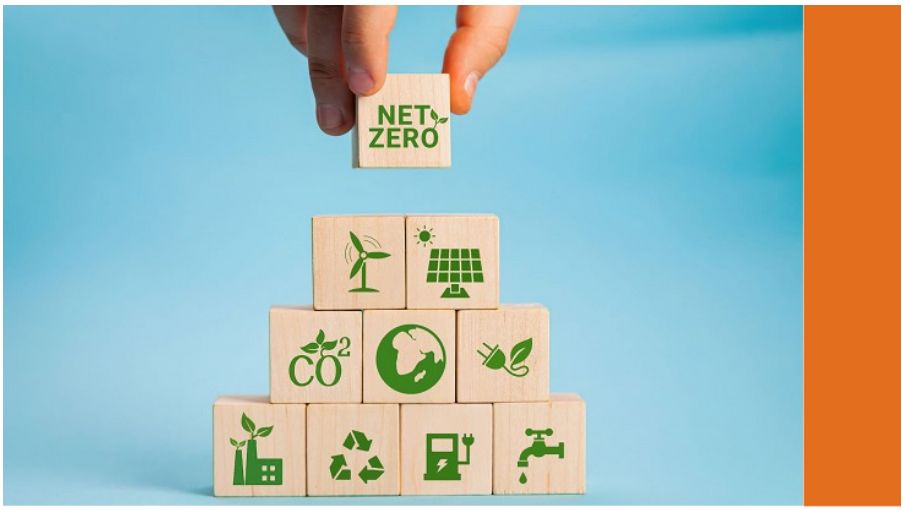
STUDY

Requested by the REGI Committee

European Parliament

EU regions in the transformation towards a climate-neutral future



Regional Development

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RESEARCH FOR REGI COMMITTEE

EU regions in the transformation towards a climate-neutral future

Abstract

This study provides information on requirements and goals for successful transformation towards a climate neutral future at regional level in the EU. Based on the analysis of six regional best practice examples across the EU, the key drivers, conditions and instruments for a successful transformation were identified. The project results in the formulation of specified policy recommendations for EU decision-makers in the field of supporting the EU regions in achieving the goals of climate neutrality.

This document was requested by the European Parliament's Committee on Regional Development.

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LIST OF ABBREVIATIONS

CF	Cohesion Fund
CIPRA	Commission Internationale pour la Protection des Alpes
CO_2-eq	Carbon dioxide equivalent
CPMR	Conference of Peripheral Maritime Regions
EC	European Commission
ED-GAR	Emissions Database for Global Atmospheric Research
EEA	European Environment Agency
EGD	European Green Deal
EP	European Parliament
ERDF	European Regional Development Fund
ESF	European Social Fund
ETS	Emissions Trading Scheme
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse gas emissions
IPCC	Intergovernmental Panel on Climate Change
JEREMIE	Joint European Resources for Micro to Medium Enterprises
JRC	Joint Research Centre
JTF	Just Transition Fund
JTP	Just Transition Plan
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics (French: Nomenclature des unités territoriales statistiques)
PO	Policy objective
PV	Photovoltaic
REACT-EU	Recovery Assistance for Cohesion and the Territories of Europe
REGI	Committee on Regional Development
SDG	Sustainable Development Goals
SME	Small and medium-sized enterprises

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EXECUTIVE SUMMARY

Regional transformation towards climate neutrality

The European Union (EU) intends to become the first climate neutral continent in the world. Ambitious policies, strategies and a dedicated use of EU funds are expected to promote and stimulate the European regions to transform their economies towards climate neutrality. Outlined by the European Green Deal (EGD) and legally enshrined in the European Climate Law, the EU should achieve a reduction of greenhouse gas (GHG) emissions of at least 55% by 2030, compared to 1990 levels. The EGD aims to protect, conserve and enhance the EU's natural capital and protect the health and well-being of citizens, including from environment-related risks and impacts. At the same time, this transition aims to be just and inclusive. The EGD is seen as an integral part of the Commission's strategy to implement the United Nation's 2030 Agenda and its 17 Sustainable Development Goals (SDGs).

Transformation towards climate neutrality is a challenging and complex process. The ways to achieve the goals set by the EU Climate Law and balance GHG emissions and removals, thereby reducing emissions to net zero (Regulation (EU) 2021/1119 Article 2), are still being developed.

There are practically no examples of regions that have achieved full climate neutrality and, consequently, there are no ready-to-use solutions available that could be easily transferred to other regions. Still, there are more and more regions successfully transforming their economies in at least one key sector or area of economy. The in-depth analysis of best practice examples of six such regions provided a wide range of approaches and solutions representing different starting points, scopes and circumstances for the process of transition. The following initiatives have been analysed:

- Climate Action Roadmap of Päijät-Häme (Finland)
- Soft mobility initiative in Werfenweng (Austria)
- 2025 Climate Plan of Copenhagen (Denmark)
- Promotion of climate neutrality in Graciosa (Portugal)
- Transformation of the economy in Wielkopolska Wschodnia (Poland)
- Climate-neutral economic zone in Plovdiv (Bulgaria)

Solutions, barriers and transferability of climate neutrality initiatives

The analysed best-practice examples are very differentiated and focus on one selected area of economic activity or try to implement a holistic transformation throughout all sectors of economy. The most important topic tackled is transport and mobility, other prominent issues addressed are power generation, and technologies enabling the transition. Furthermore, solutions for the agri-food system, and more generally the just transition to climate neutrality, could also be covered. The key roles in the process of transformation are played by the regional or local administration, which is in charge of the initiative's coordination and/or implementation, usually together with other stakeholders (such as municipalities, companies, NGOs and civil society). The private sector plays a strong role as well, or even takes the lead over the initiative.

The main **barriers** for the transformation are the lack of involvement of citizens and the general attachment to the status quo. Not yet existing results of the initiatives, that could have otherwise been shown to, and motivate, inhabitants toward action, weaken the implementation of transformation. At the same time, the absence of targets and monitoring systems as well as the lack of experts, know-how,

and resources in smaller regions, or within single municipalities, are also internal barriers. The dependency on external financial support entails a significant vulnerability to any changes in the processing of funding. Furthermore, a lack of regional autonomy for climate related decisions, dependency on complex interrelations with frameworks in the neighbouring regions, the national level, and the continent have also had a hindering influence on the progress towards climate neutrality.

The effective **solutions** can best be achieved when the internal capabilities, such as the openness to innovation and experimentation as well as experience in the development of strategies for climate neutrality and expertise are provided within the region. Smooth and efficient use of available financing sources for the transition process and further innovation move the transition forward. Inclusion of external experts and gradual detachment from external funding are also beneficial for regions on their way towards climate neutrality. It is essential that a well-performing model of a climate-neutral economy (in one sector or as a whole) is established. Then, it can gradually spread out to other areas and sectors. Small functional regions and islands are especially favourable to innovative projects for climate neutrality.

For the success of a climate neutrality initiative, it is crucial to find appropriate motivation and dedication in the region. A participatory character and communication with the citizens including experts and all relevant stakeholders are also indispensable for a successful transformation. Internationalisation, communication, and networking outside the region, as well as being part of a network together with other regions, are a valuable source of information and support regarding success stories and avoidable mistakes.

Support of climate neutrality initiatives by policy

The recommendations for the EU provided in this study underline the importance of pursuing the ambitious goals for climate neutrality and executing the agreed targets. It is advisable to strengthen the regions which are planning to actively contribute to these goals by creating a possibility for direct EU support for these initiatives. It should also be possible to support the citizen driven initiatives for climate neutrality.

Further sectoral regulations, including taxonomy regulation, e.g. introducing stricter definition and demarcation of climate neutrality should be considered. The competence of the EU in the field of transformation towards climate neutrality in terms of standards and norms, e.g. emission ceilings or technical standards for machinery and vehicles differentiated by the local/regional conditions should be further increased.

Limiting the transformation process by the funding period or semester should be avoided. For this purpose, the continuity of management on the regional and local level should be actively supported. Interruptions should be prevented by documentation and continuous transfer of knowledge within the region.

To boost the transferability of solutions, the interregional exchange should be further encouraged and facilitated. Many technological solutions for climate neutrality are still not existing, therefore applied science projects should be developed to foster the transition. It is recommendable to support the organisation of living labs to develop and try out technologies and solutions.

1. INTRODUCTION

Climate change is one of the biggest challenges of our times. The European Union, as one of the world's developed economies, has largely contributed to the current climate conditions. Human-induced climate change is even now affecting many weather and climate extremes in every region across the globe. The impacts in Europe have already been dire, ranging from high temperatures, drought and wildfires, reduced availability of fresh water, floods, sea-level rise, etc. While the Intergovernmental Panel on Climate Change (IPCC) warns that some trends are now irreversible, a strong, binding commitment to climate action is required (IPCC, 2021). Dealing with this global challenge effectively, all hands need to be on deck, and all actors committed and engaged. Climate neutrality is accordingly needed to mitigate and counteract the noxious impacts of climate change.

The European Union (EU) intends to fight climate change through ambitious policies, strategies, and a targeted use of EU funds. The European Green Deal (EGD) provides the outline for a transformational change toward a new economic model with the aim to make Europe the first climate neutral continent in the world. The EGD was adopted in December 2019 and represents the EU's new long-term strategy for achieving economic growth alongside transforming the Union into a fair and prosperous society. It aims to create a modern, resource-efficient, and competitive economy with no net emissions of greenhouse gases by 2050, and one where economic growth is decoupled from resource use. The EGD also aims to protect, conserve, and enhance the EU's natural capital and protect the health and well-being of citizens, including from environment-related risks and impacts. At the same time, this transition aims to be just and inclusive. The EGD is seen as an integral part of the Commission's strategy to implement the United Nation's 2030 Agenda and its 17 Sustainable Development Goals (SDGs).

In July 2021, the European Commission adopted a set of proposals (European Commission 2021a) to make the EU's climate, energy, transport, and taxation policies fit for reducing net greenhouse gas emissions in line with these aims. Key milestones along the path to achieving carbon neutrality by 2050 were identified. These key milestones include:

- Emissions: Greenhouse gas emissions reduced by at least 55% by 2030, compared to 1990 levels (legally enshrined in the European Climate Law)
- Energy: 40% renewable energy by 2030
- Transport: New cars emit zero CO_2 by 2035
- Buildings: 35 million buildings renovated for energy efficiency by 2030
- Farming: 25% of EU agricultural land under organic farming by 2030
- Circular economy: doubling of the EU's circular material use rate in one decade

Reaching climate neutrality requires transformational change and new types of economic activity, creating opportunities for innovation, investment, and jobs. The EGD aims to foster a fair, competitive and green transition, providing opportunities for European companies to create the jobs of tomorrow while also establishing a supportive framework to ensure that no one in Europe is left behind. To this end, the EGD establishes a policy framework touching on nearly every aspect of European society.

While most of the programmes and strategies are currently being implemented and/or under development throughout EU-27, implementation on regional and local level is difficult to be assessed. However, regional, and local implementation certainly play an important point in the funding period 2021-2027, given the backdrop of economic distortions stemming from the COVID-19 pandemic and the severity of the climate crisis.

Regional governments and regional stakeholders act within a complex multi-level system of governance. On the one hand, restrictions in competences limit the policy tools available on the regional level. On the other hand, regions have a crucial role in implementing EU and national policy on the ground, while striving to build public support and acceptance for the transformation and reconciling it with other socio-economic goals. Indeed, the achievement of climate neutrality goals entails changes in citizens' everyday lives. Local and regional authorities, as the democratic bodies closest to EU citizens, are therefore the most appropriate channel to identify the best opportunities as well as the needs and challenges influencing the sustainable implementation of climate friendly measures.

Overall, climate neutrality is about scaling up climate actions across all territories. Ensuring that all key actors are empowered and able to follow a holistic, inclusive and integrated approach leading, inter alia, to the creation of socio-economic opportunities, poverty and inequality reduction, is a sine qua non requirement in the EU's journey towards sustainable development.

1.1. Study objectives, structure and methods

The project provides information on the successful transformation towards a climate-neutral future at regional level in the EU. The overall study objective is the provision of detailed analyses of best practices in this field.

The report is structured along the defined project objectives. It begins with the summary of the requirements for regional climate neutrality based on environmental science and the context of the EU targets and policies in section 2. The core of the study builds the analysis of six regional examples across the EU as presented in section 3. On this basis, the key drivers, conditions and instruments for a successful transformation toward a climate neutral future are identified and described in section 4. The report concludes with the synthesis of findings and specified policy recommendations for EU decision-makers in the field of supporting the EU regions in achieving the goals of climate neutrality presented in section 5.

Methods

Desk research, (literature review, document analysis, data analysis)

As the basis for further work, the understanding of the meaning of climate neutrality in general and in the regional context was specified through a broad literature review and a corresponding analysis. First, the definitions of climate neutrality based on established literature and formulated by the Paris Agreement and the EU Climate Law are discussed and the requirements for the key sectors for reaching climate neutrality are reflected. Consequently, the discussion focuses on the elements of a climate neutral system, following this, examples of indicator sets based on different data bases are presented. Measuring progress towards net zero at the regional level reveals different challenges and approaches to capturing the progress towards climate neutrality of the regions. The data availability, comparability of different administrative levels, definitions of the regions, system delineation as well as regional and local conditions and starting points are discussed. Finally, a general overview of EU regions successfully transforming towards climate neutrality is listed. The identification of these regions was made through a best practice-approach and incorporates several other inventories of regional best practices.

Case studies

The case studies are the main source of evidence in this research project. Six carefully selected best practices examples of regions successfully transforming their economies towards climate neutrality (see section 3.1) were analysed in-depth. The case study design applied in in the study follows a multiple-case design with single units of analysis (Yin, 2015), corresponding to the six selected regions. In

order to collect the data according to the specified project objectives, an analysis framework comprising the guidelines, a common data collection template as well as an interview guide were developed.

The study template was developed in order to cover the general profile, regional characteristics and the rationale and objectives of the analysed climate neutrality initiative. The progress of the transformation was analysed through the achievements and impacts, obstacles and challenges, funding and policy support, as well as improvements and outlook. Finally, to address the issue of transferability of the applied solutions to other EU regions, the lessons learned, key success factors and recommendations were summarised (see sections 3.2-3.7).

The selected case study regions were analysed in detail based on the above developed framework. The data was gathered by desk research, primary and secondary data publicly available or provided by the destinations as well as 1-3 interviews with relevant stakeholders. The interview partners represented (depending on the case study): regional administration (climate specialists, climate programme management), regional or local government representatives, policy making and regional management, regional business development manager, management of regional energy provision system (plant manager, regional director). The data collection and interviews were carried out in January and February 2022.

Cross-case analysis – SWOT analysis

The findings from the six case studies were analysed in a cross-case synthesis. The findings from the case studies were structured and summarised to derive success factors and potential challenges in the different types of regions. The triangulation of the single case study results helped to provide reflection on the findings, and to narrow down the most relevant aspects supporting regional climate neutrality. A SWOT (strengths, weaknesses, opportunities, threats) analysis was conducted to identify the internal and external factors and drivers of the regional transition (see section 3.9). It allowed for general conclusions and recommendations to be drawn from the cross-case analysis and contributed to a better understanding of transferability of the solutions to other regions.

Expert workshops

The triangulation of the best practice examples was initiated during a workshop with case study experts. During a further workshop with external representatives from different EU umbrella organisations for regions and research institutions, the results based on the best practices analysis were presented and discussed in order to collect feedback and validate the outcomes. The discussion explored the replicability potential of the climate neutrality initiatives investigated in the case studies, scrutinised the hindering and facilitating factors influencing EU regional and local authorities when moving towards climate neutrality and provided suggestions on the contribution of the EU cohesion policies in supporting the transition towards climate neutrality. In a final workshop the recommendations for EU institutions on how to better support EU regions to master the transition towards climate neutrality were revised and completed.

2. REGIONAL TRANSFORMATION TOWARDS CLIMATE NEUTRALITY

KEY FINDINGS

- Climate neutrality describes a state in which net GHG emissions arising from a given territory have reached zero ("net zero"). This means that the remaining GHG emissions are in the same order of magnitude as removals through natural sinks or technical solutions.
- Reaching climate neutrality requires profound changes in all sectors of the economy as well as in cross-cutting areas such as governance and lifestyles.
- Almost all EU regions are in a process of moving towards climate neutrality and the challenge is to differentiate between different levels and rate of progress.
- Proposals for indicators to monitor progress towards climate neutrality have been developed, but their application would require additional data collection. In particular, regional data do not exist for most indicators in question.
- Due to the methodological challenges, the study does not present an overall ranking of EU regions according to their success in transforming towards climate neutrality. Instead, it applies a best practice-approach, identifying cases of EU regions that are known to have successfully implemented or started the transformation in key areas.

2.1. Climate neutrality in EU regional context

2.1.1. Definition of climate neutrality

Climate neutrality is defined in line with the Paris Agreement, which calls for achieving "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHG) in the second half of this century" (Art. 4 (1)). The EU recently specified climate neutrality as a 2050 target in its Climate Law (Regulation (EU) 2021/1119). In Article 2, the EU states that the climate neutrality objective means to balance EU domestic GHG emissions and removals reducing emissions to net zero. After reaching climate neutrality, the EU aims to achieve net negative emissions. In a regional or local context, climate neutrality means to balance GHG emissions and emission removals within the specified community or region (see e.g. ICLEI 2021).

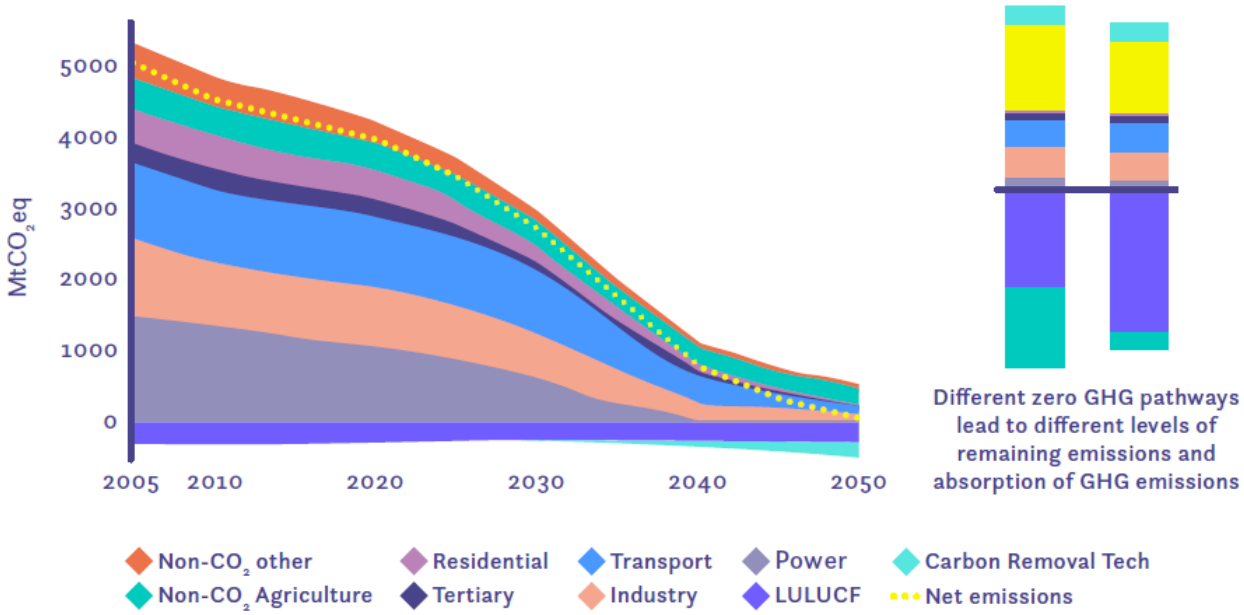
The term climate neutrality thus describes a state in which net GHG emissions arising from a given territory have reached zero ("net zero"). This means that the remaining GHG emissions are in the same order of magnitude as natural sinks such as soils, forests or wetlands and technical GHG removal taking place through capture and storage of emissions in chemicals and underground storage sites (see e.g. Geden and Schenuit 2020).

Climate neutrality or GHG neutrality is to be differentiated from carbon or CO_2 neutrality, the difference being that climate neutrality covers all GHGs that are driving the global temperature rise. The concept builds on the evidence brought forward by the Intergovernmental Panel on Climate Change (IPCC) in its report on the 1.5°C limit which specifies that to hold this limit, global CO_2 emissions have to reach net zero by 2050 and global GHG emissions have to reach net zero by around 2070 – a finding that has been confirmed by the IPCC's more recent AR6 report (IPCC 2018, p. 12; IPCC 2021, p. 29).

