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Assessment of the national Long-Term Strategies of Austria, Croatia and Slovenia

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Summary

Analysis of long-term climate strategies of Austria, Croatia and Slovenia showed some common practices as well as plenty of differences in shaping the future to low carbon society. For all three countries the submitted long-term strategies are first attempt of such strategies, therefore presenting the current long-term vision and directions in which countries are planning to follow for the next 30 years (until 2050). They all include quantified targets. Austria and Slovenia are aiming for climate neutrality. On the other hand, target for Croatia in 2050 is not to become climate neutral (like Austria and Slovenia), but the strategy gives a range of predicted reduction of emissions according to scenario analysis, although Croatia also did preliminary scenario analysis for achieving net zero, based on the EU directions. The biggest room for improvement in all three strategies is in the sections of long-term strategies covering financing and economic assessment, especially in socio-economics impacts and distributive impacts.

The aim of this comparison of long-term strategies of these three EU countries was to identify best practices and weaknesses of their strategies, to present different approaches, as well as to provide guidelines for future update of the document, which should be done every 5 years, if necessary.

Similarly, to previous reports assessing national long-term climate strategies within the Climate Recon 2050 project this report follows assessment methodology described in Annex I. The methodology starts with the framework set in Annex IV of the Governance Regulation as a basis, extending it and dividing into categories. We assessed each category on a three-point scale. Within the analysis we also prepared a crosscutting section in each chapter, based on the findings in three analysed strategies, as well as prepared recommendation for future update of the strategies:

- **Modelling**: Strategies of all three countries are based on the economy wide models with different decarbonisation scenarios, although modelling aspect is a bit stronger in the case of Croatia and Slovenia. Such approach also shows that extensive data based approach was used. In the future updates more graphical content (presentation of the results and modelling data) should be included in the document, as well as is should be clearly stated how the data has been derived, which was sometimes blurry in the case od Austria.
- **Targets**: Austria and Slovenia are aiming for climate neutrality by 2050, while Croatia on the other hand gives a range of emission reduction based on different scenarios. Countries also provide targets and data on renewable energy share and energy efficiency for 2030 and 2050. Only Slovenia states exact share of RES in 2050, while Austria and Croatia provided range. Again, only Slovenia provides target for energy efficiency, while Austria and Croatia are providing possible ranges. Although strategies are long-term documents for better implementation and setting a clear path mid term goals should be clearly specified, not only for emission reductions, but also for energy efficiency and share of renewables.

- **Sectoral approach**: all three strategies follow the suggested sectoral outline provided by the Governance Regulation to a great extent. Countries have also added some chapters (ex. Biodiversity, Financing - SI, bioeconomy- AT). Sectors contain current emission status, description of policies, measures and technologies. Quantitative analysis results for future emissions are provided in the case of Croatia and Slovenia. Only Slovenian strategy includes sectoral targets. Slovenian strategy could set an example how sectoral approaches should be done-first providing data on current emissions, which is followed by projection trajectory and also setting sectoral goals. The same approach is used for all sectors, which was not the case for other two strategies.
- **Investment needs and financing**: only Croatia and Slovenia provide the amount of investment needs to reach the countries goal. In the case of Austria such data is missing. Such analysis is a crucial part of the long-term climate strategy and also serve as a basis for planning finance in the future. It is also important to identify the vulnerable groups and the mitigation measures needed to make transition inclusive.
- **Research and development:** reaching low carbon society will not be possible without extensive research and development. Ideally in its strategies countries should prioritise research areas as well as the funds devoted to R&D. In the case of AT, HR and SI, the research and development sector is a mix-match; some define the finance devoted to R&D, others mentioning sectors of extensive research needed. All three countries should put more emphasis on the R&D in the future updates of the strategies and develop a clear vision for this sector.
- **Economic assessment:** this is the weakest part of all three documents. None of the countries provided a socio-economic impact for 2050. It is important to include aspects of just transition in the document and to identify the most vulnerable groups. In the update, strategy makers should focus on the transition's impact on economy, identifying vulnerable groups that are at risk of losing their jobs, distribution of decarbonisation cost between regions and social groups, energy poverty, as well as providing policies and measures to counteract these negative consequences.
- **Public consultation:** all three countries performed extensive public consultation, which is also an essential part of such a transformative document. Essential part of the preparation and consultation process is transparency and fairness. Slovenia fell short in this regard, where substantial changes in the strategy appeared after consultation process, leaving public without opportunity to comment on the document again. In general all three countries recognised the importance of early public involvement in the preparation of such an important document. Austrian strategy can be set as an example since there is a clear traceability how the public consultation information was included in the document.
- **Governance:** for the strategy to be operational, governance is needed. All three countries provide general information on the governance structure, but none of the strategies contains specifics of what will be done on the governance level, by when and who will be responsible for what**,** so there is a room for improvement in all three countries in the future update.

- **Regional cooperation**: difficulties in comparing the strategies translate into difficulties in managing them at the regional and EU level. In result, the processes and efforts are disintegrated into individual countries without efforts to integrate and synergize in the areas where it is possible. There are also positive sides: the diverse approach of different countries gives the opportunity to study ideas and solutions, drawing abovementioned best practices as well as cross-cutting issues. This creates an opportunity for cooperation not only in the context of greater integration of cross-border activities, but also in the context of strategy development and energy transition management.

Furthermore, the assessment's findings have been summarised in the form of the scoreboard, with each aspect scored on three-point scale from 1 to 3 based on following criteria (1) subcategory not taken into account or very modest coverage, (2) taken into account, but missing important parts, and (3) means that the implementation of this category may constitute a point of reference for future update of the strategies.

More detailed guidelines for used methodology are presented in the Annex I.

Table 1: Scoreboard- Assessment of Slovenia, Croatia and Austria by category

Category	Subcategory	Slovenia	Croatia	Austria
General	Adherence to Governance Regulation	3	3	3
	Up-to-date document	3	3	3
Targets	Net-zero target	3	2	3
	GHG emissions reduction	3	2	3
	Renewable energy share	3	2	2
	Energy efficiency	3	2	2
Sectoral details	Energy	3	3	2
	Buildings	3	3	2
	Transport	3	3	2
	Industry	3	3	2
	Agriculture	3	3	2
	LULUCF	3	2	2
	Carbon removal technologies	2	2	3
Financing and enabling policies and measures	Investment needs assessment	3	2	1
	Financing	3	2	2
	R&D	2	2	2
Economic assessment	Socio-economics impacts	2	2	1
	Distributive impacts	2	1	2
Strategy preparation and implementation	Analytical tools	3	3	2
	Governance	2	2	2
	Public consultation	2	3	3

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List of Abbreviations

AT	Austria
EE	Energy Efficiency
EEA	European Environment Agency
EU	European Union
GDP	Gross domestic product
GHG	Greenhouse gas
HR	Croatia
LTS	Long-term strategy
LULUCF	Land Use, Land Use Change, and Forestry
NECP	National Energy and Climate Plan
RES	Renewable energy share
R&D	Research and development
SI	Slovenia
WAM	With additional measures
WEM	With existing measures

1 Introduction and background

Disclaimer

This report is one of the four reports in the series of Climate Recon 2050: dialogues on Pathways and Policy project, where different national long-term climate strategies were assessed and compared. Scope and methodology of these reports was developed within the project; therefore, this report relies on the structure as well as on the same background as previous reports within the series.

All countries that signed the Paris Agreement are committed to following the objective to limit the global warming to well below 2°C by reducing greenhouse gas emissions (GHG) and to peruse to limit the global temperature increase to 1.5°C compared to pre-industrial period. Also, in line with the Paris agreement countries are invited to communicate their mid-century, long-term low GHG emission development strategies. Beside that **EU member states are required to develop national long-term strategies** on how they plan to achieve national GHG reduction under Paris Agreement as well as EU objectives. The deadline for submission was 1 January 2020.

In European Union, the obligation of creating long-term climate strategies is set out in the 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, the so-called Governance Regulation[1]. The Regulation requires from each Member State to prepare two strategic documents – the National Energy and Climate Plan (NECP)- with a time span of 10/20 years (2030, 2040) and long-term climate strategy (covering the period of 30 years -until 2050).

As it is stated in the report Assessment of the national Long-Term Strategies of the Visegrád Group Countries[2] "the creation of adequate economy-wide strategy is crucial from the point of planning and governance of climate policy in individual countries. Its objective is to present a holistic economic perspective, to bind detailed sectoral strategies exhibiting the state of the economy in relation to climate ambitions and relative effort needed in individual sectors, sectoral interdependencies and the distribution of enabling policies and measures. The strategy also strengthens regulatory stability, which reduces the investment risk and enables forward-looking perspective for addressing the impacts of the transformation." The strategy also represents the interface between scientific knowledge (modelling) and policies.

The Governance Regulation puts less emphasis on long-term climate strategies, compared to the NECPs. Only Article 15 is completely devoted to long-term strategies and in Annex IV there is an outline of chapters that long-term strategies should cover, but it is not obligatory. Therefore, as already described in WiseEuropa´s report, due to differences in the long-term strategy adoption (or draft release) dates and significant changes in climate policy in recent years, both the topicality and ambition of climate policies presented in the documents by the member states vary significantly. Also, because of not compulsory content the details and the scope of the document are diverse. Some member states still did not submit their long-term climate strategies by today, but on the other hand NECPs need to be updated by 30 June 2023.

The focus of this report were long-term climate strategies of Austria, Croatia and Slovenia. A group of medium to smaller EU countries, with two (Croatia, Slovenia) being historically part of Yugoslavia

[1] 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 (or Governance Regulation).

[2] Kobylka, K., Laskowski, K., Sniegocki, A., 2022, Assessment of the national Long-Term Strategies of the Visegrád Group countries. WiseEuropa.

and therefore former socialistic countries and gain its independence in 1991. Austria and Slovenia are considered central European countries, Croatia is defined as Southeast Europe.

Austria, Croatia and Slovenia present moderately similar approaches to strategy development, although strategies from Slovenia and Croatia have a stronger analytical background than the LTS from Austria. However, the documents differ in the degree of detail of the individual parts and in their structure. The quality of the document may be also affected by the date of its adoption, since Austria submitted its LTS before Croatia and Slovenia and is already working on new refreshed version. As well as it can take quite some time for the preparation of the document and the goals on the EU level, by the time that the document was adopted, may have changed.

This report aims to identify best practices and weaknesses of assessed strategies,[3] as well as it provides guidelines for future update of the document, which should be done every 5 years, if necessary. However, given that the Governance Regulation was adopted in 2018 in 2020 the European Council committed to the climate neutrality goal in 2050- which is now also included in the European Climate Law and the Fit for 55 package (to reduce GHG emission by at least 55 % by 2030) the ambition to reduce emissions by 2030 has increased. In light of the tightening of the climate and energy policy, the COVID-19 pandemic and the creation of NextGenerationEU for green recovery, most strategies will need to be updated. In addition, due to the energy crisis caused by Russia's full-scale aggression against Ukraine, the European Union has prepared a REPowerEU plan to further increase ambition in specific areas of transformation.

The report consists of the overview of important climate and energy indicators of Austria, Croatia and Slovenia, to describe the countries starting points and general circumstances. This section is followed by the general goals and targets and then by sectoral analysis and other specific chapters accordingly with the described methodology. For each topic, there is a short analysis and a scoreboard with cross-cutting issues.

