungary.
[49] Ministry for Innovation and Technology of Hungary. (2021). National Clean Development Strategy 2020-2050, p.27.
[50] Ministry for National Development of Hungary. (2012). Nemzeti Energiastratégia 2030 Összefoglaló [National Energy Strategy 2030 Summary].

| | | | |
|---|---|---|---|
| | | | <table><tr><td>GHG emission reduction</td><td>54%</td><td>64%</td><td>100%</td><td>54%</td><td>73%</td><td>100%</td></tr><tr><td>RES Share</td><td>Nearly double from 13,3% 2017 level</td><td>25.1 %</td><td>90%</td><td>8% growth from 13,3% 2017 level</td><td>-</td><td>90%</td></tr><tr><td>Energy efficiency</td><td>5.3%</td><td>15%</td><td>30%</td><td>1.2%</td><td>14.5 %</td><td>37.4%</td></tr></table> |
| Sectoral details | Energy | 3 | The document does not specify sectoral targets for the energy sector.<br>It outlines historical GHG emission data and provides extensive presentation of modelling results of future emissions, energy consumption mix and other sector specific indicators.<br>It discusses policies and measures and various technologies for decarbonisation of the sector.[51] |
| | Buildings | 3 | The document does not specify sectoral targets for the buildings sector.<br>The buildings sector does not have dedicated section and is discussed in the energy section. It outlines historical GHG emissions data and provides modelling results for future emissions.<br>Information on energy efficiency indicators and modelling results could be more extensive and is limited to presenting consumption in households by source, but lacks presentation of energy efficiency specific indicators on energy savings and the pace of change.<br>It discusses policies and measures for decarbonisation of the sector.[52] |
| | Transport | 3 | The document does not specify sector targets for the transport sector.<br>The transport sector does not have dedicated section and is discussed in the energy section.<br>As emissions in this sector increased by 3.5% since 2013, the strategy recognizes it as the biggest short-term challenge.<br>It outlines historical GHG emissions data and provides modelling results for future emissions, investment needs and distribution of energy consumption by fuel and different modes as well as other sector specific indicators. It discusses policies and measures for decarbonisation of the sector.[53] |

[51] Ministry for Innovation and Technology of Hungary. (2021). National Clean Development Strategy 2020-2050, p. 36-55.
[52] Ibid. p. 36-55.
[53] Ibid. p. 36-55.

| | | | |
|---|---|---|---|
| | Industry | 3 | The document does not specify sectoral targets for the industry sector.<br>The industry sector is divided into industrial processes emissions and energy emissions. The latter is described in energy section. In a separate section for industry processes, it outlines historical data of GHG emissions, and breakdown of emissions by subsectors as well as reduction trajectories for modelled scenarios.<br>It discusses policies and measures needed for decarbonisation of the sector. The document highlights the importance of development of alternative technologies to achieve decarbonisation in the industry sector.[54] |
| | Agriculture | 2 | The document does not specify sectoral targets for the agriculture sector.<br>It outlines historical data of GHG emissions and emissions sources. It also shows the emission reduction path for BAU and EA scenarios, however overall, due to lack of other charts and indicators presented, the section seems to be decoupled from the modelling. Nevertheless, the document broadly discusses current and to be implemented policies and measures for emission reduction in this sector.[55] |
| | LULUCF | 2 | The document refers to the National Reforestation Program and the National Forest Strategy's goal of 27% of forest cover level by 2050.<br>It discusses historical net sequestration and EA scenario prediction for lowering emissions and increasing sequestration, however, similarly to agriculture sector, the section does not provide comprehensive modelling results. Nonetheless, the policies and measures addressing transformation in this sector are broadly discussed.[56] |
| | Carbon removal technologies | 3 | Carbon removal technologies does not have a dedicated section, however are widely present across the strategy.<br>CCUS were included in the modelling scenarios. Hungary foresees the application of CCUS technologies both in the energy sector and in carbon-intensive industry and sees them as essential part to achieve full decarbonisation The document also mentions Direct Air Carbon Removal and is providing information on technology readiness of the CCUS value chain. |
| Financing and enabling policies and measures | Investment needs assessment | 3 | The document describes the investment needs of a transition to climate neutrality. It provides results of modelling and presents investment needs broken down by sector for both scenarios in 2020-2030 and 2020-2050 periods along with avoided cost of transition.<br>According to the results, for total investment needs to achieve decarbonisation of the Hungarian economy, they equal 13,5 (36 mld EUR) for LA scenario and 25 trillion HUF (70 mld EUR) for EA scenario.[57] |