GHG emission accounts, for each country or sub-national unit, take a production-based and territorially specific perspective, i.e. the accounting only covers emissions from sources that are located within the country's or the region's territory. Yet even a region or a country with net-zero emissions can still cause emissions elsewhere by importing goods and services. From a statistical point of view, accounting for those "embedded" emissions, in a consumption-based approach, is challenging since it requires detailed data about trade flows and assumptions about emissions caused throughout the supply chain. As a consequence, double counting or the underestimation of total emissions are both possible outcomes. Moreover, consumption decisions in importing countries alone are unlikely to eliminate emissions in states that opt against climate mitigation through policy and regulation. It can thus be argued that assigning responsibility for supply chain emissions only to final consumers can also be misleading. While the production-based approach is likely to remain dominant for practical reasons, it is important to take consumption-induced emissions into account when designing an integrated strategy towards climate neutrality. If possible, this should include some form of accounting to the extent data availability allows (see Table 2 for an example of consumption-based target setting in Zurich).

Reaching climate neutrality requires profound changes in the way we organise our economies and conduct our daily lives with all sectors contribution to emission reductions and removals (European Commission, 2018, see Figure 1). For each sector, detailed studies on decarbonisation pathways exist (see e. g. ECF 2021). Unsurprisingly, these roadmaps show that the elimination of the last percentage points of residual emissions is the most challenging as affordable decarbonisation solutions still need to be developed at the required scale for a number of activities, including concrete and steel production, and aviation (European Commission 2018, p. 11f.). Moreover, in the agricultural sector, technical solutions and changes in management can reduce emissions, but will not allow to fully eliminate non-CO_2 emissions (European Commission 2018, p. 23, see also Figure 1). Reaching climate neutrality will therefore require changes not only in our production technologies, but also in production and consumption practices, e.g. lower meat consumption and the use of new building materials. In addition to sector-based measures, climate neutrality thus requires horizontal measures reaching across sectors. A case in point is a commitment to a circular economy at all steps of the value chain, however, this also includes horizontal enablers e.g. in the fields of finance, innovation and governance (Velten et al. 2021).

Figure 1: EU pathways to climate neutrality in 2050



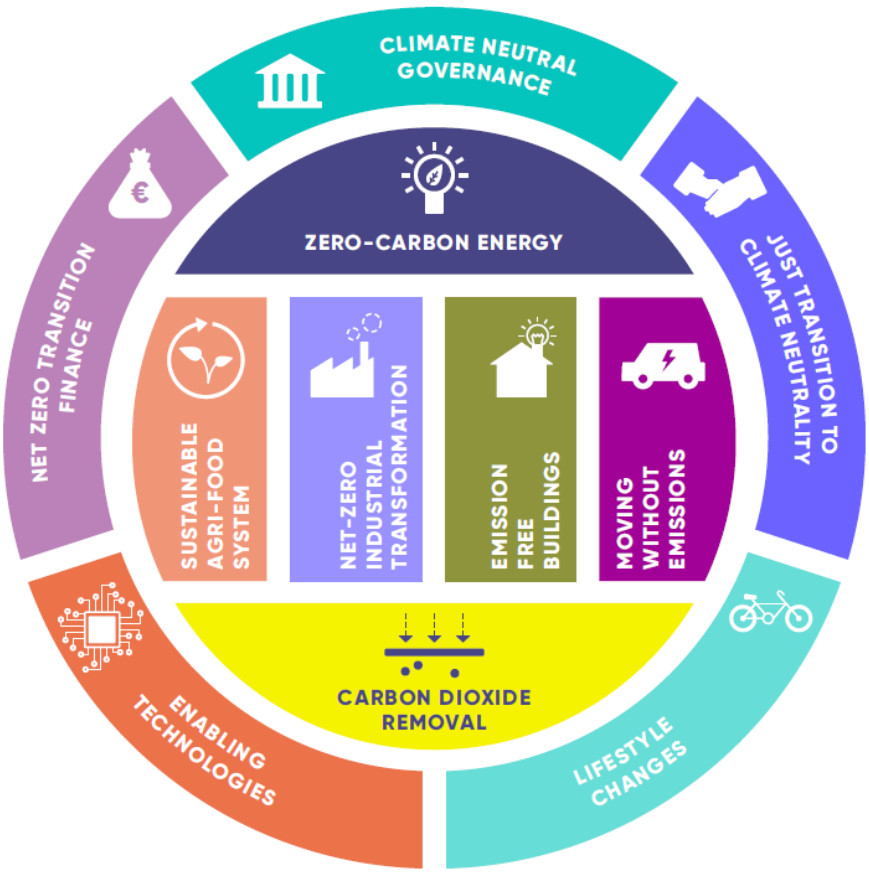
Source: Velten et al. (2021) based on European Commission (2018)

Finally, a key difference between previous climate mitigation targets, which have only focused on cutting emissions, and the climate neutrality target, is the **inclusion of removals –** sometimes also referred to as "negative emissions". By including removals, the EU neutrality target shines a light on the importance of natural sinks (Böttcher et al. 2021) and also stirs the debate about technical GHG removals which to date have not been used at scale. Some critics have also argued that a net target may incentivise actors to reduce ambition on emission reduction by claiming removals from natural sinks that would not have counted under the previous target-setting approach. Critics have also pointed out that removals – e.g. from forests – are not always permanent but can be reversed e.g. by fire or drought. However, scenarios clearly show that climate neutrality will require both: ambitious decarbonisation pathways in all sectors as well as removals – one cannot replace the other (European Commission 2018; Schenuit and Geden 2021).

2.1.2. Indicators to gauge progress towards climate neutrality

No country or region in the world can be assumed to have reached full climate neutrality from a consumption-based perspective. Considering only territorial emissions and accounting for natural sinks, a few EU regions might claim to be climate-neutral in a production-based accounting approach. This is the case for sparsely populated regions with limited point sources from industry and large forest areas acting as natural sinks. However, given that this outcome reflects specific geographic endowments rather than policy success, transferability of these cases is limited. All other EU regions are still in a process of moving towards climate neutrality and the challenge is to differentiate between different levels of progress.

Figure 2: Elements of a climate neutral regional system



Source: Velten et al. (2021), p. 5.

Given the breadth of the challenges on the road to climate neutrality, any endeavour to systematically measure progress requires an equally comprehensive approach. Velten et al. (2021) have proposed a framework using eleven elements, covering both areas of economic activity that reflect the sectors listed in Figure 1 above, and the horizontal topics graphically represented in Figure 2. The areas of economic activity include zero-carbon energy, sustainable agri-food system, net-zero industrial transformation, emission free buildings, moving without emissions and carbon dioxide removal. The five horizontal elements of financing, governance, just transition, technological innovation and lifestyle changes reflect the cross-cutting challenges that need to be tackled alongside sectorial mitigation measures to reach full decarbonisation across the economy.

For each element, Velten et al. 2021 analyse existing objectives and propose a set of indicators to measure both progress towards these objectives and changes in the enabling elements that drive this progress. Thereby, this work builds on previous research showing that long-term solutions required for full climate neutrality need to be tracked through suitable indicators early on, although they do not bring immediate GHG reductions. An additional previous finding was that key indicators used for target setting should be supplemented by auxiliary indicators that can help to contextualise and interpret the forces that lead certain outcomes, making it easier to assess the adequacy of the chosen policies (Sartor 2016). In addition, the indicator sets also encompass measurements for unwanted societal side-effects, including e. g. loss of jobs or competitiveness and social hardship. For each indicator, observed change over a given timeframe is to be compared to the trajectory needed for reaching net zero by 2050. In total, the proposed set includes about 150 individual indicators. The set is a mixture of indicators for which data is already collected in all Member States and new indicators that would require additional data collection efforts. Table 1 presents the indicators for the element "Moving without emissions" to illustrate the approach.

Table 1: Example indicator set for mobility proposed by Velten et al. 2021

Purpose of indicator use	Indicators
Formulation of objectives	GHG emissions from transport Energy consumption of transport
Enabler 1: Zero-carbon fuels	Share of low-emission fuels Average GHG emission of new vehicles Number of vehicles Electric charging points
Enabler 2: Incentivising modal shift	Modal split of passenger and freight transport Expenditure per capita on transport
Enabler 3: Urban and territorial planning	Passenger transport volume Freight transport volume Infrastructure updates and additions by mode of transport Commuting travel time Congestions and delays
Enabler 4: Digitalisation	Commuting travel time Congestions and delays

Source: Velten et al. (2021), p. 42.

A similar approach has been proposed by DIW for the German context. Based on the same recognition that trends in GHG emissions alone are not sufficient to monitor progress towards climate neutrality – even if broken down to sectors – Fietze et al. (2021) propose to integrate a set of lead indicators into the German Climate Change Act. As a first basis for discussion with stakeholders, they provide an exemplary list of 4-5 indicators for the most GHG-intensive sectors including energy, industry, transport and construction. Horizontal aspects are not addressed.

A detailed indicator dashboard has also been developed for France by Rüdinger (2018). It covers the areas energy, transport, buildings, industry, agriculture, waste, forests and carbon sinks, applying a three-tier system of indicators measuring (1) global results (i.e. targets and objectives, but also socio-economic framework indicators such as GDP), (2) structural developments by sector (i.e. monitoring of sub-sectors and activity change in order to better understand sectorial outcomes), and (3) transformation levers (similar to the enabler indicators in Velten et al. 2021). In addition to the proposed indicator set, the study also contains a discussion of underlying methodological issues and data availability.

The challenges when applying this comprehensive assessment framework are both the breadth of the indicator set and the limited data availability for a significant share of the proposed indicators.

While achieving climate neutrality by 2050 is one of the core objectives of the European Green Deal that has been legally enshrined in the European Climate Law (Council of the European Union, 2021), the EU emphasises that this transition must be just and inclusive, by paying particular attention to the regions, industries and workers who will face the greatest challenges (European Commission, 2019). To this end, the Green Deal coins itself "a new growth strategy" that puts a particular emphasis on fairness, prosperity and competitiveness alongside reaching climate neutrality and decoupling resource use from economic growth.

The definition of "success" in terms of transforming towards climate neutrality consequently also needs to take into account change in other conditions, especially socioeconomic. This is reflected in the Commission's "competitive sustainability" agenda that is at the heart of the EU's policy coordination with and among the Member States and acts as the guiding principle for the EU's recovery from the COVID-19 pandemic. In addition to "environmental sustainability", which includes the EU's commitment to climate neutrality by 2050, the competitive sustainability framework includes three further dimensions: "productivity", "fairness" and "macroeconomic stability" (European Commission 2021b). In line with this broader perspective, the present study applies a more holistic concept of what constitutes a successful regional transformation towards climate neutrality, by also considering socioeconomic aspects such as economic growth, employment, and quality of life, in addition to climate and energy related achievements.

2.1.3. Measuring progress towards net zero at the regional level

When turning to the question of how regional progress towards climate neutrality can be measured, four additional challenges come into view.

First, it is important to note that regions – even more so than countries – have very different starting points in their journey towards decarbonisation and have different characteristics which make progress more, or less, challenging. Key characteristics include demographic conditions, inherited energy systems with very different carbon intensities, presence or absence of carbon-intensive industry, natural endowment with renewable energy potential, potential for carbon removal either through natural or technical removal, and the presence of inter-regional or even international transport flows due to the region's location. Therefore, for each indicator, measuring change compared to a realistic starting point is more meaningful than considering an absolute level. While this can be accounted for in individual

assessments for separate elements or sectors, it makes overarching assessment and inter-regional comparison more difficult.

Second, one may argue that regional governments have limited competences and thus limited reach to alter GHG emission levels in their constituency. While some sectors such as buildings and local transport may offer more potential for local action, other sectors such as inter-regional travel are harder to impact through municipal or regional decision-making. On the other hand, in a multi-governance system, almost any change will require some form of joint action from several levels – with the local level playing a key role in implementation, control, information and advice. Moreover, significant pressure from municipalities and regions can also contribute to changes at national and EU level. Limited legal competences should thus not be an excuse for inaction.

Third, one might question whether every EU region needs to achieve net zero GHG emissions at its respective territory. The EU's regulatory framework for achieving the 2030 GHG emission reduction target consists, *inter alia,* of the EU Emissions Trading Scheme (EU ETS)[1] as well as national reduction targets for non-ETS sectors[2], taking into account Member States' circumstances and contexts. Applying this effort sharing principle between countries to the EU's climate neutrality target means that not every country – and consequently not every region – might need to fully achieve net-zero, since this also depends on the presence of carbon sinks such as forests or wetlands. An analysis of successful transformation cases towards climate neutrality consequently does not mean to limit itself to regions that have fully achieved net-zero GHG emissions, since this would mean leaving other regions out that have achieved considerable reductions, but that do not have sufficient carbon sinks to offset the remaining emissions.

A fourth, more serious challenge for comparing regions in their progress towards climate neutrality is data availability. Few relevant indicators are available over a sufficient duration for the EU-27 at the disaggregated level required, i.e. on a NUTS 3 level. This is especially true for data on GHG emissions, which – at least in the European case – are generally only available at national level, with a time lag of almost two years. Official GHG data are usually published by the European Environment Agency (EEA) around mid-May each year, referring to the emissions from two years earlier (i.e. in May 2022, the official GHG data for 2020 will be published) (EEA, 2021a). To increase the timeliness of the data, the EEA also publishes estimates from the "Approximated GHG inventory" for the previous year (EEA, 2021b) as well as projections of GHG emissions (currently up to the year 2035). Additionally, Eurostat has recently started publishing estimates of quarterly GHG emissions for the EU and its Member States which, at the time of writing, were available up to the second quarter of 2021 (Eurostat, 2021). Data for the subnational level (e.g. NUTS 2 or NUTS 3) can be calculated using the Emissions Database for Global Atmospheric Research (EDGAR) hosted by the Commission's Joint Research Centre (JRC), which provides 0.1×0.1 degree grid-level data for GHG emissions and other air pollutants (Crippa et al, 2021). However, these data are not regularly updated, and at the time of writing were only available up to the year 2015. Due to these limitations, the case descriptions in this study usually refer to GHG emissions data provided by the cases themselves. In addition, data on the regions' size, population, GDP and employment are presented based on Eurostat's regional statistics by NUTS classification (Eurostat, 2022).

[1] Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a system for greenhouse gas emission allowance trading within the Union and amending Council Directive 96/61/EC.

[2] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013.

2.1.4. EU Regions that are successfully transforming towards climate neutrality

Considering the methodological challenges described before, it will not be possible within the scope of this research effort to rank all EU regions depending on their success in transforming towards climate neutrality, as such a complete ranking would require a data-intensive evaluation process and a refined methodology to account for different starting points and varying levels of progress in different areas. Therefore, this study applies a best practice-approach, identifying cases of EU regions that are known to have successfully implemented or started the transformation in key areas or horizontal aspects.

Several institutions have been building inventories of regional best practices, using a sector-by-sector approach. Examples include:

- The Conference of Peripheral Maritime Regions (CPMR) provides a list of its member regions acting for climate neutrality (CPMR, 2021).
- The Covenant of Mayors has a list of good practice examples collecting sector-specific mitigation measures carried out in signatory cities and regions as well as a collection of progress reports in which signatories self-evaluate (Covenant of Mayors 2021).
- Agora Energiewende collects EU-wide net-zero success stories that are presented in fiches and – for a selection – also in short videos (Agora Energiewende 2021).
- The European Commission's Initiative for Coal Regions in Transition collects best practices of fossil-dependent regions in the EU diversifying their regional economy (Initiative for Coal Regions in Transition 2021).

Additional examples are available from various reports and expert knowledge gathered in the author team for this study. The following table presents a selection of regions progressing towards climate neutrality for elements identified as crucial for reaching net-zero.

Table 2: Selection of regions progressing towards climate neutrality

Region	Country	Sector/Element	Best practice	Sources
Graciosa	ES	Energy	Zero-carbon energy system for an island	See section Promotion of climate neutrality in Graciosa (Portugal)
Nitra Region	SK	Energy, Industry	Coal phase-out in cooperation with local utilities and industrial companies	Just Transition Plan for Upper Nitra Region
Castilla-La-Mancha	ES	Agriculture, Technology	Biorefinery pilot plant using agricultural residues	Urban biorefinery project
Plovdiv district	BG	Industry, Energy	Zero carbon industrial park	See section Climate-neutral economic zone in Plovdiv (Bulgaria)
Päijät-Häme	FI	Agriculture, Industry	Regional bioeconomy development strategy based on the local grain value chain	See section Climate Action Roadmap of Päijät-Häme (Finland)

Region	Country	Sector/Element	Best practice	Sources
Milano	IT	Buildings, Just Transition	Zero-carbon social housing project	L'Innesto project
Copenhagen, Oslo	DK, NO	Buildings	Climate-neutral district heating and cooling	Agora Energiewende And section Case 2: 2025 Climate Plan of Copenhagen (Denmark)
Vienna	AT	Buildings	Spatial energy planning to increase low-carbon heating technologies	Vienna Energy spatial Plans
Wielkopolska Wschodnia	PL	Industry, Energy, Mobility, Buildings, Just Transition	Multi-level, intersectoral transformation of the economy	See section Case 3: Transformation of the economy of Wielkopolska Wschodnia (Poland)
Werfenweng	AT	Mobility	Climate-neutral mobility for tourists	See section Soft mobility initiative of Werfenweng (Austria)
Grenoble, Paris, Milano	FR, IT	Mobility, Lifestyle Change	Rapid urban mobility transformation, redistributing public space	Paris Website
Oslo	NO	Mobility	Creating a mass market for electric vehicles	Agora Energiewende
Zurich	CH	Governance	Targets for emission mitigation includes city's direct and indirect emissions, i. e. consumption-based emissions.	Stadt Zürich

Source: Own compilation

3. BEST PRACTICES OF SUCCESSFUL TRANSFORMATION

KEY FINDINGS

Six in-depth case studies were conducted for this report representing different regions in various parts of Europe with distinct sectoral foci and at divergent stages of the transition towards climate neutrality. Data on the cases were mainly collected via interviews carried out in January 2022 and were complemented with desk research. Some interesting key findings regarding the six cases include the following:

- Despite their different sectoral foci, all cases address the topic of mobility ("moving without emissions"), and virtually all cases address the issues "zero carbon energy" and "enabling technologies". Two cases (Denmark and Poland) are quite broad in their transformational agenda, while others have a more clear-cut focus on certain areas.
- Most of the analysed regions report significant reductions of carbon emissions since the start of their respective climate initiatives. The cases of Denmark and Finland have experienced the strongest relative decline in emissions, whereas emissions in the Portuguese case have increased. Almost all regions are successfully implementing a transition to renewable energy production. Sustainable mobility efforts have been realised in many of the analysed regions, or are well underway of being put into practice. These initiatives are often facilitated through cooperation of different actors and stakeholders, and have generated socio-economic co-benefits in several cases, such as job creation and an increased interest among citizens and companies in locating to the regions.
- Despite these successes, all regions have faced significant challenges in their transformation processes. The most common obstacle is a lack of resources, either financial or in terms of expert knowledge, and a resulting dependence on external (financial) support. Similarly, some regions have experienced a lack of decision-making power necessary to implement climate neutrality strategies. Another common issue is the challenge of securing the continued involvement of citizens and general support from society. Missing societal backing also causes a reluctance with regard to making politically sensitive decisions, such as tackling traffic volumes as expressed in two of the cases. Three of the cases (Finland, Poland and Portugal) heavily depend on EU funding. In contrast, the two private-led cases are mainly financed by the involved companies. The sixth case (Denmark) is funded from municipal and state budgets.
- A key success factor highlighted in almost all of the analysed regions is a strong commitment to the goal of climate neutrality among the involved actors. In many cases, this has been facilitated through setting clear goals, communicating them openly, and ensuring societal acceptance by providing citizens with reasons to identify with the respective climate neutrality strategies.
- Another significant aspect shared by all six cases is the participatory character of the transformation processes. Active communication with and involvement of stakeholders from different sectors in all stages of the transformation process, from inception to implementation, are crucial for long-term success of the initiatives.
- Finally, all cases emphasise the importance of networking with other regions, institutions, and potential investors. This allows for an exchange of ideas and experience with other regions transforming towards climate neutrality, fostering mutual learning, and enabling a more successful transformation.