[3] Detailed assessment of individual countries is presented in the Annex II.

2 Assessment of the long-term strategies of Slovenia, Croatia and Austria

2.1 Overview of the key climate and energy indicators for Slovenia, Croatia and Austria

Although lying within 100 km and some being neighbouring countries, Slovenia, Croatia and Austria have different recent history with different political systems. Slovenia and Croatia were a part of the same country (Yugoslavia) until 1991, which was a socialist country. Today Croatia and Slovenia are both parliamentary republics and EU member states (Slovenia since 2004, Croatia since 2013). Croatia is not yet a part of the Schengen area (will become on 1 January 2023), the same date the country will adopt EUR as currency. Slovenia adopted EUR in 2017 and entered Schengen in 2007. Austria is a federal parliamentary republic. It is member of the EU since 1995, entered the Schengen area in December 1997 and a member of Euro area since 1999. The most important sector of Austria's and Slovenians economy in 2020 was industry (AT[4] more than 21 %, SI[5] more than 27 %) and in Croatia the most important sector was retail trade, transport, accommodation and food services (more than 20 %).[6] Austria also has substantially higher gross domestic product (GDP) than Croatia and Slovenia. GDP per capita in purchasing power standard (PSS) in 2019 was 126 in Austria, 88 in Slovenia and 66 in Croatia.[7]

Although different, they face similar challenges on the path to climate neutrality. The highest shares of GHG emission are coming from domestic transport, energy supply and industry sectors. In Austria the highest share of emissions in 2019 came from industry sector (more than 27 %), followed by domestic transport (24.5 %) and energy supply (10.5 %). In Croatia the highest emission share came from domestic transport (33 %), followed by industry (30,5 %) and energy supply (22 %). In Slovenia in 2019 the majority of GHG emissions came from domestic transport sector (44 %), followed by energy supply (38.5 %) and industry (23 %).

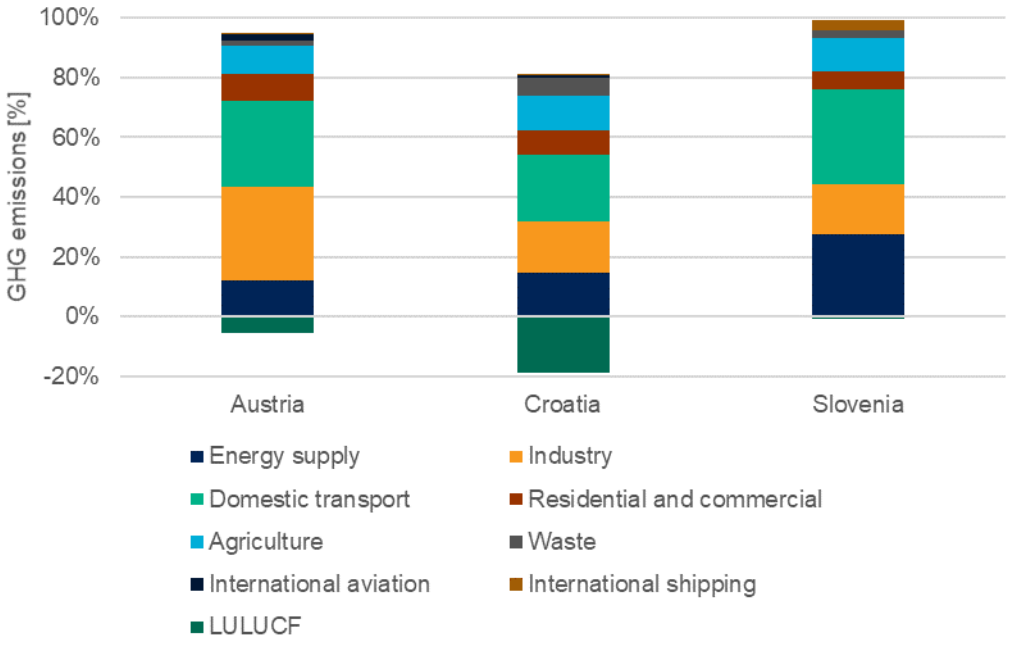
[4] European Union, country profile, https://european-union.europa.eu/principles-countries-history/country-profiles/austria_en [accessed 1.12.2022]

[5] European Union, country profile, https://european-union.europa.eu/principles-countries-history/country-profiles/slovenia_sl [accessed 1.12.2022]

[6] European Union, country profile, https://european-union.europa.eu/principles-countries-history/country-profiles/croatia_en [accessed, 1.12.2022]

[7] Eurostat, https://ec.europa.eu/eurostat/databrowser/view/TEC00114/bookmark/table?lang=en&bookmarkId=388837b6-18d3-422f-8339-fa23f0378454 [accessed, 5.12.2022]

Figure 1: Share of total GHG emissions by sectors in 2019



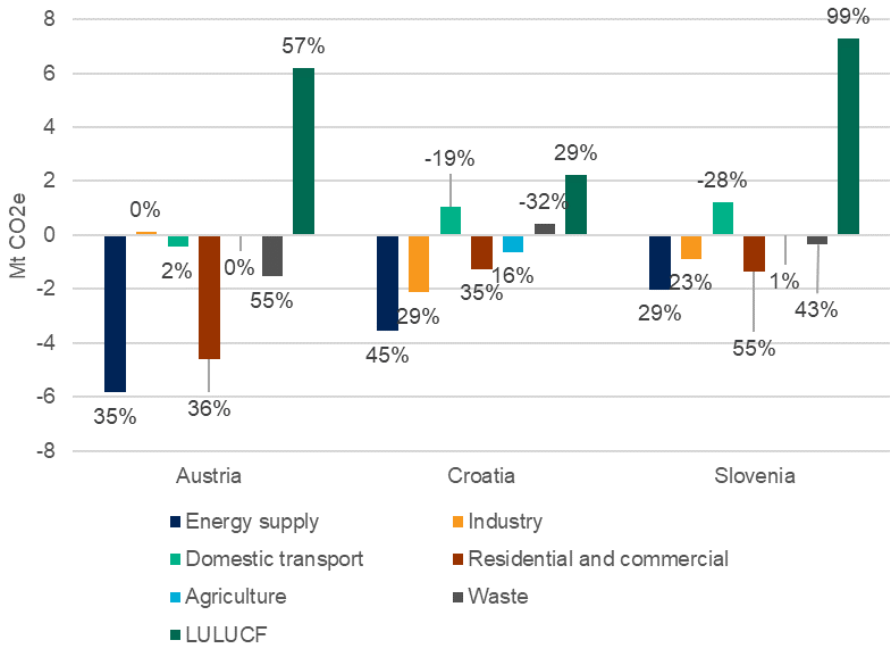
Source: WiseEuropa based on EEA data, 2022

As it can be seen from Figure 2 in each of the countries large emission reduction can be observed in the energy sector, which is not surprising, due to shutting down of some coal power plants in all three countries. Substantial reduction can also be observed in the residential and commercial sector, where renovation and energy efficiency measures play a role, as well as new ways and technologies for heating houses.

The emissions from domestic transport sector are rising in all three countries. In Austria, the majority of GHG emissions in domestic transport in 2005 and 2019 came from road transport and majority (above 55 % of GHG emissions) in both years in the domestic transport came from cars. In Croatia also, majority of the emissions in both years came from road transportation, almost 67 % road emissions in 2019 came from cars. In Slovenia the situation was similar, in both years 2005 and 2019 the majority of emissions came from road transportation, where emissions from cars in 2019 represented more than 64 % of GHG emissions. So, all three countries have “attachment” to personal cars.

In all of the three countries, carbon sinks through Land Use, Land Use Change and Forestry (LULUCF) have increased over the observed period. Slovenia and Croatia have also seen a decrease in emissions in the industry sector, while in Austria the emissions are stagnating.

Figure 2: GHG emission change 2005-2019 in selected sectors

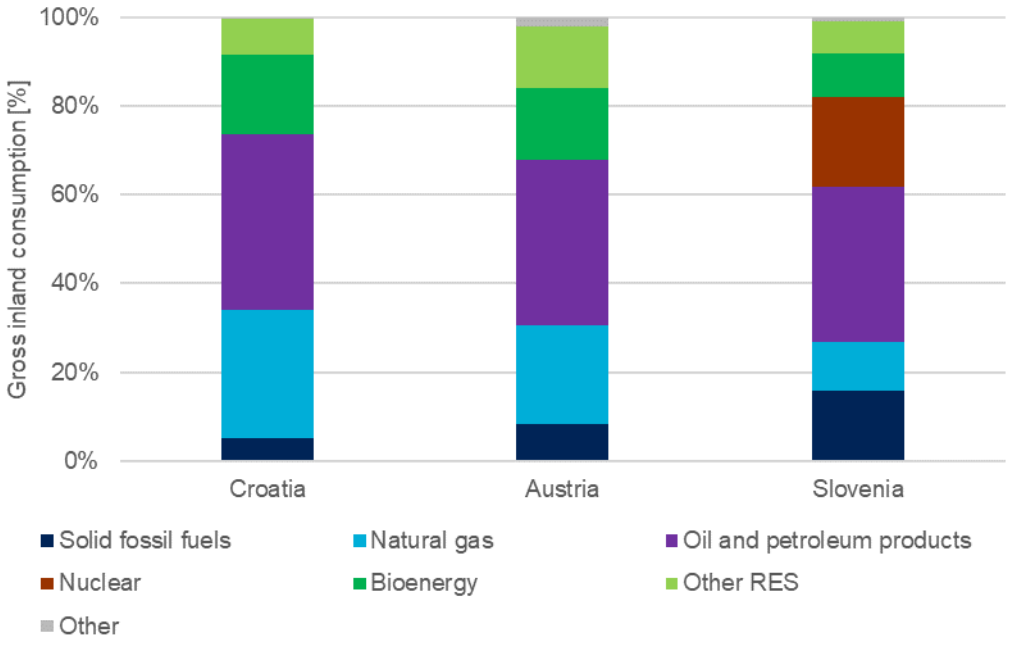


Source: WiseEuropa based on EEA data, 2022

All three countries are highly dependent on fossil fuels, especially gas and oil. However, Slovenia is the only one using nuclear and lignite for electricity generation, while Croatia is still using hard coal, although in a small share.

