Preparing Contributions to Nationally Determined Contributions (NDC and NECPs)

Fundamental decarbonisation
through sufficiency by lifestyle changes

FULFILL

Deliverable D 6.5

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Fundamental decarbonisation through sufficiency by lifestyle changes

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Project Partners

No	Participant name	Short Name	Country code	Partners' logos
1	**Fraunhofer Institute for Systems and Innovation Research ISI**	FH ISI	DE	Fraunhofer ISI
2	**Wuppertal Institut für Klima, Umwelt, Energie GGMBH**	WI	DE	Wuppertal Institut
3	**Accademia Europea di Bolzano**	EURAC	IT	eurac research
4	**Notre Europe - Institut Jacques Delors**	JDI	FR	Notre Europe Jacques Delors Institute
5	**Association négaWatt**	NW	FR	Association négaWatt
6	**Politecnico di Milano**	POLIMI	IT	Politecnico Milano 1863
7	**International Network for Sustainable Energy-Europe**	INFORSE	DK	INFORSE-EUROPE International Network for Sustainable Energy
8	**Zala Briviba Biedriba SA**	ZB	LV	Zaļā brīvība

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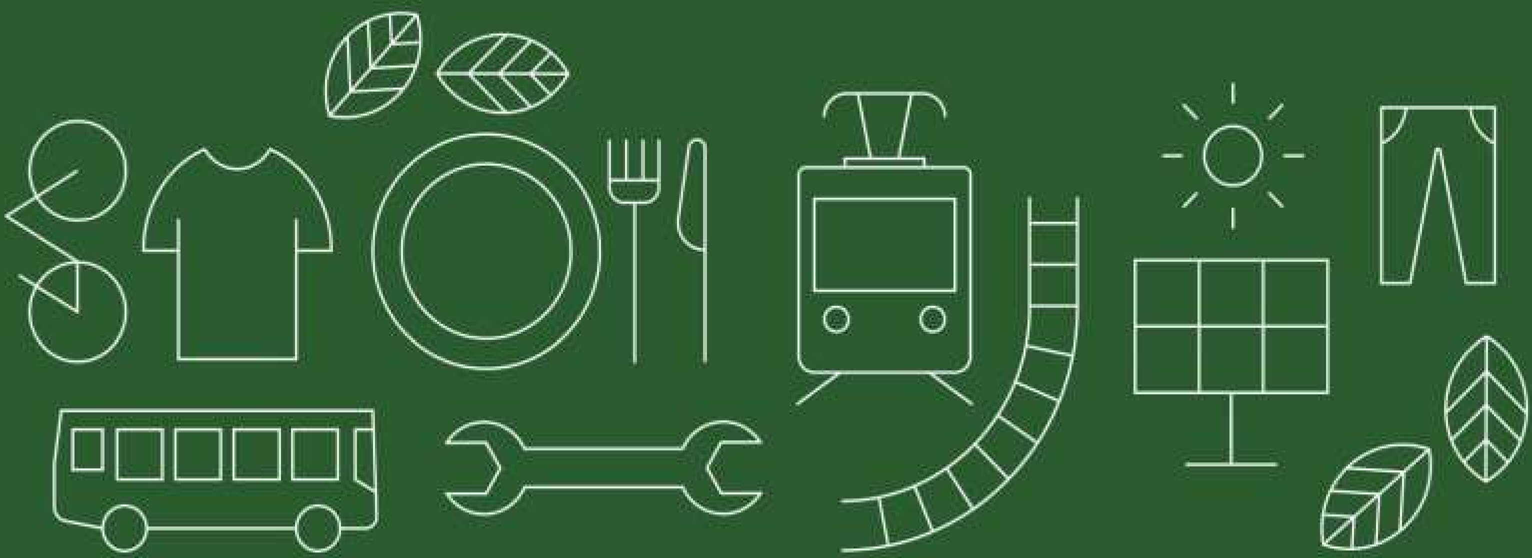