[54] Ibid. p. 56-63.
[55] Ibid. p. 63-69.
[56] Ibid. p. 69-74.
[57] Ibid. p. 84.

| | | | |
|---|---|---|---|
| | Financing | 3 | The document provides a separate section on decarbonisation financing.<br>It discusses available EU funds and provides discussion on various financing instruments. It recognizes the role of sustainable financing. It gives extensive sets of policies and measures for financing and support mechanisms for development.[58] |
| | R&D | 3 | The document provides a separate section on R&D innovative solutions and its value chain maturity in the context of Hungarian decarbonisation process. It also provides frameworks for innovation and budget estimates for pilot projects.[59] |
| Economic assessment | Socio-economic impacts | 2 | The document provides a separate section on socio-economic impacts. Two main impacts are assessed: (i) avoided cost and added benefits and (ii) employment. The analysis is supported by model results.[60]<br>The document also provides separate sections on different society-related subjects: education and training, social consciousness, access to information, lifestyle and consumption patterns.[61]<br>The strategy, however, does not envisage any negative socio-economic impacts of the proposed policies and for this reason no measures aimed at mitigating potential negative impacts have been developed. |
| | Distributive impacts | 1 | Distributional impacts were not presented in a separate section - it is mentioned that transforming economic policy should also take account of redistribution, aiming to reduce inequalities.[62] |
| Strategy preparation and implementation | Analytical tools | 3 | The document bases its analysis on two models:<br>• Model GEM – an intersectoral integrated model which consider interlinkages between population, economic activity and environmental outcomes.<br>• HU-Times model equilibrium optimisation model for modelling the energy flows for different sectors in the economy. [63] |
| | Governance | 3 | The document provides extensive information on governance of strategy implementation.<br>It informs, that the executive- and expert-level Interministerial Committee on Climate Change had been established, which is led by the Deputy State Secretary for climate policy. The data gathering is carried out by an independent scientific institution's periodical National Climate Change Assessment Reports. The document points to the role of continuous dialogue with other levels of administration and non- |

[58] Ibid. p. 92-104.
[59] Ibid. p. 105-116.
[60] Ibid. p. 81-86.
[61] Ibid. p. 89-92.
[62] Ibid. p. 93.
[63] Ibid. p. 26, Annex 6.

| | | | |
|---|---|---|---|
| | | | governmental stakeholders. It refers to NECP and NCCS and individual sectoral strategies as the main tools for implementation of the NCDS.[64] |
| | Public consultation | 3 | The Ministry of Innovation and Technology organized a workshop on 5 March 2019 on the draft, which provided an opportunity for organizations to share their views on long-term climate policy planning.<br><br>In the second half of 2019, consultations with the experts of the relevant ministries and their relevant background institutions were carried out regarding the content of the strategy.<br><br>In connection with the strategy, the Ministry of Innovation and Technology initiated a social consultation between 18 and 25 November 2019 pursuant to Article 10 of the Governance Regulation. During the consultation, a questionnaire was distributed on the government website, the results of which are summarized in a separate document.[65]<br><br>In 2020 Hungary released the draft version (which is far different than adopted version) and continue discussion with public by organising online event series with private sector, financial institutions, NGOs, public, etc.) Hungary also teamed up with GGGI (Global Green Growth Institute) organising three consultation workshops.[66] |