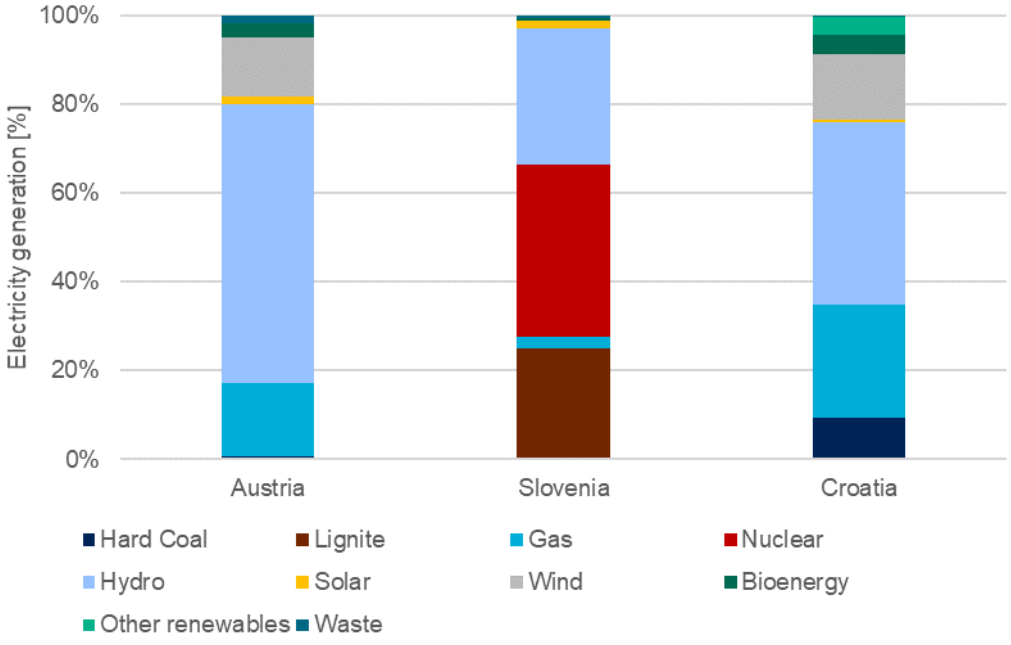
Regarding electricity generation, according to data Austria has the least emissive mix, where the majority of the electricity is generated from hydro, followed by gas and wind. Croatia also has high shares of renewables, where hydro is followed by gas and wind. Slovenia on the other hand has almost no electricity generation from wind. The share of solar energy is relatively small in all three countries.

Figure 3: Gross inland consumption of energy carriers in 2019



Source: WiseEuropa based on EEA data, 2022

Figure 4: Electricity generation by source in 2020



Source: WiseEuropa based on Ember data, 2022

2.2 General information on targets

Category		Slovenia	Croatia	Austria
General	Adherence to Governance Regulation	3	3	3
	Up-to-date document	3	3	3

Table 2: Year of adoption or draft release of LTS

Country	Date of adoption	Responsible administration unit
Slovenia	7/2021	Ministry of the Environment and Spatial Planning
Croatia	6/2021	Ministry of Economy and Sustainable Development
Austria	12/2019	Federal Ministry for Sustainability and Tourism

Among evaluated strategies, most of them are in line with the framework set out in the Governance Regulation. The Slovenian long-term strategy added some extra chapters (such as biodiversity, circular economy, education); the outline is therefore not totally in line with the Governance Regulation. The Croatian long-term strategy is in general in line with the Governance Regulation, there are just some changes in the order of chapters and also some chapters were added (among others, international cooperation, research and innovation). The Austrian strategy follows the outline on chapter level, but there is some content missing within chapters.

Nonetheless, following the framework was not a particularly difficult task due to the non-uniform and imprecise guidelines which left a lot of flexibility as to the content of the strategy.

2.3 Targets

Subcategory	Slovenia	Croatia	Austria
Net-zero target	3	2	3
GHG emissions reduction	3	2	3
Renewable energy share	3	2	2
Energy efficiency	3	2	2

Table 3: High-level targets for 2050 and 2030

	Targets 2050			Targets 2030			
	GHG emission reduction	RES share	Energy efficiency	GHG emission reduction	RES share	Energy efficiency [Mtoe]	
						Primary energy consumption	Final energy consumption
Slovenia	80-90 %	60 % (share of renewables in gross final energy consumption by 2005)	FEC not bigger than 40 TWh (33 % reduction compared to 2005)	Up to -36 %	27 %	Not exceeding 6.356 ktoe	Not exceeding 4.717 ktoe
Croatia	56.8-73.1 %	36.6% /44.1-45.8%/53.2-65.6%	FEC (25-37 % reduction compared to 2005), PEC (25-34% reduction compared to 2005)	40 % (compared to 1990)	36,6 %	8225-7851 ktoe	6853 – 6509 ktoe
Austria	72-84 %	76-93 %	FEC (52-38 % reduction compared to 2005)	-36 %	46-50 % and 100% electricity use from renewables by 2030	Improved by 24-30 % (compared to 2015)	/

All of three long-term strategies were adopted recently. Austria published their LTS first, that was in 2019. Slovenian and Austrian LTS are setting as their goal to achieve climate neutrality by 2050, although Austria is currently preparing an updated LTS, which will aim for climate neutrality by 2040. Croatia just mentions climate neutrality in terms of the EU goal but does not set a national GHG reduction goal. The Croatian strategy simply states the possible scenarios and that the goals will be somewhere within a more ambitious scenario range.

The Slovenian and Austrian strategies set out clear goals for GHG emission reductions until 2050, where Croatia states a range of GHG reduction. When it comes to the renewable energy share (RES), Slovenia sets out a goal for 2050 and also 2030 (which is in line with the NECP), where on the other hand Croatia and Austria offer a range of RES. Austria also states that until 2030, there will be electricity production from 100% renewables.

All of the strategies further provide targets or ranges for RES and energy efficiency (EE), where Slovenia is stating one clear number as a goal. The results in AT, HR and SI strategies come from modelling.

General and targets – cross-cutting issues

- Two of the LTSs (AT and SI) have clear targets for 2050 (climate neutrality), while HR LTS offers different scenarios and does not set a clear target for 2050, there are also preliminary scenario calculations for net zero scenario in HR strategy (in chapter 15 as information on climate neutrality scenario).
- Regarding RES, the HR LTS does not set a clear goal, it states again, what range of RES they expect in the future regarding different scenarios, for AT there is a mainly descriptive part of RES: what needs or will be done, but not to what extent it will be done. SI LTS has a number for RES, but it is also unclear on which level this is legally binding or not.
- For all three LTS it is not clear on which level the goals set are legally binding, SI LTS also states “indicative” goals for specific sectors and does not explain what is meant with that word.

2.4 Sectoral pathways and measures

The general framework of long-term strategies set out in Annex IV of Governance Regulation requires to include sector-specific related content in the long-term strategies. As stated in the analysis from WiseEuropa of Visegrad 4 countries[8], providing a sectoral context is of crucial importance, which gives meaning to the planned transformation. The 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.

Subcategory	Slovenia	Croatia	Austria
Energy	3	3	2
Buildings	3	3	2
Transport	3	3	2
Industry	3	3	2
Agriculture	3	3	2
LULUCF	3	2	2
Carbon removal technologies	2	2	3

All three strategies include at least some sector coverage, however, LTSs from Croatia and Slovenia in general include more data from models. Current GHG emissions from the different sectors is always stated, which is not the case in the Austrian LTS. According to this, the Slovenian and Croatian LTS also include more graphs and numbers, which illustrate current and future

[8] Kobylka, K., Laskowski, K., Sniegocki, A., 2022, Assessment of the national Long-Term Strategies of the Visegrád Group countries. WiseEuropa.

developments, which is not the case in the LTS of Austria. The Slovenian LTS also includes a graph of predicted emissions until 2050 for each sector (which is derived from the analytical data), so it provides more visual data as well. In the case of the Austrian LTS it can be seen that the analytical tools are slightly weaker and that the data provided for each sector is not unified. For the sector of carbon removal technologies only Austria has a separate chapter, while the other two incorporated the carbon removal technologies in other sectors.

While all the countries sectoral subsections contain historical emissions data and specify policies and measures in a long-term perspective, the level of detail, amount of information, structure and presentation vary significantly between sectors and countries.

In the case of Austria, there is scarce visual presentation of current and future emissions, scenarios pathways, also some graphs in annex chapter, can be hard to read. In the Croatian LTS, visual presentation is included in the first chapters within the historical emission trends as well as the short description of scenarios. All three strategies list a number of measures, but do not specify how much each measure could contribute to the GHG emission reduction. The possible contributions are explained in more detail in the data of analytical tools. The Slovenian LTS is the only one who includes proposed sectoral indicators for monitoring the LTS.

Backing up qualitative analysis with modelling results is important for going beyond just plain generic recommendations for sectors such as energy renewables deployment, energy efficiency improvement, alternative fuels development, inclusion of circular economy. The results should give at least a general impression of efforts needed in each sector and presenting the reliable paths to meet them. Qualitative data vas backed up with modelling results in all three LTS, where the AT LTS was the weakest one.

In all three strategies agricultural and LULUCF sectors are included. For the agricultural sector, all countries are following their previous sector descriptions. For the LULUCF sector, the Slovenian chapter is in line with others in SI strategy, for example including projections of the sector etc. In the case of Croatia, the document does not set any targets (not even from modelling as in previous cases), but lists the past trends and further discusses policies and measures. In the Austrian LTS, the LULUCF sector is covered together with agriculture. There is also a separate chapter on logging scenarios included in the LTS as well as one on tree species distribution.

Sectoral pathways and measures – Cross-cutting issues

- Austria, Croatia and Slovenia provide a detailed sectoral approach with mostly historical data on GHG emissions, description of policies, measures and technologies. Quantitative analysis results for future emissions are provided in the case of Slovenia and Croatia, in case of Slovenia the monitoring of indicators is listed as well.

  The visual presentation of trends and forecasts based on modelling results give better sense of current and future dynamics, which is almost entirely absent in the case of AT

- Ideally, the strategy should provide a set of sectoral targets and a reference to specific sectoral strategies. Only SI mentions sectoral targets, but does not mention the "legal status" of the targets set.

- In the future update, Austria should focus more on the visual presentation of the projections, as well as providing historical data for all the sectors, as well as visualizing the prediction of GHG emissions. In the case of Croatia, the LULUCF sector should be more addressed, since as we can see from data, plenty of sinks coming from LULUCF sector in 2019 emission status, sinks are also mentioned in the chapter 15 on climate neutrality scenario

- When discussing sectors, the presentation and the establishment of a consistent structure across the sectors is also important. It helps to understand the content and hence, the perspective and the contribution of individual sectors in the wider decarbonisation context with the Slovenian LTS is a good example.

2.5 Investment needs and financing

Category	Subcategory	Slovenia	Croatia	Austria
Financing and enabling policies and measures	Investment needs assessment	3	2	1
	Financing	3	2	2
	R&D	2	2	2

2.5.1 Investment needs assessment and financing

Slovenia and Croatia provided estimates of the investment needs of the transition that are based on the quantitative analysis. SI is also giving details on cost distribution across the sectors, where the most investments are needed in transport sector. In the case of AT there are no calculations of investment needs, it states that the calculations were done on a sectoral basis and should be available in 2020. But with new government in Austria, that followed slightly after the submission of the LTS decided that Austria will become climate neutral by 2040. Austria is now working on preparing the new LTS (together with the analytical data).

In the case of possible mechanisms and means to finance these investment needs, HR listed possible EU funds and programs, national financial mechanisms, innovative models of financing (such as ESCO financing models, crowdfunding) as well as public-private partnerships. Austria sees as a key factor in achieving climate neutrality mobilisation of private capital and directing financial flows towards low-emission economy and society. Also, as stated in the LTS, Austrian Green Finance Agenda will be developed with collaboration with key financial market participants

in order to establish Austria as a robust green financial centre (already happening). Also SI is starting to establish a national financing scheme in accordance with climate finance.