Content

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FULFILL

List of Abbreviations

AGEC	Anti-Waste Law for a Circular Economy (in French; Anti-Gaspillage pour une Économie Circulaire
ASI	Avoid, Shift and Improve
BMWK	German Federal Ministry for Economic Affairs and Climate Action
CINEA	European Climate, Infrastructure and Environment Executive Agency
CO_2e	Carbon dioxide equivalent
DG	Directorate-General (of the European Commission)
DKK	Danish Krone
EEA	European Environmental Agency
EU	European Union
FULFILL	Fundamental Decarbonisation through Sufficiency by Lifestyle Changes
GDP	Gross Domestic Product
GDR	(former) German Democratic Republic
GHG	greenhouse gas
HFC	Hydrofluorocarbon
INECP	(Italian) Integrated National Plan for Energy and Climate
IOA	Input/Output Analysis
IPCC	Intergovernmental Panel on Climate Change
LTS	Long-Term Strategy
M	Million or Mega (10^6)
MS	Microsoft
NDC	Nationally Determined Contributions
NECP	National Energy and Climate Plan
OECD	Organisation for Economic Co-operation and Development
PFC	Perfluorocarbon
SNANC	(French) National Strategy for Food, Nutrition, and Climate
SNBC	(French) National Low Carbon Strategy
SSH	Social Sciences and Humanities
SUMP	Sustainable Urban Mobility Plans
SUT	supply-use input-output tables
T or t	(Metric) tonne (1000 kg)
TAP	Territorial Alimentation Plans
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VAT	Value-Added Tax
WAM	With Additional Measures
WEM	With Existing Measures
WP	Work Package

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Abstract / Summary

This study investigates the potential contribution of sufficiency measures to closing the growing gap between projected GHG emissions and the ambitious targets set by the EU and its member states, including the FULFILL countries (Denmark, France, Germany, Italy and Latvia). By 2050, climate neutrality needed and a policy goal to be achieved, yet the current trajectory indicates a significant shortfall.

A set of six sufficiency measures were examined, with dietary changes and reduced air travel emerging as the most impactful. While sufficiency plays a limited role in the early stages of decarbonization, its importance grows toward 2050. By 2030, sufficiency measures can contribute to a small but non-negligible reduction in the emissions gap. In 2050, their potential is substantial, varying across countries. Only smaller countries like Denmark and Latvia are projected to achieve net-zero climate neutrality with maximum sufficiency savings.

However, the results are subject to significant uncertainties, particularly towards the end of the study period, and are highly dependent on underlying assumptions. The projections assume a scenario of continued economic growth.

While the investigated set of sufficiency measures are crucial for achieving climate targets, they are not sufficient on their own. This study highlights the need for complementary strategies, such as decarbonization in all sectors like industry, transport, and energy production. Addressing challenges in the agricultural sector, particularly meat and dairy production, and air transport sector, is also essential.

Recommendations include prioritizing sufficiency measures in policymaking, promoting dietary changes and reduced air travel, and implementing policies that support sustainable lifestyles. Additionally, addressing the limitations of this study, such as expanding the scope of sufficiency measures and considering supply chain effects, is crucial for future research-

.Introduction and Overview

Purpose of this Document

For five European countries, GHG emissions reduction potentials, related to energy sufficiency measures and lifestyle changes, which had been quantified in Task 6.2, were compared against overall GHG emissions prior to the adoption of measures. This derived information regarding the extent to which such measures could contribute to the shaping of new and updated NDCs and NECPs for European countries.

To this end, overall GHG emissions were calculated using the same input-output model employed in Task 6.2 and served as a reference for calculating the share of GHG reduction potential for each European country. Information from WP2 and WP5 was integrated and used to evaluate these indicators and assess their feasible and realistic contribution towards NDCs and NECPs, considering and evaluating the realistic evolution of the level of uptake of lifestyle changes.

The results shall be included in EU's coming NDC update that is to be presented to the UNFCCC until 2025 based on the Global Stocktake starting in 2023.