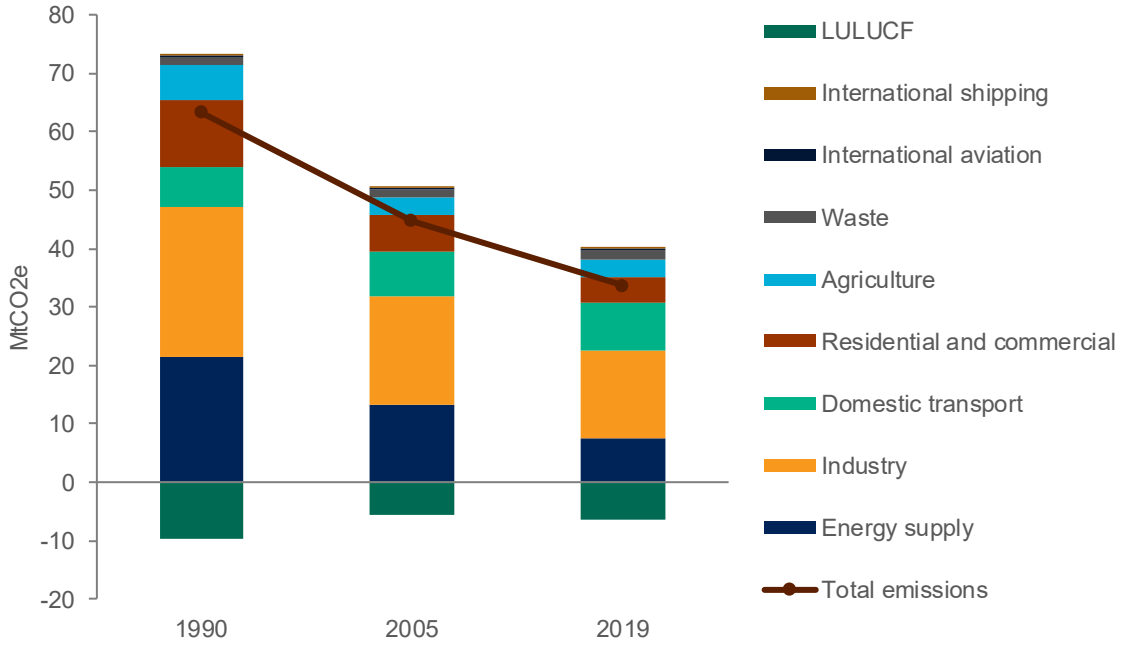
[64] Ibid. p. 118-119.
[65] Ibid. p. 9.
[66] Ibid. p. 23.

# 3. Slovakia

## 3.1. Overview of the key national climate and energy indicators

In 2019 Slovakia emitted around 34 Mt $CO_2e$ net, which is 25% less than in 2005 with the biggest decline in emissions in the energy supply sector, followed by industry and residential and commercial sectors. Contrary to other countries, the highest emitting sector of Slovakia is Industry. This is due to relatively low emissions in the energy sector, where there is no significant capacity for solid fossil fuels, but there is a very large share of nuclear energy, hydro and gas and at the same time a high degree of industry share in the country's economy, typical for the Visegrád countries.

**Figure 13. Total GHG emissions by sector in Slovakia in 1990-2019**

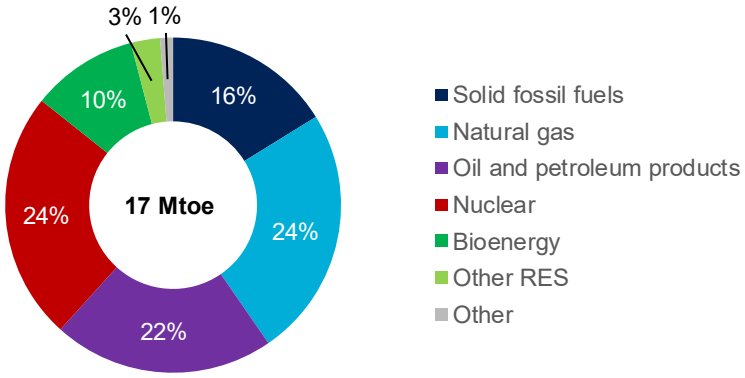



Source: WiseEuropa based on EEA data

As already mentioned, Slovakia has one of the least carbon-intensive electricity sectors in the European Union[67] with more than a half of its generation produced by nuclear power plants, followed by renewable energy sources, with biggest share of hydro power plants. The mix is supplemented by fossil fuels (12% of gas and 8% of lignite and other fossil fuels).

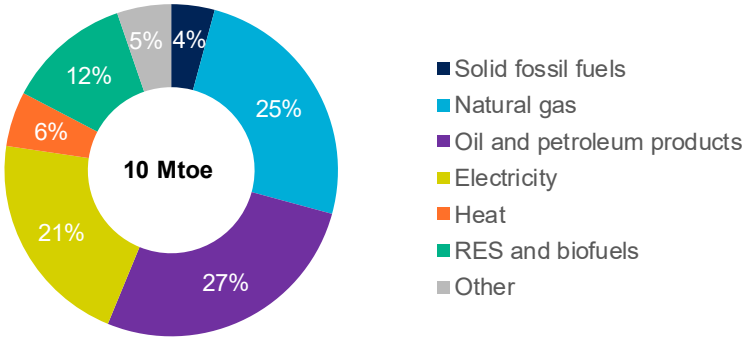
[67] EEA. (2021). Greenhouse gas emission intensity of electricity generation by country.

