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Individual Climate Action, United For Combating Climate Change

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Abstract

In the current global climate crisis, understanding the impact of individual behaviour on climate goals is crucial. However, the complex interplay of individual actions, policy frameworks, and international commitments presents a challenge. This study examines the essential role of individual behavioural adjustments in climate change mitigation, particularly for Austria's climate targets. Focusing on Austria's potential failure to meet its climate goals, this research explores the feasibility of improving its trajectory through individual behaviour changes. It considers areas such as electricity consumption, dietary preferences, transportation habits, and carbon offset initiatives. Through a systematic methodology involving literature synthesis and quantitative analysis, the study dissects prevailing individual actions, identifies behavioural drivers, and unveils alternative strategies within legal frameworks. Results show substantial potential for emissions reduction through individual behaviour changes. The sector of electricity consumption has a reduction potential of 11%, dietary choices of min. 25% and max. 52%, transportation patterns hold the reduction potential of 15.4% and additional consumption of min. 25% and max. 43%. In summary these sectoral changes result in an emission reduction potential ranging from 20% - 32% per person in Austria. However, addressing emissions across diverse contexts and socio-economic levels requires tailored strategies and carbon offset mechanisms. The study underscores the pivotal role of individual behaviour in achieving climate ambitions, highlighting the importance of robust policy frameworks, international cooperation, and sector-wide engagement. While individual actions significantly impact emissions reduction, their full potential is realized when integrated into holistic approaches spanning sectors and societal tiers. This research sheds light on the transformative potential of individual choices, offering insights into a balanced interplay between personal and collective efforts in combating climate change.

Abbreviations

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1. Introduction

1.1 Problem Statement

Climate change is currently one of the most pressing global issues. It has difficult-to-estimate long-term effects that may be severe. Recent scientific findings indicate that the average global temperature has risen by over 1°C since before industrialization and is continuing to rise (Lindsey and Dahlman 2023). The Paris Agreement of 2015 aims to limit global temperature rise to below 2°C above pre-industrial levels and 1.5°C, primarily due to human activities and greenhouse gas emissions. (United Nations 2015a; Curell, McPartlin, and Steinmetz 2018). The United Nations Framework Convention on Climate Change (UNFCCC) has mandated that all nations achieve net-zero GHG emissions by 2050. In order to attain this objective, the European Union has enacted a number of laws and policies, like the European Green Deal, to reduce emissions and promote the use of renewable energy sources (Eurostat 2021) (United Nations 1992) (European Commission 2019).

The EU also acknowledges that human behaviour has a significant role in reducing the consequences of climate change. By changing their everyday routines and choices, individuals can greatly influence the CO_2 output and thereby significantly reduce the carbon footprint of the country they are living in (Dubash 2020). Although the European Green Deal was instituted to reduce emissions, it is primarily up to individuals to modify their lifestyles to reduce their carbon footprint (Frascati 2020).

Therefore, the main issue of this study is: Can individual behavioural change help us accomplish our climate goals? This analysis will assess whether individual behavioural adjustments have the capacity to materially advance the climate targets established by the UNFCCC and the European Union (EU). It will examine present and anticipated legal standards, the regulatory environment, human behaviour, and the possibility of individual behavioural change by analysing climate legislation on three different levels: International, Europe-wide, and national. Additionally, this thesis will consider the influence of framework circumstances, as well as technical and economic conditions on individual behaviour.

1.2 Climate Policy in the EU and Austria

In a global perspective, current climate mitigation plans fall well short of the 1.5°C objective set out in the Paris Agreement. According to the first round of Nationally Determined Contributions (NDCs) made under the Paris Agreement as well as current government energy plans and objectives, the policies in place will only stabilize world emissions, with a minor decline as 2050 draws near. The average annual growth in energy-related CO_2 emissions from 2014 to 2019 was 1.3% despite abundant evidence of human-caused climate change, universal backing for the Paris Agreement thus remains lacking (International Renewable Energy Agency IRENA 2021). To comply with the Paris Agreement, the current action plans are insufficient. The average global temperature increase is likely to reach +2.8°C this century (United Nations 2015b). The quality of life would suffer significantly in this scenario.

Just as everywhere else in the world, the effects of climate change are also becoming more palpable in Austria. Extreme weather events have become more frequent in recent years. A tragic record was set in 2018, the warmest year measured in Austria to date, with 766 heat-related fatalities compared to 400 fatalities from motor vehicle accidents. While the loss of life, human or animal, is a tragic and highly visible effect of climate change, its effects can be more subtle, but highly detrimental still. Climate damages and adaptation to prevent further damage both cause significant cost. Currently, Austria spends an average of 1 billion Euros per annum on adaptation expenses and 2 billion Euros per annum on damage costs (Steininger et al. 2022a).

A swift reduction in emissions must start right away to maintain a realistic possibility of keeping global warming at or below +1.5°C. The technology and resources required to quicken the energy transition are already in place (International Renewable Energy Agency IRENA 2021). To maximise the use of renewable energy sources and reduce emissions rapidly, Austria is also investing in financial assistance and initiatives aimed at advancing green technologies. This transition is critical as the effects of climate change are not only visible in the loss of human and animal lives but also in more subtle yet highly detrimental damages that have significant financial costs. Austria has acknowledged the significance of this shift and taken action to combat climate change. The nation has enacted a National Energy and Climate Plan (NECP) with the objective of decarbonizing the energy sector entirely by 2050. Moreover, Austria has pushed the deadline for achieving carbon neutrality to 2040, showing its commitment to addressing the climate crisis domestically. The legally binding environmental and energy legislation of the European Union for 2030 compels Member States, such as Austria, to adopt their NECPs. The evaluation of Austria's NECP was released by the European Commission in October 2020. This demonstrates the commitment of the Austrian government and its national energy and climate plan to align with the EU's climate goals. The final NECP for Austria started in December 2019 (European Parliament 2021). On December 27, 2019, Austria notified the Commission of its long-term plan. Austria has pushed the deadline for achieving carbon neutrality, which was originally scheduled for "2050 at the latest," up to 2040. Domestically, Austria is aiming to meet this objective. Austria's objective for 2050, as stated in the National Energy and Climate Plan (NECP), is to thoroughly decarbonize the energy sector. It also mentions additional concerns regarding its long-term decarbonization plan. With current policies, the NECP contains the estimate that emissions in sectors that share effort will decrease by 16%, exceeding the 2030 target among these sectors by 20% (European Commission 2020b). However, Austria is most likely to miss not only its 2030 objectives but also achieving climate neutrality by 2050. Austria's carbon footprint will still be approximately 55 million tons by the middle of the century, which is substantially above zero and only 30% below 1990 levels. By implementing the plan's recommendations, this difference would shrink to 9 % points, or 5.2 Mt CO_2eq, by 2030 (Pramer 2023).

The NECP generally assumes that the 5.2 Mt CO_2eq gap until 2030 may be covered by an offset of 2 Mega tons (Mt) CO_2eq caused by the gradual elimination of fossil fuels subsidies along with other effective enticements, and by an additional decrease of 3.2 Mt CO_2eq by means of a broadening of the Emission trading scheme (ETS) to additional fields as well as a tax reform. In accordance with the Effort Sharing Regulation, the NECP establishes a goal for the year 2030 for non-ETS greenhouse gas emission cuts of 36% from 2005 levels. The plan does recognize that even in the "with additional measures" scenario, the reduction in GHG emissions would only be 9% points lower (27% rather than 36%), and it includes further efforts to close the remaining gap (Longo 2013). These potential further actions include expanding emissions trading to other industries or "decarbonizing" the tax system (European Commission 2020b).

Since 2005, Austria's greenhouse gas (GHG) emissions have declined at a slower rate than the EU average. Austria produces 2.2% of the EU's total GHG emissions. The nation's carbon footprint is bigger than the average for the European Union but is declining at the same rate. Austria had GHG emissions per resident of 9.4 tonnes of CO_2

equivalent (tCO_2e) in 2019, which was higher than the EU average of 8.4 tonnes. Average emissions per Austrian inhabitant declined by 18% between 2005 and 2019, compared to a 21% decline for all of Europe. Until 2018 Austria followed the European pattern of decline, but 2019 saw a divergence with a rise (European Parliament 2021).

The EU has committed to reducing greenhouse gas emissions by 55% by 2030. To achieve the climate objectives, however, considerably higher reduction targets would be required beyond 2030. The net zero emissions objective would require a 58% reduction in emissions by 2030. Emissions need to be lowered by 75–80% by 2030 to increase chances that temperatures won't climb by more than 1.5°C (Steininger et al. 2022a).

Every two years by the 15th of March, all member states are required under the EU Governance Regulation to submit a report to the European Commission that includes scenarios broken down by greenhouse gas evolution up to 2030. Then, despite the continuance of the prior climate protection measures, greenhouse gas emissions would reach 42 million tons of carbon dioxide equivalents, which would be 12 million more than anticipated. Austria would thus obviously miss the EU climate objectives for 2030. However, the predicted scenario only shows existing climate protection measures and ignores "additional measures," which are planned and rather ambitious actions (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie 2023b). Most climate policy designs focus on government regulations or business actions. Individual action is seen as aggregate consumer behaviour, which, through demand pressure, would change corporate climate policies. At the same time, companies and pressure groups alike stress the importance of individual ownership regarding climate change mitigation. Whether it is recycling, abstaining from air travel, a plant-based diet or installing solar panels – it seemingly all boils down to individual choice. More often than not, big corporations guilt-trip consumers into thinking they are the ones responsible for pollution and the over-emission of GHGs. However, non-governmental organizations (NGOs) and pressure groups like Greenpeace or Fridays for Future seem to buy into the same trope, as illustrated by Greta Thunberg sailing to the United States of America (USA), rather than travelling by airplane. While the author would like to leave it to philosophers to deconstruct the underlying narrative to expose its fundamental flaw, a practical examination seems in order. While it is quite clear, that aggregate individual action on its own does not even stand a chance at effectively combatting global warming, it is justified how much of a difference, if any, it could make. That is what this thesis is examining.

1.3 Research question

In the light of the present climate crisis and the fact that Austria's climate policies are failing, the question arises if individual behaviour could at least potentially and theoretically compensate the inaction of both government and the private sector. As a result, the following research question has been formulated:

R_1: Is it possible to improve Austria's climate balance for 2030/ 2050 through individual behavioural change?

H_0 No, it is not possible to improve Austria's climate balance through individual behavioural change.

H_1: Yes, it is possible to improve Austria's climate balance through individual behavioural change.

2 Methodology

This thesis examines the potential for climate-relevant behavioural changes in unregulated domains and assesses their impact on attaining the 2030 and 2050 climate objectives established by the United Nations Framework Convention on Climate Change (UNFCCC) and the European Union (EU). To answer the research question, first, it is necessary to determine the current scope for individual action, and how this will change in the future. Second, data is required on how individuals currently behave, and why. Third, alternative behavioural options need to be identified and evaluated. In other words, to answer the research question, we need to establish how Austrians currently act, and what can they change.

Both a comprehensive *literature review* and a quantitative analysis are employed. The literature review entails accumulating and analysing existing scientific findings, research papers, reports, and other pertinent sources to acquire information on the potential for climate-related behavioural changes in unregulated areas. Examining various sources, such as scientific articles, reports from government and non-government organisations, and published materials, identifies extant approaches, models, and methodologies for behavioural change in the context of climate change.

The *quantitative analysis* collects, analyses, and interprets data using statistical and numerical methods. The goal is to collect quantitative data on the potential for climate-relevant behavioural changes in unregulated domains and assess their impact on the probability of attaining climate targets. This analysis utilises information from surveys, questionnaires, experiments, models, or other suitable sources. Quantitative analysis employs statistical indicators, mathematical models, simulations, and other applicable analytical instruments.

Analysing the legal framework will determine the scope for individual action. Some types of climate-relevant behaviour are already prohibited or will be prohibited in the future, while others are or will be incentivised. For example, Commission Regulation (EU) 2015/1185 regulates the type of wood stoves EU citizens can legally acquire and use, based on their energy efficiency and CO_2 emissions. The change in individual behaviour forced by this type of norm must be attributed to the state and is consequently the direct opposite of individual action. Therefore, this paper will outline the legal norms already in force, as well as those that have been adopted and will enter into force in the future. This will determine the unregulated domains within which free choice is possible. Due to the complexity of legislative processes and the nature of the examined subject, this paper will abstain from speculation. Consequently, this thesis contains a review of extant national and EU laws and norms, as well as those ratified under the UNFCCC, its protocols and amendments, but not those currently being planned or negotiated. Other international treaties are explicitly not considered. The analysis includes an evaluation of changes in behaviour in the unregulated domain, considering both current and future standards. Since the aim of this paper is not an exhaustive analysis of the legal situation, but to determine the efficacy of individual climate action, this heuristic approach is sufficient.

To evaluate *current individual behaviour* and its associated emissions in Austria, pertinent data sources, such as official statistics, surveys, and research reports, are utilised. Consumption-based accounting is used to determine the CO_2 emissions linked to household consumption patterns in Austria. With this approach, the responsibility for the CO_2 emissions is allocated to the end consumers of products and services, regardless of where these emissions originate. For instance, if a German car is used by a household in Austria, the CO_2 emissions resulting from its production, including those in its components, are assigned to the Austrian household. This method differs from the mainstream approach used to determine National Emission Inventories (NEI) under the UNFCCC, which focuses on quantifying average emissions related to production (territorial or domestic emissions). The primary benefit of consumption-based carbon accounting for the present thesis is that it provides consistency between consumption and environmental impacts and increases mitigation possibilities. Nevertheless, consumption-based emission inventories are further removed from the statistical sources and hence have more uncertainty, meaning that considerable detail is lost (Peters 2008). In the absence of a method to distinctly allocate CO_2 emissions between production and consumption and considering the lack of consensus on differentiating emissions solely influenced by individual actions from those beyond individual control, the safest approach for modelling is to allocate all CO_2 emissions to the end consumer. This method ensures, therefore, the most comprehensive representation of the overall carbon footprint and its impact on individuals' choices and actions.

To estimate the distribution of individual emissions among Austria's income categories, various emission profiles, such as those of minimum, average, and maximum emitters, are considered. These profiles serve as the basis for the *analysis of the potential scenarios*. Based on prevalent individual behaviour and varying proportions of minimum emitters, various scenarios are constructed. These scenarios are used to evaluate the probability of climate-relevant behaviour changes in the unregulated domain, presuming that other variables, such as technological advancements, cost structures, and contextual conditions, remain constant (ceteris paribus condition). Utilising insights from related disciplines such as psychology, economics, and motivation research, the probability of various climate-related scenarios is assessed.