In Slovenian document there is an extensive chapter on financing, which includes, apart from investment needs, a chapter on green financing for the transition to low carbon society and main direction and fields of action in financing sector and on instruments of financial nature by 2050. It is describing the financial model, sources, as well as reform on tax and budgetary policies. LTS was adopted after the EU Green Deal, so it partially already leaning on to it.

All three documents are also leaning on mentioning programs on the EU level. National funding should complement EU funding. Additionally, in the case of EU funds, the use of funds from the sale of CO_2 emission allowances, the Modernization Fund, cohesion funds, etc. should be further specified.

2.5.2 R&D and innovation

While research and development (R&D) and innovation is described in all of the strategies, their level of detail varies significantly. In the case of Austria, R&D is mentioned in several chapters-transport, bio economy, industry as well as in the adaptation chapter. In the case of Croatia, R&D is mentioned through different chapters, but in a descriptive manner. In the case of Slovenia, there is stated how much of the GDP should go for R&D in 2050, but the role of the sector is not described in specific. In none of the strategies the role of R&D is clearly stated and described in terms of how much money will be invested in R&D and what are the priority areas that the country will focus.

R&D and innovation – Cross-cutting issues

- The assessment of investment needs and defining current and future frameworks for financing are fundamentally enabling elements of the strategy.
- Strategy makers should put emphasis on cost of net-zero and its distribution across sectors and years (periods) as well as European and domestic financing possibilities (with the latter modestly or not at all described across strategies).
- The funds and other financing measures should consider the individual characteristics of each sector and possible socio-economics impacts.
- R&D and innovation as one of the most important parts of enabling activities should be broadly discussed in the strategy. Including policies and measures for related research, development and innovation are required by the framework set out in the Governance Regulation.
- Added value of the documents would be setting the priorities of R&D in the context of decarbonisation.

2.6 Economic assessment

Category	Subcategory	Slovenia	Croatia	Austria
Economic assessment	Socio-economics impacts	2	2	1
	Distributive impacts	2	1	2

The level of details, as well as adopted structure of economic assessment segment differs significantly in all three strategies. Slovenian LTS includes analysis on socio-economic impacts in different scenarios, but just until the year 2030- drawing from its NECP. Results show that the WAM scenario (after 2022) and the WEM scenario (throughout) are unfavourable for the 20 % of households with the lowest income. For that reason, Slovenia is stating that it will adopt mitigation measures. In a separate chapter SI discusses these measures, also within the context of just transition, addressing energy poverty, as well as mobility poverty. The Croatian strategy only provides descriptive socio-economic impacts and it does not discuss distributive impacts. The Austrian strategy lacks the analysis of socio-economics impacts, but recognizes the fact that the analysis is needed in the upcoming years. On the other hand, AT included separate chapter on just transition describing the challenges ahead Austria acknowledges that transition to climate neutrality is not just technical challenge, but to a large extend also economic, social, structural, societal and labour policy challenge. So from AT perspective, social compatibility and fairness are fundamental pillars of the strategy. Within the chapter they discuss (not in a specific matter) the changes needed in labour markets and retraining the workers. As some will be put at risk, transformation will also create new job opportunities and business.

Economic assessment – Cross-cutting issues

- The analysis of the impact of the transformation on the low-carbon economy on society, regions as well as the distributive impact on social groups should be an essential element of the climate and energy policy.
- Countries should also identify sectors which will be the most impacted by the transition to climate neutrality and indicate mitigation measures.
- In the update, strategy makers should focus on the transition's impact on economy, identifying vulnerable groups that are at risk of losing their jobs, distribution of decarbonisation cost between regions and social groups, energy poverty, as well as providing policies and measures to counteract these negative consequences.

2.7 Strategy preparation and implementation

Category	Subcategory	Slovenia	Croatia	Austria
Strategy preparation and implementation	Analytical tools	3	3	2
	Governance	2	2	2
	Public consultation	2	3	3

2.7.1 Analytical tools

All of the strategies used at least some sort of analytical tools to shape the documents. In the Slovenian case the only selected scenario trajectories from WAM scenario were included in the Strategy, the whole background scenario analysis was a separate publication (available also during public consultation). The Austrian LTS uses transition scenario as a base for calculating 4 different pathways (all aiming for climate neutrality by 2050) with so called pathway calculator. The transition scenario was calculated in 2017 by Federal Environment Agency and a consortium of Austrian scientific institutions, with addition to scenarios WAM and WEM. The climate pathway calculator was developed in 2015 on the basis of UK carbon pathway calculator (it is an excel tool). The Croatian LTS also provides several scenarios, but as already mentioned, does not decide which path to take. The results of the model in HR and AT LTS were incorporated in the strategies to some extend and most of the analysis is provided in the annex to the strategy. In the Slovenian LTS, data from analytical tools is used in almost every chapter, also with the emission graphs.

2.7.2 Governance

All of the strategies provide information on governance. The Austrian strategy mentions that the strategy needs to be reviewed and updated on a regular basis but does not mention the exact system. There is also an idea of an independent advisory committee with scientists that could ensure the involvement of scientific approach on a long-term. They also plan to involve private sectors and workers as well as ensuring public participation. The Croatian strategy describes the bodies (and their roles) that are currently responsible for climate governance such as Ministry of Economy and Sustainable Development, Ministry of Physical Planning, Construction and State Assets, State Hydrometeorological Institute. In order to improve cross-sectoral coordination Croatia also established two commissions: Commission for cross-sectoral coordination for the national system for monitoring greenhouse gas emissions and Commission for cross-sectoral coordination for climate change mitigation and adaptation policies and measures. For implementation of the Strategy they emphasise that stronger horizontal actions are needed as well as vertical cooperation from the state level to action at the local level. The Slovenian strategy goes one step forward and also states what will be done: it mentions a body that will be directly under the government to coordinate climate policy in the country. It also states the indicators and how monitoring will be done. On the other hand, none of the strategies provides a full description of what will be done on the governance level and who will be responsible for what.

2.7.3 Stakeholder participation and public consultation

All three LTS provide information on public participation and consultation. In Austria, there was an extended consultation with the public, with information included in the LTS, there was also stakeholder consultation with three workshops. The Croatian LTS was subject to a public consultation. Before developing the LTS, there were several steps of framing the LTS, which included different stakeholders. The Slovenian LTS was also a part of public consultation, with different workshops held, and there was a prior online consultation on the LTS as well as several workshops with different stakeholders within the LIFE Climate Path 2050 project (for preparation of scenario analysis), which is mentioned in the LTS. There could be more data included in the LTS about the results of the consultation processes.

Strategy preparation and implementation – Cross-cutting issues

Slovenia and Croatia present a comprehensive approach by providing economy-wide models that intersect with the quantitative analysis along with policies and measures, while the Austrian case is a bit weaker on the analytical side.

The economy-wide modelling is an important and useful tool in complex development strategies (in which decarbonisation strategies certainly fell into) when changes in individual sectors are affecting and influencing others. These models help us understand complex cross-sector relationships and learn from the results and different scenarios.

While domestic governance is not required by the Governance Regulation, it is an important part of every strategy due to the ability to control the progress and fulfilment of certain goals set in the strategy and also addresses organisation issues related to implementation.

The strategy should establish or indicate institutional set up for governance and a monitoring system of the strategy implementation and would define appropriate framework for its operation.

Going on a path towards climate neutrality requires a whole shift of economy, everyday life, our habits and values. To make the journey successful and not get resilience on the way it is crucial to include and consult the public in a wider extend possible and since the beginning. The goals, vision and transitions also need to be clear and communicated in a clear and transparent way. With similar cases than the case from SI, where strategy was significantly changed after the public consultation, this can reflect in the lack of confidence in the government and can present a bad light on a public involvement in the future.

2.8 Conclusions

For all three countries analysed in our report this was their first “exercise” to provide its national long-term climate strategy with a scope up to 2050. Since the submission of all three strategies there were significant changes in the climate policy field, especially on the EU level. The European Climate Law was adopted in mid-2021, which includes the goal for Europe’s economy and society to become climate neutral by 2050. It also sets intermediate targets by reducing GHG by at least 55 % by 2030 (compared to 1990). EU member states should take necessary measures at the national levels to meet the target of climate neutrality. Further changes came with a REPowerEU, which is the European Commission’s plan to make Europe independent from Russian fossil fuels well before 2030, in light of Russia's invasion of Ukraine, those impeding the transition to climate neutrality. Austria already submitted its document in 2020, Slovenia and Croatia in 2021 so in none of the countries documents these significant changes are reflected (ex. Slovenia has lower emission target for 2030 that are not in line with the Fit for 55 package, Croatia is not aiming for climate neutrality, although this is now included also in the EU climate law). Although regarding the adoption date of the strategies in the case of Slovenia and Croatia, these strengthen goals could be reflected in the documents, we have to be aware that preparation and adoption of such documents takes time, so such changes can not be included in the documents immediately.

From the comparison of these three countries, we can conclude that all of them put a lot of effort in preparing the document, although strategies are different in structure, content as well as length, which can also be the consequence of the vague instructions by the EU commission, since the content written in the Regulation was not mandatory According to the Regulation strategies member states should update strategies every five years, if necessary. So, for the upcoming update, it would be wise, if the EU commission will give more guidelines also on the topic of the content for the LTS, since previously majority of the focus was put on the NECPs, but to achieve the long-term goal of climate neutrality, clear and robust long-term documents are needed, with clear pathways.

Although all three countries are covering the majority of suggested chapters from the Governance Regulation what can also be derived from our analysis is, that all three strategies are becoming slightly weaker towards the end, when moving away from traditional sectoral emission reduction. This is even more significant in the case of Austria, where some assessments are missing (ex. socio-economic impacts) and are equally if not more important part of the LTS. Topics and analysis on investment needs, just transition, socio economic impacts R&D, governance are as equally important as emission modelling reductions for specific sectors and should be strengthened in all three strategies. Reaching climate neutrality is a complex transition including all sectors, people and policies, so should be broadly integrated, which means also addressing different aspects of the transition in the strategy. LTSs should to at least provide a vision for such topics, what needs to be done and what obstacles need to be overcome towards climate neutrality.

The analysis done by WiseEuropa also pointed out the aspect of cross-border thinking or a search for joint solutions in the strategies. Also in the case of Austria, Croatia and Slovenia there is no presence of such cross border thinking, although Croatia and Slovenia at the moment do “share” nuclear power plant in Krško. (Company NEK d.o.o is owned by Slovenian GEN energija and Croatian Hrvatska elektriprivreda d.d.) and Slovenia is thinking of building a new nuclear reactor.

As an interesting fact, at the end we can also point out, that all three selected countries are mentioning in their strategies dietary habits- moving to more plant based diet, which can reduce the GHG emission.

Annex I: Methodology

The Annex IV framework set out for the LTS is much less detailed than for the NECP, which resulted in a different approach to strategy development for each country. Given the lack of precise structure and content guidelines, it makes them difficult to assess as in general, a wide range of strategies are compliant to the framework, but the outcomes differ in terms of quality and extent.

The assessment follows the general logic of Annex IV of the Governance Regulation defining elements that should be included in the strategy divided in categories. The rating is based on an indicative score on a three-point scale. In general, the highest score is given when the output of a category can be considered as best practice that can serve as example for future updated strategies. For types of categories 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.