**Figure 14. Gross inland consumption of energy carriers in Slovakia in 2019**



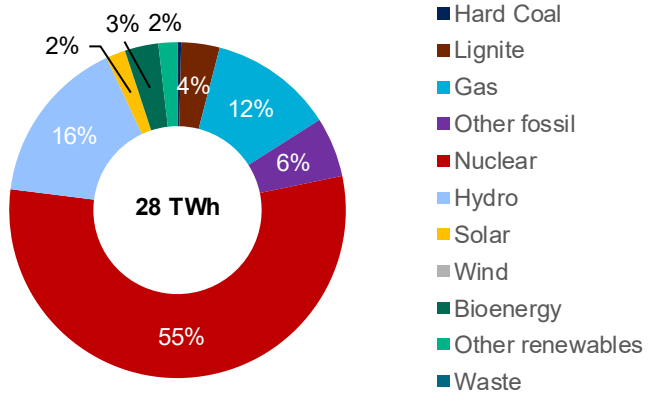

Source: WiseEuropa based on Eurostat data

**Figure 15. Final energy consumption (energy use) in Slovakia in 2019**




Source: WiseEuropa based on Eurostat data

**Figure 16. Electricity generation by source in Slovakia in 2020**




Source: WiseEuropa based on Ember data

## 3.2. Slovakia assessment details

**Table 15. Country-specific assessment**

| Category | | Score | Comment |
|---|---|---|---|
| General information and targets | Adherence to Governance Regulation | 3 | The document has been prepared in line with Regulation (EU) 2019/1999 of the European Parliament and of the Council on the Governance of the Energy Union and Climate Action (Governance Regulation). It contains the elements set out in Annex 4 of the abovementioned regulation.<br>The call for preparing a Low-Carbon Strategy also resulted from national legislation by the Government of Slovakia in the Programme Statement of the Government of the Slovak Republic for 2016-2020, according to which "the Ministry of Environment is obliged prepare a 2050 Low-Carbon Strategy".[68] |
| | Up-to-date document | 3 | Slovakian LTS presents an up-to-date analysis and was adopted in March 2020. Slovakian NECP was adopted at the end of 2019.<br>Both documents are in line with each other and are backed up by the same quantitative analysis, with LTS presenting broader, holistic approach with regards to entire economy, and envisaging climate neutrality by 2050.<br>According to the text, it will be updated no later than five years after the adoption of this version (which is consistent with the provision of Governance Regulation). |
| | Net zero target | 3 | Slovakia outlines the target of climate neutrality by 2050, however, because the EU climate neutrality commitment was declared after finishing the modelling part for LTS, it is not included in quantitative analysis.<br>Overall the document presents two scenarios and one set of additional policies and measures filling the gap between modelling and climate neutrality objective:<br>• WEM scenario – presenting the path with existing measures<br>• WAM scenario – presenting the path with target of GHG reduction for 2050 to 14 $MtCO_2e$ (without LULUCF) while climate neutrality requires 7 $MtCO_2e$.<br>• NEUTRAL – additional measures to fill 7$MtCO_2e$ gap.[69] |
| | GHG emissions reduction | 2 | The document provides a set of interim targets for 2030:<br>• GHGs emission reduction in ETS: -43% (consistent with EU target) |
| | Renewable energy share | 1 | |

[68] Government of the Slovak Republic. (2019). Low-Carbon Development Strategy of the Slovak Republic until 2030 with a View to 2050, p. 10.
[69] Ibid. p. 8.

| | | | |
|---|---|---|---|
| | Energy efficiency | 1 | • GHGs reduction in non-ETS: -20% (compared to 2005)<br>• Share of RES: 19.2 %<br>• Energy efficiency: 30.3 %<br>It does not set any specific or indicative targets for RES share or energy efficiency improvements by 2050, nor an interim target for 2040. |
| Sectoral details | Energy | 2 | The document does not specify sectoral targets for the energy sector, but it is based on overall economic-wide targets for GHG emission reductions, energy efficiency and RES share.<br>The document outlines historical trends in GHGs emission, however, leaves out additional sector specific indicators and charts such as energy consumption or power generation mix. It broadly discusses policies and measures under the WEM and WAM scenarios as well as additional NEUTAL measures.[70] |
| | Buildings | 2 | The document does not specify sectoral targets for the buildings sector, but one of presented measures considers introducing a sectoral target for buildings in the update of the strategy.<br>The buildings sector does not have a separate section and has been described in the energy sector section.<br>It outlines historical and modelling results for GHG emissions, but leaves out additional sector specific indicators and charts. It broadly discusses policies and measures needed for decarbonising the sector.[71] |
| | Transport | 2 | The document refers to NECP for interim sectoral targets in the transport sector:<br>• Increase the share of RES in fuels to 14% in 2030 in line with the indicative trajectory.<br>• Reach a share of advanced biofuels in fuels to 0.5% in 2022; 1% in 2025 and 3.5% in 2030.<br>It outlines historical and modelling results for GHGs emission, but leaves out additional sector specific indicators, charts and discussion. It broadly discuss policies and measures needed for decarbonising that sector. |
| | Industry | 2 | For the industrial sector, emissions from fuel combustion are presented in the energy section, and process emissions are in a separate subsection.<br>It outlines historical and modelling results for GHG emissions, discuss current state in the sector, but leaves out additional sector specific indicators, charts and discussion. It presents number of policies and measures needed for decarbonising that sector.[72] |