Alternative options for individual behaviour will mostly be derived from current literature on this topic, again leveraging insights from related disciplines. These options will be described, analysed, and discussed. Individual behavioural options are analysed and evaluated with the status of 2023. Likewise, the cost structure of 2023 is assumed as the basis for decision-making. Innovation and changing framework conditions are not considered, because it is not necessary for answering the initial question.

It is very likely that the overall economic situation in Europe, the demographic situation, prosperity, individual access to new technologies and climatic conditions will have changed in a significant way by 2030 and especially by 2050. The changed framework conditions can increase or decrease the scope for individual behavioural changes, whereby an increase is more likely (Luczak 2020). Therefore, the technological status of 2023 and a ceteris paribus approach is target-oriented, as this is the minimum scenario. If reaching the climate targets can be facilitated through individual behavioural change under 2023 conditions, its positive effect will be reinforced by improved circumstances.

In conclusion, this study employs a systematic methodology, incorporating literature review and quantitative analysis, to collect information, acquire quantifiable data, and assess the impact of climate-relevant behavioural changes on climate targets.

3 Literature Review

This chapter will first clearly describe the basic problem humanity is faced with today. It will therefore provide an overview of climate change and its causes. It will then discuss human responsibility for climate change and describe the potentially catastrophic consequences the phenomenon can have on all lives on the planet, including devastating humanitarian situations. After having established a clear understanding of the challenge and why it needs solving, this chapter will present current approaches to combat climate change and its consequences, starting with general strategy and then delving into specific tactics geared towards individual behaviour, their strengths, and weaknesses. Finally, this chapter will review the existing literature on individual climate action. After reading this chapter the reader should have a clear understanding of the current state of research, the problem (that is climate change) and possible solutions.

3.1 The Greenhouse Effect and Climate Change

The Greenhouse Effect is responsible for global warming and, by extension, climate change. It was first discovered by the Irish physicist John Tyndall. In 1859 he conducted experiments examining the heat absorption of gases. His experiments demonstrated that particular gases, such as carbon dioxide and water vapour, have the ability to absorb and radiate heat. Tyndall thus lay the foundation for understanding the Greenhouse Effect (Jackson 2019).

It is the combination of solar radiation and highly absorbing gases that constitutes the Greenhouse Effect. Some of the solar radiation that reaches Earth is absorbed by its surface, while the remainder is reflected into space. The warm surface consequently emits energy in the form of infrared radiation. A portion of this radiation is trapped by gases in the atmosphere, preventing it from escaping into space. As a result, the energy is diverted back towards the surface of the Earth, which results in an increase in global temperatures (Marshall and Bean 2023). The gases responsible for this effect are referred to as *greenhouse gases* (GHG). The most significant greenhouse gases include Carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), ozone (O3) and fluorinated gases (Kun et al. 2016) (National Geographic 2023).

To calculate the Greenhouse Effect, it is necessary to estimate the difference between the thermal radiation that the Earth emits and the thermal radiation it absorbs. This differential is known as radiative forcing. It measures the extra energy that greenhouse gases trap, contributing to global warming. Several variables, including the concentration of greenhouse gases, their radiative characteristics, and atmospheric conditions, must be considered when calculating radiative forcing.

The fact that the greenhouse effect itself is a natural phenomenon still causes confusion and mistrust among portions of the wider public. A frequently used argument is that GHG concentrations as well as global average temperatures have always fluctuated. So how can we be sure that humans are responsible for global warming and climate change? Until about ten years ago this argument was actively pushed by fossil fuels lobbies. Today corporate communication strategies focus more on emphasising adaptation rather than mitigation (Luczak 2020). Nevertheless, some confusion remains. Therefore, we must distinguish between the *natural* and the *anthropogenic* greenhouse effect. The source of greenhouse gas emissions is the main distinction between the anthropogenic and natural greenhouse effects. The natural greenhouse effect is caused by natural processes and cycles, whereas the anthropogenic greenhouse effect is caused by human activities that significantly increase the atmospheric concentration of greenhouse gases, such as burning fossil fuels, deforestation, and industrial activities. These actions considerably increase the atmosphere's exposure to greenhouse gases, which capture heat and contribute to global warming.

It is imperative to keep in mind that the greenhouse effect per se is not only unproblematic, but in fact vital to life on Earth. The natural greenhouse effect has existed throughout Earth's history and it is crucial for preserving a habitable environment. It is brought on by atmospheric greenhouse gases that are produced naturally, namely water vapour, carbon dioxide, and methane (Favry 2021). Natural phenomena like the greenhouse effect are essential for keeping the planet's average temperature at 14°C. Without the greenhouse effect, global average temperature might fall as low as -18°C. But when human activity upsets the equilibrium by raising the concentration of greenhouse gases, it raises concerns about accelerated global warming and related climate change (NASA 2023b).

Theoretically and empirically, it is possible to demonstrate that human activity does indeed cause an increased Greenhouse Effect, and thus global warming. The first conclusive theoretical proof of the anthropogenic Greenhouse Effect was already developed in 1896 by the Nobel laureate Svante Arrhenius.

> *"In developing a theory to explain the ice ages, Arrhenius (...) was the first to use basic principles of physical chemistry to calculate estimates of the*

extent to which increases in atmospheric CO_2 will increase Earth's surface temperature through the greenhouse effect. These calculations led him to conclude that human-caused CO_2 emissions, from fossil-fuel burning and other combustion processes, are large enough to cause global warming. This conclusion has been extensively tested, winning a place at the core of modern climate science." (Baum 2016)

Empirically, the amount of GHG in the Earth's atmosphere can be measured as far back as 800,000 years, using ice-cores from the poles. As shown in the graph below, the comparison of ice core samples and more recent direct measurements provides *proof* that carbon dioxide in the atmosphere has risen significantly since the beginning of the Industrial Revolution (Lüthi et al. 2008) .

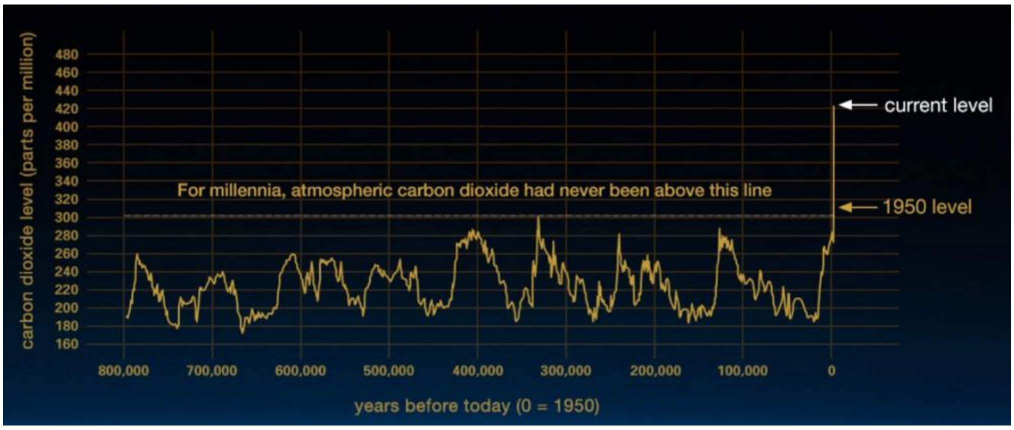

Figure 1 Based on the comparison of atmospheric data from cores of ice and more modern precise metrics, this graph shows that atmospheric CO_2 has increased as a result of the Industrial Revolution (Lüthi et al. 2008) .

This can be explained by and attributed to human activity, particularly the combustion of petroleum and coal and deforestation, which have contributed to the intensification of the greenhouse effect and global warming (National Geographic 2023). To sum up: Global warming and thus climate change at the fast rate we see today is caused by greenhouse gases emitted by human activity.

3.1.1 Consequences of climate change

Some climate sceptics argue that even though climate change is real and caused by human behaviour, it does not logically follow that it must be stopped. While the argument that humans did not cause climate change is becoming less and less prevalent, there is still strong support for the opinion that the benefits of increased global average temperatures might outweigh the costs. This is not a fringe belief. Even Nordhaus argued that global warming as high as 3°C might be "optimal" in the economic sense (Nordhaus

2018). To facilitate an informed debate, this section will provide an overview of the current knowledge about the consequences of climate change.

As greenhouse gas concentrations rise, more heat is trapped in the atmosphere due to an amplified greenhouse effect. The result is global warming, which in turn causes climate change. Some of the most significant consequences of global warming include rising sea levels, greater frequency and severity of severe weather events, impacts on biodiversity and ecosystems, shifts in output from agriculture, and potential health issues (Umweltbundesamt 2022). The higher global average temperatures rise, the more dire the consequences. That is why the authors of the Paris Climate pact relied on advanced scientific knowledge to alert world leaders about the potential repercussions of exceeding a 1.5° C temperature increase when the pact was signed in 2015. These conclusions have been further supported by subsequent studies.

The effects of climate change on the world's *oceans, marine life, and environment* are significant. At a temperature increase of 1.5 degrees Celsius, sea levels could rise by 48 centimetres. Two degrees of warming would already result in a 56-centimetre rise in sea levels, but the precise amount is unknown due to feedback loops and the accelerated melting of global ice. At 3 degrees, hundreds of millions of people currently living in coastal communities would be displaced, causing a mass exodus. The risk of severe weather events, such as heat waves, is increased by climate change, with an increase of 1.5 degrees causing 19 additional days of severe heat per year. Increasing ocean temperatures imperil coral reefs, vegetation, animals, and the income and food sources of coastal communities (McCarthy 2021).

Climate change has *changed precipitation patterns*, resulting in unparalleled floods and droughts, which are threatening agriculture, displacing populations, and creating economic instability. At 1.5 degrees of global warming, 17% of land is exposed to excessive rainfall, while 2 degrees would expose 36% of land and boost average precipitation by 4%. Due to increasing temperatures and habitat devastation, species are becoming extinct; habitat loss for all species has doubled or tripled. If the planet warms by more than 4.5 degrees, most surface areas will become uninhabitable.

In addition to the damage to our planet, climate change will cause a huge increase in *human suffering* and thus cause a damage of billions of Euros to the global economy. Climate change makes it difficult to cultivate speciality crops such as coffee, grapes and chocolate, as well as staple crops such as wheat and maize, resulting in a global increase in starvation. By 2100, wheat and maize crop yields will decrease, while rice and soy production will increase, causing dietary changes. Mass migration caused by climate change will destabilize governments, exacerbate inequality, and cause economic damage. Public health risks include heat waves, waterborne diseases, and air pollution. As mosquitoes expand, malaria becomes more prevalent (McSweeney and Pearce 2018).

To sum up, the consequences of a rise in global average temperatures of more than 2 degrees Celsius are likely to be catastrophic for mankind and all ecosystems on the planet (United Nations 2015a). It is therefore imperative to prevent as many of the negative consequences as possible, not only out of humanism, but also, because the cost of 'untreated' climate change will most likely outweigh any potential benefits, on a global scale.

3.2 Combating Climate Change

3.2.1 Grand strategy of Mitigation and Adaptation

We can compare climate change to an illness. To improve the overall health of the patient, it is certainly necessary to treat and ideally remove the causes of the illness. At the same time, it may be necessary to treat the symptoms, in order to prevent them from destroying the entire organism and thus any chance of restoring the patient's health. In the struggle against climate change, these two approaches are called mitigation and adaptation. *Mitigation* concentrates on limiting temperature rise by reducing greenhouse gas emissions. It involves transitioning to renewable energy sources, promoting energy-efficient technologies, improving buildings and industries, and promoting sustainable land use and aims to prevent or mitigate long-term climate system changes (Cieschinger 2021). *Adaptation* involves measures to reduce the *impact* of climate change on societies, communities, and ecosystems. It involves developing drought-tolerant agricultural commodities, promoting climate-resilient infrastructure, and adapting communities to rising sea levels. Adaptation aims to *curb the negative effects* of climate change and enhance society's capacity to adapt to changing conditions (Cieschinger 2020).

Mitigation and adaptation are not separate concepts. They are intricately intertwined and necessitate an integrated approach to finding effective climate change solutions. Both mitigation and adaptation are essential components of an all-encompassing climate policy. They are complementary and should be implemented concurrently to effectively combat climate change. Together, they aid in mitigating the effects of climate change and bolstering the adaptability of societies and ecosystems. By incorporating steps that decrease greenhouse gas emissions (mitigation) and by adapting to the consequences of global warming (adaptation), it is possible to increase the likelihood of mitigating climate change's negative effects and creating a more sustainable future (NASA 2023a).

The Intergovernmental Panel on Climate Change (IPCC) report from 2022 mentions several *basic* climate change mitigation *strategies*. The most important measure is *reducing GHG emissions*. This can be achieved by switching to renewable energy, improving energy efficiency, supporting sustainable transportation, avoiding deforestation, and encouraging sustainable agriculture. The promotion of renewable energy is essential. Improved use of solar, wind, hydropower, and geothermal energy can reduce greenhouse gas emissions and reliance on fossil fuels (Pörtner and Roberts 2022).

Increasing energy efficiency is a second essential strategy. By using energy more efficiently in industry, structures, and transportation, it is possible to reduce energy consumption and CO_2 emissions. Improved insulation, energy-efficient equipment and vehicles, and intelligent infrastructures all play a significant role in this regard.

Considering the already-observed effects of climate change, it is also crucial to adapt to altering climate conditions and to increase resilience. This can be accomplished through the development of adaptation strategies in areas including agriculture, water management, coastal protection, and urban planning. The reforestation of deforested areas and the preservation of extant forests are also crucial means of combating climate change. Forests absorb CO_2 and act as carbon sinks; therefore, their preservation and restoration are essential. Encouraging technological innovation is crucial. Investing in the research and development of new technologies can accelerate the transition to a low-carbon economy and facilitate the discovery of innovative solutions to reduce greenhouse gas emissions. Examples include developments in the fields of renewable energy, battery storage, hydrogen technology, and Carbon Capture and Storage (CCS). The investment option presents a significant opportunity for the wealthier segment of society to participate in reducing emissions, particularly when their lifestyle hinders them from adopting the same sustainable changes as the broader population.

Finally, robust national and international political leadership is required to effectively combat climate change. This includes the introduction and implementation of climate-friendly laws, regulations, and incentives, as well as international cooperation to implement global climate agreements. Domestic greenhouse gas emissions, the promotion of renewable energies, energy efficiency, adaptation and resiliency, reforestation and forest conservation, technological innovations, policy, and international cooperation are all important factors in addressing the issue of climate change (Deutsche Welle 2022).