3.1. Case study selection

A main objective of this study was to conduct an in-depth analysis of six EU regions that have been or are successfully transforming their economies towards climate neutrality. In the selection of these six cases, focus was placed on the different starting points and on a high transferability potential to similar regions across the EU. Moreover, as it is unlikely that a region manages to achieve an equally strong progress towards climate neutrality across all economic sectors, the case selection also considered regions that have achieved or have successfully started a transition of their economy in at least one key sector or area. Consequently, the following criteria were applied to select the most representative combination of the six best practice examples:

(a) Full coverage and differentiation of the most relevant sectors for climate neutrality;

(b) Different stages of the transition process (initial, middle, advanced);

(c) Representation of different types of territories (rural, intermediate, urban, island, mountain, coastal);

(d) Balanced geographical coverage across Europe (Northern, Central, Eastern, Western, Southern Europe);

(e) Representation of different regions based on their overall social and environmental performance, as per the EU social progress index (European Commission 2020).

Figure 3 indicates the final selection of cases for the in-depth analysis as agreed with the European Parliament at the start of the project. It indicates the geographical coverage and the representation of different region types according to points (c) and (d) above.

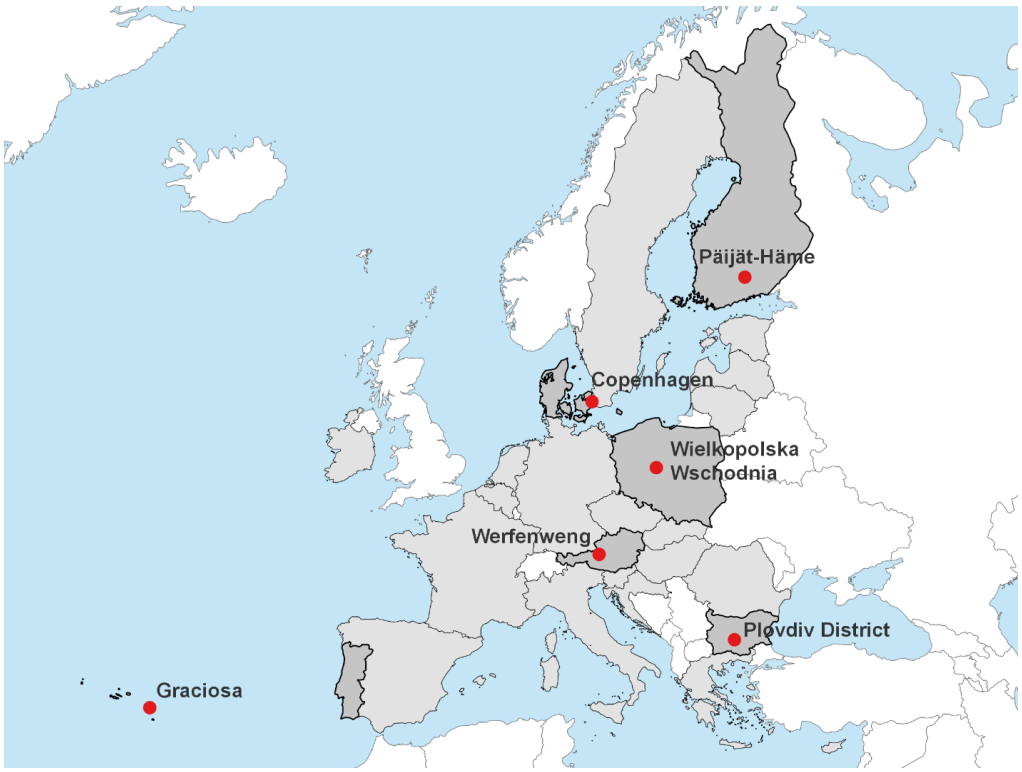
Figure 4 shows the different stages of the respective region's transition process according to point (b) above. Two cases – the Climate Action Roadmap of Päijät-Häme (Finland) and the soft mobility initiative of Werfenweng (Austria) – build on an already long history of predecessor projects (starting in the 1990s) regarding climate issues in the two regions. Two further cases – the 2025 Climate Plan of Copenhagen (Denmark) and the climate neutrality activities of Graciosa (Portugal) – are based on work that started some 10-15 years ago. Finally, the remaining two cases – the economic transformation of Wielkopolska Wschodnia (Poland) and the climate-neutral economic zone of Plovdiv (Bulgaria) – have only started recently and can therefore be considered to represent cases that are at the beginning of the transition process. The coverage of the six cases with regards the sectors relevant for climate neutrality is illustrated in the description of each case study further below.

In the subsequent sections, the six cases are presented in more detail, following a common template. Firstly, statistics on the region[3] including on the topics of population, size, the economy[4] as well as GHG emissions (usually stemming from Eurostat's regional database) are presented. This is followed by a description of the initiative, its achievements and impacts as well as the obstacles and challenges faced. Next, a description of the funding sources and other policy support that the initiative is receiving is provided, together with the monitoring and review processes in place to make adaptions, and an outlook on the future of the transformation process. Each case description concludes with a presentation of the lessons learned as regards key success factors and the most important policy recommendations.

[3] The data usually refer to the respective NUTS 3 region of the case (or in which the case is located). NUTS stands for Nomenclature des Unités territoriales statistiques (Nomenclature of territorial units for statistics) and is a geographical nomenclature subdividing the EU territory into regions at three different levels (NUTS 1, 2 and 3 respectively, moving from larger to smaller units). Above NUTS 1, there is the "national" level of the Member States (Source: Eurostat).

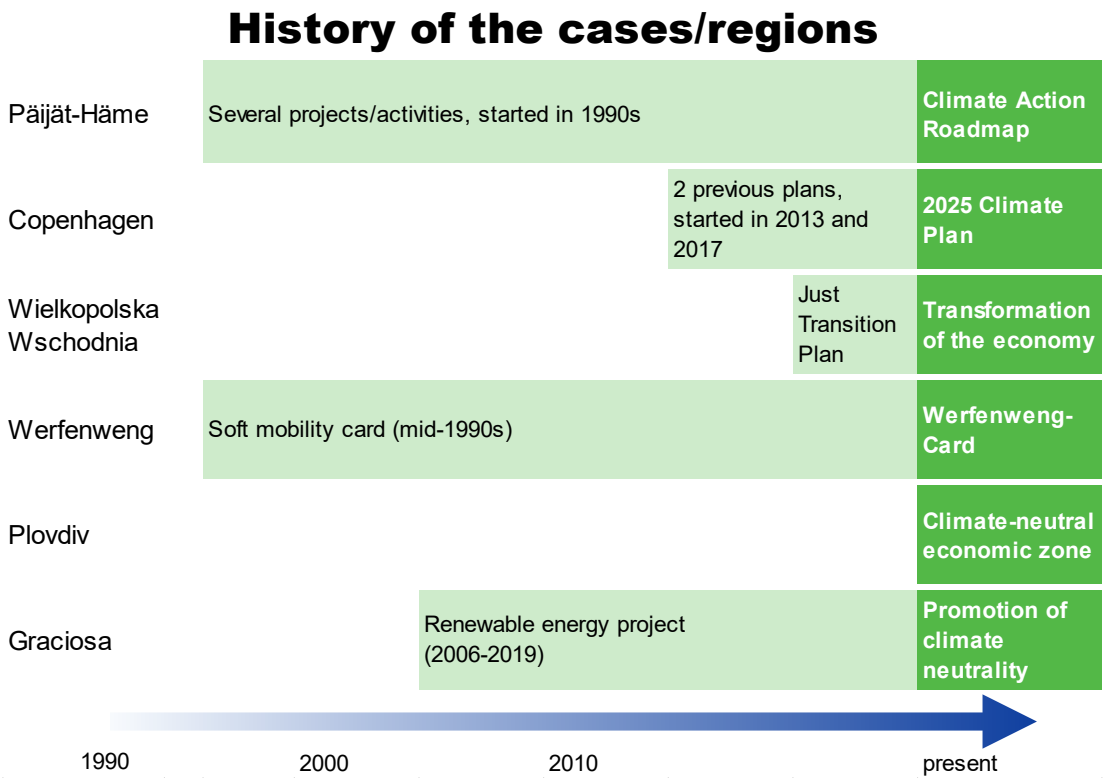
[4] Data on the main sectors in a region in terms of employment refer to persons employed in the industry, construction and services sectors (NACE Rev. 2 codes B-S), except insurance activities of holding companies (NACE Rev. 2 code K642). Other sectors such as agriculture, forestry and fishing (NACE Rev. 2 code A) are excluded.

Figure 3: Overview of the selected case study regions/cities



Source: Own compilation

Figure 4: History of the six cases in terms of predecessor projects/activities



Source: Own compilation

3.2. Case 1: Climate Action Roadmap of Päijät-Häme (Finland)

3.2.1. Regional profile

Region: Päijät-Häme (NUTS code: FI1C3), Finland

Size: 6,255 km² (2016), 199,604 inhabitants (2020), 39 inhabitants per km² (2019)

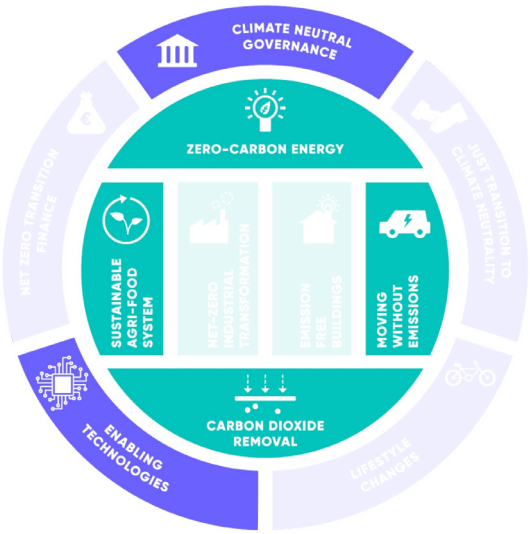
Economy: (a) GDP: EUR 26,600 per capita (2018), 2.2% nominal annual growth since 2010; (b) Main sectors: Industry (31% of employment in 2018), retail (18%) and services (15%)

GHG emissions: 6.3 tonnes CO_2 per capita (2019), 1.3 million tonnes CO_2 (2019), 34% decrease since 2010

3.2.2. Regional characteristics and governance competences

Päijät-Häme is a region in Southern Finland with a population of around 200,000 inhabitants. Lahti is the biggest city in the region and was named European Green Capital in 2021. Päijät-Häme consists of ten municipalities, who are all members of the Päijät-Häme Regional Council. The Regional Council has administrative duties, promotes regional interests and is responsible for the regional development strategy and land use planning, whereas the municipalities also have regulatory competences.

3.2.3. Rationale and objectives of the initiative



Source: Velten et al. (2021), own editing

Päijät-Häme's capital, the city of Lahti, started a restoration project for the polluted local lake Vesijärvi in the 1970s, which opened up a discourse for other environmental and climate topics in the 1990s. There have been a lot of different regional initiatives over the past 20 years. For example, almost all municipalities in the region are committed to energy saving or promoting sustainable transport. Päijät-Häme Regional Council has its own regional development strategy, which promotes sustainability issues to development project groups as a prerequisite o f getting funding. Climate and environmental issues such as clean tech or circular economy are important aspects of the regional strategy. In 2019, Päijät-Häme joined the Hinku network, a national network for carbon-neutral municipalities and regions. This required the region to establish a climate working group, formulate a Climate Action Roadmap and, importantly, provided them with a common climate neutrality goal by 2030, in the form of a public commitment.

The Päijät-Häme Regional Council launched the Climate Action Roadmap together with ten municipalities, higher education institutions and a regional energy company. The Roadmap's objective is to achieve carbon neutrality by 2030, defined as an 80% greenhouse gas emissions (GHGe) reduction from 2007 levels, calculated with a production-based method. To this end, the Roadmap addresses a range of sectors causing GHG emissions, including energy, transport and agriculture. The Roadmap is part of the national Canemure project (2018-2023), which is funded by the EU LIFE programme. Six other regions are also part of the Canemure project, comprising a useful network for exchanging information

and sharing climate action ideas. The Regional Council is responsible for coordination and facilitation of the Roadmap and the work of the climate coordination group, which meets four times a year. Actors responsible for implementation include the municipalities, higher education institutions, development organisations, the regional energy company and a few other relevant companies.

3.2.4. Achievements and impacts

While it is difficult to measure whether regional impacts are the direct result of climate initiatives, Päijät-Häme's GHG emissions have fallen by 33% since 2007 (SYKE 2021) – a positive development. However, more action is needed to reach the 2030 carbon neutrality goal. Overall, Päijät-Häme has progressed best in the energy sector. The regional energy company stopped using coal a couple of years prior to this study representing an important transformation in district heating and energy production, which has led to reduced emissions. Most municipalities in the region have replaced oil with biomass for heating. Solar energy is getting increasingly popular in all of Finland, both for companies and municipalities. Increasingly, companies have invested in circular economy, which may have created some jobs, however, unemployment is still an issue in the region. The city of Lahti was the European Green Capital in 2021, which has brought a lot of positive publicity to both the city and the region, creating interest in companies to to operate in the region. Another positive side-effect of the regional climate work is that by working together in different EU projects, actors have gotten to know and collaborate with each other. Stakeholder communication is further facilitated through different forums such as the regional climate coordination group. Climate initiatives are well aligned with other socioeconomic objectives, especially given the central role of circular economy, which emphasizes social sustainability alongside environmental goals.

3.2.5. Obstacles and challenges

One obstacle both for the regional development strategy and for the Roadmap is absence of decision-making powers at the level of the Regional Council meaning that the aims of the Roadmap cannot be enforced. More work by the municipalities is needed to specify the actions laid out in the Roadmap because at the current rate of GHG emissions reductions, the carbon neutrality goal will not be reached. In particular, sustainable transportation remains a big challenge. People prefer using private cars, especially in rural communities, where public transportation is still difficult. While electric and hybrid cars are gaining popularity, the amount of driving has remained level for years. An additional challenge is a lack of resources in many smaller municipalities. In this sense, integrating climate issues into the organisation of municipalities remains problematic. This problem is addressed in workshops with municipal and sector directors to emphasise that climate work is a leadership question. Another obstacle is the growth paradigm that is still perpetuated by many business owners, making it difficult to reduce consumption levels. However, the city of Lahti has managed to involve some big companies in the Green Capital project (see above).

3.2.6. Funding and policy support (national/EU/other)

The Päijät-Häme Regional Council obtains ERDF money from the Finnish Ministry of Economic Affairs and Employment, which it then distributes to regional development projects. The Council only receives about 2 million per year, due to a North-South divide in Finnish regional development funding. The regional ELY Centre for Economic Development, Transport and the Environment, a state-owned department, coordinates money from the ESF, ERDF, and a national fund for regional development. Universities and research organisations fund their projects via Horizon Europe and similar funding opportunities. Other funds include three different Interreg funds, as well as the ministry's AKKE fund for smaller projects. The Climate Roadmap is part of the Canemure project, which is funded by the EU LIFE

programme. Problems with funding may arise due to the complex funding structure and detailed monitoring, as is the case with the LIFE programme. While ERDF and other EU funds are less complex, reporting is very strict, creating a project-professional elite where concerned are focused more on accounting and project management, rather than project outcomes and the development of creative solutions. Moreover, for smaller municipalities with fewer resources or stakeholders that fall on the outside of the project elite, obtaining EU level funding can be quite challenging. Still, climate-neutrality actions in Päijät-Häme heavily depend on external (EU) funding, and many initiatives would not exist otherwise.

3.2.7. Monitoring, improvements and outlook

In general, regional development project implementers report to the Finnish Ministry of Economic Affairs and Employment, but the Regional Council also monitors the process. Every project has a steering group, which meets at least twice a year to monitor and decide whether divergences from the project plan justify changing the original strategy, which then has to be accepted by the Regional Council. Project groups are required to follow both the national programme document for ERDF or ESF and the Regional Council's strategy. Applicants are evaluated mainly against the national programme document and only little against the regional strategy. The Regional Council will launch a new regional strategy in 2022, with the first ERDF project calls starting in February.

The Climate Action Roadmap itself is reviewed annually. While most actions in the Roadmap do not have quantified targets, monitoring of whether the municipalities and organisations responsible have implemented them in some way takes place. Based on the review, new actions are added to the Roadmap. The evaluation is public, such that citizens and stakeholders are able to follow the implementation process, putting pressure on municipalities to move forward with their climate actions. The Roadmap is to be reviewed in more detail in upcoming years, in order to make adjustments if needed. For instance, the issue of climate adaptation is still underrepresented in many municipalities and will be included in the future.

In order to make Päijät-Häme's climate initiatives even more successful, political decision-makers would need the courage to implement more radical strategies, even if they are unpopular. The municipalities and other actors responsible for implementation have no obligation to follow through on their promises. Thus, despite the common commitment to carbon neutrality, municipalities have focused on actions that are easy to implement, such as energy savings. Issues like sustainable transportation and restricting private car use are still sensitive topics that would require a more open discussion as well as political resolution. Moreover, a citizens' movement on carbon-neutral lifestyles and reduced consumption would be necessary to achieve these goals. However, the structure of project initiatives does not invite citizens to get and stay involved.

3.2.8. Lessons learned: key success factors and recommendations

One key factor in Päijät-Häme's climate-neutrality success was the definition of a common climate goal that all involved actors are committed to. On a higher level, climate goals of EU programmes, which are often more radical than national ones, helped formulate more ambitious aims and actions. Stakeholder participation and communication (such as workshops with municipalities) have been important to ensure the integration of climate issues into regional organisation. Concrete projects have created visibility for climate work among citizens. Apart from this, strong personalities among the relevant actors have been important in making sure these topics are regionally accepted.

The case of Päijät-Häme shows that it is crucial to be able to lead a network and to design good communication around it. By promoting sustainability solutions as exciting new projects, both regional decision-makers and external actors can be inspired to move forward on climate action. Leadership of, and good communication among, regional actors is important for ensuring that all actors move in the same direction, even if individual opinions on climate action differ. The use of external examples of other best practice cases can be helpful in creating competition with other cities and regions, and promoting regions to become better at climate action. By marketing climate actions well and distributing them on social media, as was done in the Lahti Green Capital campaign, it is possible to inspire other regions to step up their climate ambitions as well. For instance, the fact that the city of Lahti has been active with climate issues has encouraged smaller municipalities to follow suit. In addition to leadership, being part of a network together with other regions is a valuable source of information and support regarding success stories and avoidable mistakes.

It is crucial that EU policy recognises the role of regions in climate work and facilitates cooperation between different regions. While many different funding options are available already, a focus on the private sector might speed up the transformation. Moreover, it would be important to support citizens and communities, who are not part of professional project-based organisations, to engage them in climate issues.

3.3. Case 2: 2025 Climate Plan of Copenhagen (Denmark)

3.3.1. Regional profile

Region: Byen København (NUTS code: DK011), Denmark

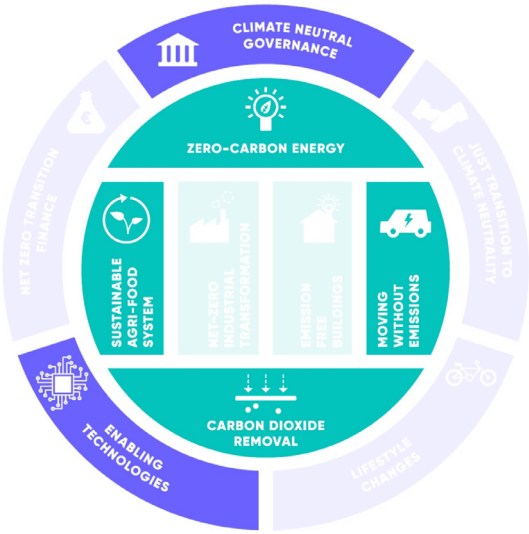
Size: 180 km^2 (2016), 794,128 inhabitants (2020), 4,537 inhabitants per km^2 (2019)

Economy: (a) GDP: EUR 55,900 per capita (2019), 1.7% nominal annual growth since 2010; (b) Main sectors: Services (21% of employment in 2018), retail (14%) and finance (13%)

GHG emissions: 760,656 tonnes CO_2-eq (2020), 1.2 tonnes CO_2-eq per capita (2020), 65% decrease since 2010[5]

3.3.2. Regional characteristics and governance competences

Copenhagen is the largest city and capital of Denmark, with about 800 000 inhabitants. It is the country's cultural, economic and governmental centre. Copenhagen is usually listed among the most environmentally friendly cities with the highest quality of life in the world. Copenhagen consists of several municipalities, which are responsible for a range of public services including land-use and environmental planning. Copenhagen City Council is the municipal government of the city and its highest political authority. It has seven administrative departments, one of which is the Technical and Environmental Administration responsible for Copenhagen's climate neutrality initiatives. The Climate Secretariat of the Technical and Environmental Administration has a mandate to implement climate actions and is obliged to report to the City Council.