Project Summary

The project FULFILL takes up the concept of sufficiency to study the contribution of lifestyle changes and citizen engagement in decarbonising Europe and fulfilling the goals of the Paris Agreement. FULFILL understands the sufficiency principle as creating the social, infrastructural, and regulatory conditions for changing individual and collective lifestyles in a way that reduces energy demand and greenhouse gas emissions to an extent that they are within planetary boundaries, and simultaneously contributes to societal well-being. The choice of the sufficiency principle is justified by the increasing discussion around it underlining it as a potentially powerful opportunity to actually achieve progress in climate change mitigation. Furthermore, it enables us to go be-yond strategies that focus on single behaviours or certain domains and instead to look into life-styles in the socio-technical transition as a whole. The critical and systemic application of the sufficiency principle to lifestyle changes and the assessment of its potential contributions to decarbonisation as well as its further intended or unintended consequences are therefore at the heart of this project. The sufficiency principle and sufficient lifestyles lie at the heart of FULFILL, and thus constitute the guiding principle of all work packages and deliverables.

Project Aim and Objectives

- To achieve this overarching project aim, FULFILL has the following objectives:
- Characterise the concept of lifestyle change based on the current literature and extend this characterisation by combining it with the sufficiency concept.
- Develop a measurable and quantifiable definition of sufficiency to make it applicable as a concept to study lifestyle changes in relation to decarbonisation strategies.
- Generate a multidisciplinary systemic research approach that integrates micro-, meso-, and macro-level perspectives on lifestyle changes building on latest achievements from research into social science and humanities (SSH), i.e. psychological, sociological, economic, and political sciences, for the empirical work as well as Prospective Studies, i.e. techno-economic energy and climate research.
- Study lifestyle change mechanisms empirically through SSH research methods on the micro- (individual, household) and the meso-level (community, municipal):
    - achieve an in-depth analysis of existing and potential sufficiency lifestyles, their intended and unintended consequences (incl. rebound and spillover effects), enablers

and barriers (incl. incentives and existing structures) as well as impacts (incl. on health and gender) on the micro level across diverse cultural, political, and economic conditions in Europe and in comparison to India as a country with a wide range of economic conditions and lifestyles, an history which encompasses simple-living movements, and a large potential growth of emissions.

  - assess the dynamics of lifestyle change mechanisms towards sufficiency on the meso-level by looking into current activities of municipalities, selected intentional communities and initiatives as well as analysing their level of success and persisting limitations in contributing to decarbonisation.

- Integrate the findings from the micro and meso-level into a macro, i.e. national and European, level assessment of the systemic implications of sufficiency lifestyles and explore potential pathways for the further diffusion of promising sufficiency lifestyles.
- Implement a qualitative and quantitative assessment of the systemic impact of sufficiency lifestyles which in addition to a contribution to decarbonisation and economic impacts includes the analysis of further intended and unintended consequences (incl. rebound and spillover effects), enablers and barriers (incl. incentives and existing structures) as well as impacts (incl. on health and gender).
- Combine the research findings with citizen science activities to develop sound and valid policy recommendations contributing to the development of promising pathways towards lifestyle
- Generate findings that are relevant to the preparation of countries' and the EU's next NDCs and NDC updates to be submitted in 2025 and validate and disseminate these findings to the relevant stakeholders and institutions for exploitation.
- Consider the relevance and potential impacts of sufficiency lifestyles beyond the EU.

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1. Introduction

In 2015, the global community agreed in the so-called Paris agreement, to limit global warming to 1.5°C or at least well below 2°C (United Nations, 2015). However, the current path on GHG emissions, as reported by the signatories, does not reach this goal: The Intergovernmental Panel on Climate Change (IPCC) states with high confidence in their summary for policymakers that; "Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850-1900 in 2011-2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals (high confidence) (IPCC, 2023, p. 4). Therefore, reducing GHG emissions and at the same time contributing to a more equal distribution requires additional measures that go beyond technological improvements for more efficient energy use (UNFCCC, 2024). Switching to energy sufficiency lifestyles, is one such lever which meets basic needs and ensures a decent quality of life without excess.

The aim of this report is to assess the potential contribution of a set of sufficiency measures to GHG emission reductions in five EU countries and the EU overall. Specifically, the report quantifies and evaluates energy sufficiency and lifestyle changes, examining their potential to shape new and updated Nationally Determined Contributions (NDC for EU27 as a whole) and National Energy and Climate Plans (NECPs) for the six FULFILL EU countries Denmark, France, Germany, Italy and Latvia. The analysis involves comparing quantified GHG emission reductions (derived in Task 6.2) against baseline emissions, providing insight into the role of sufficiency in EU climate targets.