As mentioned earlier, the main goal of adaptation is to curb the negative effects of climate change and enhance society's capacity to adapt to changing conditions. At the heart of this societal effort is the individual, who must be empowered to modify their behaviour effectively, enabling them to navigate the challenges posed by climate change. Moreover, this empowerment serves to not only facilitate personal adaptation to new circumstances but also to foster the understanding that individuals wield significant influence in diminishing the collective CO_2 footprint. This means that establishing the aforementioned GHG reduction options as the status quo and making them affordable is crucial to facilitate individual climate action.

3.2.2 Policy Designs addressing individual behaviour

This section examines measures that can influence individual behaviour and their effectiveness, efficacy, and efficiency, in the pursuit of it. It will first discuss normative approaches, using laws or regulations. It will then talk about non-normative approaches, focused on nudging or changing the incentive structure through direct or indirect carbon pricing.

One possible approach to influence actors is using norms. *Climate laws* already in place have shown to be quite effective at cutting carbon emissions. Between 1999 and 2016, these regulations have reduced carbon emissions globally by a total of about 37.7 Giga tons (Gt)CO_2, or nearly one year's worth of emissions. Nevertheless, different regions have different levels of success with climate laws. There are multiple reasons why the success of climate laws varies between countries and regions: One important factor is the concentration and early adoption of climate laws in particular regions, which has led to better success in lowering emissions and combating climate change (Sindico and Mbengue 2021). For example, the Organisation for Economic Cooperation and Development (OECD) and the European Union (EU), two early adopters, have both made major contributions to the decrease of global emissions. The EU and OECD nations are accountable for over two-thirds of the global carbon reductions, according to a study done in 2020 by Shaikh M. Eskander, Sam Fankhauser, and Joana Setzer. Nevertheless, early adoption and concentration are not the only factors affecting how well climate laws work in various locations. The success of climate laws is also influenced by political will, policy design, technological capacity, and public awareness. The results of climate policy also depend on socioeconomic factors and regional variables. Therefore, it is critical to take these elements into account when evaluating the effectiveness of climate legislation globally (Eskander, Fankhauser, and Setzer 2020).

Executive directives typically have a far smaller influence than climate laws. Laws are more likely to produce long-lasting changes in incentives and are less likely to be overturned, which results in greater emission reductions. Even if exact information on the precise percentage reductions attributable to each new climate law introduced could not yet be established through empirical research, climate laws are undoubtedly essential for addressing GHG emissions and fostering sustainable practices. Enforceable and stable norms help the world's efforts to slow down global warming and progress towards a more sustainable future (Dubash 2020).

While institutional norms mostly operate within a framework of crime and punishment, or at least infringement and consequence, other approaches to influencing individual climate action focus on *nudging* or *incentives*. One of these techniques is *green finance*, that is: channelling money towards projects that reduce GHG emissions, increase energy efficiency, create renewable energy sources, or adopt sustainable practices. A study by Wang, Cai, and Elahi found that green financing and environmental regulations work best when combined. Green financing tools act as equity or practical measures, providing practical and efficient solutions to environmental problems. They tend to flow towards businesses needing technical advancement and clean projects, reducing GHG emissions intensity. However, green funding alone is not enough to effectively reduce global GHG emissions. Micro-entities sometimes skip policy dividends of green finance for high-polluting investments, highlighting the importance of environmental regulations. These regulations impose administratively required measures, such as carbon taxes, to control local greenhouse gas emissions. These regulations guide the distribution of green financing resources and optimize their distribution among various regions, effectively reducing emissions. Green finance and environmental legislation can complement each other to significantly reduce GHG emissions. Environmental regulations serve as a compass, directing resources towards businesses needing technical upgrades and assisting in GHG emissions reduction, while green financing provides funding for sustainable projects (Wang, Cai, and Elahi 2021).

Pricing carbon has come to be an essential instrument for tackling climate change and promoting the transition to a low-carbon economy. In accordance with the World Bank's yearly "State and Trends of Carbon Pricing" report, carbon pricing revenue reached a record $84 billion in 2021, an increase of nearly 60 percent from the previous year. The report highlights the potential of carbon pricing to promote sustainable economic recovery, finance fiscal reforms, and invest in regional economies. *Direct carbon prices* cover less than 4% of global emissions, falling within the Paris Agreement's temperature target range. However, several jurisdictions, including the European Union, Switzerland, New Zealand, California, Korea, and Canada, have experienced record-high carbon prices (World Bank 2022b). The World Bank emphasises the significance of building on this positive momentum to increase carbon pricing's coverage and price levels. This will be necessary to realise the maximum potential of carbon pricing in promoting inclusive decarbonisation and achieving climate objectives. In addition, the implementation of updated regulations for international carbon markets at the 26th Conference of the Parties (COP26) in Glasgow provides a clearer policy direction and facilitates the resolution of cross-border carbon pricing issues. The "State and Trends of Carbon Pricing 2022" report covers a variety of significant topics, including international approaches to carbon pricing, challenges and opportunities deriving from rising energy prices, and the influence of emergent technologies and governance structures on the carbon market. This analysis sheds light on the current global condition of carbon pricing and its potential to accelerate long-term mitigation goals (World Bank 2022a).

The externalities caused by GHG emissions can also be priced indirectly, which can be reached by *emission trading*, an instrument of environmental policy that serves to reduce greenhouse gas emissions at the lowest cost to the economy. The rationale for emission trading was developed by John H. Dales and T. D. The Crockers. Dales initially proposed the notion of restricting pollutant emissions by tying the right to emissions to pollution charges in 1968 in “Pollution Property and Prices - An Essay in Policy-Making and Economics”, referring to water contamination (Dales 1968). Emission trading generates economic *incentives* to minimize pollutant emissions. This allows individuals and households to minimize their greenhouse gas emissions by purchasing or trading emission allowances. It presents a flexible and market-based approach, allowing companies that can cut their emissions more effectively to acquire allowances from industries that find it difficult to reduce emissions (Umweltbundesamt Deutschland 2021). Emission trading systems for CO_2 and other greenhouse gases have proven to be beneficial by driving enterprises to reduce their emissions while pursuing cost-efficient solutions. The implementation of emission quotas should cut greenhouse gas emissions in a way that is economically advantageous for impacted companies. Companies should not be subject to limitations or restrictions but rather should be free to benefit from the system by using environmentally beneficial production techniques. Measures should also be voluntary and long-lasting so that they can withstand political changes without turning into prohibitions or restrictions. Finally, a system that doesn't distort competition and considers the potential of individual states should be developed at the European level (Favry 2021). It is vital to emphasize that *emission trading alone is not sufficient* to reach the climate targets set forth in the European Green Deal or the Paris Agreement. However, *it is a vital aspect* of a complete climate strategy based on many policies and tools to reduce greenhouse gas emissions.

Another promising approach to *indirect carbon pricing* is a policy tool known as *Personal Carbon Allowance* (PCA). PCAs aim to link individual behaviour with global carbon reduction goals. Each resident is assigned a *comparable and tradable allowance* which can be applied to carbon-emitting activities including energy, heating, and transportation. This policy design has the potential to result in monetary, mental, and societal modifications that lower individual carbon emissions (Harwatt et al. 2011). To achieve the lofty objectives set forth in the Paris Agreement, it is crucial to consider PCAs as a novel approach as well as conventional policy instruments. PCAs have an opportunity to substantially influence societal norms in the direction of low-carbon behaviour. They provide a restricted carbon allocation for trading, which incentivizes individuals to cut their carbon emissions. Individuals' decision-making processes may be influenced by this economic factor, which may encourage them to select low-carbon options and behaviours. Additionally, PCAs increase knowledge of and attention to individual carbon emissions (Fuso Nerini et al. 2021). As people manage and exchange their allowances, they become more aware of their carbon footprint. This increased awareness may prompt people to adopt energy-saving habits or choose environmentally friendly forms of transportation (He and Veronesi 2017). PCAs can also significantly reduce individual carbon emissions by directly connecting individual action to global carbon reduction targets. They establish a framework where individual accountability and group effort converge, encouraging a sense of shared accountability for halting climate change. Utilising PCAs in addition to conventional legislative tools can increase the efficacy of additional efforts to mitigate climate change. This will make it simpler to achieve the Paris Agreement's objectives (Nerini et al. 2021).

While there are many arguments supporting carbon pricing, there are a number of valid points opposing or relativising it. To provide an overview, the following section will examine the ongoing debate about the issue in a structured manner. It will first present arguments for carbon pricing, and then those against it.

Mayer et al. examine the *effectiveness* of carbon pricing *in Austrian economic sectors*, analysing macroeconomic and distributional effects via a computational model that is not covered by EU ETS. The findings show that carbon pricing without targeted compensation is progressive, *positively impacting lower-income households* (Mayer et al. 2021a). Gugler et al. found that carbon pricing is *more efficient than* renewable *subsidies* for reducing emissions in the German and British power sectors finding that modest rates (€30/tCO2) can lead to substantial reductions in gas-fired power plants. In both Mayer's and Gugler's papers, the efficacy of carbon pricing in accomplishing emission reductions is demonstrated. By imposing a price on carbon emissions, carbon pricing encourages the reduction of carbon-intensive activities. This encourages businesses and households to adopt environmentally friendly technologies and reduce their carbon footprint. Gugler et al. also emphasise the interaction effects between carbon pricing and renewable energy subsidies. The efficacy of renewables in mitigating emissions is contingent on the current level of the price of carbon and the particular circumstances, such as what technology (coal or gas) is being supplanted (Gugler, Haxhimusa, and Liebensteiner 2021).

The aforementioned *literature supports the effectiveness of carbon pricing* as a climate policy measure for achieving emissions abatement. Carbon pricing induces behavioural changes, promotes the adoption of cleaner technologies, and provides economic incentives for emission reductions. It is considered more cost-effective compared to subsidizing renewables in terms of achieving significant abatement. However, it is worth noting that the design and implementation of carbon pricing schemes, including revenue use and compensation mechanisms, play a crucial role in addressing distributional concerns and enhancing policy effectiveness (Mayer et al. 2021b) . Carbon pricing is *not universally embraced as a favourable solution* and often encounters significant opposition. While it is a strategy employed to internalize the costs of carbon emissions and incentivize emission reductions, its acceptance varies across different regions and stakeholders. This disparity arises due to concerns about potential economic impacts, particularly on industries heavily reliant on fossil fuels, as well as worries about the distributional effects of pricing mechanisms on vulnerable populations. As a result, carbon pricing initiatives can face resistance and differing levels of support in various contexts.

Despite the existence of certain carbon pricing systems, such as the EU Emissions Trading System (ETS), the current cost of carbon is substantially below what is required to achieve substantial greenhouse gas emission reductions. International climate agreements such as the Kyoto Protocol and the Paris Agreement have attempted to coordinate national policies, but more concerted efforts are necessary (Nordhaus 2018).

Jakob Mayer et al. underline the significance of considering distributional effects and revenue utilization to address potential regressive outcomes. While it does not argue against carbon pricing as a preferred solution, the article stresses the necessity for targeted compensation and careful analysis of distributional impacts (Mayer et al. 2021b).

Jeffrey Ball contends that the implementation of carbon pricing programs has faced problems, such as continuously low permit prices, particularly in the EU's carbon-pricing system. He also discusses California's cap-and-trade system encountering similar challenges. Furthermore, Ball believes that carbon price can offer the illusion that climate change is being responsibly dealt with, leading to lessened pressure to take additional carbon-cutting measures (Ball 2018). Ball says that carbon prices are fascinating in idea but worthless in practice. He believes that carbon pricing, while intuitively rational, has not proven helpful in lowering emissions and driving green alternatives. This essay underlines the limitations of carbon pricing as a solution to climate change. The essays by Jeffrey Ball highlight doubts regarding the effectiveness of carbon pricing in practice and warn that it can create a misleading impression of achievement while neglecting other required carbon-cutting measures (Ball 2019).

Kemfert, Schmalz, and Wägner argue against the extension of emissions trading, particularly as the main or principal instrument for greenhouse gas reduction in the transportation sector. They point out that setting the cap level effectively is problematic due to inadequate information, leading to ambiguities regarding the ensuing CO_2 pricing. They also claim that there was insufficient political feasibility, resulting in a low cap level and exemptions for industries due to perceived dangers of carbon leakage, i.e., companies moving production to locations with lower or no carbon pricing. They suggest that an expansion of *emissions trading alone* is insufficient to tackle the climate change problem (Kemfert, Schmalz, and Wägner 2019).

The article "Carbon pricing" in the European Economic Review also provides an outline of the possible benefits and pitfalls of carbon pricing systems. The authors highlight the effectiveness of carbon pricing in driving emissions reductions across all sectors of the economy by giving a clear price signal. They add that carbon pricing can produce funds to offset the costs of emissions reductions or fund other climate change mitigation activities. However, they admit that the design and implementation of carbon pricing systems are vital and face significant problems. These issues include the possibility for carbon leakage as well as the regressive impact on lower-income households due to higher energy costs. To address these difficulties, the authors offer options such as introducing border carbon adjustments to lower the likelihood of carbon leakage and using income recycling systems to mitigate the regressive impact (European Economic Review 2020).

In conclusion, the publications imply that carbon pricing may not be the best strategy for addressing climate change successfully. They emphasize problems, such as continuously low permit prices, the illusion of progress, and the need for additional action beyond carbon pricing. To establish a holistic approach, it may be necessary to consider alternatives, such as phasing out coal, investing in renewable power, eliminating fossil fuel subsidies, and strengthening energy-efficiency laws and regulations. Subsequent chapters will show that the EU is currently employing all these approaches.

3.3 The role of individual climate action

This chapter will review the existing literature on individual climate action, in order to help the reader understand its importance and its role in the overall efforts to combat climate change.

In 2018 William D. Nordhaus received the Nobel prize in economics for his insights into the challenges posed by global warming and the critical need for international cooperation to resolve the externalities associated with climate change (The Nobel Prize, 2018). William Nordhaus's research emphasises the importance of individual behaviour in affecting greenhouse gas emissions and the necessity of collective action to combat climate change. He acknowledges the potential for individuals to play a significant role in addressing the climate crisis through their actions. Nordhaus argues that lifestyle, energy consumption, and transportation decisions have a significant impact on greenhouse gas emissions and, by extension, climate change. In a 2022 interview with the Washington Post, Nordhaus emphasises the government's role in empowering individuals to reduce greenhouse gas emissions efficiently and effectively (Mufson 2021). He emphasises the significance of governments creating an environment that enables people to make sustainable decisions and supports their efforts to combat climate change. Nordhaus' insights provide a compelling case for contemplating individual behaviour modification as a crucial element in attaining Austria's climate goals. By emphasising the significance of government facilitating actions and the implementation of effective policies, he underlines the significance of aligning individual behavioural changes with broader systemic changes in order to achieve the necessary emission reductions. Understanding the significance of individual behaviour and its relationship to collective efforts can help policymakers and stakeholders design effective strategies to meet the 2030 and 2050 climate goals (Nordhaus 2018).