It is important to highlight that the analysis aims at assessing the general concept, content scope and structure, incorporation of certain details and quality of presentation (such as visual data presentation) rather than assessing the quality of individual policies and measures or qualitative and quantitative analysis.

Category	Subcategory	Score guidelines
General	Adherence to Governance Regulation	1 - the document cannot be considered a strategy (e.g., different type of document - short declaration, study etc.), 2 - the strategy is broadly consistent with regulation, but has major discrepancies (e.g., only partial sectoral coverage), 3 - the strategy is consistent with the regulation, with potential minor deviations
	Up-to-date document	1 - the document was published before 2015, 2 - the document was published between 2015 and 2018, 3 - the document was published in 2019 or later
Targets	Net zero target	1 - the document does not consider net zero target, 2 - the document considers net zero target, but does not commit to it, 3 - the document commits to net zero target
	GHG emissions reduction	1 - the document has no high-level targets, 2 - the document presents a range of potential (indicative) targets by 2050 beyond already established NECP targets, 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, 2 - the document presents limited sectoral detail. It outlines historical and future trajectories of GHG emissions and discusses the current state and policies and measures for decarbonisation. 3 - the document presents a comprehensive overview of the sector and its contribution to long-term decarbonisation. It provides quantitative and qualitative analysis beyond the criteria for score 2.
	Buildings	
	Transport	
	Industry	
	Agriculture	
	LULUCF	
	Carbon removal technologies	

Financing and enabling policies and measures	Investment needs	1 - no assessment of investment needs, 2 - partial assessment of investment needs (e.g., only energy sector), 3 - full assessment of investment needs (all sectors)
	Financing	1 - no overview of financing instruments, 2 – partial or/and descriptive review of financing instruments, 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, 2 - descriptive review of R&D state and role, 3 - prescriptive provisions, policies and measures for R&D sector
Economic assessment	Socio-economic impacts	1 - no overview of socio-economic impacts, 2 - descriptive review of socio-economic impacts, 3 - prescriptive provisions, policies and measures for the mitigation of negative impacts
	Distributive impacts	1 - no overview of distributive impacts, 2 - descriptive review of distributive impacts, 3 - prescriptive provisions, policies and measures for the mitigation negative impacts
Strategy preparation and implementation	Analytical tools	1 - no analytical tools used, 2 - partial/qualitative assessment tools used, 3 - comprehensive modelling tools used to support qualitative analysis
	Governance	1 – the document does not provide information on governance, 2 – partial review of the governance mechanisms, 3 – prescriptive provisions, indicating or establishing institution governing and assessing the implementation of the strategy, defining a framework for its action
	Public consultation	1 – the document was not subject to public dialogue, 2 – the document was subject to public consultations (comments on draft), 3 – the document was consulted on an ongoing basis with the public, dialogue with the public

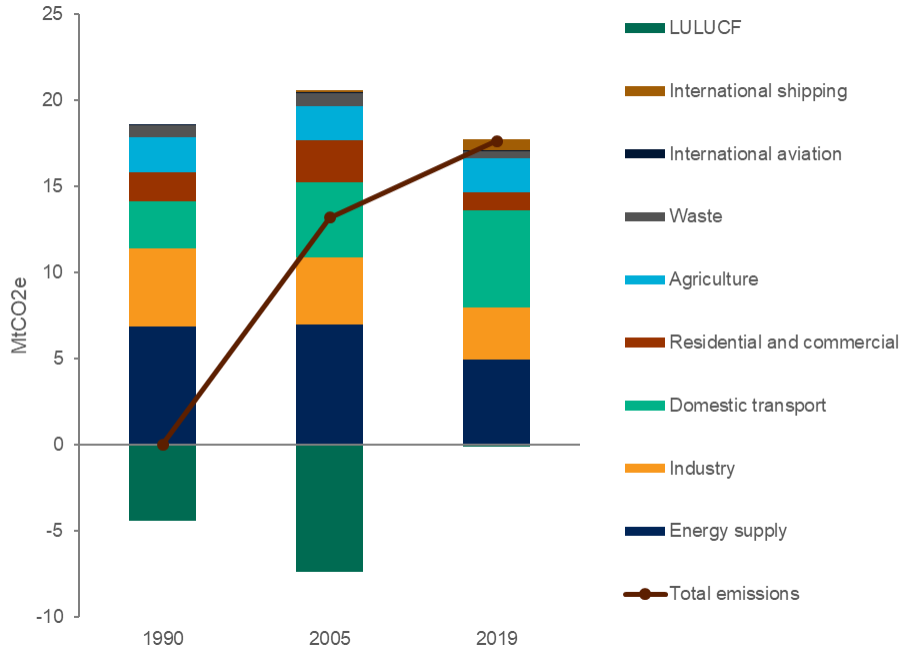
Annex II: Country details

Slovenia

Overview of the key national climate and energy indicators

Slovenia emitted slightly over 17,6 Mt CO_2e in 2019 which is a decrease in annual emissions compared to over 20 Mt CO_2e emitted in year 2005. Most of the reduction was made in the energy supply sector and residential and commercial sector while transport saw the biggest increase in emissions. LULUCF almost went from carbon sink to net source (- 0,1 Mt CO_2e in 2005).

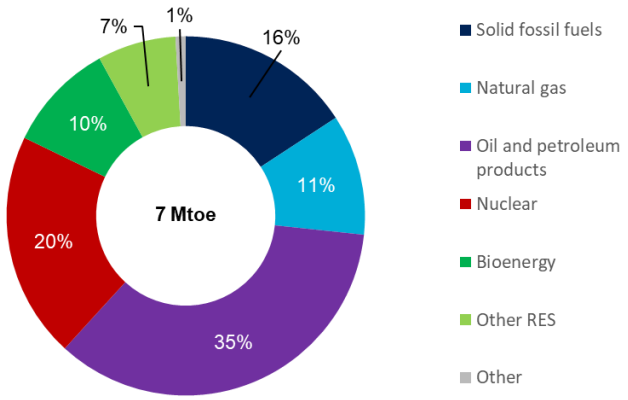
Figure 5: Total GHG emissions by sector in Slovenia in 1990-2019



Source: WiseEuropa based on EEA data 2022

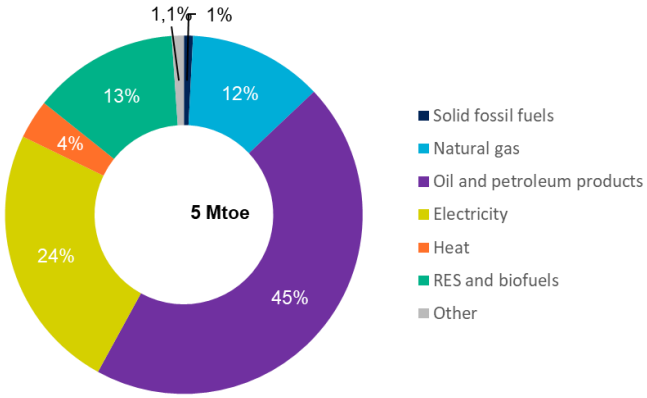
Emissions in Slovenia from transport are rising, which also contributes to large portions of petroleum products being used in the share of gross inland consumption of energy carriers. Nuclear and solid fossil fuels (lignite) are used for the electricity production. The electricity generation in Slovenia is dominated by three sources: nuclear (39 %), hydro (31 %) and lignite (25 %). It is important to mention that half of the electricity produced in Slovenia's nuclear power plant goes to Croatia (intergovernmental agreement).

Figure 6: Gross inland consumption of energy carriers in Slovenia in 2019



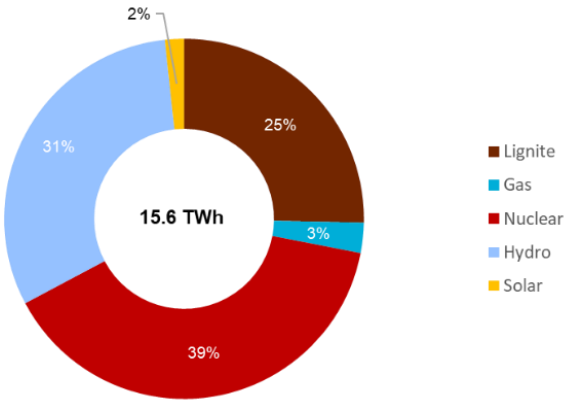
Source: WiseEuropa based on Eurostat data, 2022

Figure 7: Final energy consumption (energy use) in Slovenia in 2019



Source: WiseEuropa based on Eurostat data, 2022

Figure 8: Electricity generation by source in Slovenia in 2020



Source: WiseEuropa based on Ember data, 2022

Slovenia assessment details

Category		Score	Comment
General	Adherence to Governance Regulation	3	The document was prepared to comply with the EU Regulation EU 2018/1999 of the European Parliament and of the Council on the Governance of Energy Union and Climate Action. It also contains some additional chapters. The document presents historical emission data and a set of policies and measures. Two scenarios lead to the climate neutrality goal and are discussed within the chapters.
	Up-to-date document	3	The document was adopted in June 2021 as Resolution in the National Assembly. It is based on the same analytical data as NECP, which is also stated being a LTS Action plan until 2030. It also says that due to the common EU emission reduction goal until 2030 (-55 %), probably in the year 2021 Slovenia will update its NECP (this is now an ongoing process).
Targets	Net zero target	3	The document sets net zero as a target (two different scenarios lead to climate neutrality).
	GHG emissions reduction	3	The document provides the following GHG reduction targets: • reduce the Slovenian emissions up to 36 % (compared to 2005) by 2030 • reduce emissions by 55-66 % by 2040 (compared to 2005) • reduce emissions by 80-90 % by 2050 (compared to 2005) There is a special chapter on renewable energy share. Share of renewables in gross final energy consumption in 2050 is supposed to be at 60 %. Sectoral goals by 2050 are: - At least 65 % RES in transport sector - At least 50 % share in heating and cooling - At least 80 % share in electricity generation. There is also a special chapter on EE, discussing current state and also goals and directions of the NECP. The goal for 2050 is that Final Energy Consumption (FEC) in 2050 will not be higher than 40 TWh. In 2040, the primary energy consumption should not exceed 65 TWh, while FEC does not exceed 47 TWh.
	Renewable energy share	3	
	Energy efficiency	3	