[70] Ibid. p. 27-41.
[71] Ibid. p. 38-41.
[72] Ibid. p. 42-25.

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| | Agriculture | 2 | The documents outline historical data, trends on GHG emissions, and sets out policies and measures for the WEM scenario. Only WEM scenario was modelled, leaving out the WAM scenario.<br><br>Slovakia recognizes that existing measures are not sufficient to achieve any reduction in GHG emissions (which is reflected in modelling results showing that not taking additional measures for the emissions from agriculture will result in a significant rise in these emissions), however, the document presents additional measures for achieving climate neutrality.[73] |
| | LULUCF | 2 | The document does not specify sectoral targets for the LULUCF sector.<br><br>It outlines historical and modelling results for GHGs emission, discuss current state in the sector, but leaves out additional sector specific indicators, charts and discussion. It presents a number of policies and measures needed for decarbonising that sector.[74] |
| | Carbon removal technologies | 1 | There is no dedicated section on carbon removal technologies. CCU and CCS is mentioned as R&D priorities to promote as policy measures needed to achieve the climate neutrality. These technologies were excluded from modelling WAM scenario for the energy sector and were not mentioned in industry emission reduction discussion. |
| Financing and enabling policies and measures | Investment needs assessment | 3 | Slovakia provides estimates of investment needs for the WAM scenario and compares it against the WEM scenario.<br><br>By 2030, the extra investment cost of the WAM scenario will be 8 billion EUR and 168 billion in the 2041-2050 decade. By 2040, average additional annual expenditure will be 1.8% of GDP, in 2021-2050 it will account for 4.2% of GDP on average per annum. It shows that the biggest investment effort is planned mostly for period after 2030.<br><br>The results provide insight into how investment needs are distributed across sectors: industry, third sector, households and transport. The authors point out that in the case of the climate neutrality objective (which is not outlined in the WAM scenario), these costs are probably significantly higher.[75] |
| | Financing | 2 | The document gives descriptions and estimates on funds available for investment support from the European Union. It does not discuss support mechanisms for decarbonisation and does not refer to any domestic financial instruments nor does it refer to other documents.[76] |
| | R&D | 2 | The document outlines expenditures on R&D for the 2021-2024 period. It mentions draft State R&D Programmes for 2020-2024 with outlook to 2029 that was ready for approval by the Government at the time of adopting LTS, which envisages the financing of research and development in Slovakia. |

[73] Ibid. p.53-56.
[74] Ibid. p. 57-61.
[75] Ibid. p. 66-67.
[76] Ibid. p. 67-71.

| | | | |
|---|---|---|---|
| | | | The document refers to NECP for more details regarding the institutions and objectives of Slovakia.[77] |
| Socio-economics impacts | Socio-economic impacts | 3 | The document discusses various socio-economic impacts: workforce reallocation, energy poverty, unemployment, decrease of real wages. The latter two were presented in numerical form as a result of modelling.<br><br>Slovakia has also recognized possible negative results of implementing the strategy for the economy and society. For this reason, some measures to prevent these negative impacts from happening have been developed (e.g. to mitigate negative consequences of a projected rise in unemployment).<br><br>Moreover, Slovakian LTS provides a description of the distribution of the socio-economic costs of the transition process between individual sectors and social groups.[78] |
| | Distributive impacts | 2 | |
| Strategy preparation and implementation | Analytical tools | 3 | Generally, the document bases its analysis on two models:<br><br>• Energy, General Algebraic Modelling System, Compact Primes Model. It is a country-level energy model, named the Compact PRIMES for Slovakia (CPS). The model takes into account the demand of the industrial sector (and 10 subsectors), transport and others.<br><br>• Macroeconomic, general equilibrium model ENVISAGE Slovakia using energy system results from the CPS as an output. ENVISAGE shows economy-wide impacts.<br><br>The document provides more insight on modelling for each of the sectors (where additional models are also used).Extensive use of modelling is not reflected in the strategy, where without few exceptions only GHG emissions projections were presented[79] |
| | Governance | 2 | The Council of the Government of the Slovak Republic for the European Green Deal and Low-Carbon Transformation will be responsible for the implementation of policy and measures in this strategy, which is approved along this strategy. |
| | Public consultation | 2 | The document was prepared with cooperation with the “general professional public and academia”. The public could also fill in a questionnaire and propose measures that should be included in the document. The public was invited to comment on the draft text.[80] |