Michael P. Vandenbergh is another prominent figure in the field of climate change, environmental behaviour and environmental governance (Vanderbilt Law School, 2023). His work highlights the *significance of the individua*l in reducing greenhouse gas (GHG) emissions. Vandenbergh argues that legislators and regulators should not only address industrial sources of emissions, but also individual behaviour, in order to achieve the essential greenhouse gas (GHG) reductions. In his seminal article "The Carbon-Neutral Individual," co-authored with Anne C. Steinemann, Vandenbergh constructs a model illustrating how individual activities can considerably level off and reduce GHG emissions (Vandenbergh and Steinemann 2007). Vandenbergh et al., examine the spillover effects of pro-environmental behaviour interventions, providing a theoretical framework for comprehending how various behaviours influence one another and casts light on the complex dynamics of pro-environmental behaviour spillover. Positive spillover describes situations in which one environmentally friendly action enhances the likelihood of subsequent pro-environmental actions. Negative spillover, on the contrary, happens when one environmentally friendly action diminishes the likelihood of future pro-environmental actions (Mattioli, Büchs, and Scheiner 2023) . These effects have been observed in previous research, and Vandenbergh et al. propose a theoretical framework that identifies motivation as a critical factor in predicting whether spillover effects will be positive or negative. They argue that affect-based decisions may have unfavourable cascading effects, in which engaging in pro-environmental behaviour can decrease environmental concerns and decrease motivation for other behaviours. In contrast, choices based on a person's role influence their self-perception, reinforcing their identity as environmentally conscious individuals and leading to more pro-environmental behaviour (Truelove et al. 2014). Vandenbergh also explores incentives and methods that encourage individuals to adopt more environmentally responsible behaviours. Effective strategies for promoting resource and energy conservation include positive reinforcement, goal-setting and feedback, incentives and rewards, framing energy-saving actions in terms of environmental benefits, and leveraging social and peer pressure (Vanderbilt Law School 2023). These pragmatic interventions can be incorporated into energy and environmental policies to encourage individuals to engage in environmentally responsible conduct.

Angela Druckman, a professor of sustainable consumption and production at the University of Surrey's Centre for Environment and Sustainability (CES), and Ottmar Edenhofer, a renowned climate economist and professor at Technische Universitat Berlin, have conducted research that is highly pertinent to the research question (Edenhofer 2015; Druckman, Sorrell, and Gatersleben 2020). Druckman's research focuses on determining the effect of individual actions and decisions on greenhouse gas (GHG) emissions, particularly in the home. Her research sheds light on the factors that influence household carbon footprints, including income, employment status, awareness of climate change, energy use, food consumption, education, social and cultural differences, and leisure activities. This research is important for Austria's climate goals because it identifies the main variables that can be targeted by policy interventions to promote sustainable behaviour and effectively reduce emissions (Druckman and Clift 2016).

Edenhofer's research on carbon pricing and its role in incentivizing environmentally beneficial behaviour can also shed light on this paper's research question. His findings emphasise the significance of moral and ethical considerations in the design and implementation of carbon pricing policies. Carbon pricing can accelerate the transition to renewable energy, stimulate investment in low-carbon innovations, and create synergies between energy and climate policies by prioritising behavioural and political factors over productivity and efficiency advantages. This research is crucial for Austria because it provides guidance on how to effectively employ carbon pricing as a policy instrument to influence individual behaviour and achieve climate goals (Edenhofer et al. 2018).

Druckman and Edenhofer's research provides vital insights into how individual behavioural changes can contribute to Austria's 2030 and 2050 climate goals. Druckman's concentration on household emissions and their influencing factors informs policy interventions to promote sustainable behaviours, whereas Edenhofer's research emphasises the role of carbon pricing and moral considerations in incentivizing environmentally favourable decisions. The literature places greater emphasis on matters of morality and ethics, as well as determining where emissions should be reduced, rather than providing a comprehensive framework for identifying effective strategies to enhance emission reduction. Nevertheless, this body of work can enhance the comprehension of underlying intrinsic motivations driving individuals to modify their behaviour. By contemplating and implementing these findings, Austria could develop targeted strategies that capitalise on the potential of individual behaviour change in order to make substantial progress towards its climate objectives.

The study "The Role of High-Socioeconomic-Status People in Locking in or Rapidly Reducing Energy-Driven Greenhouse Gas (GHG) Emissions" by Dr. Kristian S. Nielsen, postdoctoral research associate at the University of Cambridge, investigates how *individuals with high socioeconomic status* (SES) contribute to energy-driven GHG emissions and the potential impact of changing their behaviour on reducing energy use and advancing climate goals. The research exposes a number of significant findings, such as the disproportionate share of emissions from high-SES individuals, their ability to influence emissions through consumer and non-consumer roles, and the significance of understanding their behavioural plasticity. This study seeks to elucidate the relationship between the emissions of high-SES individuals and climate change, as well as identify mitigation opportunities. It aligns with Nielsen's emphasis on comprehending how individual behaviour modification can contribute to the achievement of sustainability objectives, particularly in reducing GHG emissions (Nielsen, Nicholas, et al. 2021) (University of Cambridge 2023).

The article titled "It begins at home? "Climate policies targeting household consumption and behavioural decisions are essential for low-carbon futures" by Ghislain Dubois emphasises the importance of households in attaining significant reductions in greenhouse gas emissions. The relevance of this article to the research question, lies in the understanding of individual behavioural change in a specific cultural context as well as the *importance of education* when it comes to the reduction of GHGs. The article emphasises the significance of educating and informing households about the environmental impact of their consumption decisions and how these choices affect their carbon footprint. Dubois also acknowledges that certain low-carbon practises, such as reducing livestock consumption or air travel, may conflict with the lifestyle preferences and cultural norms of households. When promoting sustainable decision-making, it is essential to consider individual preferences and cultural contexts, which is directly related to the exploration of behavioural changes in the context of improving on Austria's climate goals. In addition, the article acknowledges that high initial costs may prevent households from implementing low-carbon technologies. Consequently, it may be necessary to provide households with financial assistance or incentives for them to surmount these obstacles and adopt low-carbon practises. In supporting low-carbon practises, the article also emphasises the significance of equitable access to information, resources, and infrastructure, particularly for low-income or rural households. This aspect is directly related to the research question's consideration of the potential for climate-relevant behaviour changes in the unregulated sector, as it investigates the barriers and opportunities for individuals to contribute to Austria's climate goals. It will not alone answer the research question because the literature is slightly different in focus but relevant for the understanding of problems encountered by individuals trying to change their behaviour (Dubois et al. 2019).

The article by Karin Schanes titled "Low carbon lifestyles: A framework to structure consumption strategies and options to reduce carbon footprints" presents a framework for organising consumption strategies and options to reduce carbon footprints. The relevance of this article to the research question lies in its examination of various individual behavioural changes that can contribute to reducing CO_2 emissions and aligning with Austria's climate goals. The article by Schanes emphasises energy conservation in the home, with a focus on reducing usage of energy through employing appliances that are energy-efficient, turning off lighting and electronics when not in use, and instituting suitable insulation and thermostat settings. By delineating specific behavioural adjustments in areas such as transportation, energy consumption, water usage, food choices, waste management, and the adoption of renewable energy, the Shanes' article provides individuals with actionable steps. Understanding and implementing them is crucial because they empower individuals to actively combat climate change. By providing a structured framework for consumption strategies and carbon footprint reduction alternatives, the article offers guidance and assistance to individuals who wish to make sustainable decisions. This text is significant because it may encourages individuals to recognise their role in attaining Austria's climate goals and highlights the influence that individual behaviour change can have on broader climate mitigation efforts (Schanes, Giljum, and Hertwich 2016). It is essential to note that again the need for a multifaceted approach that combines individual behavioural changes with supportive policies, technological advancements, and community engagement to achieve significant reductions in CO_2 emissions.

Finally Andreas Luczak emphasises the difficulties and complexities of attaining climate objectives. Luczak argues that it was unjust to demand sacrifices from individuals who support state-mandated climate protection measures, such as carbon pricing or restrictions, when not everyone is making the same effort to reduce their personal emissions. The text underlines the human desire for justice and the difficulty of making personal sacrifices for climate protection when others are not doing the same. It suggests that relying exclusively on voluntary changes is ineffective and that historically, laws have been required for significant societal changes. The text contends that government intervention and the establishment of consistent regulations that make climate-friendly practises economically advantageous are necessary. Individual actions cannot accomplish the desired climate neutrality because the energy sources required for habitation, consumption, and mobility must be climate-neutral, which is beyond the control of an individual.

Measures to reduce emissions immediately include the mandatory labelling of CO_2 emissions on all products and the imposition of a high price for CO_2, which could reduce the impact of consumption on the environment. The labelling would aid those consumers who already regard CO_2 emissions to be a significant factor in their purchasing decisions, but who have difficulty accurately assessing the climate impact of individual products. As CO_2 is expensive, the purchase price would explicitly indicate whether a product is detrimental to the environment or not. However, such a measure is inconsistent with a growth-oriented economic system. Consequently, the objective of the energy transition is to make energy supply climate-friendly, so that consumption and economic development no longer conflict with climate neutrality. Until this is accomplished, the easiest and safest method for individuals to reduce their emissions is to reduce their consumption.

Individual consumption measures to reduce the carbon footprint like the purchase of an electric vehicle should be carefully considered in terms of mobility, as different studies indicate varying environmental impacts. Frequently, the high resource utilisation in the production of electric vehicles is contrasted to a relatively short distance. Especially for longer distances, where electric vehicles are still inferior to combustion vehicles, it may be more beneficial to compensate for the expense and restrictions associated with the use of an electric car elsewhere. In addition, replacing one's own vehicle with a car-sharing vehicle does not result in a direct reduction in greenhouse gas emissions, as the reduction in kilometres driven and the consumption per kilometre are ultimately the most important factors. Due to the shortened service life of car-sharing vehicles, private cars typically last longer than car-sharing vehicles. Therefore, the argument that private cars are a waste of resources because they are inactive most of the time is unconvincing.

When it comes to the diet question, Luczak emphasizes that the composition of consumables has a significant effect on greenhouse gas emissions in terms of nutrition. A so-called "Planetary Health Diet" containing recommendations for a more climate-friendly and healthier diet has been developed. The recommendations include minimising beef and sugar consumption and increasing vegetable, fruit, nut, and legume consumption.

It is essential for consumers to reconsider their purchasing decisions, reduce their consumption, and consider whether they truly need a product or whether a lesser quantity or version will suffice. Individuals can mitigate climate change through conscious consumption and an eco-friendlier diet.

Personal emissions can only be reduced to a limited extent by conserving electricity, it is noted in reference to electricity consumption. Instead, it is recommended to rely on environmentally favourable energy sources. Significant behavioural changes or financial investments in the field of electricity are relatively inconsequential. Instead, political pressure could be applied to government parties to advocate for additional emissions-reduction measures in the electricity sector.

Luczak also examines the possibility of compensating emissions, such as by paying airlines. This is preferable to inaction, but it does not accomplish climate neutrality. The most effective method to reduce emissions would be to purchase EU emission allowances, which individuals are not permitted to do.

In addition to individual behaviour modification, political engagement is cited as a means of introducing government climate protection frameworks. This can be accomplished by supporting parties that promise effective climate protection or by taking part in climate protests. The conclusion of the text is that effective change is only possible through comprehensive, state-mandated measures that incorporate all facets of society, including the energy industry. It recognises that personal behaviour can have an impact and emphasises the significance of individual conscience and the potential for behavioural changes to permeate society. The findings of this analysis show that the adaption of a minimal emitter profile does not suffice to achieve Austria’s climate goal for 2030 supporting the existing literature’s findings in its claim to first and foremost change policies to facilitate the implementation of climate friendly behaviour.

Engaging with Luczak's book offers insightful perspectives on the overarching struggle to curtail greenhouse gas emissions. Luczak underscores the limited scope of individual agency in achieving substantial emissions reduction. Consequently, he stresses the significance of government-mandated initiatives, ensuring that each member of society contributes optimally to the battle against climate change. These measures, when appropriately regulated, hold the potential to effect meaningful change and collectively drive progress toward this critical goal.

4 The regulatory framework

This chapter analyses the legal framework to determine the scope for individual action in Austria. It will outline the legal norms already in force, as well as those that have already been adopted or ratified and will enter into force in the future. In addition to national norms and policies this chapter will consider Austria's international treaty obligations created by the UNFCCC, its amendments, and protocols, as well as EU climate legislation. This will determine the unregulated domains within which free choice is possible, as well as expected changes in incentive structures.

4.1 International Climate Law

Austria is party to several international treaties concerning the protection of the environment and the climate. Most important among them is the United Nations Framework Convention on Climate Change (UNFCCC), which Austria ratified in 1992 (United Nations 1992). It was signed by the representatives of 154 countries at the United Nations Conference on Environment and Development (UNCED) (a.k.a. Rio Earth Summit) and entered into force in 1994. The convention set up procedures, as well as one important substantive provision: The signatories agreed to the non-binding aim to stabilise atmospheric concentrations of greenhouse gases at 1990 levels by the year 2000 to prevent harmful human intervention (United Nations 1992). Because of its nature as a framework conference, further legal obligations can be created under the UNFCCC, by the way of protocols or amendments. The most important norms created under the UNFCCC are the Kyoto Protocol (1997) and the Paris Agreement (2015).

4.1.1 The Kyoto Protocol

The Kyoto Protocol is aimed at addressing global climate change by reducing greenhouse gas emissions. It was adopted in 1997 and came into force in 2005. Under the Kyoto Protocol, signatory countries commit to setting specific targets for reducing their greenhouse gas emissions. The protocol sets differentiated obligations for developed and developing countries, known as Annex I and non-Annex I parties, respectively. Developed countries, considered more responsible for historical emissions, are obligated to reduce their emissions collectively by an average of 5.2% below 1990 levels during the first commitment period from 2008 to 2012. This reduction target aims to achieve sustainable development while preventing dangerous interference with the climate system United Nations Framework Convention on Climate Change (UNFCCC) 1997) Article 3 (1).

The Doha Amendment, agreed upon in 2012, is an extension of the Kyoto Protocol's second commitment period from 2013 to 2020. It brought about changes to the emission reduction obligations of the signatories. One of the key changes was the introduction of more ambitious emission reduction targets for developed countries. The Doha Amendment set a new collective reduction target of at least 18% below 1990 levels for developed countries during the second commitment period. Moreover, it introduced a new mechanism to encourage increased emission reductions and sustainable development in developing countries by allowing them to participate in emission trading and other market-based mechanisms (United Nations 2012). The Doha amendment entered into force on 31 December 2020, after ratification by 144 states, which was the mandated minimum. On the same day, the second commitment period ended, rendering the amendment inapplicable.