Sectoral details	Energy	3	The document includes sectoral targets or milestones for the energy sector. The goal is to have minimal GHG emissions in 2050 from this sector (according to the scenario analysis, the strategic sectoral goal is a GHG reduction by 90-99 % compared to 2005). The document gives sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector. The main principle is energy efficiency first (before new power supply infrastructure). Usage of coal will be dropped in line with the national phase out coal strategy. After the development of the LTS, the year for coal phase-out was set to 2033. At the beginning of all sectoral chapters there is a paragraph where main topics, goals and directions from the NECP are summarised.
	Buildings	3	The document specifies sectoral targets or milestones for the buildings sector. The document gives sectoral background (current emission, NECP targets and directions) and provides a descriptive overview of policies and measures for reducing emissions. The goal for 2050 is to achieve minimal GHG emissions from the sector (according to the scenario analysis, a 87-96 % emission reduction in wider usage sector is envisaged). The strategic goal is to reduce GHG emissions from the sector between 85-95 % until 2040. The document also mentions a long-term renovation strategy for 2050, which is very important for the sector to achieve minimal emissions. District systems will also play an important role in the decarbonisation of the sector, as well as RES and energy renovations.
	Transport	3	The document specifies sectoral reduction targets and milestones for the transport sector. The document gives sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector. Emissions in the transport sector are growing. The goal for 2050 is to achieve minimal GHG emission (according to scenario analysis 90-99% reduction compared to 2005). It also summarizes important measures and directions from the NECP (emissions can increase for 12 %). To achieve the goal for 2050 will be very challenging. The strategic goal for 2040 is to reduce emissions by 55-65 %. Special attention will be given to reduce everyday mobility. On the short distances, the country will support walking, cycling and public transport (together with the spatial planning). Railway connections and infrastructure will be improved as well as replacing fossil fuels in the sector (electrification).
	Industry	3	The document specifies sectoral targets or milestones for the industrial sector. It describes the current status of GHG emissions as well as current measures. GHG emission from industry account for 17 % of national GHG emission. The goal for 2050 is to reduce GHG emissions by 80-87 % (compared to 2005) to achieve minimal emissions. Until 2030, the strategic goal is to reduce emissions by 41 % and by 60-70 %

			in 2040. Changes to achieve minimal emissions (80-87 % reduction) will be structural and technological with incorporation od circular economy. Regarding the industry, the principle is the same: energy efficiency comes first. Whenever possible, gas will be substituted with electricity. Slovenia will also encourage the connection of the industry with district heating systems (to use the extend heat). The document gives sectoral background and provides a descriptive overview of policies and measures for reducing emissions in the industrial sector.
	Agriculture	3	The document specifies sectoral reduction targets and milestones for the agriculture sector. Same as in other chapters, this sector describes current emissions and measures, as well as NECP targets and measures. In 2018, agriculture accounted for 9,8 % of national GHG emissions. The goal is to reduce GHG emissions for 22 % by 2050 (compared to 2005). The strategic goal until 2040 is 8 % reduction. GHG emissions will be reduce together with improvement with self sufficiency in food. Priority areas for action are: - Methane emissions from gastrointestinal tract of farm animals - Methane emissions from livestock manure storage - Efficient nitrogen cycling in agriculture The document gives sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector. The chapter also mentions a Rural Development Programme.
	LULUCF	3	The document specifies sectoral targets or milestones for the LULUCF sector. It describes the current status and measures and gives a short summary of the directions and goals in the NECP. The goal of the sector for 2050 is to achieve net sinks at least – 2.500 kt CO_2 ekv. At the same time, the carbon stock change (calculated as sink) in harvested wood products should be considered, emissions due to spreading of villages/towns needs to be 0 (compared to 2005). A national forest program is mentioned. The document gives sectoral background and provides a descriptive overview of policies and measures for reducing emissions in this sector. The directions are given for forestry as well as land use.
	Carbon removal technologies	2	Carbon removal technologies do not have a dedicated section. However, CCU/CCS are mentioned in line with the coal power plants it is predicted that either until 2040 the coal power plants stop working, or cutting emissions through CCS/CCU will be in place. (Current plan is to phase out the Šoštanj coal power plant by 2033). CCU is also mentioned and predicted in the sectors that are emitting process emissions such as the cement industry and metal production. The LTS also mentions that there is a need for supporting environment and pilot projects and infrastructure as well as regulatory frameworks to establish CCS or CCU.

			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. Besides the mentioned scenario, a wide use of these technologies is not envisaged nor discussed in the document.
Financing and enabling policies and measures	Investment needs	3	Slovenia provides investment needs for 2 ambitious scenarios and scenario with existing measures for several sectors (agriculture and LULUCF are missing). Transport sector is the sectors that needs the most investments to achieve climate neutrality. Approximately 66-71 billion of EUR is needed for investment to achieve climate neutrality.
	Financing	3	The document gives descriptions on green financing for a low carbon society and on instruments of financial nature. It summarizes the EU Green deal. Until 2023, Slovenia will prepare a system and financing model for the transition. Different financial instruments are mentioned as well as a modelling starting point. Chapters also list sources of financing, as well as mechanisms from the EU. The LTS also states that the tax policy will be changed in line with the transformation. There is also a short summary of most important directions from NECP.
	R&D	2	The document gives an overview of policies and measures in R&D regarding climate change. The goal for 2050 is to increase the financial resources for R&D to 4 % of GDP. The document again refers to the NECP for 2030 goals. It also mentions that the Research and innovative strategy of Slovenia has to include climate goals.
Economic assessment	Socio-economics impacts	2	The document includes an analysis of socio-economic impacts, but just until the year 2030. In the separate chapter is also discusses mitigation measures for the most vulnerable citizens, where it also discusses just transition in Slovenia.
	Distributive impacts	2	

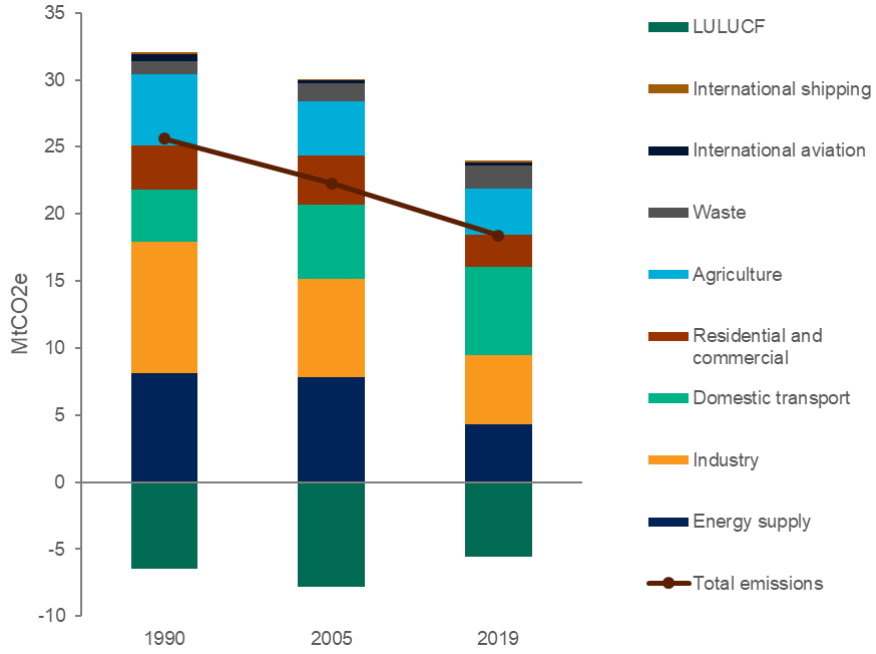
Strategy preparation and implementation	Analytical tools	3	The document is based on analytical tools. The model used is REES SLO model, scenario analysis was prepared. The whole analytical process is described in a separate document which is/should be a part of the strategy. The same analytical tools were also used for the NECP.
	Governance	2	Slovenia provides a separate chapter on governance. On a national level it mentions the establishment of a Slovenian Climate deal, which will further include a green financial plan. It will also establish an independent scientific-expert council. It also contains plan for monitoring and implementation of climate politics. Besides national reporting, international reporting is included in the section. A yearly monitoring report will be done in line with the NECP. The report will be public.
	Public consultation	2	Public consultation was conducted before the draft was published (159 people/organisation responded). Public consultation of the document was from 1.9.2020- 30.9.2020. There were also two public presentations during COVID times. Plenty of workshops with different stakeholders were conducted within the LIFE Climate Path 2050 project, where the participants discussed different aspects of analytical tools and the procedure. Score 2 is given since some changes (for the final version) in the LTS were not done in a transparent way and were done without public consultation.

Croatia

Overview of the key national climate and energy indicators

Croatia cut the GHGs emissions from roughly 25,6 Mt CO_2e in 1990 to slightly over 18 Mt CO_2e in 2019 (including LULUCF sector, which acted as sink). During that period of time, Croatia also went through several structural changes and became independent in 1991. Since 2005, the biggest decline of emissions has happened in the energy and residential sectors. In contrast, the domestic transport increased its emissions. Sinks in LULUCF sector have also decreased.

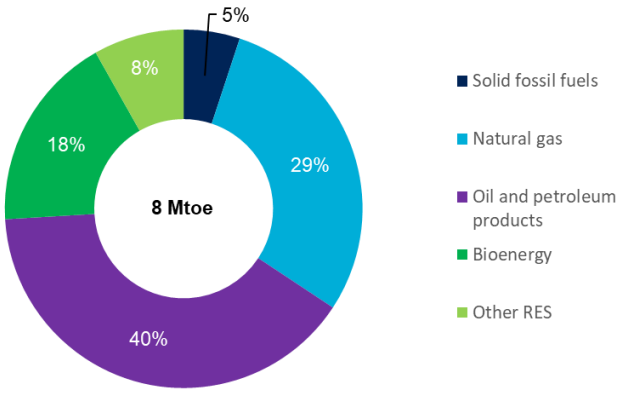
Figure 9: Total GHG emissions by sector in Croatia in 1990-2019



Source: WiseEuropa based on EEA data 2022

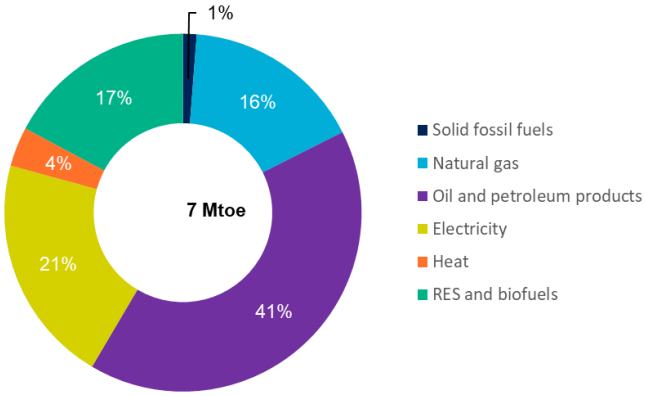
Gross inland consumption of energy carriers is dominated by oil, natural gas, and bioenergy. In electricity generation hydro is dominating, followed by gas and wind. There is still a small portion of coil left in the mix.