Source: Velten et al. (2021), own editing

3.3.3. Rationale and objectives of the initiative

While Copenhagen has a longstanding tradition of dealing with environmental matters, two concrete events were crucial in shaping their current initiatives. First, the city hosted the UN Climate Change Conference in 2009, inspiring the City Council to launch an emissions reductions target for 2015 along with a precise implementation plan, and to create the Climate Secretariat in the Technical and Environmental Administration. Second, there was a severe cloudburst in Copenhagen in 2011, which caused significant damage to buildings and infrastructure, leading to the recognition of a need for adaptation strategies.

The Copenhagen 2025 Climate Plan was adopted in 2012, with the aim of making Copenhagen carbon neutral by 2025. The Plan has been implemented via three consecutive roadmaps. It is organised in

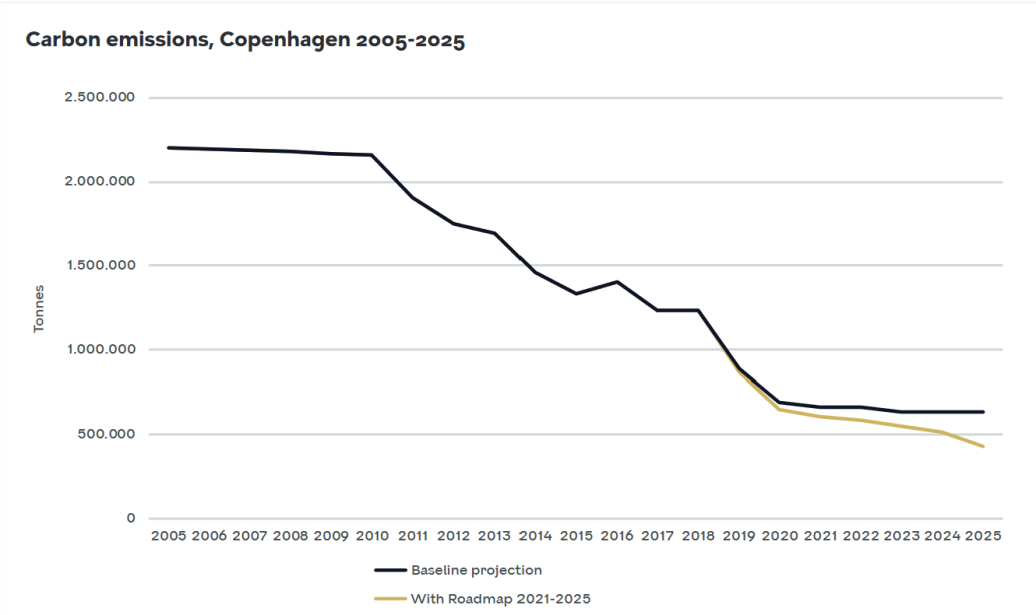
[5] Numbers refer to emissions after the renewable energy adjustment, which adds renewable energy generation outside city boundaries that invested in and owned by the city or the city utilities. 2020 emissions before the renewable energy adjustment amounted to 1.1 million tonnes CO_2-eq, leading to 1.6 tonnes per capita, which is a 52% drop from 2010 levels.

four work streams: energy consumption, energy production, mobility and City Administration initiatives. Energy consumption actions aim at reducing consumption levels and improving energy efficiency. The focus of energy production initiatives lies on replacing fossil fuels with renewables; mainly biomass and wind. Almost all buildings in the city rely on district heating, making it a crucial focus for this transition. Other topics in this work stream include waste handling (from waste to energy), carbon capture, and solar energy. Concerning mobility, biking has been prominent in the city for decades, and is further being promoted. However, CO_2 emissions from the transport sector remain an issue. Actions in the work stream of City Administration initiatives focus on green solutions regarding the city's buildings and vehicles, acknowledging the importance of leadership in the transformation (Municipality of Copenhagen, 2020). There are quantified targets for several Climate Plan activities, for example regarding reductions in energy consumption, energy mix, transport modes, and carbon neutrality. The City Council is in charge of the overall process, and the Climate Secretariat of the Technical and Environmental Administration is responsible for the daily work. Other key actors include the city-owned utility company providing heat, water supply and sewage, the waste-to-energy company, and the public transport company. The actions in the climate plan have been developed in cooperation with a range of partners, such as energy companies and industry, international organisations, and other European cities. Financing of the initiatives stems from municipal and state budgets, as well as the utility companies (Municipality of Copenhagen, 2020). Some projects are also funded by the EU, such as by Horizon and Interreg programmes, and by the Carbon Neutral Cities Alliance.

3.3.4. Achievements and impacts

Copenhagen has reduced emissions by 48% since 2005, to around 1.2 tonnes of CO_2 in 2018 (Municipality of Copenhagen, 2020). Carbon emissions are calculated annually and show a significant decline relative to 2005 levels (see Figure 5).

Figure 5: Carbon emissions, Copenhagen, 2005-2025



Source: Municipality of Copenhagen, 2020

The use of coal in district heating was replaced with biomass, making more than 80% of Copenhagen's district heating carbon neutral in 2019 (Municipality of Copenhagen, 2020). The waste handling system was changed to increase waste separation and recycling. A task force was established for retrofitting

buildings to reduce energy consumption. The city has constructed new bridges and bike lanes to increase connectivity and provide incentives for citizens to use alternative traffic modes. The involvement of companies in the Climate Plan and its actions has incited new solutions in technology and production, and the national energy company has put an emphasis on being renewable. Employment has increased, with unemployment being close to zero, and the Danish industry has flourished in recent years. To ensure knowledge sharing and collective learning, Copenhagen has held annual stakeholder conferences with national audiences. By collaborating with universities and thereby securing better access to data, the Climate Secretariat has an increasingly improving picture of the social and economic impact of their initiatives. While aligning socioeconomic objectives with climate neutrality goals is not necessarily easy, to avoid potential conflicts there is an emphasis on open discussions with the stakeholders involved.

3.3.5. Obstacles and challenges

The main obstacle for reaching the 2025 carbon neutrality target is the topic of mobility. Carbon emissions from the transport sector remain a considerable challenge. Reaching a common understanding on issues such as reducing traffic volumes has been difficult, which is why Copenhagen is behind schedule on the 2025 target. Policies on restricting private car use may be the only solution, but this is a highly sensitive topic politically. Car users have complained about a lack in the availability of parking slots, causing some political parties to argue for more parking options in election debates. Offering additional parking facilities would however be costly and take time to build. Apart from the mobility issue, another challenge is the limited scope of Copenhagen's climate neutrality success, as Copenhagen is only responsible for a small part of national CO_2 emissions, putting a limit on the impact such reductions can achieve.

3.3.6. Funding and policy support (national/EU/other)

The city-owned utility company is responsible for investing in new plants, which is part of the heating cost for citizens. The same is true for waste handling. Waste cost is projected to increase, but they are also working on reducing waste levels, which should even out the cost in the future. Citizens have a vital role in the climate neutrality transformation, and the necessary lifestyle changes may have cost implications. While some projects are funded by the EU, the Climate Plan is not dependent on external funding. According to the interviewee, EU programmes are very bureaucratic and require a lot of knowledge on their internal structures. Moreover, many EU programmes require cooperation with other European cities, even if they have little in common regarding their respective circumstances and needs. Thus, it would be beneficial to foster cooperation of cities that have more similarities and can benefit from each other evenly, to learn from each other's processes.

3.3.7. Monitoring, improvements and outlook

Climate Plan targets are monitored twice a year via reporting from project managers of the different initiatives. If necessary, Climate Plan activities are adjusted accordingly. Regarding concrete actions, Copenhagen's utility company is currently looking into carbon capture technology, which may be crucial for achieving the 2025 goal. Moreover, the creation of a new solar energy plant is in process, and the waste handling system will switch to electric cars completely by 2025. After 2025, the Climate Secretariat will look into potential future developments of the Climate Plan, focusing on the year 2035. Relevant topics will be the reduction of biomass and consumption-based emissions. There will be a greater potential for involving citizens in these future activities. One central issue post 2025 will remain transport sector emissions. To reduce these, Copenhagen would need to implement policies on restricting car use, in combination with carbon capture technologies, which are however not yet ready.

3.3.8. Lessons learned: key success factors and recommendations

The case of Copenhagen shows that one of the **most important factors** in a successful climate neutrality transformation is **cooperation with society.** A partnership with citizens is crucial, as City Administration actors cannot deliver the necessary changes without citizens' support. Apart from general society, **key stakeholders** should be **involved** in the process of developing climate strategies, since they will be implementing the resulting actions in practice. Another success factor is the **cooperation between local and regional organisations** to support and learn from each other, as well as with local or national regulatory authorities. Finally, regions which are creating climate plans should take into account that circumstances change, and unforeseeable issues may arise along the way. Thus, a **successful climate plan needs to be flexible and adjustable.**

It is to be noted, that despite the above described partly limited scope of climate neutrality actions within the 2025 Climate Plan, Copenhagen is an important best practice example globally, and has been inspiring change for decades with their innovative technologies and practices.

3.4. Case 3: Transformation of the economy of Wielkopolska Wschodnia (Poland)

3.4.1. Regional profile

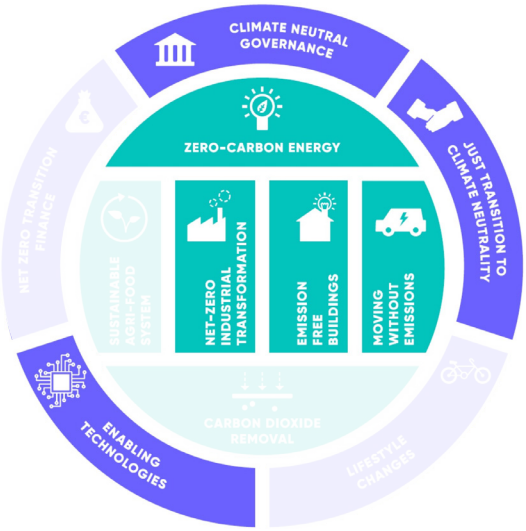
Region: Koniński (NUTS code: PL414), Poland

Size: 4,439 km^2 (2020), 431,109 inhabitants (2020), 97 inhabitants per km^2 (2020)[6]

Economy: (a) GDP: EUR 16,600 per capita (2018), 4.2% nominal annual growth since 2010; (b) Main sectors: Industry (36% of employment in 2018), retail (25%) and construction (11%)

GHG emissions (Poland)[7]: 11 tonnes per capita (2018), 10.9 tonnes (2010), 1% increase since 2010

3.4.2. Regional characteristics and governance competences



The region of Wielkopolska Wschodnia (Eastern Greater Poland) is part of the Wielkopolska province. The 4 counties (powiaty) in this region are turecki, kolski, słupecki, koniński, and are predominantly rural areas. The core of the economy of the reg ion has been based on brown coal extraction and energy production for many years.

Regional authorities of Wielkopolska province (Voivodeship) coordinate communication and are responsible for agreements and contracts with the EU for the whole province. The allocation of climate-related competences for managing the Eastern Wielkopolska transformation initiatives is a result of a broadly participatory project. This began with the informal increase of the issues and opportunities for the transformation process initiated by NGOs, which was immediately supported by provincial government actions. The just transition plans are elaborated on NUTS3 level. Therefore, the subregional manager was delegated by the province authorities to be on site in Konin and the Regional Development Agency in Konin (ARR) was given a mandate of managing the entire process. In April 2019, an agreement for the just transition of Eastern Wielkopolska was formed, bringing together all local government officials from the territory covered by just transition (mayors, village reeves, president of Konin), NGOs, trade unions, and business associations. Together, an agreement was made to transform Eastern Wielkopolska and subsequently the Board of the Wielkopolska Region for the Restructuring of Eastern Wielkopolska was formed. Working groups emerged as a result of this agreement, which developed the conception and strategy for the region resulting in the development of the formal transition agreement and strategy. All of the mentioned players and entities participate in steering the process. However, the formal main authority is the regional government of Wielkopolska province.

[6] Source: Samorząd Województwa Wielkopolskiego, 2021.
[7] Source: GUS, 2020.

3.4.3. Rationale and objectives of the initiative

The provincial government of Wielkopolska recognised the need for promoting a transformation of the region, as moving away from coal had been becoming a very important issue in the region. ZE PAK Group – Pątnów-Adamów Power Plant Complex (Zespół Elektrowni Pątnów Adamów Konin SA), the main employer in the region, also began moving towards closing its operations. The participation in the platform launched by the EC for post-mining regions in the process of transformation and exchange with different regions already implementing similar initiatives, led the region to develop a concept for the transition, recognising that this transformation is absolutely necessary and essential due to:

- brown coal deposits in the region beginning to run out;
- the new 2021-2027 EU cohesion policy indicated that the region should move in this direction.

On the one hand, the region set up the administrative framework for the development and management of the transition strategy and, on the other hand, ZE PAK Group was persuaded not to close its activities, but rather to transform its business model – basing itself on a new approach to energy production. By 2019, three smart specialisations were being developed, with the aim of replacing, as well as building on, what used to be the core activity in the region, professional identification, and regional identity – coal-based energy production.

1. Renewable energy sources; i.e. photovoltaic farms and wind farms. Aiming at providing more energy capacity than was being produced by ZE PAK Group. The new energy farms are being built in the areas that have been destroyed by open pits, using the land that has already been degraded over many years.

2. Electromobility in a very broad sense; to establish the new industry investments focused on electromobility elements, e.g. battery factories, production of electrolysers, and parts for windmills shall be attracted into the region. Moreover, one of the major projects that will be supported by the Just Transition Fund (JTF) is to change all transport to zero-emission transport.

3. Hydrogen technologies; as early as 3 years ago, when the initiative started, it was projected that hydrogen related knowledge and human capital would become relevant in the mid to long-term future. Today, the Eastern Wielkopolska is the most advanced region in Poland when it comes to hydrogen technology. The Wielkopolska Hydrogen Platform was created for the entire Wielkopolska province, for the implementation of hydrogen-based solutions in various fields e.g., purchase of hydrogen trains or production of green hydrogen in the region. In addition, the region's transport is to be changed to electric and hydrogen (buses) in the future.

Furthermore, thanks to the advantageous location of the region, with good east-west and north-south connections, logistic and industrial projects are planned. The Greater Poland Energy Valley project (WDE – Wielkopolska Dolina Energii), apart from being an economic project, is also an identity project aimed to support and ensure the successful transformation of the region. The goal of the energy project is to transform the region, so that the inhabitants may still feel proud of playing an important role in energy production, the development of a successful industry, and have access to various job opportunities (previously up to 20,000 people worked in the brown coal related jobs). In this regard, the transformation plan is broader than just economic, or even environmental, but also addresses social issues.

The main milestones and targets of the WDE initiative are:

- Working on the agreement with the European Commission for the Just Transition Process: presentation of the vision in Brussels 2019 and qualifying for the JTF in 2020. Working out the Just Transition Plan (JTP). 2 main targets have been set:
    - 2030: reduce CO_2 emissions in power and heating by 90-95%.

The GHG emissions in Easter Wielkopolska account for 60% of all emissions in the province. Meeting the 90-95% target, will mean an emissions decrease by 64% for the whole Wielkopolska.

- 2040: achieve climate neutrality throughout all areas of activity:
  - Transport: convert all public transport to zero-emission transport;
  - Building: implement deep thermal modernisation of 90,000 buildings, this aim represents a large challenge.
- The region must address the issue of 90,000 inefficient housing heating sources (e.g. coal-fired heating systems). However, in the city of Konin 90% of heating is produced with green energy. Apart from one small coal-fired heating plant, ZE PAK Group has a biomass unit, geothermal, and photovoltaic.
- The closure of all coal pits. In 2022, Drzewce and Jóźwin are to be closed, while the closure of Tomisławice is scheduled by 2030.

After elaboration of the strategy for JTP, the working groups have been focused on further actions such as the preparation of the subregional strategy spanning 2040. Approaching climate neutrality is a broader and longer process than one financial perspective and the JTP. This process shall then be implemented at every administrative level.

3.4.4. Achievements and impacts

While the region is waiting for the launch of planned actions to fulfil the main targets set for the JTF, smart specialisation plans are already being implemented. As a part of the smart specialisation strategy, renewable photovoltaic and wind farms are being developed. For example, recently the biggest photovoltaic farm in Poland (70 MW) was opened in Brudzew (Turecki district). Wind farms are being built in various areas, such as Przykona or near Rychwał. There are national and international companies already investing in the region in the emerging economic sectors (e.g. battery elements production). With respect to hydrogen technologies, ZE PAK Group has bought an electrolyser and will produce pure hydrogen for cars (green hydrogen), which will start operation in 2022. Furthermore, the Regional Development Agency in Konin supports existing entrepreneurs with various instruments. For example, eco-energy loans from EU funds for transforming businesses into being increasing ecological by supporting photovoltaic (PV) installations, energy efficiency retrofitting of buildings, and low-emission transport.

In the last 3 years, the CO_2 emissions produced by ZE PAK Group have decreased by 25-30%. The Pątnów power plant in the Turecki district, as well as the local open pit, were closed. The project of switching public transport to zero-emission has largely been prepared. Recently, 4,000,000 PLN (still from the previous ESF funding period) were committed for assistance to miners who will be laid off in 2022 in connection with the closure of Drzewiec and Jóźwin pits. The measures will include re-qualifications, training, and assistance in establishing own businesses.

There are also further initiatives being developed supported by the expertise of the World Bank. One project is being elaborated together with the Regional Development Agency in Konin for the labour solutions. Another large environmental project (6,500 ha) concerns the hydrology to restore water conditions of degraded areas and to shorten the land reclamation period from 30 years to 8-10 years. In addition, there is an initiative of the town of Konin, the Green Energy Cluster (Klaster Zielona Energia), which is to become a platform for connecting many institutions to low- or zero-emission energy sources.

Thanks to the participative character of the process, residents and the society as a whole of the region have understood that the initiated transformation process is irreversible. As a result, private business

cooperation on environmental issues has been established and entrepreneurs are joining it. Participation in international interest group networks, initiatives, and platforms draws attention and contributes to the visibility of the region for potential investments, which are in line with the region's strategy for transformation towards climate neutrality. Additionally, the region has become a partner for many international organisations.

3.4.5. Obstacles and challenges

A significant challenge is the delay at the beginning of the JTF process. The region itself has done everything that was required and the JTP for Wielkopolska Wschodnia was accepted as early as 2020, the funding period shall have started in 2021. In this process, the region continues to wait for other negotiations on the state and regional level to come to a close. As a result, the region has experienced delays in JTF implementation since it is very difficult to make any binding plans or promises if financial means have not yet been secured or defined. As a result, such delays and uncertainties can cause disappointment and mistrust among the citizens and represent a large challenge in the planning process. Furthermore, there are generally some nostalgic feelings in the society, especially by the older generations. The solution is not to ignore such emerging issues, but to remain in a dialogue with all groups and encourage participative processes.

3.4.6. Funding and policy support (national/EU/other)

There have been several funding areas and financial sources to date:

- NGOs implementing their projects on transformation: WWF, Polska Zielona Sieć *(Polish Green Network);* they are acquiring different funds from EC, Horizon programmes, etc.
- Wielkopolska Regional Operational Programme and money from the previous funding period (there will be also money from the next one). I.e. loan projects for enterprises were financed by the means.
- ESF, JEREMIE, LIFE funds
- National resources

The transformation will take place with the help of the JTF. However, the JTF-means are only a starting point and further resources have to be mobilised, e.g. the modernisation fund financed by the means of the Emissions Trading System (ETS) and the allowances that have been sold. All possible sources available to support the region's GDP growth will be mobilised. Only economic activities, which do not cause environmental cost, but which give the added value to the process of transformation will be supported. Medium and small enterprises will be prioritised.

Regional management also sees significant financing opportunities in activating other indirect financing mechanisms. Producing unclean energy causes social and health effects that are very cost intensive. Moving towards climate neutrality by switching to the production of clean energy will automatically massively reduce these social costs, thus possibly freeing the budgetary resources that can be used to finance other actions.

3.4.7. Monitoring, improvements and outlook

There is no formal monitoring yet in place. Monitoring is currently carried out through various kinds of research, i.e. the World Bank has completed research on employee preferences considering the development perspectives for the region.