4.1.2 The Paris Agreement

Negotiations in the framework of the UNFCCC on the measures to be taken after the commitment period of the Kyoto Protocol led to the Paris Agreement, approved during the 21st Conference of the Parties in Paris in December 2015 and entered into force on November 4, 2016, after ratification by more than 55 Parties representing a minimum of 55% of the world's greenhouse gas emissions. It contains two significant innovations. First, the differentiation of the Kyoto Protocol has been abolished: mitigation and adaptation obligations are the same for developing and developed countries (Maizland 2022) (United Nations 2015a). Second, the Paris Agreement sets the binding target to keep “the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C“ (Art. 2(1)), thus focusing on the outcome of mitigation, rather than the process itself. Additionally, it aims for global GHG emissions to peak as soon as possible, and to reach Carbon neutrality by 2051 at the latest (Art. 4(1)) (United Nations 2015b).

The Paris Agreement is the first universal, legally binding global climate agreement in history, but it contains *no specific emissions targets or schedules*. Rather, the parties are free to decide how to put the agreement into action. However, Article 3 of the Paris Agreement states that "all Parties are to undertake and communicate ambitious efforts

[...] with the view to achieving the purpose of [the] Agreement." To make the Paris Agreement’s long-term goals operational, it establishes a cyclical model. Countries plan and *communicate* their nationally determined contributions (NDCs), *implement* their plans, and finally, *review* the results individually and collectively. According to Article 4 (9) of the Paris Agreement parties must report their nationally determined contributions (NDCs) every five years. This reporting process will be complemented by a 'global stocktake' that occurs every five years, beginning in 2023. The stocktake will involve detailed evaluations of countries' NDCs, leveraging the expertise of the Intergovernmental Panel on Climate Change (IPCC). Initially, the parties submitted their NDCs as Intended Nationally Determined Contributions (INDCs) in 2015. These contributions were officially recognized as NDCs once the Paris Agreement came into effect (Bodansky 2017)

The Paris Agreement entered into force on November 4, 2016, and according to Article 4(2) NDCs should be communicated by each party "well in advance" of each new commitment period. The first commitment period of the Paris Agreement commenced in 2021. Hence, the deadline for countries to submit their initial NDCs was set for 2020. Because the EU is a party to the Paris Agreement, its members submit collective EU NDCs. The EU has submitted its INDCs in 2015, and in 2020 followed up with its NDCs. Austria has not posted additional individual NDCs.

4.2 Climate Law in the European Union

To comprehend Austrian climate law, it is essential to understand the law of the European Union, since EU law is directly applicable in all member states, and EU law has primacy over national law conflicting with it, including constitutional law. This chapter will therefore examine EU climate law with special regard to Austria and individual climate action.

The legal basis for the EU’s environment and climate policy is laid out in Articles 11 and 191 to 193 of the Treaty on the Functioning of the European Union (TFEU). According to these articles the EU has the competence to act in all areas of environment policy, including air quality and water, waste management, climate change or sustainable development. As a subject of international law the EU may conclude international agreements creating legal obligations for its member states (Recht der Europäischen Union 2019). In areas of exclusive EU competence, as outlined in Art. 3 TFEU, member states do not need to counter-sign the international agreement for it to become binding. In its judgments CJEU "Meryem Demirel v Stadt Schwäbisch Gmünd" (C 12/86) the Court of Justice of the EU (CJEU) established that international agreements can have direct effect, following the same guidelines as in the "Van Gend en Loos" case (C 26/62).

The European Union is a party to the UNFCCC (since 1992) and the Paris Agreement, which was *signed* on behalf of the European Union (EU) on April 22, 2016 in New York, and *ratified* by the Council of the European Union on October 5, 2016 by Council Decision (EU) 2016/1841 and thus transposed into secondary EU legislation, hence leaving no doubt about the binding legal force on EU member states.

As party to the Paris Agreement, the EU submitted its nationally determined contributions (NDCs) in 2025 and 2020. EU member states' contributions are submitted collectively to create the overall NDCs for the EU. In its first NDCs, the EU committed to reducing greenhouse gas emissions by at least 40% by 2030 compared to 1990. This was part of its wider 2030 Climate and Energy Framework, Targets for 2030, which also aimed at a 27% share of renewable energy consumption and at least 27% energy savings compared with the business-as-usual scenario by 2030 (IEA 2014). In December 2020, the European Union (EU) presented its revised and strengthened nationally determined contribution (NDC), outlining its objective to achieve a minimum 55% reduction in greenhouse gas emissions by 2030, compared to 1990 levels. Additionally, the EU included comprehensive information to enhance clarity, transparency, and understanding (ICTU) of the NDC, aiming to provide clear insights into their climate action plans (United Nations 2015b).

To implement the pledges made under the Paris Agreement, the EU employs a combination of legislative, regulatory, and policy measures. The most important among them are the 2030 EU climate and energy framework, the EU Emissions Trading System (EU ETS), the European Climate Law and most importantly the European Green Deal. The Effort Sharing Regulation ((EU) 2023/857), initially adopted in 2018 and amended in 2023, is another noteworthy implementation measure. It establishes *legally binding national emissions reduction targets* for each member state in the sectors: domestic transport (excluding aviation), buildings, agriculture, small industry, and waste (European Parliament 2023c).

4.2.1 The 2030 EU climate and energy framework

The 2030 EU climate and energy framework was agreed upon by the European Council in 2014. It endorsed four important targets: I. A binding EU target of at least 40% less greenhouse gas emissions by 2030, compared to 1990, II. a binding target of at least 27% renewable energy consumption in 2030, III. an indicative target at EU level of at least 27% improvement in energy efficiency in 2030, IV. and to support the completion of the internal energy market by achieving the existing electricity interconnection target of 10% no later than 2020, as well as the aim to arrive at a 15% target by 2030. The 2030 EU climate and energy framework formed the basis for the EU's first NDC submission, mentioned earlier in this chapter (European Council 2014).

4.2.2 The EU Emissions Trading System

The EU Emissions Trading System (EU ETS) has it legal base in Directive 2003/87/EC. It constitutes a crucial element of the EU's strategy in addressing climate change and it is *directly concerned with individual non-state actors*. Operating as a "cap and trade" program, the EU ETS sets a restricted allowance (the cap) on the emission of designated pollutants within a specific geographical region. Under this scheme, businesses have the option to trade emission allowances within the defined area (Environmental Protection Agency 2023). The EU ETS targets emissions that can be accurately measured, reported, and verified and covers various sectors and gases. These include carbon dioxide (CO_2) emissions from electricity and heat generation, as well as energy-intensive industries such as oil refineries, steel works, and the production of various materials like iron, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids, and bulk organic chemicals. Additionally, it encompasses aviation within the European Economic Area and departing flights to Switzerland and the United Kingdom, along with maritime transport. The system also addresses nitrous oxide (N2O) emissions from the production of nitric, adipic, and glyoxylic acids and glyoxal, as well as perfluorocarbons (PFCs) emissions from aluminium production. Participation in the EU ETS is obligatory for companies operating in the aforementioned sectors, with some exemptions based on size or specific measures implemented by governments to cut equivalent emissions. Until at least 31 December 2026, the EU ETS will also apply to flights between airports within the European Economic Area. As a preliminary measure, since 1 January 2019, aircraft operators are required to monitor and report their emissions for flights within the European Economic Area (Environmental Protection Agency 2023).

The EU ETS was shown to be highly effective in its objective of reducing GHG emissions in the sectors it regulates (Dechezleprêtre, Nachtigall, and Venmans 2023). Nevertheless, some high polluting sectors are not yet covered by it. The EU plans to change that via its “Fit for 55” package, which aims at ensuring that EU policies are in line with the climate goals (European Council 2023b). The revised ETS directive, adopted in April 2023 makes considerable changes to the EU ETS. *First*, the overall ambition of emissions reductions by 2030 in the sectors covered by the EU ETS has been increased to 62% compared to 2005 levels. *Second*, new sectors will be included, such as emissions from maritime transport. *Third*, and most importantly, the directive sets up *a new emission trading system* for buildings, road transport and additional sectors (mainly small industry). Individuals will not be charged directly, but rather the entities selling fuels “which are used for combustion in the buildings and road transport sectors, […] as well as in the additional sectors” from 2027 (European Parliament 2023d). Consequently, heating with fossil fuels as well as road transportation with internal combustion engines using fossil fuels (i.e., using cars) will become significantly more expensive for individual consumers in the EU. This will in turn *change the incentive structure* for individual decision making towards adopting more climate friendly behaviour. At the same time there may be negative side-effects for socio-economically disadvantages EU citizens. To prevent this, the EU set up the Social Climate Fund. It will assist vulnerable households, small businesses, and transport users in dealing with the price effects of an emissions trading system applied to buildings, road transport, and other sectors (European Council 2023c).

4.2.3 The European Climate Law

The European Climate Law (Regulation (EU) 2021/1119) is the is the overarching framework ensuring the EU and its member states fulfil their obligations under the Paris Agreement. It is therefore not concerned with individual behaviour, but it guides EU institutions and the member states to ensure they take the measures necessary to achieve net-zero greenhouse gas emissions by 2050, as stipulated in Art. 2 (2). It writes into law the goals set out in the European Green Deal, sets a legally binding target of net zero greenhouse gas emissions by 2050 and includes means to reliably track the progress of each member state building on measures already in place, like the national energy and climate plans (NECPs) introduced by regulation (EU)2018/1999. (European Union 2021b; Federal Ministry Republic of Austria - Sustainability and Tourism 2011). Member states must submit a long-term plan in accordance with the Paris Agreement by January 2020, along with a National Energy and Climate Plan (NECP) (Federal Ministry Republic of Austria-Sustainability and Tourism 2019).

4.2.4 The European Green Deal

The European Green Deal is a comprehensive policy framework introduced by the European Commission in December 2019 with the aim of making the European Union climate-neutral by 2050. It serves as the EU's roadmap for achieving sustainable growth and transitioning to a greener, more resource-efficient, and circular economy. The Green Deal covers various sectors, including energy, transport, agriculture, and industry, and it involves a wide range of initiatives and measures to reduce greenhouse gas emissions, protect biodiversity, and promote sustainable development (European Commission 2019). Specific legislative proposals and regulations are introduced and implemented to support the objectives outlined in the Green Deal and to ensure its successful implementation.

According to the European Commission the European society should be led on a more sustainable route by involving all sectors to work towards the common goal of slowing down climate change. It is understood that Europe cannot solve these ambitious problems alone. In light of this, the Commission's strategy for the Green Deal involves carrying out the 2030 and 2050 Agenda of the United Nations, the Sustainable Development Goals, and other priorities enumerated in President von der Leyen's political guidelines (European Commission 2019).

While the European Green Deal is concerned with several policy areas that require concerted state-level efforts and leave little room for individual action, such as carbon pricing, consolidating legislation, preventing carbon leakage, or setting up a Carbon Border Adjustment mechanism through international trade policy, the Commission has always stressed the crucial importance of bottom-up processes for the success of the initiative. "Citizens are and should remain a driving force of the transition" (European Union 2019).

Several measures outlined in the European Green Deal affect the scope for individual climate action:

4.2.4.1 The proposed renovation wave of public and private buildings:

As part of the "Fit for 55" package, all new buildings in the EU must be carbon neutral by 2030, while existing buildings are to be transformed into zero-emission buildings by 2050. Member states agreed to introduce minimum energy performance standards for buildings, establishing the maximum amount of primary energy that buildings can use per m^2 annually. The purpose of this measure is to trigger renovations which in turn shall lead to a gradual phase-out of the worst-performing buildings and a continuous improvement of the national building stock (European Council 2023b). According to data provided by the European Commission, buildings account for 40% of energy consumed and 36% of energy-related direct and indirect greenhouse gas emissions in the EU (European Council 2022).

4.2.4.2 The sustainable and smart mobility strategy

The sustainable and smart mobility strategy aims at a 90% reduction in emissions from transport by 2050. It is structured around three key objectives: making the European transport system sustainable, smart and resilient (European Union 2020). The strategy contains several aims that are relevant to individual climate action, but they have not yet been implemented into legislation, and will therefore not be considered any further.

4.2.4.3 Carbon pricing for transportation

As outlined in the new EU ETS (See chapter 4.2.2, p.34), a new trading system has been set up that will affect the cost of personal transportation. This is in line with the aims laid out in the European Green Deal and will change the decisions individuals make regarding mobility.

4.2.4.4 Alternative fuels infrastructure

The Commission supports increasing the amount of recharging and refuelling points for sustainable individual transportation. This policy goal has been written into law as the alternative fuels infrastructure regulation (AFIR). It has been published on July 14, 2023 in the official journal of the European Union (European Union 2021a) and entered into force 20 days after its publication, on August 3, 2023. The recently enacted regulation is set to significantly influence individual behaviour and choices in transportation. With the widespread installation of fast recharging stations along major transport corridors and the provision of easy and transparent payment options for electric and hydrogen-fuelled vehicles, people are likely to opt for eco-friendly transportation options. Additionally, the emphasis on deploying hydrogen refuelling stations in urban nodes and along key networks will further encourage the use of hydrogen-powered vehicles. As individuals witness the expansion of sustainable infrastructure at ports and airports, they will be more motivated to embrace greener modes of transportation, aligning with the EU's efforts to combat climate change and reduce emissions (European Council 2023a).

4.2.4.5 Stricter CO2 emission performance standards for cars and vans

According to Regulation (EU) 2023/851 by 2035, new cars and vans must be emission-free. Incentives end in 2030 (European Parliament 2023b). This measure will reduce the emissions caused by individual transportation and it will limit the choices available to individuals, as well as change the cost structure. According to data provided by the Commission, the average lifespan of a vehicle is estimated at around 15 years. This is why 2035 was chosen as the cut-off date to reach net zero by 2050.

4.2.4.6 Stimulation of sustainable food consumption

The “Farm to Fork” strategy is the portion of the European Green Deal concerned with sustainable production, processing, distribution, consumption, and waste management of food. It is made up of both regulatory and non-regulatory approaches. The Commission is planning on presenting a formal legal proposal by the end of 2023 (European Commission 2019). While it is highly likely that this initiative will be successful, at the current time including it in calculations would still be too speculative for the purpose of this thesis.

4.2.4.7 Strengthening foundations of sustainable private investment

The financial market plays a key role in the structural shift towards a sustainable and climate-neutral economy. Financial market participants can significantly contribute to mitigating the impacts of climate change, adapting to its effects, and facilitating the transition to a more sustainable and resilient economy. Empirical evidence indicates that sustainable finance is a highly effective tool. For example, a 2020 study by Ziolo e. a. shows a close correlation between sustainable finance and the achievement of sustainability goals in the context of the UN Agenda 2030. “[T]he more sustainable the finance model, the better the results of a given country in achieving SDGs” ((Ziolo, Bak, and Cheba 2020)). This analysis explicitly considers climate action as laid out in SDG 13 and states that it can only be achieved by mobilising private and public finance.