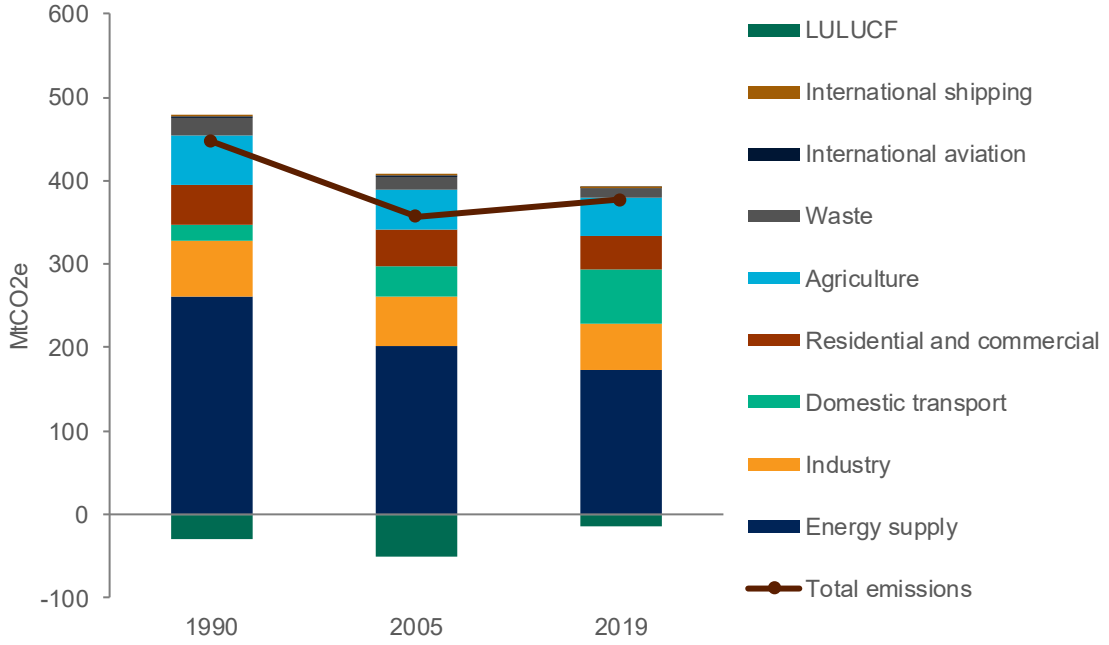
[77] Ibid. p. 72.
[78] Ibid. p. 73-79.
[79] Ibid. Annex I.
[80] Ibid. p. 14.

# 4. Poland

## 4.1. Overview of the key national climate and energy indicators

From 2005-2019, emissions in Poland increased by 5%, mainly due to a significant rise in emissions from domestic transport (almost 80%), which as mentioned in comparative part of the analysis can be explained by rapid economic growth of the country). On the other hand, the largest reductions were made in energy supply and residential and commercial sectors with significant potential to further cut of their emissions, due to high carbon-intensity of these sectors in Poland.

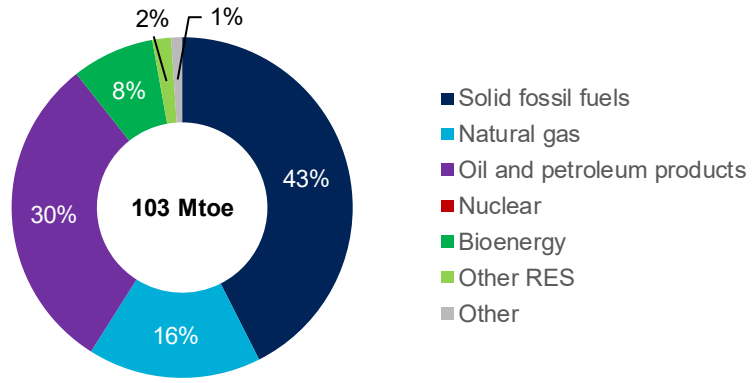
**Figure 17. Total GHG emissions by sector in Poland in 1990-2019**