The constant efforts of working groups which often provide valuable information is also a relevant form of monitoring. Furthermore, the Regional Development Agency in Konin collects all materials and research results. The process is very dynamic and demands flexibility; e.g. Covid19 pandemics outbreak is followed by changes in the logistic chains. Therefore, the region is ready to adjust the three smart specialisations according to the conditions in place. The initiatives appearing in the JTP are under consistent review, to determine the trajectory of the transition. One study monitoring the extent to which the plan is being implemented and whether it should be adjusted is planned for every year from the point of initiation. The transition process will be also monitored through advisory bodies and monitoring committees.

It is absolutely necessary to have a clear roadmap for climate neutrality at the national level, clearly defining the aims and goals of the country and the regions. Delegating the management of climate neutrality issues to regions is necessary, since it is not possible or practical to predict from the national level all the elements and ways in which climate neutrality can be achieved in a certain area.

3.4.8. Lessons learned: key success factors and recommendations

The **three key success factors** for moving towards climate-neutrality in Eastern Wielkopolska are: (1) **real participatory character** of the process, (2) provision of **knowledge for all actors and very good communication,** and (3) very **clearly defined expectations** for current and future investors (e.g. no development spoiling the regional climate neutrality will be accepted).

The **recommendations to other regions** implementing similar initiatives focus on the combination of two dimensions of communication: local and global. It implies the communication with and accompaniment of the local community during the transformation process, and at the same time building a strong network outside the respective region. A society is more likely to accept a regional transformation, if people can identify themselves with the new strategy being developed. The internationalisation of the regional initiative means to learn from other regions. Therefore, it is important to actively take part in various relevant initiatives. Representing the region and communicating its climate neutrality strategy awakes additional interest of institutions, experts, and business to the region. Furthermore, a clearly designated responsible and dedicated person is required to continuously coordinate the process.

Recommendations for EU for better support of the regions in their transformation:

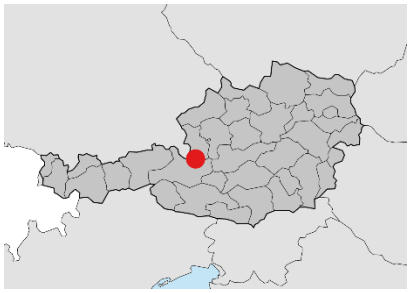
- The climate neutrality goals once set for the EU, countries, and regions, shall be accepted as such, and revised by experts in this field and should not be the subject of a constant discussion between different political parties and levels of political governance.
- Elaboration of a clear definition of the mutual expectations between the individual regions and the EU is necessary. This can be followed by strategies and initiatives focused on clear goals. The direct agreements shall strengthen the regions in their efforts to achieve climate neutrality. Even if the country itself is still in the process of negotiations considering the programming period, there should be new solutions to support the regions willing to implement initiatives in line with the EU objectives. There should be a possibility of supporting single ambitious regions by means of more flexible procedures. Of course, the regions shall then be held accountable for their progress in achieving the goals.
- There is a significant discrepancy between the timeline for the actions planned in the JTP for Wielkopolska Wschodnia and the status of negotiations concerning the programming period 2021-2027. There is currently no reliability on when funding will begin (e.g., no partnership agreement between the state of Poland and the EU and no final agreement on the JTP-regions in Poland resulting in insecurity of the final JTF financial volume for Eastern Wielkopolska). The

negotiations (especially the budgetary negotiations for the programmes) shall be finalised before the implementation period has started. It is necessary to introduce a new procedure for the negotiations and the agreements when it comes to building a new funding period. The process shall be reviewed and redesigned for the future programming periods to avoid the recurrence of such problems.

- JTF is a very interesting fund because it is point-based and focused on specific activities. The creation of more dedicated funds would be worth considering (e.g., strictly urban or industrial regions), so that they could solve some of the specific problems with high emissions. To avoid potentially unproper use of very large and extensive funds it would be worthwhile to always clearly define what the means should be spent on.
- The NUTS3 formula (sub-regions) is being implemented for the first time in JTF to stimulate economic development. Perhaps it is worth going down to this lower level to activate local communities. The JTF is in its first programming period. This will only become clear in a few years.
- With the JTF, from the beginning, EU officials have been keen to have the participation of all possible regional actors in place. The EC should require that programming activities be highly participatory and not fall into a general top-down procedure.
- It is important to support small and medium towns of 20,000-30,000 inhabitants (Polish example and may vary in other countries), as they can become the hubs for the immediate surrounding area. The JTF is an example of a programme with the potential to reinvigorate smaller centres. Further programmes fostering polycentric regional structures should also be developed.

3.5. Case 4: Soft mobility initiative of Werfenweng (Austria)

3.5.1. Regional profile



Region: Werfenweng (located in NUTS 3 region Pinzgau-Pongau, with NUTS code AT322), Austria

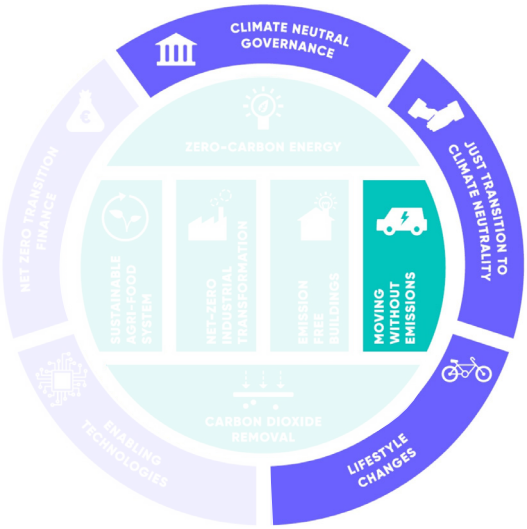
Size: 45 km^2 (2020), 1,064 inhabitants (2021), 23 inhabitants per km^2 (2020)

Economy[8]**:** (a) GDP: EUR 40,300 per capita (2018), 3.5% nominal annual growth since 2010; (b) Main sectors: Accommodation (30% of employment in 2018), industry (16%) and retail (13%)

GHG emissions (Salzburg, 2019): 6.6 t CO_2eq/inhabitant, 3.7 million tonnes CO_2eq, 3.8% decrease since 2010 (in 1.000 t CO_2eq)[9] or 9.6% decrease since 2010 (t CO_2eq/inhabitant)[10] (UBA, 2021)

3.5.2. Regional characteristics and governance competences

The rural community of Werfenweng is particularly characterised by tourism. It is a member of the cooperation Alpine Pearls[11], which offers its guests environmental ly friendly and sustainable tourism. It also belongs to the e5-municipilities of Salzburg (SIR Salzburg).[12] The special feature of the municipality is the strong population growth and the low average age of the population. According to the representative of the tourism association of Werfenweng *[Tourismusverband Werfenweng],* it is a municipality with a high quality of life and goo d job opportunities.



Source: Velten et al. (2021), own editing

Key levers for energy transition and climate protection fall within the competence of Austria's nine federal states (with their own climate and energy policy strategies) (Austrian Energy Agency, 2021). The mayor of Werfenweng rated the region's autonomy to act on transformation towards climate neutrality as medium. On the one hand, the municipality has a lot of organisational and administrative leeway (for example, in the field of public transport, energy management, awareness raising), on the other hand, as part of an administrative association, it is also dependent on higher-level framework conditions.

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8 Data refer to NUTS 3 region Pinzgau-Pongau.

9 GHG emissions (total) 1,000 t CO_2eq: 3.843 (2010); 3.696 (2019). (UBA, 2021)

10 Per capita GHG emissions (total) (t CO2eq/inhabitant): 7.3 (2010); 6.6 (2019). (UBA, 2021)

11 Alpine Pearls is a cooperation of 19 tourism communities from five Alpine Countries. The aim of this tourism association is to promote sustainable mobility offers. (Alpine Pearls, 2016-2021)

12 e5 is a strategy for climate protection and energy efficiency and address all energy-related field of municipalities. The success of a community is measured by its numbers of "e". Werfenweng is awarded with "eeee", and "eea" (European Energy Award)

3.5.3. Rationale and objectives of the initiative

The initiative "Werfenweng Card" (which was initiated at the end of 2021) is a follow-up project of the "Samo-Card" *("Stay mobile, but softly please!").* Whereas the focus from the Samo-Card was primarily on sustainable mobility solutions, the Werfenweng Card aims at including additional aspects of sustainability into its concept. Tourists (but also locals) benefit from this card by receiving the different services at a much lower rate compared to a situation if purchased individually. In addition, they are transported to these different sites for free. Thus, the new card links sustainable mobility with regional (winter and summer) offers. The original aim in the mid-1990s was to make the municipality of Werfenweng more attractive and to enhance its position compared to other touristic regions. Economic reasons were in the foreground for this plan. The community tried to create a new profile – attractive for tourists – and thus to become more competitive. In 1994, a mission statement was developed. Other car-free regions were considered as models (for example Swiss role models). In contrast to these regions, which primarily focused on sustainable mobility on site, Werfenweng also tried to promote the arrival and departure of tourists via sustainable means of transport (especially by train). In addition to the original economic focus, environmental aspect also gained importance. In 1996, Werfenweng was chosen as a model region by the Austrian Ministry of the Environment (in cooperation with the ministry of Transport and Economy) and received financial support. In 1999, the working group "Vacation from the Car" *[Urlaub vom Auto]* was founded and involved experts from different levels (i.e. ministries, Land Salzburg, transport planners and regional developers) to promote soft mobility solutions (Klimabündnis Österreich).

Since the region is characterised by its alpine location, the importance of climate neutrality and the protection of nature are reflected in its goals. Beside enhancing the pull for tourists, it also should remain an attractive place for living. The new "Werfenweng Card" aims at integrating in particular offers from the region, which should ensure that the money stays in the region. As the main public subsidies have already expired a few years prior, the initiative is now financed primarily by participating companies and the sale of the card. Participating companies are accommodations such as hotels, which pay EUR 1.70 per guest per night so that their guests receive the Werfenweng Card at a lower price. The organisation mainly in charge of the initiative is the tourism association of Werfenweng. In addition, companies and locals are also involved in the initiative.

The following topics are reflected in the initiative:

- Moving without emission, due to its comprehensive mobility offers (e.g. a shuttle from the train station or different fun mobility offers such as Velo-Taxis), people have the opportunity to be mobile without being dependent on the own car.
- Lifestyle changing, sustainable mobility is a major topic of Werfenweng and the use of alternative means of transport has become established among both guests and residents.

3.5.4. Achievements and impacts

Werfenweng is a positive example that has already invested in alternative and sustainable mobility solutions in an early stage. Through its successful implementation of various sustainable mobility concepts and by combing ecological effects with economic benefits, it has already been recognised and awarded different prizes (like the CIPRA award in 2005 or the NETS AWARD in 2004)[13]. Thus, it can be

[13] Werfenweng has been awarded by many prizes over the years. A list of these prizes can be found on the page of the Austrian Climate Alliance.

concluded that the original goals have been achieved. Sustainable tourism in the region has contributed significantly to the development of the village and region. One indicator is the strong growth of the population, which has doubled in just a few decades (against the general population decline trends in remote rural areas in Austria). Jobs have been created and new opportunities have sprung up for securing additional income – for example, a farmer can offer his fields as cross-country ski trails in winter – generating additional income. In addition, a farm store ("Bauernladen Werfenweng") with regional products was established. As a result of the initiative, the share of tourists arriving by train has increased significantly. Originally from 6% in the late 90s, the share can be said to have increased to more than 20% (before the outbreak of the Corona pandemic). In addition, other sustainable measures were implemented. One example is a biomass heating system, to which municipal buildings and large hotel facilities are connected. According to the website of the Austrian Climate Alliance *[Klimabündnis Österreich]* the initiative of "Soft mobility Werfenweng" *[Sanfte Mobilität Werfenweng]* saves more than 400 tons of CO_2 per year (Klimabündnis Österreich).

3.5.5. Obstacles and challenges

The main challenge, as mentioned by the representative of the tourism association of Werfenweng, is to keep the residents and the participating companies motivated. The once very innovative mobility initiative is already taken for granted by many Werfenweng residents. Hence, some companies no longer wish to invest their money into this initiative. The reorientation of the newly established "Werfenwenger Card" – which focuses not only on sustainable mobility but in particular on local offers – brought local players back on board. The process behind this new orientation took approximately one and a half years and was characterised by strategic and participatory processes.

3.5.6. Funding and policy support (national/EU/other)

At the time of receiving its designation as a model region in 1996, Werfenweng received financial support from the ministries (environment, transport and economy). In addition, it was involved in various INTERREG projects. Now, individual subsidies (via the klimaaktiv mobil program or the Klimaanergiefond) are used, for example, to finance e-vehicles or micro-public transport solutions (e.g. shuttle service). With regard to INTERREG, there were problems concerning "first-level control". Offers from different providers for very small services (in particular sleigh rides) had to be submitted to the province of Salzburg. The effort was described as being disproportionate. Support from international partners (in particular INTERREG-knowledge provided by partners from South Tyrol) was perceived as very helpful.

As the main public funding in place expired a few years ago, the initiative "Werfenwenger Card" (former Samo-Card) is financed mainly by local companies and by sales to tourists. Revenues are reinvested in order to adjust the offered products and services. The aim of this initiative is to keep money in the region, and to promote regional value chains.

3.5.7. Monitoring, improvements and outlook

The original "Samo-Card" measured direct sales figures, but the monitoring processes were facing some issues concerning the documentation of online bookings. The newly adapted "Werfenwenger Card" is monitored on an ongoing basis. In particular, the number and type of cards sold and the type of services consumed by tourists are documented. The results are presented to the committee meetings on a regular basis. Since the "Werfenwenger Card" was only introduced at the end of 2021, complete monitoring data is not available yet – in particular numbers from the summer season are still pending. At the end of season, the results will be evaluated. Services that are not sufficiently booked might need to be adjusted.

Since the initiative is carried and financed by local players, its success depends primarily on these groups. In order to create an attractive offer for tourists, this must be regularly evaluated and adapted. However, this process depends mainly on internal (local) and less on external factors. Nevertheless, it needs to be emphasised that a lot of financial support came from the ministries and the province of Salzburg. Without this support, the initiative would not have been implemented in the 1990s.

3.5.8. Lessons learned: key success factors and recommendations

The interviewed representative of the tourism association of Werfenweng identified the three **most important factors for success:** (1) The **joint development of the initiative:** strong interactions with the locals and tourists are needed, (2) the **linkage of mobility and local offers:** tourists are coming to Werfenweng because of the leisure offers and the authenticity of the region. The mobility represents the link to these services. (3) **Commitment and financing:** the identification with the plans by local actors is essential for the financial support and thus for the success of the initiative.

The **recommendations** to other regions implementing similar initiatives are mainly to exchange ideas and experiences and to visit regions that successfully implement such initiatives. Courage is needed to try something new. It is of utmost importance to have as many stakeholders as possible on board and to implement and sustain such an initiative on a common basis. Working groups are needed in which everyone is provided the opportunity to get involved.

The following **recommendation for the EU** were mentioned by the two interview partners:

- The mayor of Werfenweng emphasises the importance of promoting model regions rather than individual measures. Model regions have a completely different effect. For example, due to its comprehensive concept and approach, Werfenweng is visited by other communities and universities as a model for learning. In addition, Werfenweng representatives are regularly invited to give presentations on regional initiatives.
- Funding opportunities should be presented as clearly as possible (e.g., on a common EU or national website). For example, if funding is sought for a specific topic (e.g., promoting the climate neutrality of a region), the various funding opportunities should be found in an easy-to-understand manner. Since small regions also contribute to the transition to climate neutrality, tailored information from national and European institutions on funding opportunities is needed.
- Funding opportunities between the federal states in Austria vary. In Tyrol, for instance, the topic of "soft mobility and climate neutrality" receives more attention than in Salzburg. Recommendations or guidelines (also from the EU) are necessary to foster a more national-wide promotion of climate neutrality initiatives.
- Solutions between Member States are also needed. Even if tourists can easily make use of the sustainable mobility solutions within Werfenweng and its surrounding regions, the traveling costs needed to reach this destination are not proportionate. International travel by train – compared to air travel – is still very expensive. Further, if a whole family is traveling, it is much less expensive to travel by car than by train. Thus, in addition to local initiatives that promote sustainable mobility solutions, European solutions are needed to make the use of rail more financially attractive.

3.6. Case 5: Climate-neutral economic zone in Plovdiv (Bulgaria)

3.6.1. Regional profile

Region: Plovdiv (NUTS code: BG421), Bulgaria

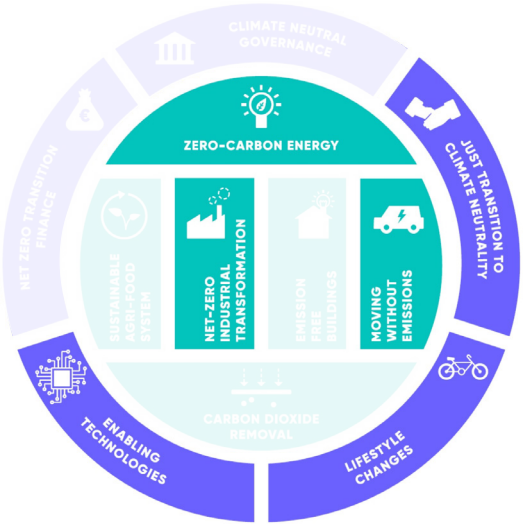
Size: 5,961 km² (2016), 666,801 inhabitants (2020), 113 inhabitants per km² (2019)

Economy: (a) GDP: EUR 13,100 per capita (2018), 6.7% nominal annual growth since 2010; (b) Main sectors: Industry (35% of employment in 2018), retail (20%) and education and health (13%)

GHG emissions: Bulgaria: 6.8 t $CO_{2\text{-}e}$ per capita (2019), 47.1 million t $CO_{2\text{-}e}$ (2019), 1.1% decrease since 2010 (EEA, 2021).

3.6.2. Regional characteristics and governance competences

Trakia Economic Zone (TEZ) is one of the largest industrial zones in Eastern Europe. It covers 10.7 km² and hosts companies with investments exceeding EUR 3 billion (Trakia Economic Zone, n.d.). TEZ includes six major industrial zones in several rural as well as urban areas around Plovdiv – Maritsa Industrial Zone, Rakovski Industrial Zone, Kuklen Industrial Zone, Industrial Park Plovdiv, High- Tech Innovation Park Plovdiv and Agro Park Kaloyanovo. More than 200 Bulgarian and multinational companies operate in TEZ (Trakia Economic Zone, n.d.).



Source: Velten et al. (2021), own editing

TEZ is a public-private partnership project (Investment Destination Plovdiv, 2021). During the interview, the business development manager rated autonomy when implementing climate initiatives high and did not single out any limitations, except such, connected to the private nature of TEZ. The implementation of projects is usually initiated and funded by the investors in TEZ, however support from external stakeholders, such as the municipalities where the industrial zones are located, is also necessary – for example in the provision of infrastructure and permits.

3.6.3. Rationale and objectives of the initiative

Climate neutrality began to crystallise as a goal even before the introduction of the European Green Deal, although initiatives, such as Farm to Fork, have been determinative for the management of TEZ. As existent as well as aspiring investors pushed for modernisation in the direction of green energy and reduced greenhouse gas (GHG) emissions, TEZ launched an initiative towards becoming first an eco-industrial park, and second a climate neutral zone. "Climate neutrality is a continuation of the service we provide," said the interview partner.

The main objectives of this initiative are: (1) to increase competitiveness, create an appealing investment environment for companies with zero emission policies and maintain investors' interest, (2) to create an attractive working and living environment for employees and their families – to improve quality of life, (3) to reduce GHG emissions.

TEZ set up a 12-point plan, entitled "Carbon Neutral Industrial Park Strategy" (CNIP Strategy) in September 2021 to illustrate the aim of the industrial park to become climate neutral (Trakia Economic Zone, 2021). The strategy addresses the topics of enabling technologies (green hydrogen), moving without emissions (electromobility), net-zero industrial transformation and zero-carbon energy. The plan also contains quantitative targets for TEZ until 2040. These include powering 40% of Maritza, Rakovski and Kuklen industrial zones with renewable energy by 2025, 60% by 2030 and 100% by 2040. In addition, TEZ also aims to improve energy efficiency when new buildings are constructed and plans on using rainwater as a water source for industrial purposes, as opposed to drinking water.

Due to a lack of know-how and experts, the starting point of the initiative has not yet been recorded sufficiently. Currently, TEZ is gathering estimates of the amounts of electricity used by each company, as a basis to develop demand-tailored photovoltaic (PV) installations on-site.

3.6.4. Achievements and impacts

At TEZ, most climate neutrality related ideas, plans and processes are currently ongoing and thus results (i.e., quantitative measures of reduced GHG emissions) are to be expected in the future. Nevertheless, with the launch of the CNIP Strategy, TEZ has taken upon concrete actions towards climate neutrality.