Sustainable investment is addressed in the European Green Deal Investment Plan, also known as the Sustainable Europe Investment Plan. In the period from 2021-2030, the Commission wants to mobilise at least one trillion Euros of sustainable investment by increasing EU budget resources devoted to climate action and by additional *public and private* financing (European Parliament 2023a). One of the prerequisites for directing private finance towards the objectives of the European Green Deal is a clear taxonomy for classifying environmentally sustainable activities. This has been achieved by the Taxonomy Regulation ((EU) 2020/852), which entered into force on July 12, 2020. It defines whether an economic activity counts as sustainable. According to Art. 3 an activity counts as sustainable if it serves at least one of the environmental objectives, without substantially hindering any other of the objectives listen in Art. 9.

"The EU taxonomy allows financial and non-financial companies to share a common definition of economic activities that can be considered environmentally sustainable. [I]t plays an important role in helping the EU scale up sustainable investment, by creating security for investors, protecting private investors from greenwashing, helping companies become more climate-friendly and mitigating market fragmentation" (European Commission 2023b).

Additionally, the Sustainable Finance Disclosure Regulation ((EU) 2019/2088), entered into force on March 10, 2021, creates a harmonised legal framework for financial market participants and financial advisors on transparency in the inclusion of sustainability risks and the consideration of adverse sustainability impacts in their processes and in the provision of information on the sustainability of financial products.

The named legal norms are part of the EU's overall sustainable finance strategy that will affect individual investment decisions in significant ways, which in turn will influence the development of business sectors significant for climate change adaptation and mitigation. Nevertheless, analysing the specific consequences of this EU policy on individual decisions merits exceeds the scope of this thesis.

4.2.4.8 Re-skilling and upskilling the European workforce

Climate change itself, as well as adaptation and mitigation policies and the transition to a circular economy will permanently and significantly change the labour market. Some sectors will be negatively affected, while others will grow. Consequently, the European workforce will be affected, as the skills needed change over time. To move workers from declining sectors and move them towards growing sectors, a re-skilling and upskilling initiative is necessary.

In a 2019/20 study the European Centre for the Development of Vocational Training (CEDEFOP) concluded that about 128 million adults in the EU (46.1% of the adult population) need upskilling and reskilling (European Centre for the Development of Vocational Training. 2019). The EU has responded to this necessity with the European Skills Agenda, which links the Green Deal with other important policy areas (European Commission 2023c). So far, this project has not resulted in active legislation. But trough protecting the purchasing power of the EU workforce, raising climate literacy and strengthening sustainable industries it *makes a ceteris paribus approach more plausible*, since it relies on continues prosperity and growth.

4.2.4.9 The European Climate Pact

The European Climate Pact engages with the public through public information campaigns, involvement of the civil society in decision making processes and capacity building for grassroots initiatives (European Union 2019). Just as the re-skilling and upskilling of the workforce, this will increase climate literacy and can empower individuals to take action and become agents of change in their communities.

4.3 Climate Law in Austria

This chapter will outline Austria's climate law. It will take into considerations Austria's legal obligations under international law, its obligations derived from EU law as well as independent national legislation, with particular attention to its relevance for and effects on individual behaviour.

Austrian climate law is a cross-cutting issue. As such, it has multiple legal sources, stemming from international law, EU law and national law. The norms derived from international and supranational sources have been mostly covered in the previous chapters. Nationally, the most relevant documents and sources are the Austrian long-term strategy, the National Energy and Climate Plan (NECP) and the Climate Protection Act (Klimaschutzgesetz).

According to regulation (EU) 2018/1999 member states are required to develop national long-term strategies on how to achieve the greenhouse gas emissions reductions needed to meet their commitments under the Paris Agreement and EU objectives (European Commission 2023a). Austria has published its long-term strategy in 2019.

Also in 2019, Austria has published its National Energy and Climate Plan (NECP) in accordance with directive (EU)2018/1999, which obliges member states to explain in detail how they intend to handle decarbonisation, energy efficiency, energy security, the internal energy market, research, innovation, and competitiveness. While the NECPs provide member states with some flexibility in how they achieve their targets, the overall goals and commitments outlined in the plans are legally binding. Nevertheless, due to the limited European competences under Art 194 TFEU57 and the unanimity in the Council required for environmental competences under Art 192 (2) (c) TFEU, the responsibility for achieving the targets lies with the member states.

In 2011 Austria has passed the Climate Protection Act Klimaschutzgesetz, (KSG), which was designed to delineate Austria's annual GHG budget and allocate emission quotas to six different sectors, encompassing transportation, buildings, and agriculture, among others. It regulated the development and implementation of effective climate protection measures outside of the EU ETS and thus formed an essential pillar of Austria's climate policy until 2020. Since then, the framework of the KSG has not been updated accordingly, meaning that Austria does not have quantifiable emission targets on the national level, while its obligations under EU law, including the Effort Sharing Regulation, remain upright.

Nevertheless, there are relevant national norms influencing individual behaviour. One of the most important among them is the *eco-social tax reform*, which entered into force on July 1, 2022. The Act's key features comprise phased reductions in income tax brackets, higher family-related benefits, expanded tax advantages, support for climate-friendly initiatives, and the establishment of a national emissions trading system for non-ETS sectors (Österreich.gv 2022). The eco-social tax reform will improve the incentive structure for individual behaviour congruent with the EU and UN climate targets, such as installing more efficient heating systems (which is subsidised), installing photovoltaic panels or consuming less emission-intensive goods and services, including a change in transportation habits, because a higher mineral oil tax and CO_2 pricing encourage the shift from individual to public transportation. In addition, a discounted single ticket for all forms of public transportation in Austria has been implemented since October 2021 (Mayer et al. 2021b).

The Environmental Subsidies Act (Umweltfördergestz) writes into law subsidies for environmentally beneficial investments, such as e-mobility, heat pumps, ecological finance, and renovations. Important examples include the subsidies for businesses, homeowners, and renters to transition from oil/gas to distance heating or heat pumps in response to the 2020 ban on oil heating and the anticipated 2040 ban on gas heating (Umwelt Bundesamt Environment. Agency Austria 2021b).

In conclusion, the legal framework curbs highly polluting activities while incentivising individual climate action. This will lower GHG emissions caused by individuals and thus contribute to reaching the common climate targets. Nevertheless, the legal situations remains highly complex, and many projects are still in their infancy.

5 Quantitative Analysis

After having examined existing studies on individual climate action and outlining the norms guiding and limiting individual decisions regarding climate change in chapter 2.3, the next step towards answering the research question is a quantitative analysis of both the status quo and different scenarios for the future. This chapter will therefore present data on current individual emissions in Austria. It will proceed to categorising Austrian individual emitters, thus creating simplified yet realistic emission profiles. This chapter will then describe and analyse different scenarios using these profiles, to determine the degree to which individual behaviour and change thereof will help achieving the 2030 and 2050 climate goals.

5.1 Necessary individual emission reduction

The annual CO_2 equivalent emissions from an average Austrian home in the year 2020 were 21.3 tons, or 9.6 tons per person (Frascati 2020). Given that the total CO_2 emissions for Austria in 1990 were 76,610 kilotons, we can deduce the decrease in emissions required to achieve the 2030 target. The 2030 target is to cut greenhouse gas emissions by 55% from 1990 levels (European Commission 2020a).

First, we need to determine the emissions target for Austria in 2030 based on the 1990 emissions:

2030 emissions target =	1990 emissions x (1 - reduction percentage)
Goal for emissions in 2030 =	34,475 kt

We deduct the 2030 emissions target from the current emissions to determine the necessary reduction from the current emissions. Assuming the present emissions are 9.6 tons per person or 21.3 tons per home annually (Frascati 2020), we must convert these numbers to kilotons.

1kt = 1000t → 9.6t = (9.6 / 1000) kt) = 0.0096kt

Current emissions per capita for Austria =	Current emissions * Population

Assuming Austria has 8.9 million people (Frascati 2020): Austria's total current annual emissions are =	85,440 kt
Total current emissions minus 2030 emissions goal equals the amount of reduction needed.	Reduction required = 85,440 kt – 34,475 kt
Reduction required	50,966 kt

As illustrated in the calculations above, Austria would need to lower its CO_2 emissions by 50,966 kilotons from 2023 to fulfil the *2030 emissions goal* of a 55% reduction compared to 1990 levels.

Examining the average household and the top/bottom 10 percent of private households in Austria provides a sense of the extent of the unequal distribution of CO_2 emissions resulting from consumer behaviour identified in this study.

The wealthiest ten percent of private households in Austria emit more than four times as much CO_2 as the bottom ten percent; and more than twice as much CO_2 as the average budget in Austria (Frascati 2020). We proceed from the fact that Austria has 8.9 million people. Considering Austria currently emits 85,440 kt of CO_2 equivalents, an emission cut by 50,965.50 kilotons is needed as previously calculated and confirmed by the International Energy Agency (IEA) (IEA 2020).

From the numbers provided, the following can be derived:

top 10% of Austria's population emit	17,088 kt	890.000p	19.2 t/person
average 10% of Austria's population emit	8,544 kt	890.000p	9.6 t/person
bottom 10% of Austria's population emit	4,272 kt	890.000p	4.8t/person

To reach the 2030 climate goal Austria would require a reduction of 60% by 2023. But even if every single citizen of Austria were to emit as much as the bottom 10% the 2030 climate goal cannot be reached.

4.8 t x 8,900,000 =	42,720 kt
This result is still 25% higher than the emission target of	34,475 kt

To achieve the 2030 climate goals for Austria the following calculation will shed light on how many tons must be deducted to achieve the emission goal of 34,474.5 kt.

42,720.00 kt -34,474.50 kt	=8,246.50 kt
8,246,500 t : 8,900,000 people	=0.9265…t
CO_2 reduction/person to achieve the 2030 goal	4.8t - 0.93 t = 3.87 t

This calculation serves as a hypothetical scenario where individuals have complete control over their CO_2 footprint. However, it's important to acknowledge that certain individuals, particularly maximum emitters, cannot simply reduce their emissions to 3.87 t per year due to their responsibilities and operational constraints, making it challenging for them to achieve a zero-emission lifestyle (Statistik Austria 2017a). Therefore, other ways to offset their carbon emissions need to be discussed.

In accordance to the Paris Agreement, the EU has pledged to achieve net climate neutrality by 2050, which entails an 80 to 95% reduction in total emissions. This objective was established as an orientation paradigm for total Austrian emissions; it demonstrates that the Federal Environment Agency's "with additional measures scenario" (WAM+) is insufficient. Austria's maximum budget of 610 $MtCO_2eq$ (see Figure 2) could be reached with a net emission of 73.9 $MtCO_2eq$ in 2021 and a reduction of 4.5 $MtCO_2eq$ per year until 2030, followed by a reduction of 3.4 $MtCO_2eq$ per year until 2040 considering it is linear (Steininger et al. 2022b).

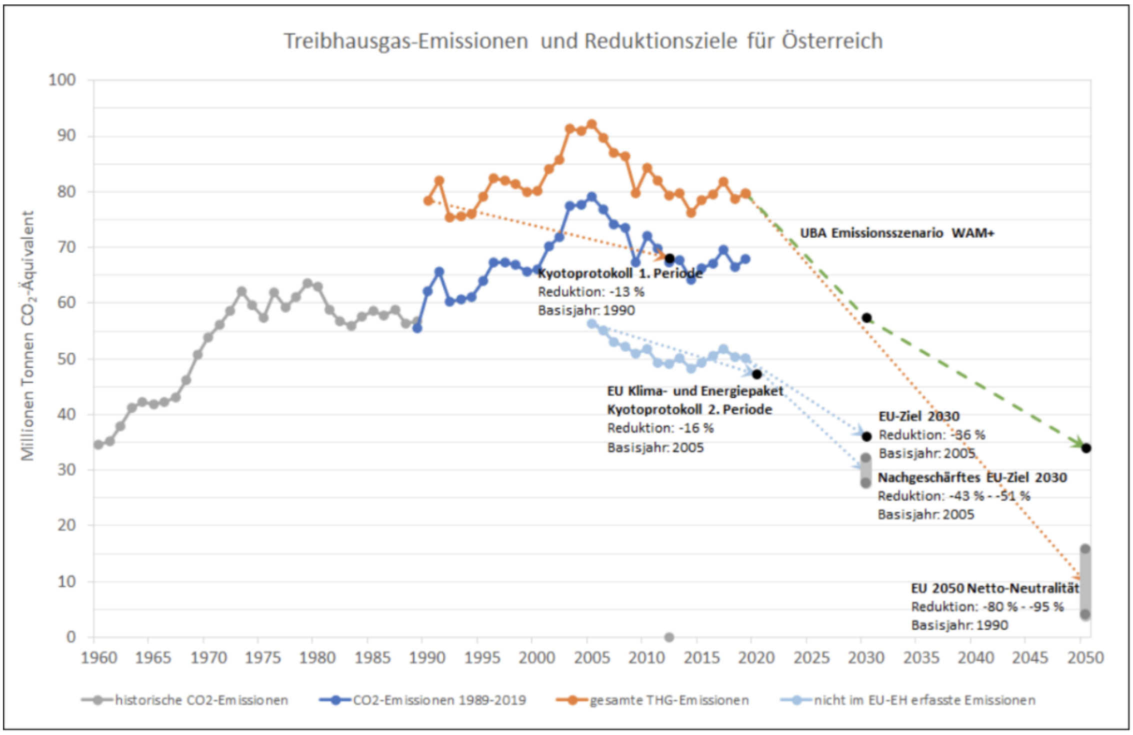

Figure 2 Austria's GHG emission reduction goals (Steininger et al. 2022a)

Austria's emissions need to be reduced by 4.2 $MtCO_2eq$ per year if it is to achieve a net reduction of zero by 2040, based on its present level of emitting approximately 80 $MtCO_2eq$ per year (80$MtCO_2$:19years until 2040). From 2022 to 2040, this results in a total emission of 720 $MtCO_2eq$. Minimal emitters are responsible for 4.8 t per person per year. If all Austrians achieved this value every year, emissions would total 42,720 kt rather than 85,000 kt CO_2 equivalent. However, as already mentioned above such a reduction is not realistic considering the emission profiles, in particular of maximum emitters.

The reality that Austria could not achieve its climate goal even if every citizen would have the emission profile of a minimal emitter, namely the equivalent of 4.8 tonnes of CO_2 per year indicates that additional steps are required to reach the reduction targets.