Source: WiseEuropa based on EEA data

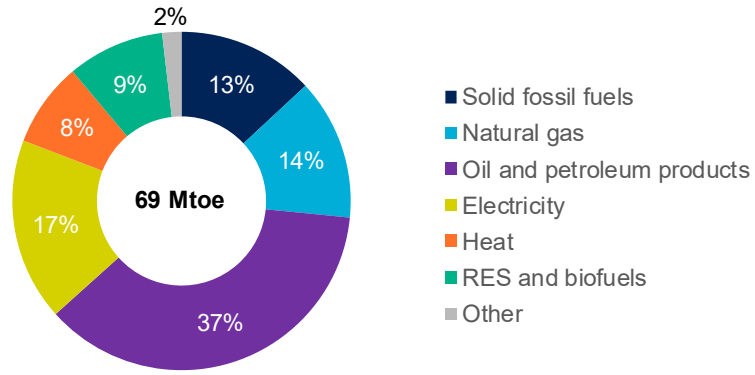
Polish gross inland consumption of energy carriers and power generation are dominated by solid fossil fuels, mainly hard coal, with respectively 73% and 85% of share by source. Renewables are emerging in Poland with 11% and 16% share respectively. In recent years, wind and solar capacities are rapidly expanding and a progressive trend of transition from centralized conventional power plants, combined heat and power plants and heating capacities from solid fossil fuels to gas is visible.

**Figure 18. Gross inland consumption of energy carriers in Poland in 2019**



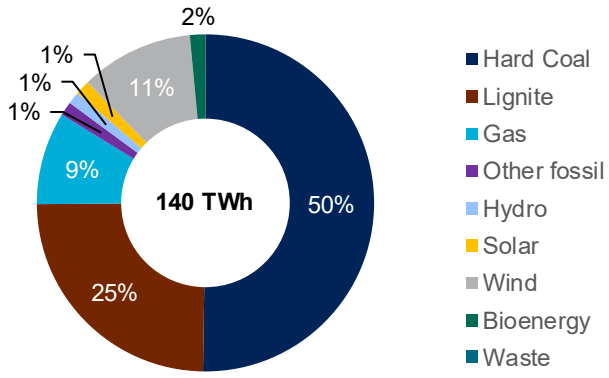

Source: WiseEuropa based on Eurostat data

**Figure 19. Final energy consumption (energy use) in Poland in 2019**




Source: WiseEuropa based on Eurostat data

**Figure 20. Electricity generation by source in Poland in 2020**




Source: WiseEuropa based on Ember data

### 4.2. Poland assessment details

**Disclaimer:** *Polish long-term strategy is still in the making – the quantitative analysis for the strategy is completed, but qualitative analysis is still in the progress and is subjected to change, hence assigned score and references to Polish strategy can change significantly, once the strategy is completed, and it cannot constitute a reference to the official position of Poland regarding the LTS.*

**Table 16. Country-specific assessment**

| Category | | Score | Comment |
|---|---|---|---|
| General information and targets | Adherence to Governance Regulation | 3 | The document has been prepared in line with Regulation (EU) 2019/1999 of European Parliament and of the Council on the Governance of the Energy Union and Climate Action (Governance Regulation).<br>It contains the elements set out in Annex 4 of the abovementioned regulation. At the same time, it is also fulfilling the obligation to create a "Strategy for the transformation to a low-carbon economy" provided for in the "Strategy for Responsible Development until 2020 (with a perspective until 2030)" of 2017. |
| | Up-to-date document | 3 | Polish long-term strategy is still work in progress.<br>It presents an up-to-date analysis and contains several paths of decarbonization based on economic and energy models.<br>The document does not consider any update beyond provisions of Governance Regulation (i.e. update if necessary after 5 years, new strategy every 10 years).<br>Once the document is adopted, it will be the most up-to-date energy and climate strategy in Poland.<br>Besides the range of climate neutrality scenarios, LTS provides two additional scenarios: PEP2040 scenario is in general consistent with Polish Energy Policy until 2040 (domestic strategic document adopted in 2021) scenario with high EU ETS prices, and a reference scenario consistent with NECP (which was adopted almost 2 years ago and is mostly outdated). |
| | Net zero target | 2 | Poland outlines the target consistent with the EU-wide climate neutrality in 2050 and provides modelling results for achieving it in 2050 in the form of a range of scenarios, however, it does not commit to it. |
| | GHG emissions reduction | 2 | The document provides set of interim targets for 2030 and indicative targets for 2040 and 2050.<br>PEP2040 scenario sets the following milestones:<br>• GHG emissions reduction in 2030: 335 Mt $CO_2$e annual emissions (30% reduction compared to 1990)<br>• GHG emissions reduction in the 2030s: another 210 Mt $CO_2$e annual emissions |
| | Renewable energy share | 2 | |
| | Energy efficiency | 2 | |