To start with, TEZ has set up the "Zero Carbon Industrial Parks (ZCIP) Consortium – Strategic Intent" with the support of five Bulgarian municipalities: Plovdiv, Haskovo, Burgas, Gabrovo and Ruse. The consortium foresees the construction of a complete technological system including renewable energy generation (hydrogen production and storage, biogas, solar energy, wind energy), energy storage and end-user energy distribution. In Haskovo, a "Trakia Economic Zone-South" project is planned. As part of the project, as well as TEZ's CNIP Strategy, Germany-based renewable energy company AE Solar, in a joint venture with Water and Energy Savings AD and TEZ is set to invest EUR 150 million in the construction of a solar panel factory with a 1 GW capacity in 2022 (Petrova, 2021; personal communication). An R&D centre to develop technologies for the production of heating, cooling and electricity using solar radiation, as well as for training engineers and designers will also be established in early 2022. Other plans for the site include a solar panel recycling and reuse factory, the production of energy storage systems and the production and development of hydrogen technologies. A 100 MW green hydrogen plant is also planned in the Haskovo park.

In Rakovski Industrial Zone, a 20 MW photovoltaic plant will be built in 2022, covering 80% of the electricity needs of the zone. These measures will allow companies to produce and use electricity on site. Currently, most investors buy electricity on the free market (i.e., wind energy at the Black Sea coast), where transmission causes significant losses.

Moreover, a partnership between Austrian motorcycle and electric bicycle manufacturer Pierer Group and Bulgarian bicycle manufacturer Maxcom will produce electric bicycles and other two-wheeled electric vehicles at TEZ worth 1 billion BGN by 2027. The investment is expected to provide 1,000 new jobs to the region of Plovdiv.

Among recent investors is also Milara International – a Bulgarian EV manufacturer. At TEZ, the company produces small electric trucks for logistics, which are not only exported abroad, but also used by several Bulgarian municipalities for utility services.

The new investors are regarded as an achievement for TEZ. According to the business development manager, they are amongst a growing number of companies, actively seeking climate neutrality oriented industrial parks and would thus not have chosen TEZ as their factories' location had it not been for the ecological benefits that TEZ offers as well as its carbon neutrality goal.

Other impacts of TEZ's aim to become climate neutral are the evolving social benefits at the zone. These include Farm to Fork catering solutions involving local farmers and the possibility to tend a small private garden on site for workers to grow their own produce.

3.6.5. Obstacles and challenges

The interview partner explicitly stated that there have been no negative side effects since TEZ started implementing its green ambitions. On the contrary, with the introduction of new green measures, investments and accordingly the number of jobs have increased. TEZ would rather lose investors if there was no climate transformation goal, as companies would have to examine and construct green solutions themselves instead of focusing on their production processes.

The biggest challenge that TEZ has encountered so far has been the lack of know-how and experts. Since the business profile of TEZ is not climate-related, the park would benefit from experts in all fields of ecology, i.e., from measuring GHG emissions and monitoring progress towards climate neutrality to electromobility and hydrogen.

3.6.6. Funding and policy support (national/EU/other)

Funding for the initiatives of TEZ has been mostly private. National support has also been present in matters of infrastructure. EU funding has so far been utilised the least. However, with support from Operational Programme "Innovation and Competitiveness" 2014-2020, co-financed by the EU through the European Regional Development Fund and the national budget of Bulgaria, a Vocational Training Centre has been opened in the Rakovski zone. In the training centre, not only workers are qualified and retrained, but also students from five vocational schools in the district are taught practical classes with the latest equipment and technologies.

So far, experiences with EU funding have been positive, funding for green practices is always welcome and applying for EU support is not complicated. Funding could nevertheless be improved if more EU projects aimed directly at industrial parks are offered.

Moreover, as mentioned in Section 3.6.5, the lack of experts is the largest setback for TEZ. The recommendation of the business development manager for improving EU-level funds to better support regions in the transformation towards climate neutrality is to provide more funds for consultants to monitor the availability of funding opportunities (i.e., programmes) which TEZ and other similar industrial parks could apply for. Since funding is mostly private, initiatives at TEZ would still exist without external financing, but "not in this scale".

3.6.7. Monitoring, improvements and outlook

No monitoring processes are currently in place, as TEZ management does not have the capacities to monitor and there is a lack of experts. Feedback by investors has been positive and expressed during the Advisory Board "TEZ-Carbon neutral industrial parks" meetings.

As the biggest hurdle for TEZ is the lack of know-how, the integration of partners who are experts in different points of carbon neutrality is vital for the success of TEZ's initiatives. Future improvements foreseen include the hiring of consultants to monitor the availability of programmes for funding on EU and national levels for TEZ to apply for.

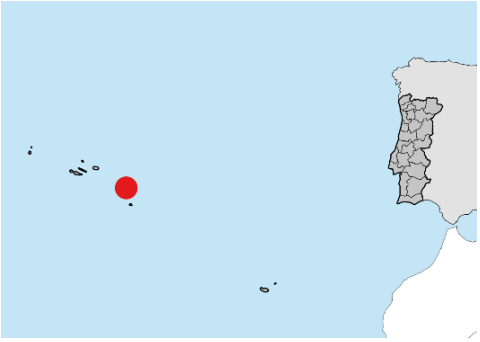
3.6.8. Lessons learned: key success factors and recommendations

The three **key success factors** mentioned by the interviewee are: (1) **management** (mainly in terms of setting goals, upgrading them and following them up), (2) **know-how** and (3) **resources,** both financial and human. The main recommendation to other regions for launching similar initiatives is to look for municipalities with already established structures for investors, i.e., human capital or infrastructure for factories.

According to the interview partner, EU-level policy makers could better support regions in transformation by interlinking them and supporting training initiatives. For example, as coal regions in Bulgaria must transform their economies, their workers could be re-qualified in climate neutrality practices and employed at eco-industrial parks such as TEZ.

3.7. Case 6: Promotion of climate neutrality in Graciosa (Portugal)

3.7.1. Regional profile



Region: Graciosa (located in NUTS 3 region Região Autónoma dos Açores, with NUTS code PT200), Portugal

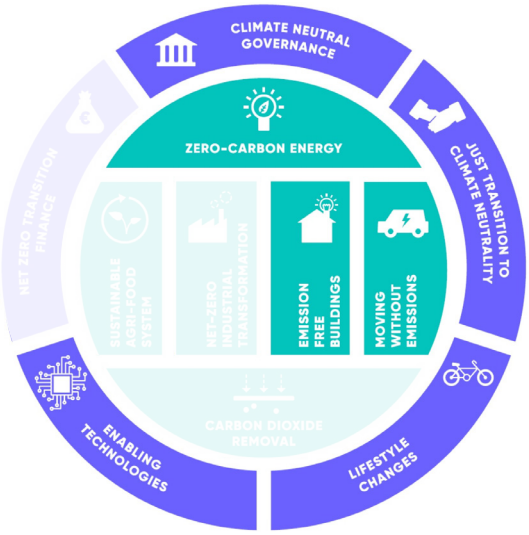
Size: 60,6 km^2 (SREA, 2019), 4,091 inhabitants (INE, 2021), 68,1 inhabitants per km^2 (INE, 2021).

Economy[14]**:** (a) GDP: EUR 20,900 per capita (2018), 1.7% nominal annual growth since 2010; (b) Main sectors: Retail (25% of employment in 2018), services (15%), and industry and accommodation (14% each).

GHG emissions: 7,5 tonnes per capita (2019), 1,84 million tonnes (2019), 12,7% increase since 2000.

3.7.2. Regional characteristics and governance competences

The Azores Region is characterised by insularity, territorial fragmentation (9 islands) and an ultraperipheral situation in EU context. Graciosa is the second smallest island, predominantly rural, concentrating, in 2021, 1,4% of the regional population (236.440 inhabitants in 2021).



Source: Velten et al. (2021), own editing

Since the 1990s and with the support of the ESI Funds, the economic situation of the Region has developed very favourably with an economic trajectory of convergence. It is no longer the least developed Region of the EU and has moved closer to European transition regions.

The Region has exceptionally favourable conditions for extensive livestock production. The agri-food sector, including dairy and meat sectors and fisheries, constitutes the regional economy's specialisation sectors and the main economic drivers. In the last decade, tourism registered a consistent and robust development.

Under the Portuguese Republic constitution and the Political-Administrative Statute of the Autonomous Region of the Azores, the Regional Government is responsible for defining the energy policy measures and implementing programs, measures, and actions for their execution. In this context, it has full autonomy to design and implement the transition from fossil energy sources to renewable and endogenous energy sources, decarbonise the economy, and develop energy efficiency policy, alone or in partnership with the other stakeholders.

3.7.3. Rationale and objectives of the initiative

The Government of the Azores intends to promote climate neutrality in the Azores, in line with national and European plans and is developing the Azorean Energy Strategy for 2030 *(Estratégia Açoreana para a Energia 2030)*. This regional integrated energy policy aims to encourage the energy transition, provid-

[14] Data refer to NUTS 3 region Região Autónoma dos Açores.

ing immediate opportunities while preparing the region to face future challenges. In this way, the options followed are based on developing energy production through renewable resources (geothermic, wind, solar), promoting energy efficiency, and intensifying the electric mobility.

The climate neutrality process on Graciosa Island is supported by two main projects implemented over the last few years, focused on three key dimensions: zero-carbon energy consumption, moving without emissions and emission-free buildings.

The first project, and the most mature, started in 2006 and was completed in 2019. It incorporates a 4.5 MW wind farm, a 1 MW photovoltaic farm and a 7.4 MW/2.6 MWh energy storage and management plant with lithium-ion batteries. The project was promoted by Graciólica (private company), in cooperation with the company responsible for providing electricity in the Region *(EDA – Electricidade dos Açores)* and benefited from regional and European financial support.

The second project *(Graciosa – Ilha Modelo),* created by the Regional Government in 2019, takes advantage of the high availability of renewable energy in the island. The project aims to promote electric mobility, contemplating the following actions supported by regional and European funds: (i) financial incentives for the acquisition of electric vehicles to be used in rent-a-car and taxi sector; (ii) acquisition of an electric minibus for the public transport fleet of the Island (replacing a diesel-powered bus); (iii) electric bicycle sharing system; (iv) network of electric car charging points; and (v) management platform for the shared public fleet.

In addition, the Regional Government created a system of incentives for the production and storage of energy from renewable sources, which allows the end-users to produce their power and heat from clean sources. This incentive is increased at Graciosa Island.

Those initiatives are focused on three cross-cutting issues: (i) climate neutral governance, allowing a coherent action between the different stakeholders (regional and local, public and private); (ii) enabling technologies, particularly using batteries and sophisticated management systems to increase energy efficiency; (iii) lifestyle changes, encouraging active modes of mobility.

3.7.4. Achievements and impacts

The project to increase renewable energy production has already reached the intended objectives. Between January and November 2021, the rate of renewable energy used on the Graciosa Island was 64,9%, compared to the 15% recorded before August 2019. The quality of the energy supply service was significantly enhanced, with less supply interruptions and improved voltage wave quality.

This innovative project is having a major impact on the decarbonisation of the entire region, with investments being made on other islands to install renewable energy storage batteries to increase the penetration of energy from renewable sources in the production of electricity. Between 2022 and 2026, *EDA – Electricidade dos Açores* will invest circa 181 million euros in renewable energy and battery energy storage systems (BESS). When fully in place, this investment is estimated to help reduce the emission of 304 thousand tons of greenhouse gases per year. 31.7 million euros will be financed by the Operational Program 2014-2020, 22.5 million by the Recovery and Resilience Plan (PRR) and the rest by the Regional Operational Program 2021-2027.

Regarding the *Graciosa – Ilha Modelo* project, given the short implementation timeframe, there are still no results that can be reported.

3.7.5. Obstacles and challenges

The main difficulties observed to implement the two central projects to achieve climate neutrality in Graciosa differ in terms of technical characteristics, complexity, and targets.

Due to its innovative nature, the investment to increase renewable energy production faced technological and bureaucratic obstacles. Simultaneously, implementation was affected by the Portuguese finance and economic crises (2008 to 2015) and the constraints to find financial support. This obstacle was overcome through the action of the Regional Government (providing funding to support this type of initiatives and guiding investors on how to access funds) and the mobilization of Cohesion Policy funds.

Given the initial stage of the project *Graciosa – Ilha Modelo* it is not yet possible to anticipate obstacles, but the actors involved identified the adhesion of the population as a critical aspect.

In terms of challenges, the main question faced by small islands, such as Graciosa, is how to increase the levels of renewable energies penetration by up to 100%, considering their disconnection with continental European grids and the intermittence of renewable sources, like solar and wind power. This situation could be mitigated by exploring other more stable renewable sources such as geothermal.

3.7.6. Funding and policy support (national/EU/other)

The experience to use European funds is considered positive, by public and private stakeholders. Both pointed out the European Funds as decisive for realising investments that allow climate neutrality. Given the typology of investments made, the ERDF and the CF are especially important.

European funding played an especially vital role in constructing the wind farm, the photovoltaic farm and the energy storage and management plant, given the difficulties to access bank financing by the private promoters.

On the other hand, the Region's involvement in pan-European projects, like IANOS, RESOR, EMOBICITY or the European initiative Clean Energy for EU Islands, is highly valued by public actors. These types of projects promote the exchange of knowledge between the different EU regions, improving the regional and local capacity building related to energy innovation and implementation of carbon neutrality projects.

3.7.7. Monitoring, improvements and outlook

The use of renewable energies is monitored by the promoter (Graciólica) and by *EDA – Electricidade dos Açores*. This process has clarified how the project goals are being achieved and has offered information about the improvement obtained in the service quality.

These results are encouraging the replication of renewable energy storage in other Azores islands, making Graciosa a pilot for climate transition for the entire region.

The main limiting factor for carbon neutrality in Graciosa, to achieve even greater use of energy from renewable sources, is related to the reliability and safety issues of the service. The impossibility to connect to the Trans-European Energy Network and the intermittence of renewable sources prevent a greater use of renewable sources. To overcome this constraint, the region requires an increase in the storage capacity and/or the use of other more reliable endogenous renewable energy sources (i.e. geothermal).

On the other hand, the mobility electrification is strongly dependent on public financial incentives, given the socioeconomic characteristics of the Region and the strong dependence on individual transport, provided particularly that it is a predominantly rural area.

3.7.8. Lessons learned: key success factors and recommendations

The **main success factors** identified by stakeholders were: (1) **initiatives from the private sector** and its ability to **generate innovation;** (2) **cooperation** between all entities (promoter, Regional Government, regulatory entity, and entity responsible for the provision of electricity); (3) the **Regional Government support** for solving financial and bureaucratic obstacles; (4) the **European financial instruments** that made the investment viable.

The case of Graciosa allows us to understand that innovation is one of the critical aspects of climate neutral transition (in policies, measures, and projects). To promote innovation in the energy sector and capacity building to lead this type of process, it is essential to increase trans-regional cooperation, offering learning opportunities for regions in similar circumstances and helping to accelerate climate neutrality transition.

The reinforcement of funding and the creation of more favourable access conditions, adapted to the realities of the outermost EU regions is the main recommendation at EU level. The outermost regions, given their handicaps, should be adequately treated by European policies, namely through financial support mechanisms that ensure sustainability, competitiveness, and economic and social development.

The geographical characteristics of the outermost regions block the access to the Trans-European Energy Network and, in turn, to the Connecting Europe Facility, which constitutes an obstacle to the implementation of the single energy market and to reduce the fossil fuels dependence of these regions. Thus, the derogations to the "common rules for the internal electricity market", should be maintained.

3.8. Summary: cross-case comparison of best practices

Before analysing the strengths, weaknesses, opportunities and threats (SWOT) across the six cases in the following section, it is worth making a cross-case comparison regarding the aspects relevant for this study, including for providing policy recommendations.

Sectoral and horizontal areas addressed

The comparison of the sectoral and horizontal areas of the used climate-neutrality framework (see section 2.1.2 and Figure 2) reveals that the most important topic is "moving without emissions", which is tackled in all six of the cases. Other prominent issues addressed by five of the six cases are "zero carbon energy" and "enabling technologies". In contrast, the topics "sustainable agri-food system" and "just transition to climate neutrality" are only relevant in one case each. No case addresses the topic of "net zero transition finance", which is obviously more applicable at the national and EU level. Overall, the sectoral coverage shows that the cases of Copenhagen and Wielkopolska Wschodnia are quite broad in their transformational ambition, while Werfenweng in contrast has a very specific focus on mobility.

Key players

The six cases also differ with regard to the key players responsible for their implementation, as shown in Table 3. In four of the six cases – Päijät-Häme, Copenhagen, Wielkopolska Wschodnia and Graciosa – the regional or local administration is in charge of the initiative's coordination and/or implementation, usually together with other stakeholders (such as municipalities, companies, NGOs and civil society). In the two other cases – Werfenweng and Plovdiv – the private sector plays a stronger role, or is even in the lead.

Table 3: Key players for the implementation of the six cases

Case	Key players
Päijät-Häme	Päijät-Häme Regional Council, ten municipalities, higher education institutions, regional energy company, development organisations
Copenhagen	Copenhagen City Council, Climate Secretariat of the Technical and Environmental Administration, city-owned utility company, waste-to-energy company, public transport company, further companies and international organisations
Wielkopolska Wschodnia	Regional government of Wielkopolska, together with local governments, NGOs, trade unions, business associations
Werfenweng	Tourism association of Werfenweng, together with companies and citizens
Plovdiv	Trakia Economic Zone (TEZ) public-private partnership, cooperation with municipalities
Graciosa	Regional Government, together with electric utility companies

Funding sources for the initiatives

The differences in the key players in charge of implementation are also mirrored in the utilised funding sources. The two cases with a stronger role of the private sector – Werfenweng and Plovdiv – are also mainly funded by the participating companies (in the case of Werfenweng, public funding has already

expired several years ago). The Copenhagen Climate Plan is mainly funded from regional and national sources, while the other three cases are heavily dependent on a variety of EU funding streams, in particular from ERDF, ESF and LIFE. Four cases – Päijät-Häme, Copenhagen, Wielkopolska Wschodnia and Plovdiv – also reported a utilization of funding from Horizon 2020 for accompanying research projects. For a detailed analysis of the cohesion funds contribution to climate neutrality, see section 4.2.

Table 4: Overview of the case study initiatives funding sources

Case	Funding
Päijät-Häme	EU LIFE programme (Roadmap); ERDF, ESF, Horizon Europe, Interreg, national funds (regional development)
Copenhagen	Municipal and state budgets, utility companies, a few EU funds (Horizon and Interreg), Carbon Neutral Cities Alliance
Wielkopolska Wschodnia	Mainly JTF; ESF (2014-2020), JEREMIE, LIFE as well as Horizon 2020 (NGOs)
Werfenweng	Financed by participating companies and sale of the card (public funding has expired a few years ago)
Plovdiv	Mostly private funding (by companies that invest in TEZ); national funding for infrastructure; one H2020 project
Graciosa	ERDF, CF

3.9. Drivers, conditions, barriers and solutions for EU regions

A synthesis of the conducted case studies reveals the internal and external aspects of regional transformation towards climate neutrality. The challenges and barriers as well as conditions, drivers and solutions are organised along the SWOT analysis framework (see Figure 6).

The main groups of **strengths** consider the regional and political competence and autonomy to act on the transformation. Small functional regions and islands are especially favourable to innovative projects for climate neutrality. The participatory character and the involvement of different actors allowing cooperation and joint development strengthen the success of the initiatives. The plans and strategies themselves have better chances of actually bringing a region closer to climate neutrality if sustainability has been recognised as the core regional development value, there is a combination of ecological and economic aspects, the plans are ambitious, multilevel, but also concrete, and quantified targets are agreed upon. For the implementation of the transformation, it is crucial to define clear rules for all developments and investments. Furthermore, the internal capabilities, such as the openness to innovation and experimentation as well as experience in the development of strategies for climate neutrality and expertise (e.g. on emission monitoring), help regions to achieve their goals.