This result highlights the need for more aggressive and comprehensive greenhouse gas emission reduction efforts in Austria. It suggests that individual efforts, even if substantial, may not be sufficient to meet national climate objectives. It may necessitate systemic changes, such as the transition to renewable energy sources, the improvement of energy efficiency, the implementation of sustainable transportation solutions, and the adoption of stricter regulations and policies, to reduce emissions across various sectors.

To effectively combat climate change and achieve Austria's climate objectives, it is likely that a combination of government initiatives, private sector participation, technological advancements, and behavioural changes will be required. These efforts should aim to reduce emissions in sectors such as energy, transportation, industry, and agriculture, while simultaneously advocating sustainable practises and nurturing international cooperation.

5.1.1 The Impact of Individual Climate Action

This section will specify how much Austrian households emit by sector to then examine how Austrians can reduce their GHG emissions through individual action.

As illustrated in *Figure 4*, the primary sources of greenhouse gas emissions in Austria are the sectors energy and industry (Energie &. Industrie-Emissionshandel), transport (Verkehr), buildings (Gebäude), and agriculture (Agrikultur). In the year 2021, the energy and industry sector together emitted 34.5 million tons of CO_2 equivalents (37%), while the transport sector contributed 21.6 million tons of CO_2 equivalents (27.8%). Additionally, the building sector accounted for 9.1 million tons of CO_2 equivalent emissions (11.7%), Agriculture contributed 8.2 million tons of CO_2 equivalent emissions (10.6%), waste management accounted for 2.3 million tons of CO_2 equivalent (3%), and fluorinated gases made up 1.9 million tons of CO_2 equivalent emissions (2.4%) (Umwelt Bundesamt Environment. Agency Austria 2021a).

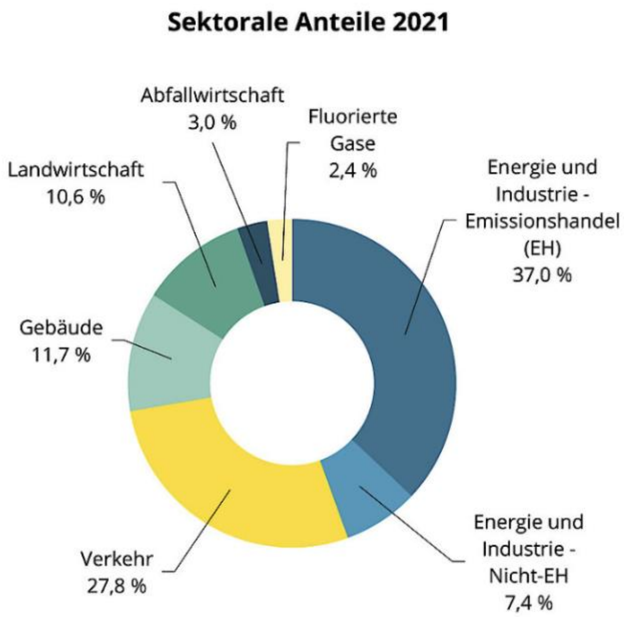

Figure 3 Emissions by sector in Austria 2020 (Umwelt Bundesamt Environment. Agency Austria 2021a)

The distribution of *household emissions* differs from these numbers. According to data acquired via consumption-based carbon accounting, an average household in Austria emits 21.3 t CO_2 (9,6 t per person on average in Austria). These emissions are composed of 22% for electricity and heating, 20% for mobility (commercial mobility is excluded),16% for food, 42% for additional consumption (Frascati 2020).

Calculating energy reductions in the *electricity and heating* sector is probably the most complex. At the same time, it is the most difficult to create an average emitter profile. Emissions in this sector depend on the type of dwelling (house or apartment), the heating system, the cooling system, natural and artificial shade, water boilers, household devices, insulation, the energy mix used to run these devices as well as induvial habits. The Austrian Federal Ministry for Climate Protection (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie) deems a 11% emissions reduction to be feasible through individual behaviour change (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie, n.d.). The measures listed by the ministry range from simple changes like setting the room temperature 1-2° lower in winter, or higher in summer (in case the respective household has air-conditioning), to drastic and expensive changes, like installing new windows and doors, improving a building's insulation or installing heat pumps (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie 2023c). It is evident that some of these measures are universally accessible, while others strongly depend on disposable income. Nevertheless, we will use the reduction targeted by the ministry as a value that seems realistic enough. Given that a *household* realises the individual reductions projected by the Austrian government, total emissions would go to (0.22 x 0.89)[1] x 21.3t = 4.2t CO_2. For the individual that would mean to go from 2.1t to 1.9t CO_2 per year in this sector, again – of course – corresponding to a 11% reduction.

Considering the impact of different *dietary choices* on carbon footprints, research conducted by Scarborough et al. (2023) reveals intriguing insights. A high-meat eater's carbon footprint may reach up to 2,621 kg CO_2 equivalents per year, while a medium

[1] 0. 22 taken from the sectoral quota for electricity and heating

0.89 due to the 11% reduction possible in the sector electricity and heating meat eater could generate around 2,055 kg CO_2 equivalents annually. In comparison, vegetarians contribute significantly less, emitting only 1,199 kg of CO_2 equivalents per year. Consuming animal products is more harmful to the environment than importing food from across the world. Transporting food was only responsible for 6% of emissions, while dairy, poultry, and eggs were responsible for 83% (Ritchie 2020). The data clearly indicates that the most substantial reduction in CO_2 equivalents can be achieved by high meat eaters transitioning to a vegan diet (Scarborough et al. 2023). It follows, that the most environment friendly dietary choice appears to be the vegan diet, with a carbon footprint as low as 778 kg CO_2 equivalents per year.

To calculate the percentage of CO_2 saved when transitioning from one diet to another, we can use the following formula:

$$\text{Percentage of CO2 saved} = \frac{\text{Initial CO2 emissions} - \text{CO2 emissions after transition}}{\text{initial CO2 emissions}} * 100$$

The minimal emitter, by definition, cannot save any more GHG emissions. The maximum emitter would logically be a high meat eater, meaning they could make the most drastic individual reduction. Transitioning from a high-meat eater to a medium meat eater can save approximately 22% of CO_2 emissions, transitioning to a vegetarian can save around 54% of CO_2 emissions, and transitioning to a vegan diet can save about 70% of CO_2 emissions. Nevertheless, these two contributions cancel each other out, meaning that we can concentrate on the average emitter's potential reduction. From the four food profiles described above we can deduce that the group of average emitters should be mostly comprised of medium meat eaters and vegetarians, who, as a group, on average emit $(2{,}055 + 1{,}199)/\ 2 = 1627kg$ CO_2 equivalents per year. This value roughly corresponds to the sectoral proportion of food in household emissions (16%), which would result in average food related emissions per person per year of 9.6t x 0.16 = 1.5t CO_2 equivalents per year. This result proves that the working assumption that average emitters are comprised of medium meat eaters and vegetarians is useful. The medium emitter can consequently reduce $(1627 - 778)/\ 1627 = 0.52 = 52\ \%$ of food related emissions. 52% represents the maximal realistic reduction potential, which should be attainable but also means that meat consumption would come to a full stop. A more realistic estimated guess can, therefore, be made at around 25%. This demonstrates the significant impact a dietary change can have on an individual's CO_2 footprint with regards to food consumption alone. A simple shift in eating habits can make a substantial difference in reducing individual carbon emissions. Sharing information like this can motivate and empower individuals to realize their crucial role in combating climate change and the meaningful impact they can have.

We can divide *mobility* into two categories: individual transport and non-individual transport, with motor vehicle making up the biggest proportion of emissions from individual transport. The carbon dioxide emissions of a typical passenger car can vary depending on several factors, including the car's make, model, fuel efficiency, and driving conditions. The average CO_2 emissions of a passenger car can be *estimated* to be around 116 grams per kilometre (g/km) in Austria (ACEA 2022). An Austrian adult drives their car for 6,530 km per year, with a spread between 4,030km for Vienna residents, and 7,935km for Carinthians (VCÖ 2019). Consequently, a typical Austrian car emits approximately 0.75 tons of CO_2 in a year after driving 6,530 km, when considering an average CO_2 emission of 116 grams per kilometre.

The place of residence has the most significant influence on how much individuals use their cars, while other factors may also be relevant. About 3.7 million Austrians live in rural communities. A study by Demox Research has highlighted the necessity of car usage in Austria's countryside. The survey was conducted among 3,400 residents to study their mobility patterns. The focus of the survey was to understand *how rural citizens commute* and how they *evaluate* different means of transportation. Over the twelve months they were studied, 83 percent of the respondents drove their private cars on a daily or frequent basis, and 27 percent used them as passengers. About 56 percent of the participants walked at least several times a week, while 20 percent used bicycles, 10 percent opted for public buses, and 8 percent relied on trains for their transportation needs. 84 percent of the respondents either strongly or mostly agreed with the idea that "people in rural areas depend on cars to be mobile." This sentiment was especially prevalent in Burgenland, Carinthia, and Styria. 78 percent strongly agreed that *"increased expenses for car usage disproportionately impact rural areas."* Additionally, 55 percent expressed the view that *"rural regions face limitations and are disadvantaged concerning their mobility."* (Demox Research 2019).

Two basic approaches can reduce emissions from individual transportation: switching to shared and *public transportation* or switching to *less carbon intensive* means of transportation. Additionally, one of the easiest yet highly effective measures is to reduce the number of kilometres driven by car. As illustrated above, rural residents in Austria are substantially dependent on means of individual transportation. Given the relatively long distances (over 5km) they must cover for basic activities as going to school, work or grocery shopping, and considering the lacking state of public transportation in rural areas, it would be difficult for them to drive less without significantly reducing their quality of life. This approach therefore holds greater promise in urban settings. Nevertheless, current data show that people living in highly urbanised environments like Vienna already drive significantly fewer kilometres per year. Additionally, 11% of Viennese people over the age of 15 rarely drive a car, and 41% *never* drive. The national average of people over who never drive is half that value, with 21% (VCÖ 2021). Also, the number of cars per person is the lowest in Vienna, with 366 vehicles per 1000 inhabitants (Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie 2023a). While all this illustrates the limited efficacy of such a measure, for the argument's sake we can calculate that if the 5 million Austrian city dwellers were to reduce their car usage by 20% - cutting down their distance driven from 4,030km to 3224km per person per year – their CO_2 emissions would decrease to around 370 kg per person per year, which is a whopping 49% lower than the current Austrian average. However, it is important to acknowledge that these avoided car kilometres will be offset by utilizing alternative transportation such as trains or public transit which of course also emit CO_2 but to a much lesser extent.

Rural residents can most easily reduce transport-related emissions by switching to individual transportation with *alternative fuels*. While some might undertake that shift because of personal convictions, economic stimuli are more reliant predictors of human behaviour. Given the changes in the EU ETS from 2027, fossil fuels will become significantly more expensive. Austrian CO_2 taxation will further increase that effect. This means that it will soon become unreasonable *not* to use hybrid, hydrogen, or electric vehicles. Additionally, the EU has already written into law that additional infrastructure for alternative fuels will have to be built. And from 2025 onward *no new conventional combustion engine cars may be purchased* in the EU. Therefore, significant cuts from individual transport are to be expected in the future.

The 20% of total household emissions for mobility are comprised of 16% of total emissions for car use plus 3.2% for car acquisition plus 0.8% for public transport. Public transport obviously does not change. The *supply chain emissions* for electric vehicles are 35 to 50% higher than for new combustion vehicles (Polestar and Rivian 2023).

We can therefore calculate supply chain emissions (i.e., acquisition emissions) to make up 0.032 x 1.5 = 4.8%[2] of current household emissions. Average *emissions* for a medium sized electric vehicle are estimated to be around 75g per kilometre. Even the *least efficient* electric vehicle would bring a CO_2 reduction of 37% compared to internal combustion engines (Transport and Environment 2022), which would in turn mean that car use would make up 10% of current household emission levels. The sectoral emissions would decrease from 20% to 15.6% (= 10% + 4.8% + 0.8%) of current levels. In Austria, for every 1000 people there are 565.7 vehicles (Statistik Austria 2023b). Consequently, an individual statistically owns 0.56 cars. A negligible 2.6% of all vehicles in Austria are electric, while 92.9 % have internal combustion engines and the rest being hybrid vehicles, which are too ineffective in reducing emission to make a significant impact (Statistik Austria 2023a). Accounting for the electric vehicles already in use, a 15.4% reduction[3] of CO_2 emissions is possible in this sector.

This illustrates that individual behaviour change can have a *massive* influence in the mobility sector. At the same time, it is clear that in reality such a shift cannot occur over night. It has been shown in chapters 3.2 and 3.3 that infrastructure and incentives are being changed to facilitate this scenario, but much remains to be done, especially concerning the cost of alternative vehicles.

Another way for the individual to reduce their carbon footprint is in *reducing air travel*. In our model, this is *part of additional consumption* and *not mobility*. Despite efforts to include the aviation sector in emission reductions on the EU level, Austria's climate targets for 2050 do not encompass international aviation. Nevertheless, air travel has a significant impact on individual emissions. Air travel emissions vary based on the distance and duration of the flight. Airlines categorise flights into three types: Short-haul, Medium-haul, and Long-haul. Short-haul: For flights up to 1000 km and 2 hours, one person emits approximately 125 kilograms of CO_2. Medium-haul: For flights up to 3000 km and 3.5 hours, one person emits about 375 kilograms of CO_2. Long-haul: For flights

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[2] (3.2% for car acquisition) x (*supply chain emissions* for electric vehicles which are up to 50% higher than for new combustion vehicles) = 4.8% (percentage of supply chain emissions of current household emissions)

[3] (0.16 x 0.63) x 0.974 = 0.098 (emissions per household in the sector mobility)

9.8% + 4.8% + 0.8% = 15.4%

over 3000 km and over 3.5 hours, one person emits around 125g of CO_2 per kilometre travelled (Mensen 2013; Our World in Data 2020). Minimal emitters may find it challenging to afford frequent flights. Consequently, the responsibility for driving meaningful change in reducing emissions primarily falls upon the more affluent segment of society. Their choices and actions hold the potential to make a significant difference in promoting a sustainable transformation.

Additional consumption is the sector where socio-economic status becomes most evident as factor contributing to individual emissions. Some individuals may not be able to consume much more than the bare necessities, thus becoming minimal emitters, not by choice, but as an effect of their limited financial capabilities. But also, in the domains of transportation, apparel, and housing, *household earnings predominantly dictate the impact of consumption on resource use*. This remains accurate even when accounting for other influential factors. Elevated-income households exhibit notably greater resource consumption to a certain extent. The situation is more varied for the remaining explanatory factors. In the context of this examination, there is no indication that resource usage and income disassociate at any juncture. Especially in the context of mobility, a pronounced correlation exists between higher income and greenhouse gas emissions (Oehlmann et al. 2021).