| | | | |
|---|---|---|---|
| | | | Modelling results for RES share until 2050 are discussed, however, no binding target is set.<br>Modelling results for energy efficiency until 2050 are discussed, however, no binding target is set. |
| Sectoral details | Energy | 3 | The document does not specify sectoral targets for the energy sector.<br>It broadly discusses the modelling results for different scenarios and indicative targets (milestones), available and future technologies as well as current and future policies and measures. |
| | Buildings | 3 | The document does not specify sectoral targets for the building sector.<br>It broadly discusses the modelling results and indicative targets (milestones) available, future technological solutions for buildings as well as current and future policies and measures. |
| | Transport | 3 | The document does not specify sectoral targets for the transport sector.<br>It broadly discusses the modelling results and indicative targets (milestones), available and future technological solutions as well as current and future policies and measures. |
| | Industry | 3 | The document does not specify sectoral targets for the industry sector.<br>It broadly discusses the modelling results and indicative targets (milestones), available and future technologies as well as current and future policies and measures. |
| | Agriculture | 2 | The document does not specify sectoral targets for the agriculture sector.<br>It briefly discusses the modelling results and GHG emissions reduction targets (milestones), available and future solutions as well as current and future policies and measures. |
| | LULUCF | 2 | The document does not specify sectoral targets for the LULUCF sector.<br>It briefly discusses the modelling results and GHG emissions reduction targets (milestones), available and future solutions as well as current and future policies and measures. |
| | Carbon removal technologies | 3 | Carbon removal technologies does not have a dedicated section, however are widely present across the strategy.<br>Poland foresees the use of carbon removal in the scenarios to climate neutrality, both in energy and industry sector. CCU and CCS technologies and their possible implementation are widely discussed |
| Financing and enabling policies and measures | Investment needs assessment | 3 | The document provides estimates of investment needs for different scenarios and its distribution across sectors. |
| | Financing | 3 | The document provides an overview and evaluation of possible domestic and European financial support mechanisms.<br>It also analyses future solutions for financing implementation, also in the context of the EU sustainable finance framework. |

| | | | |
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| | R&D | 2 | The strategy highlights the importance of R&D for achieving climate neutrality. Polish expenditure on R&D in the energy sector in 2009-2020 is discussed in details. However, neither a strategic approach is developed (no specific, prescriptive policies and measures are proposed), nor the document determines precisely how much of this spending will actually contribute to the development of low and zero carbon technologies. |
| Economic assessment | Socio-economic impacts | 2 | The document discusses various socio-economic impacts but policies and measures for mitigation of potential negative impacts are not included. |
| | Distributive impacts | 2 | When it comes to distributive impacts, Poland realizes that the transition to a net-zero economy will hit coal and heavy industry regions, households and private consumers. These issues are said to be addressed with some policies in the future; yet the strategy itself does not provide any preventive measures. |
| Strategy preparation and implementation | Analytical tools | 3 | The document bases its analysis on two models:<br>• Model PRIMES (Price-Induced Market Equilibrium System) energy system model has been developed by the Energy-Economy Environment Modelling Laboratory at the National Technical University of Athens in the context of a series of research programmes co-financed by the European Commission.<br>• The PLANE 2.0 model is a multi-sector dynamic macroeconomic model of the CGE (Computable General Equilibrium) type. It represents the fuel and energy sector, taking into account the production structure and final energy consumption by individual sectors of the economy and households. The model covers 54 economic sectors included in the input-output tables published by Eurostat. |
| | Governance | N/A | No information on the governance available. |
| | Public consultation | N/A | As for 26th January 2022, the public did not participate in the process of creating the draft of strategy. Polish strategic documents will be available for written comments once the draft is released. |

A report written by **WiseEuropa**

In collaboration with **Ecologic Institute**

as part of the **Climate Recon 2050** project

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