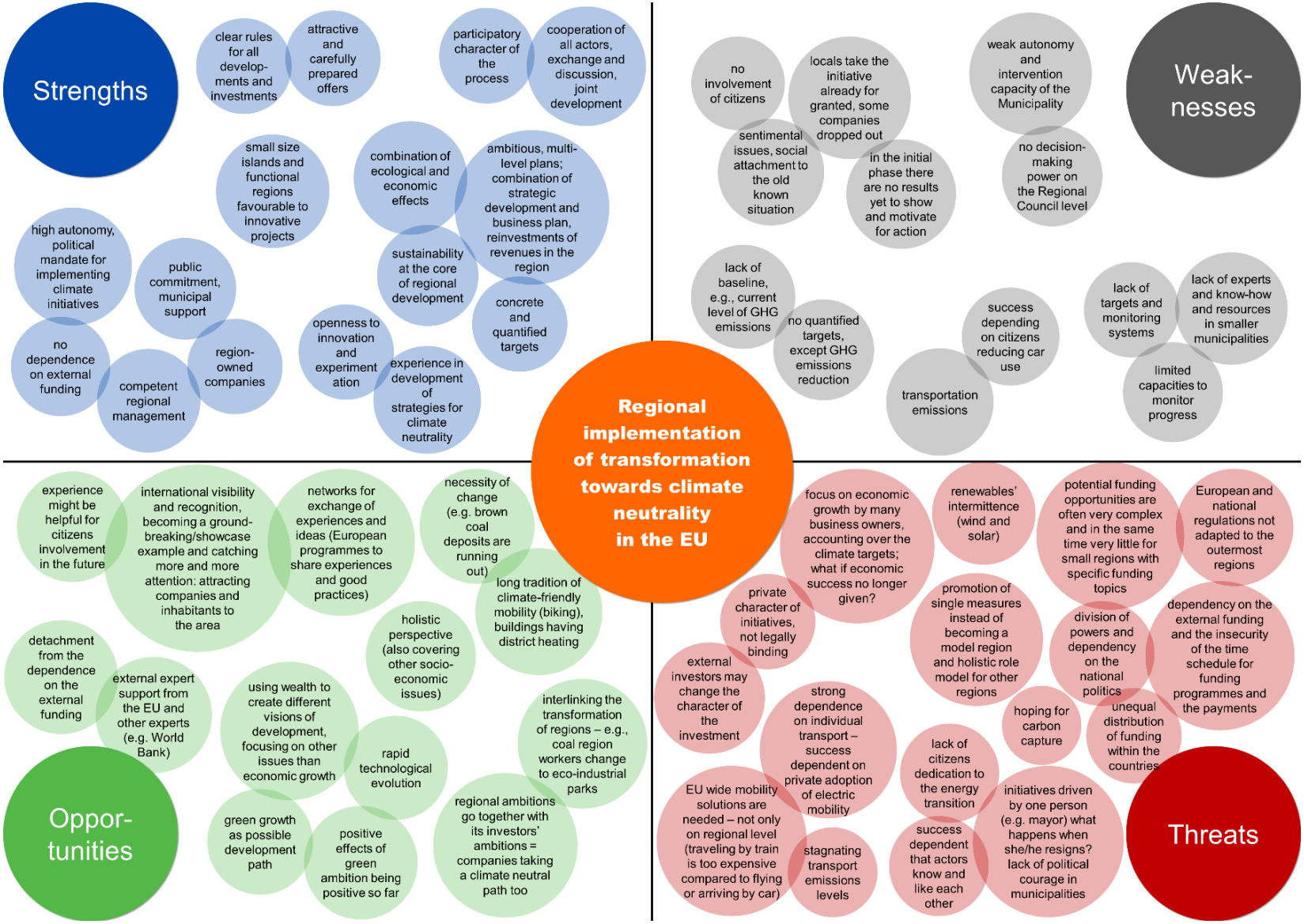
In opposition to the first group of strengths, the lack of sufficient autonomy and intervention capacity at municipal or regional level is a significant **weakness** on the journey towards climate neutrality. A lack of involvement of the citizens, attachment to the status quo and not yet existing results of the initiatives that could be shown and motivate the inhabitants for action weaken the implementation of transformation. At the same time, the absence of targets and monitoring systems as well as the lack of

experts, know-how, and resources in smaller regions, or within single municipalities, are also internal barriers. The possibilities of influencing lifestyles and private households' decisions, especially in the mobility sector, can currently be perceived as scarce. Furthermore, the implementation of the transformation is lagging if there are no quantified or quantifiable targets that cover aspects other than only GHG emissions. Even GHG reduction targets are also not always easy to define due to insufficient information on baselines (current emissions).

The **threats** observed on the basis of the case studies encompass hoping for and relying on external solutions (e.g. carbon capture) and at the same time sidestepping further changes. Focusing only on the promotion of single measures instead of becoming a model region with a holistic concept does not go far enough to foster transformation. Depending on the area of transformation, the threat of significant dependency and complex interrelations with frameworks in the neighbouring regions, the national level, and the continent as a whole manifests itself in different intensities. In the case of changes in transport modes, it is very apparent that while these changes can be implemented locally (like in Werfenweng), if there is no EU-wide systemic solution for longer distance journeys, people will still choose to arrive by plane or car, thus causing much higher emissions than the savings achieved on site. Furthermore, the intermittency of renewables (wind and solar power), together with the insufficient technological capacities for energy storage, make a switch to an energy supply relying entirely on renewable sources challenging. The dependence on external investors, who might change the investment character and private character of some initiatives not ensuring the legal binding, can threaten the regional transformation. The focus on economic growth is on the one hand very relevant, but on the other hand presents a significant threat of the abandonment of climate-neutrality initiatives that do not directly contribute to this growth. The potential funding opportunities are often very complex for small regions. The regions also encounter inequalities inside the countries in in terms of the division of both funding and decision-making powers. The dependency on external funding entails a significant vulnerability to insecurities and changes in the time schedule for payments, such as those resulting from external negotiations (e.g. at EU level). This is especially challenging if a region has already started implementing its initiatives.

On the site of the **opportunities,** detachment from external funding and establishing internal financing system makes the transformation process more independent. At the same time, including external experts from the EU or other organisations (e.g. World Bank) can be beneficial for regional efforts. Participation in global networks, making the transformation process visible to the others and fostering exchange with other regions, creates opportunities to improve strategies and plans, to learn from others' experiences, and also to become a best practice example for other regions. International visibility attracts investors and inhabitants to the area. Further development of successful traditions and strategies (e.g. soft mobility in Copenhagen), but also not influenceable factors such as limited brown coal deposits, pull and push the transition processes forward. In contrast to the threat of not taking an action due to the risk of economic setbacks, green growth can be seen as a possible development path. Furthermore, the favourable economic situation of more developed regions could be used to create different visions of development focusing on issues other than only economic growth.

Figure 6: SWOT analysis of the regional implementation of transformation towards climate neutrality in the EU



Source: Own compilation

Transferability of proven climate neutrality solutions for other EU regions

Although transformation processes are necessary and may move the regions in to a new very beneficial dimension of development, it is a demanding journey through a partly unknown field. There is no universal recipe for a successful transformation that can be provided and applied throughout Europe. Still, many success factors identified within the case studies can be very helpful for guiding other regions. The crucial aspects are listed as follows:

- Real participatory character of the process involving all groups of actors and stakeholders; communication and provision of knowledge and information to all actors;
- Openness for actual cooperation with and learning from the society and other stakeholders;
- Visibility of climate work among citizens, interactions and partnership with citizens are needed;
- Cooperation on different levels between local and regional organisations; support and learning from each other, with local as well as national regulatory authorities;
- Strong personalities among the relevant actors, commitment of all involved actors;
- Know-how; resources (financial and human); ability to generate innovation;
- The support of a higher administrative level (e.g. regional government) for solving financial and bureaucratic obstacles;
- Internationalisation, communication and networking outside the region; being part of a network together with other regions is a valuable source of information and support regarding success stories and avoidable mistakes; contribution to the exchange;
- A successful climate plan needs to be flexible and adjustable as circumstances change and unforeseeable issues may arise along the way while long-term targets can help steer progress over the long haul;
- Clearly defined expectation for investors and following the rules and agreed goals;
- Linkage between different solutions and implementation strategies. The transformation does not have to encompass all sectoral and horizontal areas at once, it can gradually spread to other areas and sectors.

4. ANALYSIS OF THE CONTRIBUTION OF EU COHESION POLICY TO CLIMATE NEUTRALITY

4.1. Overview of EU policies and instruments supporting the transformation

KEY FINDINGS

The European Union contributes, through a wide range of funds, tools, and support mechanisms to fostering the transition of regions and cities towards climate neutrality. Identifying the most relevant and appropriate type(s) of support depends on the Member State as well as on the context influencing a region or city' endeavour. More specifically, the analysis of the case studies has shown that:

- The use of cohesion funds to support climate neutrality-related activities at local and regional level is influenced by the type of actors involved.
- The climate and environmental mainstreaming potential of cohesion funds remains relatively untapped.
- Hindering factors to the use of cohesion funds include the lack of awareness on possible funding and financing opportunities and the related limited resources to access such information.

The European Union provides climate finance and contributes to supporting a transition towards climate neutrality in various ways and through different channels. The EU action against climate change has notably been carried out in the 2014-2020 multiannual financial framework through an innovative approach called climate mainstreaming. This approach required all EU programmes, in all policy areas, to consider climate priorities in their design, implementation and evaluation phases. To help achieve the goals of reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and reaching climate neutrality by 2050, climate mainstreaming has been further strengthened across the entire EU budget 2021-2027. Similarly, the EU Commission seeks to adapt infrastructures to climate change by integrating mitigation and adaptation measures into the development of infrastructure projects, which is referred to as climate proofing.

While climate action has been integrated in all EU programmes, the Cohesion Policy, through its various funds (hereinafter referred to as Cohesion funds) represents a key instrument to deliver on the EU's priorities. The Cohesion funds, namely the European Regional Development Fund (ERDF), the European Social Fund + (ESF+), the Just Transition Fund (JTF) as well as the Cohesion Fund (CF), are contributing (to a varying extent) to each of the five policy objectives (PO)[15] set for the programming period 2021-2027. The second policy objective, i.e. a greener, low-carbon transitioning towards a net zero carbon economy is of particular relevance. The ERDF and the CF are principally focussing on supporting investments related to this second policy objective. Indeed, operational programmes in Member States have to allocate 30% of the ERDF funding and 37% of the CF funding to finance projects contributing to climate objectives. Along those lines, given that the Cohesion funds are jointly managed by the Member States and the EU Commission, the thematic concentration, i.e. the allocation of resources between the different policy objectives is ultimately decided by the Member States.

[15] PO 1. a more competitive and smarter Europe; PO 2. a greener, low-carbon transitioning towards a net zero carbon economy; PO 3. a more connected Europe by enhancing mobility; PO 4. a more social and inclusive Europe; PO 5. Europe closer to citizens by fostering the sustainable and integrated development of all types of territories

The JTF was designed to complement the ERDF and ESF+ and seeks to mobilise EUR 150 billion to support the transformation of EU-27 regions into a more climate-neutral economy and to alleviate economic turbulences tied to the transitioning. This funding is implemented until 2030 and open to all Member States and regions via the Just Transition Platform.

Moreover, as a means to counteract the impacts of the Coronavirus pandemic, the EU Commission launched a recovery plan, REACT-EU, which provides Member States with additional resources, distributed notably through the ERDF and ESF, to support operations contributing to preparing a green, digital and resilient recovery of the economy.

Against this backdrop, the aim of the present analysis is to examine and review the characteristics of the previously mentioned funds (ERDF, ESF+, JTF, CF, and REACT-EU) and describe their respective intended contribution to supporting a transition towards climate neutrality. Each of the following tables presents an overview of the main findings per fund, along the following elements:

- Relevance and role of the fund
- Territorial approach (requirements and role of Member states/regional/local authorities)
- Resources (total and climate specific)
- Sectoral relevance and scope of the support
- Synergies with other funds

Table 5: Overview of the ERDF's contribution to climate neutrality

Element of analysis	European Regional Development Fund (ERDF)
Relevance and role of the fund	The ERDF invests in infrastructure, innovation and research, the digital agenda, support for small and medium-sized enterprises (SMEs) and the low-carbon economy. The aim is to strengthen economic and social cohesion in the European Union by correcting imbalances between regions. In the 2021-2027 period, the concentration of ERDF funding varies based on the EU Member States and a regions' prosperity.
Territorial approach (requirements and role of Member states/regional/local authorities)	The ERDF finances programmes in shared responsibility between the European Commission and national and regional authorities in Member States. The Member States' administrations choose which projects to finance and take responsibility for day-to-day management.
Resources (total and climate specific)	The budget earmarked for the ERDF is EUR 226.1 billion for the 2021-2027 period. All Member States must allocate a minimum of 30% of their budget to the environmental PO2 (a greener, low-carbon transitioning towards a net zero carbon economy) and more developed regions (or Member States) must dedicate at least 85% of their allocation to PO1 (a more competitive and smarter Europe) and PO2.
Sectoral relevance and scope of the support	Pursuant to this thematic concentration, the ERDF focuses on key priority areas, inter alia innovation and research, the digital agenda, support for small and medium-sized enterprises (SMEs), environment and the transformation towards a climate neutral future.
Synergies with other funds	The ERDF is also able to provide support for activities under the specific objectives of the ESF+.

Sources: Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 establishing the European Regional Development Fund and on the Cohesion Fund; https://ec.europa.eu/regional_policy/en/funding/erdf/

Table 6: Overview of the ESF+'s contribution to climate neutrality

Element of analysis	European Social Fund Plus (ESF+)
Relevance and role of the fund	The ESF+ focusses on investing in people, addressing socio-economic issues (also linked to the Covid-19 pandemic), promoting high employment levels, building social protection and developing a skilled and resilient workforce ready for the transition to a green and digital economy. The ESF+ actions to reskilling and upskilling people to support this green and digital transition are particularly relevant. This includes support in the area of green skills development, green entrepreneurship, search assistance for green jobs, job creation in green sectors, social inclusion of people impacted by the transition, and occupational safety and health.
Territorial approach (requirements and role of Member states/regional/local authorities)	Given that the majority of the ESF+ funding is allocated under shared management with the Member States, operational programmes will dedicate the support to projects responding to the needs of the regions and/or country.
Resources (total and climate specific)	The total budget for the ESF+ is over EUR 99 billion (current prices) and its resources will be allocated by MS as follows: a) at least 25% to the specific objectives for the social inclusion, including integration of migrants; b) at least 2% to the specific objective addressing material deprivation; c) at least 10% to targeted actions for young people not in employment (NEET) in the case of having a rate of NEET above the EU average.
Sectoral relevance and scope of the support	The ESF+ shall (inter alia) contribute to the green and digital transitions by driving investment in skilling opportunities so that workers can thrive in a climate-neutral, more digital and inclusive society.
Synergies with other funds	On a voluntary basis, Member States can transfer resources between the Cohesion Funds at any point in time of the programming period.

Sources: Regulation (EU) 2021/1057 of the European Parliament and of the Council of 24 June 2021 establishing the European Social Fund Plus (ESF+); https://ec.europa.eu/commission/presscorner/detail/en/QANDA_21_6823; https://ec.europa.eu/esf/main.jsp?catId=62&langId=en

Table 7: Overview of the CF's contribution to climate neutrality

Element of analysis	Cohesion Fund (CF)
Relevance and role of the fund	The CF principally supports the second and third policy objectives and targets the reduction of social and economic disparities supporting environmental projects and transport infrastructure.
Territorial approach (requirements and role of Member states/regional/local authorities)	The CF covers Members States whose Gross National Income (GNI) per inhabitant is lower than 90% of the EU average (over the period 2021-2027). Cohesion Fund programmes should take account of content of integrated national energy and climate plans.

Element of analysis	Cohesion Fund (CF)
Resources (total and climate specific)	EUR 48.1 billion are allocated for the 2021-2027 period, and 37% of the overall financial allocation of the CF must contribute to achieving climate neutrality by 2025.
Sectoral relevance and scope of the support	Besides transport infrastructure, supported projects also include energy efficiency, use of renewable energy or sustainable urban mobility entailing environmental benefits.
Synergies with other funds	On a voluntary basis, Member States can transfer resources between the Cohesion Funds at any point in time of the programming period.

Sources: Regulation (EU) 2021/1058 of the European Parliament and of the Council of 24 June 2021 establishing the European Regional Development Fund and on the Cohesion Fund; https://ec.europa.eu/regional_policy/en/funding/cohesion-fund/

Table 8: Overview of the JTF's contribution to climate neutrality

Element of analysis	Just Transition Fund (JTF)
Relevance and role of the fund	The JTF will finance projects which alleviate the socio-economic costs for communities across the EU that are heavily dependent on fossil fuels or greenhouse gas-intensive industries and need to diversify the local economy.
Territorial approach (requirements and role of Member states/regional/local authorities)	To prevent the widening of disparities between territories which are differently impacted by climate change, the JTF will specifically target territories which need to phase out the production and use of coal, lignite, peat and oil shale or transform heavily polluting industries. Funding will be made available on the basis of territorial just transition plans prepared by member states together with the relevant local and regional authorities. The plans shall identify the most affected territories and their investment needs. The JTF will support a total of 11 types of activities which can be regrouped into three broad categories: **1. Economic revitalisation:** (a) productive investments in SMEs, including start-ups, leading to economic diversification and reconversion; (b) investments in the creation of new firms, including through business incubators and consulting services; (c) investments in research and innovation activities and fostering the transfer of advanced technologies; (d) investments in the deployment of technology and infrastructures for affordable clean energy, in greenhouse gas emission reduction, energy efficiency and renewable energy; (e) investments in digitalisation and digital connectivity; (g) investments in enhancing the circular economy, including through waste prevention, reduction, resource efficiency, reuse, repair and recycling; **2. Social support:** (h) upskilling and reskilling of workers; (i) job-search assistance to jobseekers; (j) active inclusion of jobseekers; **3. Land restoration:** (f) investments in regeneration and decontamination of sites, land restoration and repurposing projects.

Element of analysis	Just Transition Fund (JTF)
Resources (total and climate specific)	EUR 17.5 billion, composed of EUR 7.5 billion available for budgetary commitment for the 2021-2027 period and EUR 10 billion from the recovery instrument (Next Generation EU) available over the years 2021, 2022 and 2023. For each Euro that EU Member States want to unlock from the JTF, they have to re-allocate between 1.5 and 3 Euros from their ERDF or ESF+ budgets to JTF projects (with a limit of 20 percent in each case). They will also have to directly co-finance projects according to cohesion rules. The EU Commission therefore foresees that the overall financing capacity of the JTF will be between 30 and 50 billion Euros.
Sectoral relevance and scope of the support	Support provided to SMEs, start-ups and for the creation of new enterprises. A key focus is on fostering employment opportunities via investment in training and retraining of workers and job seekers, job-search assistance as well as measures for social inclusion. Other types of investment include research and innovation, the transfer of advanced technologies, affordable green energy and energy storage, the decarbonisation of local transport, digitalisation, and enhancing the circular economy, including through waste prevention.
Synergies with other funds	Member States can transfer resources from the European Regional Development Fund and the European Social Fund Plus.

Sources: Regulation (EU) 2021/1056 of the European Parliament and of the Council of 24 June 2021 establishing the Just Transition Fund; https://ec.europa.eu/regional_policy/en/funding/jtf/; Cameron et al 2020.

Table 9: Overview of REACT-EU's contribution to climate neutrality

Element of analysis	Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU)
Relevance and role of the fund	REACT-EU funds are mainly allocated through the European Regional Development Fund (ERDF) and the European Social Fund (ESF). REACT-EU provides additional funding to these cohesion policy programmes for the years 2021 and 2022, to be used by the end of 2023. Its aim is to support economic and social recovery from the coronavirus crisis by fostering crisis repair and resilience of healthcare, business and support to the most vulnerable groups. The funding also contributes to the green and digital priorities for a smart and sustainable recovery.
Territorial approach (requirements and role of Member states/regional/local authorities)	The funding allocation methodology takes into account the GDP drop and rise of unemployment caused by the pandemic, including among young people, as well as the relative wealth of EU Member States. National co-financing is not obligatory.
Resources (total and climate specific)	REACT-EU provides EUR 50.6 billion of additional funding (in current prices). REACT-EU is expected to contribute 25% of the overall financial envelope to climate objectives[16].

[16] Reducing net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels and reaching climate neutrality by 2050

Element of analysis	Recovery Assistance for Cohesion and the Territories of Europe (REACT-EU)
Sectoral relevance and scope of the support	Given the thematic scope of the EU funds, there are a wider range of climate action investments possible under the ERDF, as it supports a variety of relevant infrastructures and actions. By contrast, climate action through ESF can mainly be linked to training for green skills and jobs, i.e., skills that will be useful for jobs in environmentally-focused sectors.
Synergies with other funds	From the ERDF, the additional resources shall primarily be used to support investment in products and services for health services and to provide support in the form of working capital or investment support to SMEs. Moreover, it should also be possible to support investments contributing to the transition towards a digital and green economy as well as in infrastructure providing basic services to citizens, or economic measures in the regions that are most dependent on sectors most affected by the crisis (e.g. tourism, culture, hospitality services etc.). From the ESF, the additional resources shall primarily be used to support job maintenance, including through short-time work schemes and support to self-employed. The additional resources shall also support job creation, especially for people in vulnerable situations, youth employment measures, skills development, in particular to support the twin green and digital transitions, and enhanced access to social services of general interest, including for children.