Table 1 Monthly carbon emissions for Austrian Households per income decile. "Alle Haushalte" is representing the "average household", whereas the "1. dezil" is representing the "minimal emitter" (Frascati 2020)

Category	Alle haushalte	1. dezil	2. dezil	3. dezil	4. dezil	5. dezil	6. dezil	7. dezil	8. dezil	9. dezil	10. dezil
	Average monthly carbon emissions, kgCO2/month										
Ernährung, alkoholfreie Getränke	**277**	**164**	**187**	**196**	**218**	**249**	**294**	**316**	**336**	**374**	**438**
Ernährung	269	159	181	191	212	241	286	307	326	363	426
Alkoholfreie Getränke	8	5	5	6	7	8	9	9	10	11	12
Alkoholische Getränke, Tabakwaren	**22**	**16**	**18**	**17**	**19**	**20**	**23**	**25**	**27**	**25**	**29**
Alkoholische Getränke	11	6	8	8	9	10	11	13	14	16	19
Tabakwaren	11	10	10	9	10	10	11	12	14	9	11
Bekleidung, Schuhe	**72**	**30**	**40**	**43**	**46**	**55**	**77**	**80**	**84**	**119**	**147**
Bekleidung, Accessoires	55	21	31	29	33	41	61	60	61	91	117
Schuhe	17	9	9	14	13	14	16	20	23	28	30
Wohnen, Energie	**375**	**232**	**284**	**266**	**315**	**338**	**384**	**428**	**456**	**474**	**574**
Tatsächlich gezahlte Wohnungsmieten	44	57	49	55	51	50	49	38	38	29	25
Imputierte Mieten (Erstwohnungen)	81	24	46	46	59	66	84	101	105	128	148
Wohnungsinstandhaltung	48	14	36	14	28	34	39	62	70	76	107
Betriebskosten, Sonstige Zahlungen	24	21	21	23	25	25	26	24	24	25	29
Energie	178	116	131	128	153	164	186	203	219	215	266
Wohnungsausstattung	**125**	**52**	**69**	**67**	**82**	**128**	**128**	**136**	**163**	**195**	**229**
Gesundheit	**49**	**23**	**28**	**29**	**40**	**45**	**48**	**52**	**61**	**76**	**87**
Verkehr	**335**	**102**	**154**	**199**	**234**	**287**	**326**	**396**	**448**	**517**	**683**
KFZ-Anschaffung	54	10	17	36	32	54	57	64	66	89	113
KFZ-Reparatur, -Zubehör, Treibstoff	267	80	126	153	190	222	261	320	366	408	548
Öffentlicher Verkehr	14	12	11	11	12	11	9	12	15	21	22
Kommunikation	**17**	**9**	**11**	**13**	**13**	**16**	**17**	**20**	**19**	**23**	**26**
Freizeit, Sport, Hobby	**180**	**72**	**89**	**100**	**122**	**147**	**177**	**179**	**239**	**286**	**390**
Unterhaltungselektronik, Film-, Foto- und EDV-Geräte	16	9	8	10	12	15	17	17	17	24	30
Sonstige Sport-, Hobby und Freizeitartikel; Haustiere; Garten	44	19	26	24	29	35	42	54	64	67	81
Sport-, Freizeit- und Kulturveranstaltungen	20	10	9	12	15	18	17	20	25	31	40
Printmedien, Papier- und Schreibwaren	18	9	10	10	14	17	18	17	23	26	34
Urlaub	83	25	36	44	51	63	83	72	110	137	205
Bildung	**7**	**4**	**4**	**2**	**5**	**4**	**6**	**7**	**7**	**15**	**17**
Café, Restaurant	**89**	**40**	**49**	**60**	**65**	**81**	**87**	**91**	**102**	**136**	**177**
Sonstige Ausgaben	**122**	**52**	**81**	**82**	**90**	**131**	**119**	**135**	**142**	**172**	**216**
Körperpflege	56	30	45	41	40	65	53	57	62	73	94
Persönliche Ausstattung	9	3	5	8	5	8	8	10	8	13	19
Versicherungen	57	20	31	32	45	58	58	68	72	86	104
TOTAL	*1.669*	*797*	*1.013*	*1.075*	*1.248*	*1.503*	*1.686*	*1.864*	*2.084*	*2.411*	*3.013*

.

The sector additional consumption is comprised of alcoholic beverages and tobacco goods (Alkoholische Getränke & Tabakwahren), apparel (Bekleidung und Schuhe), furnishing (Wohnungsausstattung), health (Gesundheit), communication (Kommunikation), freetime, sport and hobbies (Freizeit, Sport und Hobby), education (Bildung), café and restaurant and other expenditures (Sonstige Ausgaben). By comparing the monthly CO_2 emissions in various categories per household, considering both the average emitter and the minimal emitter, we can make a reasonable estimate of achievable emission reductions for individuals in Austria. It is important to exclude unrealistic emission reductions that would either demand significant sacrifices or result in minimal overall impact. As such, reductions in the categories of health, communication, and education are not accounted for, as they either fall outside the scope of meaningful reduction or offer only marginal contributions to noteworthy emission reductions.

To estimate the reduction that is possible in the sector additional consumption, an analysis of Table 1 can help to make an estimated guess of a realistic emission reduction: The estimated reduction is set, corresponding to the degree of necessity and the price range in each sub-sector. For instance, items considered luxury goods, such as alcohol and tobacco, could feasibly undergo a reduction of 100% as part of the analysis. Nevertheless, according to the data presented in Tabel 1 the median emission reduction potential lies at 25%, the realistic sectoral reduction potential can, therefore, be set on a range from 25%-43%, 43% representing the most drastic but still realistic measures that can be taken to minimize *additional consumption* emissions.

In summary, we can define the potential for total emission reduction in Austria through two key benchmarks, as depicted in the provided tables. The first benchmark, set at 20%, signifies a more modest yet readily attainable goal for individual emission reduction within the Austrian context. On the other hand, the second benchmark, set at 32%, represents a more ambitious target for per-individual emission reduction in Austria. These two benchmarks, 20% and 32%, effectively outline the spectrum within which Austria's emission reduction endeavors can be strategically calibrated, encompassing both pragmatic achievements and aspirational advancements.

Table 2 Illustrates the reduction potential per sector the difference two Table 3 is the reduction potential of 25% in the food and additional consumption sector.

		*) 9.6 t CO2equ/pers/y	from MTH		
	Fraction CO2equ		Reduction Potential	Reduced Emission	Reduction in % of total
	%	tCO2eq/person/year	%	tCO2eq/person/year	individual GHG Emission
Electricity and Heating	22	2,11	11	0,23	2,4
Mobility	20	1,92	15	0,30	3,1
Food	16	1,54	25	0,38	4,0
Additional Consumption	42	4,03	25	1,01	10,5
Sum		9,60		1,92	
Reduction Potential (%)				20 %	20
*) Data: Frascati 2020			from LLH MTH	Result from	
				LLH Data	

Table 3 The difference to table two is illustrated in the reduction potential of the food sector (52%) and the additional consumption sector (43%)

		*) 9.6 t CO2equ/pers/y	from MTH		
	Fraction CO2equ		Reduction Potential	Reduced Emission	Reduction in % of total
	%	tCO2eq/person/year	%	tCO2eq/person/year	individual GHG Emission
Electricity and Heating	22	2,11	11	0,23	2,4
Mobility	20	1,92	15	0,30	3,1
Food	16	1,54	52	0,80	8,3
Additional Consumption	42	4,03	43	1,73	18,1
Sum		9,60		3,06	
Reduction Potential (%)				32 %	32
*) Data: Frascati 2020			from LLH MTH	Result from	
				LLH Data	

5.1.2 Carbon Offset

It is essential to acknowledge that Maximum emitters, Minimal emitters, and Average emitters exhibit varying capacities to adopt sustainable practices. It is unrealistic to expect identical behavioural changes from all these groups. While it may be comparatively easier for Average emitters to modify their lifestyles and reduce emissions, we must recognize that Maximum emitters face unique challenges due to their distinct responsibilities, such as managing large companies with potentially significant carbon footprints.

While lifestyle changes may not be as feasible for Maximum emitters, there exists a viable option for them to address their emissions. Instead of solely relying on personal behavioural shifts, they can implement emissions reduction strategies within their corporate settings. By prioritizing sustainability measures, optimizing operational efficiency, and investing in green technologies, Maximum emitters can make significant contributions to curbing overall emissions. If not able to make the important reductions needed there exist other ways to positively influence the global CO_2 footprint. Largescale carbon offset representing a very convenient measure.

In essence, both "carbon offset" and "carbon offset credit" are terms used interchangeably, although they can have slightly different meanings. A carbon offset refers to a reduction in greenhouse gas (GHG) emissions or an increase in carbon storage, like through reforestation or land restoration, that compensates for emissions occurring elsewhere. On the other hand, a carbon offset credit is a certified, transferable instrument representing the reduction of one metric tonne of CO_2 or an equivalent amount of other GHGs. Purchasers of offset credits can use them to claim the emissions reduction towards their own GHG reduction goal. Carbon offset credits are generated by various activities that reduce greenhouse gas emissions or increase carbon sequestration, such as renewable energy development, capturing high-potency GHGs, and avoided deforestation. These projects can range from small-scale to large-scale and often provide social and environmental co-benefits, such as improved community employment, better air and water quality, biodiversity conservation, and enhanced energy access. While some projects yield high-quality carbon offsets, they may offer fewer co-benefits, presenting a challenge to strike a balance between emission reduction and broader social and environmental contributions (Broekhoff et al. 2019).

The United Nations Climate Change platform provides organisations and companies with a valuable opportunity to offset their emissions. The process begins with calculating their respective emissions, followed by selecting a sustainable project for investment, such as afforestation, solar panels, or wind power. Once the payment is made, the platform issues an attestation, allocating carbon credits to the organization or company, acknowledging their commitment to offsetting their environmental impact.

This system encourages and supports businesses in taking proactive steps towards sustainability while contributing to global efforts to combat climate change (United Nations Climate Change 2023). An alternative option for companies to reduce their CO_2 emissions would be to invest into carbon capture programs that remove CO_2 from the atmosphere and store it underground (Metz and Intergovernmental Panel on Climate Change 2005).

Promoting a comprehensive and inclusive approach to addressing climate change, will be essential by recognizing the diverse roles and responsibilities of different emitters. While prioritising preventative measures to avoid emissions in the first place is ideal, the current reality may not offer immediate carbon-neutral solutions for companies. In this context, incorporating carbon offset and capture as part of a broader sustainable strategy can be a viable combination to address their environmental impact. By leveraging both preventative measures and carbon offsetting, organizations can take significant steps towards achieving their sustainability goals while contributing to global climate efforts.

As this chapter illustrates, evaluating individual climate action is highly complex. Unfortunately, these efforts cannot be confined to a one-size-fits-all approach, and, therefore, there is no universal formula to determine the exact percentage of emissions reduction that can be achieved by each individual, be it in Austria, or elsewhere. The challenges and responsibilities vary across different segments of society, necessitating tailored strategies for each. Acknowledging these diverse circumstances is essential in the collective fight against climate change, as it calls for inclusive and customized measures to effectively address the unique challenges faced by various groups in Austrian society.

6 Summary and Conclusion

This study delved into the intricate web of individual behaviours, policy frameworks, and their collective impact on Austria's climate balance in the context of the urgent global climate crisis. By synthesizing a wide array of information, this paper illuminated the intricate dynamics between individual actions, governmental policies, and international commitments in the pursuit of climate goals.

In the chapter on Climate Policy in the EU and Austria, this paper presented the stark reality of insufficient climate mitigation plans both at the national and international levels. Despite Austria's tangible experiences with climate change and its efforts to combat the crisis through the National Energy and Climate Plan (NECP), it remains poised to miss its 2030 and 2050 climate targets. This study revealed that Austria's emission reduction progress lags behind the EU average, necessitating rapid, collaborative action on multiple fronts to mitigate the adverse effects of climate change.

Addressing the research question, "Is it possible to improve Austria's climate balance for 2030/2050 through individual behavioural change?" this paper's findings indicate a nuanced picture. The examination of individual behaviours and their associated emissions underscored the potential for significant reductions through various avenues. In the chapter on Quantitative Analysis of Individual Climate Action, it was revealed that actionable strategies related to electricity consumption, dietary choices, and transportation patterns could lead to substantial emissions reductions. Adjusting one's diet has the potential to reduce CO_2 emissions by 25% to 52%. In the context of mobility, a sectoral reduction potential of 15.4% should be possible. Additionally, in the areas of electricity and heating, implementing measures can potentially yield a reduction of up to 11% and in the sector representing additional consumption a reduction potential of 25%-43% in CO_2 emission equivalents should be achievable. Therefore, the emission reduction potential in Austria per person can be defined using two benchmarks: 20% for achievable goals and 32% for more ambitious targets. These benchmarks, 20% and 32%, guide Austria's emission reduction efforts, covering both practical achievements and aspirational advancements. The study, therefore, demonstrated that individual choices hold the potential to make a meaningful contribution to Austria's climate objectives.

Moreover, this paper underscored the pivotal role of policy frameworks in shaping and steering individual behaviour. The analysis of regulatory frameworks, such as the European Green Deal, highlighted the multifaceted impact of these frameworks on individual climate action. From stricter CO_2 emission standards for vehicles to the stimulation of sustainable food consumption, the European Green Deal's comprehensive approach aimed to guide both individual choices and larger systemic shifts. However, as revealed in the examination of Carbon Offsetting, the complexity of addressing emissions across various sectors, socio-economic statuses, and roles should not be underestimated. While individual efforts hold promise, this paper recognised that the responsibilities and capacities of different groups, such as Maximum emitters, require tailored strategies that extend beyond personal lifestyle changes. In this context, the concept of carbon offset emerged as a viable mechanism for compensating for emissions in sectors where immediate reductions might be challenging.

In the broader context, the study demonstrated that individual behavioural change is a critical component of achieving climate goals, but it is most effective when complemented by robust policy frameworks, international collaboration, and the engagement of various sectors. The findings confirmed the validity of the research hypothesis, H1: Yes, it is possible to improve Austria's climate balance through individual behavioural change, while acknowledging the limitations posed by diverse contexts and responsibilities.

Ultimately, this paper's comprehensive analysis highlighted that addressing the complex challenge of climate change requires a collective effort that spans individual, governmental, and international spheres. While individual actions can contribute significantly to Austria's climate objectives, achieving meaningful change necessitates a harmonious orchestration of policies, societal engagement, and a shared commitment to a sustainable future.

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