Figure 10: Gross inland consumption of energy carriers in Croatia in 2019



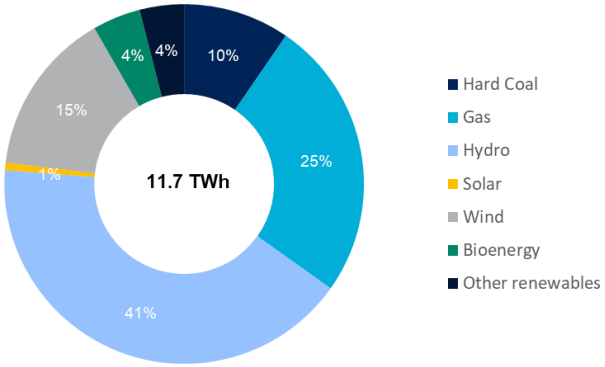
Source: WiseEuropa based on Eurostat data 2022

Figure 11: Final energy consumption (energy use) in Croatia in 2019



Source: WiseEuropa based on Eurostat data, 2022

Figure 12: Electricity generation by source in Croatia in 2020



Source: WiseEuropa based on Ember data, 2022

Croatia assessment details

	Category	Score	Comment
General	Adherence to Governance Regulation	3	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.
	Up-to-date document	3	HR has adopted LTS in June 2021.
Targets	Net zero target	2	The LTS does not present the net zero target. The LTS presents 3 scenarios for GHG emission reduction: - Reference scenario: BAU in line with legislation in force and the agreed targets for 2030, it includes technological advancement and increased RES and EE market share - Gradual transition scenario (NU1): meet the Paris agreement goals through cost effective measures, strong incentives of EE and deployment of RES - Strong transition scenario (NU2): calibrated with the objective to achieve GHG emission reduction of 80 % in 2050 (compared to 1990) The goal of Croatia's GHG emission pathway is to be in range between NU1 and NU2 scenarios, with a tendency towards the more ambitious NU2. Net zero target is mentioned within chapter 15. Preliminary calculation of net zero scenarios was already done in Croatia. Chapter also summaries EU policies and states that for net zero broad discussion needs to be done.
	GHG emissions reduction	2	The target for 2050 is to reach emission reductions between the two low emission scenarios, with the tendency to reach the most ambitious one (to reach -80 % GHG emission reduction until 2050, scenarios show range from 56,8-73,1 % (excluding removals)). For the 2030, non-ETS emissions should be lowered by 7 % (compared to 2005).
	Renewable energy share	2	
	Energy efficiency	2	The share of renewables in gross final energy consumption ranges from 56,8-73,1 % in 2050 (in NU1 and NU2 scenario). (NU1 scenario: 2030 (36,6 %, 2040 44,1 %, 2050 53,2 %), (NU2 scenario: 2030 36,6 %, 2040 45,8 %, 2050 65,6 %). Data for energy efficiency comes from modelling: - FEC; 5.38 to 4,53 Mtoe in 2050 (25-37 % reduction compared to 2005) (NU1 and NU2 scenario) - PEC; 6,85 to 5,99 Mtoe in 2050 (25-34 % reduction compared to 2005). (NU1 and NU2 scenario) All numbers are modelling results and not considered as set targets.

Sectoral details	Energy	3	The document does not specify sectoral targets for the energy sector. But it states numbers from the modelling. So according to NU1 and NU1 scenario the reduction could be from 61,0 – 93,3 % in 2050. It outlines historical GHG emission data and provides extensive presentation of modelling results (additional data is in Annex) of future emissions, the energy consumption mix and other sector specific indicators. It discusses policies and measures and various technologies for decarbonisation of the sector.
	Buildings	3	Buildings are included in the chapter 6.4. General consumption sector. Sector accounted for 13.5 % of GHG emissions in Croatia in 2018. 22.1 % of the sector falls into emissions from fuel combustion in agriculture, forestry and fishing sector. The document does not specify sectoral targets for the buildings sector, but it states expected reduction from modelling, ranging from 55.3-73.8 % in 2050. The chapter also discusses policies and guidelines in the sector for emission reductions for 2030 and 2050. It also discusses energy renovation of buildings and modernisation of thermal systems. It also refers to long-term building renovation strategy (until 2050).
	Transport	3	The document does not specify sector targets for the transport sector. But there are numbers from the modelling. According to the NU1 scenario, the reduction in 2050 could be 28,3 % and in NU2 scenario 55,4 % (compared to 1990). Transport accounted for 27 % of GHG emissions in 2018 in Croatia. The chapter also discusses policies and guidelines in transport sector for emission reduction, for 2030 and 2050.
	Industry	3	The document does not specify sectoral targets for the industry sector, but again provides data from modelling. So for 2030, the expected reduction ranges from 54,1 - 57,5 % for 2030 and from 64.4 - 83 % in 2050. In 2018, emissions from this sector presented 21,1 % of all GHG emissions in Croatia. The industry sector is divided into emissions from industrial processes and energy emissions. The chapter discusses policies and measures for low carbon development. The NU2 scenario also includes CCS in the cement industry after 2040. It also discusses guidelines for the sector until 2030 and 2050.
	Agriculture	3	The document does not specify sectoral targets for the agriculture sector, but states data from modelling. In 2030 expected reductions are from 44,5 - 46,3 % in 2030 and from 50,9 - 55,8 % in 2050. The agricultural sector accounted for 11,4 % of total GHG emissions in Croatia (in 2018).

			The chapter then discusses policies and measures for low carbon development, it also highlights that sector is vulnerable to climate change. It also mentions dietary habits as potentials for reducing GHG emissions in the sector if moving to more vegetable-based diet. As in other chapters, there are also guidelines/directions for the year 2030 and 2050.
	LULUCF	2	The document does not have any targets set, not even from the modelling. It gives a data about past years (in 2017 the sinks were on the lowest level and on the highest in 1995, at 8954,6 kt CO_2). There is a trend in decline in sinks in the sector. Further it discusses policies and measures in the sector, a lot of it referring to EU regulations and different ways of calculating LULUCF sector. Further it discusses guidelines for 2030 and year 2050 in the sector.
	Carbon removal technologies	2	Carbon removal technologies do not have a dedicated chapter, however they are presented across the strategy (namely CCS). Croatia has technical and natural prerequisites for use of CCS technology. CCS is seen as transitional solution which in the next three decades should allow the continued use of fossil fuels with a share in total electricity production, while gradually reducing greenhouse gas emissions, until technological and organizational conditions for low carbon development are achieved. NU1 scenario can be achieved without CCS, NU2 scenario predicts CCS on gas powered power plants and cement industry after 2040.
Financing and enabling policies and measures	Investment needs assessment	2	The document provides an assessment of required investments for both scenarios (NU1 and NU2). According to the modelling results, the transition to low carbon development will require investments of 38.65 to 65.92 billion HRK (around 5 billion EUR to 8,6 billion EUR) in the period of 2021-2030 from 0.92-1.6 % of GDP and in the period of 2031-2050 the costs will be from 107.09 to 167.96 billion HRK (14 billion EUR-22 billion EUR) (from 0.96 to 1.51 % GDP). The investment needs are not broken down by sector.
	Financing	2	The document provides a separate section on financing sources, where mainly EU programs and funds and instruments are described as possible financial sources. It does not include specific financial instruments developed or needed in Croatia.
	R&D	2	The document does not provide a separate section on R&D innovative solutions, but the topic is mentioned several times through different sectoral chapters. It is stated that Croatia needs to increase its R&D expenditure to move closer to EU average and access to funds should be provided to the private sector, for applied scientific and development research and pilot and demonstration studies. The elements of low carbon development need to be integrated in programmes to foster

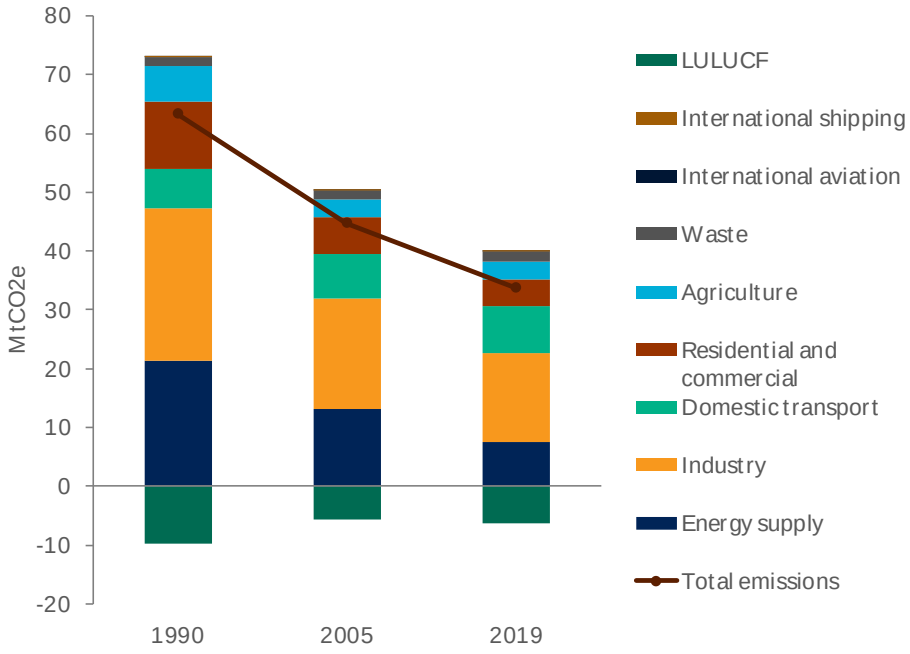
			innovation, research and development of higher technologies in the private and public sectors.
Economic assessment	Socio-economic impacts	2	The document provides descriptive socio-economic impacts. It mentions that with the energy transition the main costs move from fuel procurement costs to investment costs. The increase of energy prices for end consumers will also have negative impact on citizens personal consumption and development of small integrated photovoltaic systems for own consumption. It also states that in the initial period the strategy is expected to create approx. 40 000 green jobs.
	Distributive impacts	1	Distributive impacts were not presented.
Strategy preparation and implementation	Analytical tools	3	The document bases its analysis on NUSPCRO model – integrated model for national GHG projections. The model allows for the planning of scenarios for other pollutants, so the targets under the obligations of the UNFCCC and the Convention on Long-Range Transboundary Air Pollution can be carried out simultaneously. The annex of the document presents the assumptions for different scenarios.
	Governance	2	The document provides a chapter on the implementation of the strategy as well as the institutional framework. It describes current arrangements and also current reporting and implementation and indicated what should be done in the “future” or what should be done for effective implementation.
	Public consultation	3	The document was developed in four steps and each step involved consultations with the experts and interested public. For each sector, a vision and need from stakeholder and public consultations are provided in a table.

Austria

Overview of the key national climate and energy indicators

In 2019, Austria emitted around 77 Mt CO_2e net, which is 8 % less (including LULUCF) than in 2005 with biggest decline in emissions in the energy supply sector, followed by industry and the residential and commercial sector. Contrary to other countries, Austria's sectoral biggest emitter is the industry. Also, transport emissions increased from 1990 in 2019, but decreased slightly from 2005-2019.

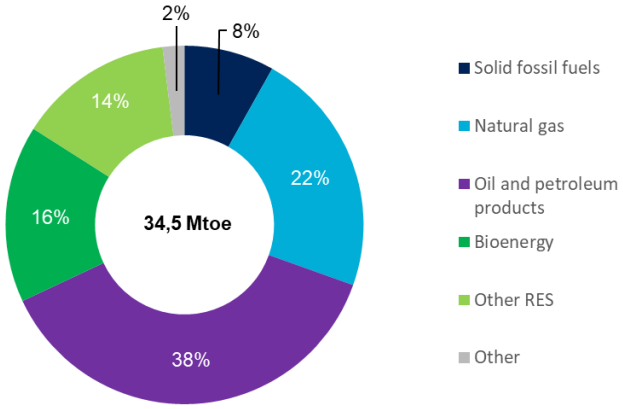
Figure 13: Total GHG emissions by sector in Austria in 1990-2019



Source: WiseEuropa based on EEA data, 2022

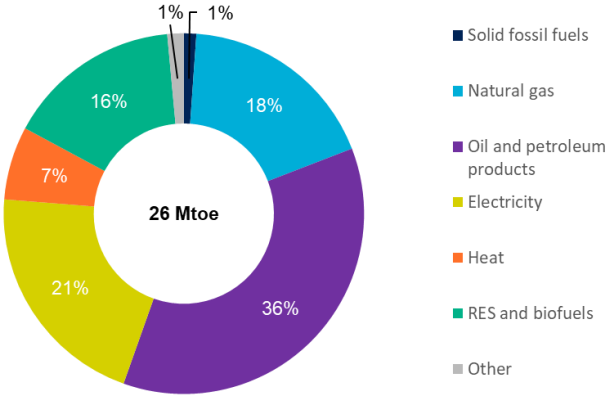
As already mentioned, Austria's biggest share of emission in 2019 came from industry, transport came second. This is also reflected in the gross inland consumption of energy carriers where oil and petroleum products have the highest share (38 %), followed by natural gas (22 %). Austria also uses natural gas for electricity generation (16 % by natural gas), with the majority of electricity coming from hydro power plants (63 %).