Sources: https://cohesiondata.ec.europa.eu/stories/s/REACT-EU-Fostering-crisis-repair-and-resilience/26d9-dqzy/; https://ec.europa.eu/regional_policy/en/newsroom/coronavirus-response/react-eu

4.2. Use of cohesion funds for climate neutrality initiatives

This section aims at analysing the characteristics (needs, challenges, and focus), presented above in section 4.1, in line with the use of the cohesion funds and REACT-EU, when mobilised. The overall objective is to assess the appropriateness and alignment of the funds' objectives and scope of intervention vis-à-vis the types of initiatives implemented in the transition towards climate neutrality. Table 4 in the case study-summary (see section 3.8 on page 49) specifies the funding sources per case study.

Overall, various funding streams are tapped on in each case. The cohesion funds which have been or are presently used are principally the ERDF, the ESF, the JTF, and the CF. Other EU funds such as Life and Horizon Europe are also mobilised due to their direct focus on supporting climate change mitigation and/or adaptation and environmentally related projects. Based on the analysis of the case studies, it appears that the funding choices, i.e. whether to use cohesion funds, is related to the three following aspects:

- Theme or focus of the initiative
- Type of actors leading and/or involved in the initiative
- Development stage of the initiative

In the Päijät-Häme case, the projects linked to the Climate Action Roadmap focus on the transition from fossil fuels to biomass for heating, leading to reduced emissions. Emphasis is placed on supporting investments in clean tech and on fostering the development of a circular economy. Through the territorial development projects funded, the ERDF support provided contributes to the implementation of the roadmap. The role, involvement and especially financial support provided by the ERDF-ESF managing authority is essential to complement the other sources of funding which allow for the implemen-

tation of the roadmap as well as to palliate the limited capacities of key implementers, i.e. the municipalities. While the Päijät-Häme region has been at the forefront of the fight against climate change for several decades, the introduction of the roadmap and the mobilisation of actors for its implementation is still relatively recent (2019) and the support from cohesion funds is critical.

While different types of initiatives are being undertaken, the cases of Copenhagen (2025 Climate Plan) and Werfenweng (soft mobility initiative) present some similarities. In both instances, the implementation of the initiatives is not dependent on external funding. The focus of the interventions may be relevant to EU cohesion policy support. However, it appears that the long-lasting experience gained in Austria (since the mid-1990s) and the substantial leading role of Denmark's capital have allowed the implementation of mainly self-sustaining climate actions. In the Plovdiv case, EU support remains relatively limitedly used (despite of ERDF funding being allocated to finance a vocational training centre). However, this seems to rather be linked to a visibility and awareness of EU funding and financing opportunities.

Driven by their regional governments, the initiatives undertaken in Wielkopolska Wschodnia (Poland) and in Graciosa (Azores, Portugal), are making use of cohesion funds to progress towards climate neutrality. In Wielkopolska Wschodnia, ERDF support is used to promote investments in photovoltaic panels and wind farms. Also of note, financial instruments are being used, e.g. loans to support local businesses' sustainability transitions (e.g. via the implementation of energy saving measures). The support provided by the JTF, although delayed, is central to the initiative as it is focussed on electromobility investments. In Graciosa, the initiatives in place to promote climate neutrality are similarly aligned with and articulated around the CF and ERDF operational programmes. The CF has notably taken a central part in improving the island's economic trajectory, as the island was previously one of the least developed EU regions. Graciosa's regionally integrated energy policy aims at encouraging the energy transition by providing immediate opportunities while preparing the region to face future challenges. The supported projects focus on developing energy production through renewable resources (geothermic, wind, solar), promoting energy efficiency, and intensifying electric mobility. Importantly, cohesion funds (ERDF and CF) are used to provide incentives for citizens and local businesses to make investments supporting the island's transition towards climate neutrality. This is essential, given the difficulties to access bank financing by the private promoters.

All in all, the cases of Wielkopolska Wschodnia and Graciosa have placed the support provided by the cohesion policy in the centre of their territorial development strategies, thereby highlighting the climate mainstreaming potential of cohesion funds. However, it appears that the other four cases made little to no use of the cohesion funds support.

Cohesion funds have increasingly (throughout this last programming period and for 2021-2027) embedded climate and environmentally related aspects from the programming stage to the selection of supported projects. Moreover, the thematic scope and range of fields of intervention of cohesion funds (as described in section 4.1) cover relevant transformation pathways and strategies which are the core focus of a transition towards climate neutrality. The longstanding existence and impacts of the approaches applied in these four cases in undeniable. As such, considering whether the use of cohesion funds may have further reinforced these impacts is an intricate question. Yet, given the availability and relevance of cohesion policy funding and financing opportunities, it is certainly interesting to investigate reasons which may hamper the use of these funding and financing opportunities.

The administrative burden linked to the application, implementation and reporting requirements of the cohesion funds has been mentioned as a hindering factor, especially for local public bodies with limited capacities such as municipalities. Overall, approaches to make the best use of EU funds differ. The strong of involvement of regional authorities and the continuity of local and regional strategies using EU funds may be two of the most critical factors to ensure that the potential contribution of cohesion funds continues to be harnessed.

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Synthesis of research results

Transformation towards climate neutrality is a challenging and complex process. There are practically no examples of regions that have achieved full climate neutrality and, consequently there are no ready-to-use solutions available that could be easily transferred to other regions. Ways to achieve the goals set by the EU Climate Law and balance GHG emissions and removals, thereby reducing emissions to net zero (Regulation (EU) 2021/1119 Article 2), are still being developed. Most of the operational programmes for the cohesion funds aim at supporting the climate transformation at the regional level. The JTF targets territories carefully delineated in the process of developing the just transition plans, and these plans must consider at least the NUTS 3 level (Regulation (EU) 2021/1056). The functional regions of different sizes represent the territorial level designated for the development and implementation of climate neutrality strategies and measures by regulatory demands as well as by its character (ARL 2018).

The six analysed examples of regions that have achieved, or successfully initiated, the transition of their economy in at least one key sector or area of economy provided a wide range of approaches and solutions representing different starting points, scopes, funding approaches and circumstances for the process of transition.

In Päijät-Häme, the Climate Action Roadmap aims at achieving carbon neutrality by 2030 through tackling GHG emissions including carbon sinks, climate change adaptation, and resilience initiative. It focuses on GHG reductions especially in energy transport, agriculture, and forestry. So far, the Finnish region has achieved a reduction in GHG emissions of 33% GHG from 2007 levels and has increased the share of biomass and solar energy in energy production.

Werfenweng is a small municipality in the Austrian Alps, which started their soft mobility initiatives as early as the 1990s. With the primary objective of attracting tourists and remaining an attractive place to live, Werfenweng managed to influence the share of tourists arriving by train from 6% (end-1990s) to more than 20% (pre-Covid) and has implemented further projects like the installation of municipal biomass heating, saving 400 tons of CO_2 per year. This remote rural community experiences population and job growth.

Copenhagen is known for its ambitious 2025 Climate Plan intending to achieve carbon neutrality by 2025 through implementing sustainable energy consumption and production, tackling mobility and promoting other city administration initiatives. This very broad initiative sets the objectives of having net-zero CO_2 emissions by 2025, significant reductions in heat and electricity consumption and carbon-neutral public transport. So far, a 65% reduction of CO_2 emissions has been achieved since 2010. Furthermore, such initiatives have resulted in the transition of district heating to biomass, increased waste separation and recycling, and additional bike lanes and bridges. Still, transport sector emissions remain the central issue. In the upcoming plan with a time horizon spanning 2035, the city plans to significantly increase the involvement of citizens in activities promoting climate neutrality.

The small Azorean island Graciosa promotes climate neutrality through a renewable energy transition. The objectives in place are that of increasing the share of renewable energy production, increasing the share of electric vehicles, and incentivising the production and storage of renewable energy. While it was possible to achieve a 65% share of renewable energy, the topic of mobility remains an issue to be addressed.

Wielkopolska Wschodnia, after realising the necessity of shifting the economy away from coal mining, decided to focus on renewable energy, as well as different aspects of electromobility and hydrogen

technologies. The already accepted JTP for this region includes the objective of reducing CO_2 emissions in power and heating by 90-95% until 2030 and achieving climate-neutrality by 2040. The hitherto results are operating photovoltaic, and wind, farms. Moreover, the CO_2 emissions of the region's main power producer have fallen by 25-30% over the past 3 years.

The public-private partnership for one of the largest industrial zones in Eastern Europe, the Trakia Economic Zone in Plovdiv, aims at transforming the area into a climate-neutral zone by switching to green energy. Through this transformation, the zone seeks to increase its competitiveness, create attractive working and living environments for employees, and reduce GHG emissions by increasing share of renewables (40% by 2025, 60% by 2030 and 100% by 2040). Being the youngest of the analysed initiatives, the transformation has begun only recently and has thus not yet recorded any results. After setting up these goals, the region is still looking for the appropriate know-how and resources, both financial and human, to bring the transformation initiative forward. It appears that the early identification of the most difficult aspects to overcome in the process of transformation is very relevant. While the process shall continue in other fields, there should be a particular focus and resources allocated to explore possible experimental solutions.

The most noticeable focal topics based on the case studies consider mobility (Copenhagen, Graciosa). In the local and regional dimension, the lifestyle and characteristics of the spatial structures of the built environment influence mobility and consumption patterns. Reducing traffic volumes caused by private car users remains an unsolved issue. The frameworks influencing mobility choices (cost, time, availability) in the national and international context promote rather emissions intensive travelling modes (plane, car). There is a need for a European, or even global, solution to promote sustainable mobility choices.

Each of the analysed examples, and generally EU regions, have some special characteristics. Taking the example of Graciosa Island, which is an outermost region without the possibility of connecting to the European energy grid, it is very clear that there is a need to elaborate a specific solution aimed to overcome this problem.

The various cases also differ with respect to their funding choices. Cohesion fund supports is only prominent in two out of the six cases. While the number of cases is admittedly too limited to draw any conclusions, the extent to which the use of cohesion funds is tapped upon to their full potential can be raised. The territorial level at which the initiatives are being implemented as well as the types of steering actors involved play an important decisive role in the uptake of cohesion funds to support such initiatives. Moreover, the results of the case analyses and review of funds, show that while the funds' potential contribution to climate neutrality is substantial, there are still critical hindering factors which may influence implementers' funding choices. The main issues raised related to the administrative complexity associated with the use of cohesion funds as well as a lack of awareness of available funding and financing options.

All the analysed transformation processes are in different stages of advancement, and none has yet been completed. They represent dynamic process that are to be continuously observed and adapted in evaluation and learning loops. In this context, some **knowledge gaps** that could be further investigated in future studies can already be recognised. While considering the solutions for mobility and consumption patterns, it is crucial not to fall into the adoption of greenwashing strategies to the regional development context, well-known from the commercial strategies of various companies (see de Freitas Netto et al. 2020). There is still no systemic solution for including the links between the regional, European and global dependency chains of emissions and resource use into the climate neutrality discussion. Consequently, there is a need for further investigation in this field. Achieving the net-zero emissions does not end with the accounting of the emissions and resources input covering only the proper territory of a region or country. The production and supply chains are very complex and there

is no established approach to clearly calculate and assign the emissions. Further research in the field investigating consumption-induced emissions could support development of more integrated and holistic strategies towards climate neutrality.

A further area still requiring additional exploration is an investigation into the general possibilities, or emerging best practices, of decoupling regional prosperity from economic growth based on expanding consumption. The exploration of green growth models focused on environmental sustainability and not exceeding natural assets and the continuous availability of resources should be prioritised in the future. Especially high expectations have been directed towards the most developed regions as their potential for implementing innovative investments and the scale of their effects is expected to be high (Tawiah et al. 2021). Furthermore, climate neutrality increases the overall self-sufficiency (resources, energy supply) of a region, reducing its vulnerability and strengthening its resilience, which is crucial for an undisturbed development within the framework of sustainability (Hat and Stöglehner 2019). The new development strategies for climate neutrality give a potential chance to the less developed and more vulnerable regions. In order to strengthen Europe's future, these regions should focus on new development paradigms without exceeding the framework of sustainability. At the same time, the most developed regions of the EU can play a very important role in the development of green growth models for economies, and entire regional systems, by making use of their enhanced capital. Interregional cooperation is required to foster innovation and to contribute to establishing a knowledge-based economy and facilitating the transfer and dissemination of best practices and new solutions (see European Commission 2022).

5.2. Policy recommendations

The main purpose of this study is to provide relevant, feasible and appropriate recommendations at EU level, in particular to EU policy makers. The evidence collected in the previous working steps forms the basis for the formulation of policy recommendations.

First of all, policy recommendations were collected and discussed in the context of the case studies with each interviewee. The lessons learned section of each case study includes the results of this research step (see chapter 3).

On the basis of the synthesis of findings, preliminary recommendations were formulated, which specifically address the current and future possibilities of supporting the EU regions in mastering the transformation towards climate neutrality. These recommendations were then refined and validated through expert workshops.

The following **matrix** (Table 10) displays the recommendations formulated to improve future EU support to the regions on their way towards climate neutrality and at the same time strengthen the cohesion and lower the risk of new disparities among the EU regions (in accordance with: European Commission 2022). The recommendations are ordered along the level of executive power: EU, national, regional/local and their effect. Support or regulation and control are presented on the right side while general and cross-section issues are listed on the left side.

Table 10: Policy recommendations by type and addressee

General recommendations for all territorial levels		SUPPORT (e.g. funding)	REGULATION & CONTROL
• Boost and force the cooperation between the regional/local and national level • Let applied science projects be developed to foster the transition. Organise living labs to develop and try out technologies and solutions.	EU	• The timeline for programme development, planning and negotiations shall be ordered along to increase feasibility of implementation. • The political priorities shall be presented clearly and precisely. • There should be a greater focus on how the interregional exchange of practices is being conducted, on setting good rules and then on money and funding. • Proliferation of funds shall be avoided. • Avoid conflicting incentives from different EU funding streams and policies. Streamline and orient the funding towards unified goals.	• Increase the competence of the EU in the field of transformation towards climate neutrality in terms of standards and norms, e.g. emission ceilings or technical standards for machinery and vehicles; differentiated by the local/regional conditions. • Execute Climate Law. • Consider further sectoral regulations, including taxonomy regulation, e.g. introducing stricter definition and demarcation of climate neutrality. • The framework of the ETS shall be further developed e.g. by gradually enlarging groups of market participants. To do so it is necessary to investigate and assess the costs and benefits that would result from an expansion of the ETS.
• Take the fear of unknown transition process by supporting more and more showcases. • Provide inception financial input ("seed money") to set up climate plans • Advanced cities could tutor and support less advanced transitioning cities	EU	• Funding opportunities should be presented as simply as possible (e.g. on a common EU or national website). It should be possible to seek and find various funding opportunities in an easy manner. • A guidance for spending the EU provided resources is needed to increase effectiveness of spending, and effective monitoring of effects. • EU shall support citizen driven initiatives/projects/solutions (e.g. showcasing behaviour change). • Create opportunities for direct EU support to the proactive regions implementing strategies to achieve climate neutrality.	• Avoid limiting the transformation process by the funding period or semester. Foster continuity of management on the regional and local level. Prevent the interruptions by supporting documentation and transfer of knowledge within the region.

General recommendations for all territorial levels		SUPPORT (e.g. funding)	REGULATION & CONTROL
• Limit political influence on the approval and success of the climate neutrality initiatives. • Further engage with climate neutrality initiatives' implementors	NATIONAL	• Create advisory board/clearing house for the transition. • In countries with weak regional governance, the central government should empower the regional level to move forward on the way towards climate neutrality. • A review of existing climate neutrality initiatives and the role cohesion funds may play could help provide implementers with a clear idea of the available types of funding as well as of the added value that cohesion funds support may bring.	• Introduce sectoral regulations for achieving climate neutrality targets. Set legally binding thresholds for emissions/technical standards, that are in line with the climate neutrality goals. The same applies to the public spending rules/public procurement (do no harm) • Determinate CO_2 pricing according to the climate neutrality objectives.
	REGIONAL/LOCAL	• Dedicate jobs for management of transformation and its implementation process. Not additional administrative personal, but increase the presence of real experts in the field. • Facilitate exchange platforms for bridging sectors and actors, and ensure a greater visibility of relevant funding and financing opportunities • As the communication of potential regional benefits is a key success factor for a transition process, prioritise it and spend resources and time for it. • Make the regional know-how visible and approachable (small regions): specialists in the fields of transition shall be encouraged to register on a dedicated homepage	• Establish a responsible person (e.g. regional manager), who is dedicated to bringing people and initiatives together, sharing information, etc. Provide the necessary means, giving a long-term development perspective. • At the same time avoid an overload of actors on the regional level or steer it to make the most out of the transformation towards climate neutrality. • Group and connect responsible persons. • Reserve resources for management and implementation of transition.

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ANNEX: INTERVIEW GUIDE FOR CASE STUDIES

a) Details on the specific initiative(s)

- Why did your region/city/island start the **transformation towards climate neutrality,** and what are the **concrete activities** that are being implemented?
- **When** was the regional transformation towards climate-neutrality and the respective initiative(s) started, and **by whom?**
- What are the **main objectives** of the initiative(s)?
- Are there concrete and **quantified targets?** Which ones?
- Which administration(s) or organisation(s) are now **in charge** of the implementation?
- What is your (= interviewee's) **role** in the initiative?
- **Who else** is involved in the implementation?

b) Impacts, side-effects and obstacles

- What are the **concrete results and impacts** your climate initiative(s) have achieved so far?
- Would you say that your initiative(s) have (so far) **achieved its/their goals?**
  - If not, why not?
- Were there any **unintended side-effects,** both positive and negative?
  - If yes, which ones?
  - How were the negative side-effects addressed or solved?
- What were the **most important obstacles** you encountered in your region's transformation towards climate-neutrality, and how were they resolved?

c) Improvements & outlook

- Do you **monitor and evaluate** the progress and success of your climate initiative(s)?
  - If yes, how?
- Are the monitoring/evaluation results used to **adapt and improve** the initiative(s)?
  - If yes, how?
- What would need to change to make your region's transformation towards climate-neutrality **even more successful?**
- How will your regional transformation processes **continue after** the current initiative(s) have ended?
  - Which changes or improvements are planned to the initiative(s) in the future?

d) Funding (especially from EU-level)

- How are your region's initiatives towards climate neutrality **funded?**
- What are your **experiences – both positive and negative –** with the funding itself and the funding authorities?
- Would your region's initiative(s) **exist without** external funding?
- Do you have **recommendations** for improving especially the EU-level funds to better support regions in the transformation towards climate neutrality?

e) Horizontal governance

- How easy or difficult is it to **align** your climate neutrality initiatives and targets **with other socio-economic objectives?**

- How do you ensure that other projects or initiatives **do not negatively affect or even undo** your region's transformation towards climate neutrality?
- How do you ensure a **good coordination** between the different climate neutrality-related initiatives and the administrations and organisations in charge of them?

f) Vertical (multi-level) governance

- On a scale from 1 to 10, how would you **rate your region's autonomy** to act on transformation towards climate neutrality? 1 would mean "all decisions are taken at a higher level", and 10 would mean "we can decide everything on our own".
- Which competences are **lacking,** and at which level are these located?
- Is there anything the EU – for example the European Commission, the European Parliament or the Committee of the Regions – could do to **better empower regions** for moving towards climate neutrality?

g) Key takeaways: lessons learned & recommendations

- What are the **three most important factors** on which the **success** of your climate initiative(s) depends on?
- What are your **main recommendations** for other regions who want to set up and implement similar initiatives on climate neutrality?
- Which **recommendations do you have for EU policy makers** to better support regions in the transformation towards climate neutrality?
- We have reached the end of our interview. Is there **anything important** about your region's transformation towards climate neutrality **that we haven't talked about?**

This study provides information on requirements and goals for successful transformation towards a climate neutral future at regional level in the EU. Based on the analysis of six regional best practice examples across the EU, the key drivers, conditions and instruments for a successful transformation were identified. The project results in the formulation of specified policy recommendations for EU decision-makers in the field of supporting the EU regions in achieving the goals of climate neutrality.

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