Figure 14: Gross inland consumption of energy carriers in Austria in 2019



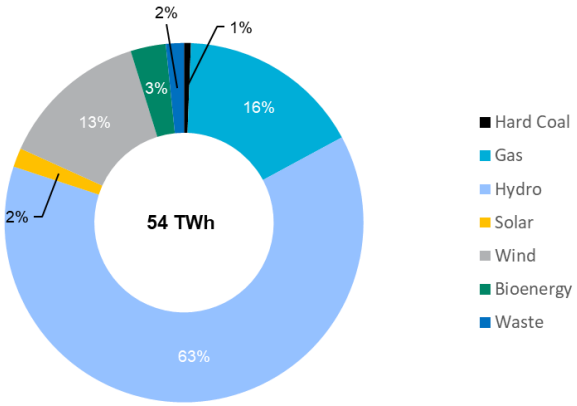
Source: WiseEuropa based on Eurostat data, 2022

Figure 15: Final energy consumption (energy use) in Austria in 2019



Source: WiseEuropa based on Eurostat data 2022

Figure 16: Electricity generation by source in Austria in 2020



Source: WiseEuropa based on Ember data, 2022

Austria assessment details

	Category	Score	Comment
General	Adherence to Governance Regulation	3	The document has been prepared in line with the EU Regulation 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. It broadly follows the template of the Governance Regulation, there are some slight differences in the subchapters.
	Up-to-date document	3	The Austrian LTS was adopted in 2019. There is a plan to prepare an updated document, where climate neutrality will be reached in 2040. There is no known timeline when exactly the new version will be adopted. A draft of the NECP was submitted at the end of 2018 and it is based on #mission2030, Austria's integrated climate and energy strategy.
Targets	Net zero target	3	Austria commits to be climate neutral by no later than 2050, without using nuclear power (that is clearly stated). The goal is a policy statement. Austria is currently in a process to refresh its LTS and set the new goal of becoming climate neutral by 2040. The LTS mentions results from a transition scenario, which was updated in 2019 and where emissions until 2050 will decrease by 80 % (compared to 1990). Working from the model-based transition scenario, an excel based tool was used to select and calculate four different pathways that all aim at achieving climate neutrality by 2050. The four pathways (A-D) have different assumptions. *Beside the transition scenario, also scenario with existing measures (WEM) and scenario with additional measures (WAM) were calculated (scenarios are developed for the use of EU reporting).*
	GHG emissions reduction	3	The GHG emission reduction varies from 72 % - 84 % decrease (depending on the pathway). The document provides set of interim targets for GHG reductions by 2030: • GHG emission reduction in ETS: - at least 43% • GHG reduction in non-ETS: -36% (compared to 2005) in line with NECP For the share of renewable energies, there is a range from 76 %- 93 % (range from different scenarios). There is no clear target. For energy efficiency in FEC, there is a reduction from 52 – 38 % (according to 2005). It is also based on scenarios and no specific target is set. There are also no interim targets for 2040, some number could be read out of scenario graphs.
	Renewable energy share	2	
	Energy efficiency	2	

Sectoral details	Energy	2	The document does not specify sectoral targets for the energy sector. There is also no special chapter on it, sector is covered (mostly) within the renewable energy chapter. There are targets for 2030 (from the Austrian climate and energy strategy #mission2030, where there is an increase in the share of renewables to 46-50 %, and the goal to produce enough electricity to cover 100% of the total electricity use by renewables by 2030. Then it discussed the need for digitalisation, innovation, technologies needed in the future, increase use of photovoltaic and further topics. It is mostly descriptive, no figures or commitments. A core element of the future system is sector coupling. On coal they mention that decarbonising energy sectors implies a rapid coal phase out (without specific date), it also states that in 2050 the use of heating oil will be down to zero. There is also special chapter on energy storage systems.
	Buildings	2	In 2017 buildings presented 10 % of total emission. The target vision for 2050 is that buildings are heated and cooled virtually free on CO_2 emissions. The supply of hot water is provided exclusively via renewable energy. There is also data on energy consumption in households. It is a separate chapter, including plenty of descriptions (including measures for new buildings, renovation of the old ones), it is also stated that fossil fuels will be used in exceptional cases. District heating planning will play a central role in urban areas. Also, results from public consultations are included. Although the sector is well described, it lacks some numbers and figures how emissions will fall until 2050.
	Transport	2	Emissions from passenger and freight traffic will be reduced to an absolutely necessary minimum. There is data on current emissions (close to 29 % emission in 2017), the emissions rose by around 80 % between 1990 and 2005. There is no data what the necessary minimum is expected in 2050. The chapter also covers e-mobility, fuel cell vehicles and hydrogen from renewable sources, as well as addressing that workers will travel to work by bicycle or public transport and business trips will be done with public transport or carpooling in e vehicles. But it does not provide the shares and importance of this developments. It also sums results/directions from #mission2030 as well as the Cycling Master Plan, which aims to double the share of bicycle traffic from 7 % to 13 % by 2050. There is also a subchapter on the holistic approach for the transformation of the transport sector, as well as a chapter on reducing traffic by the scheme “avoidance, modal shifts and improvement as well as a subchapter on Lifestyles in 2050: People and companies profit from the mobility transformation.

			From the chapter of different pathways emission presented we cannot read the transport emissions, since the category is international air traffic and shipping and fuel consumption (in general).
	Industry	2	In the chapter on industry there is a lot of descriptive information, but no specific target of emission reductions stated as well as no specific number/data of how much and when technologies/changes will be implemented. There is also no data on emissions from the industry sector, just the structure of the final energy use and also data of the share of fossil fuels. The chapter outlines that the goal is to create a competitive, modern and climate neutral economy in Austria. The goal is also a clean growth-decarbonisation, with a high degree of technological innovation. Renewable hydrogen is set to play a central role in the decarbonisation of industry, special in energy intensive sectors. Coal and other harmful fossil energy sources will be replaced in the first wave of transformation. There is also a special chapter on bioeconomy. From the back chapter where the different emission pathways are presented, we cannot read out industry emissions, since the category only refers to industrial processes.
	Agriculture	2	There is a joint chapter on agriculture and LULUCF. In 2017, the GHG emissions from agriculture accounted for about 10 % of Austria's total emissions. To reduce emissions, especially methane, nitrous oxide from livestock farming, fodder cultivation must decline. Meat consumption in Austria is above average. The chapter is mentioning plant-based food which can reduce emissions as well as can be used as capture of CO_2. Also, this chapter contains results from online consultations. Different measures are described in the chapter; from climate friendly livestock farming, reduction of use of mineral nitrogen fertilisers, organic farming to measures for sustainable conventional agriculture, as well as digitalisation. As it can be read through the pathways scenario, a small decrease in the GHG emissions from agriculture is predicted.
	LULUCF	2	LULUCF is covered in a chapter together with agriculture. Sinks accounted for 4 906 thousands of tonnes of CO_2 ekv in 2017. Further, there is a descriptive part, including fields of action, where multi-functionality is also mentioned. Forest policy activities are coordinated within Austrian Forest Dialogue. The chapter further highlights adaptation and a holistic approach which can ensure that optimal contribution is made to reaching the goal climate neutrality by 2050.

			There is a separate chapter on just logging scenarios included in the LTS as well as tree species distribution. In all scenarios forest remain sinks until around 2040. In all scenarios except scenario 2, the forest becomes a net source of GHG between 2040 and 2060, as the sink decreases due to more intensive use.
	Carbon removal technologies	3	There is a dedicated chapter on CCS and CCU. The LTS highlights that current permanent storage in geological structures is currently very limited in AT. It is up to 6.5 times the current annual CO emission in AT. In the long-term it could also be considered to use long-distance transport CO_2 to storages outside AT. There are different options/technologies listed from carbonation to microalgae (for CCU). On CCS, there is currently a moratorium in place (until 2023), which is evaluated every 5 years based on international experiences. Austria wants to promote CCU in the industry, since it will play a key role in path of decarbonisation.
Financing and enabling policies and measures	Investment needs	1	There are no calculations of investment needs. It is stated that calculations to estimated required investments in Austria on a sectoral basis were done and results should be available in 2020.
	Financing	2	The document gives a general description. It stresses out that mobilising private capital and directing financial flow towards the low-emission economy and society will be a key factor. It mentions the Austrian Green Finance Agenda that will be developed. It also lists measures which need to be implemented, although they are not specific.
	R&D	2	The document does not contain any special sector on R&D. On innovation, the document highlights that the innovations will be needed to ensure long-term decarbonisation of the economic system. Some of the national innovation programs are listed, as well as those on the EU level. There is no holistic view on the topic.

Socio-economics impacts	Socio-economics impacts	1	The document states that an in-depth analysis of the impact of the transformation and the consequences of climate change on jobs and social aspects is needed in the coming years.
	Distributive impacts	2	Just transition and social effects are just briefly described in a general way.
Strategy preparation and implementation	Analytical tools	2	The document used models that are used every two years for the EU reporting obligations. Beside WEM and WAM scenarios, a transition scenario was calculated in 2017. The transition scenario was updated in 2019. They also used selected results from the climate pathway calculator- it was developed in 2015 on the basis of the UK carbon pathway calculator and was updated in the 2019. Working from model-based transition scenario (described above) with this tool they have calculated 4 different pathways, which all achieve climate neutrality by 2050. From the graphs in the document it is hard to read their sectoral scope and numbers. The sectors used in the pathways were agriculture, fuel consumption, waste, forest, industrial processes, international air traffic and shipping. CCS/CCU as well as the standard sectors such as transport, building, industry are merged into other sectors. There was no macroeconomic impact modelling.
	Governance	2	The strategy must be reviewed and updated on a regular basis, coherence with the 2030 plan will be assured- It is not specified who is responsible for these tasks. An independent scientific advisory committee could be set up to ensure the involvement of sciences over the long-term.
	Public consultation	3	Public consultation with questions on the objective and action areas for LTS was held in summer 2019. The target group was the general public. 1060 people have submitted questionnaires. Three workshops were held with relevant stakeholders in addition to the online consultation. On the last workshop the results were presented, and an in-depth discussion was held on the LTS. In several chapters it can be seen how the results from the public consultations were incorporated in the document.

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