1.1. The concept of energy sufficiency and lifestyle changes

Energy sufficiency is a concept that emphasizes reducing energy consumption through changes in behaviour, lifestyle, societal norms, and infrastructures rather than relying solely on technological advancements. This approach is grounded in the recognition that technological efficiency alone may not be enough to achieve the necessary and fast enough reductions in energy use and greenhouse gas emissions to mitigate climate change as needed (Lorek & Fuchs, 2013).

The term "lifestyle" refers to the patterns of behaviour and consumption that characterize how individuals, households, or communities conduct their daily lives. These patterns encompass various domains of everyday life, including housing, mobility, nutrition (diet), and clothing (what they wear). Additionally, lifestyles are influenced by the division of labour and gender roles within a society. Lifestyles are not merely individual choices but are shaped and maintained by both "hard" and "soft" institutions. Hard institutions include regulations and laws, while soft institutions encompass cultural norms and societal expectations. Therefore, lifestyles are intertwined with consumption patterns, as the way people consume resources and goods is a key aspect of their lifestyle. They are also reflected in daily behaviours, manifesting in the routine actions and habits of individuals and groups. Additionally, lifestyles are embedded in societal structures, being influenced by the broader social, economic, and cultural context, including gender roles and community norms.

Lifestyle change involves altering these established patterns of behaviour and consumption, which can occur at various levels: at the individual level, changes made by a single person, such as adopting a healthier diet or using public transportation instead of driving; at the household level, changes made by a family or household, such as reducing energy use by installing energy-efficient appliances; and at the collective level, changes made by a community or society, such as implementing policies that promote sustainable living practices. Lifestyle changes are often driven by a combination of personal choices and external influences, such as new regulations, shifts in cultural norms, or increased awareness of environmental issues. These changes aim to create more sustainable and equitable patterns of living that reduce environmental impact and improve quality of life.

An energy sufficiency lifestyle meets basic needs and ensures a decent quality of life without excess. Indicators include metrics for measuring energy use in households, transportation, and other sectors. One of the primary aims of adopting a sufficiency lifestyle is to minimize environmental impact of the individuals and, collectively, contribute to decarbonise the society. This is crucial in order to mitigate climate change in line with the goals of the Paris Agreement.

Examples of measures associated with energy sufficiency lifestyles investigated in the FULFILL projects constitutes of these six sufficiency measures:

1) Cycling more - Modal shift to biking in daily mobility:

Switching from cars to bicycles or e-bikes for transportation reduces energy use, lowers emissions, and promotes health through increased physical activity.

2) Diet change - Reducing the quantity of animal products:

Choosing plant-based diets can greenhouse gas-intensive livestock production, reducing GHG emissions and energy consumption.

3) Flying less:

Reducing air travel can significantly decrease energy consumption and greenhouse gas emissions associated with aviation.

4) Moderation of Car size – Make smaller car segments dominant in sales:

Opting for smaller, more efficient cars reduces energy use and emissions from manufacturing and operating larger vehicles.

5) Sharing products – washing machines;

either peer-to-peer, in communal laundries (inside a building) or in laundromats: Sharing products (only washing machines investigated) can reduce the number of appliances needed, lowering energy consumption and resource use

6) Sharing spaces in Housing – Reducing excessive space consumption;

by developing shared housing for a target population: e.g. among older adults with excess space, can reduce the overall housing surface area per capita, leading to lower energy consumption for heating, cooling, and lighting.

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1.2. The role of NDCs and NECPs in climate policy

The Nationally Determined Contributions (NDCs) are crucial components of the global response to climate change. The NDCs, part of the Paris Agreement, are climate plans developed by countries to show their contribution to limit global warming in line with the Paris Agreement. These plans are reviewed within the United Nations Framework Convention on Climate Change (UNFCCC). This process includes technical dialogues, political negotiations, and a final decision.

The European Union (EU) submits a single NDC covering all of its 27 member countries. To help the Member States to plan their efforts to contribute to the EU's climate goal and to give a tool to the EU Commission to monitor ambition and progress at the Member State level, each EU country submits an NECP to the European Commission. The NECPs are drafted, reviewed, and finalized over a period of about a year and a half, after which the European Commission makes an EU-wide assessment.

This process is instrumental in helping the EU meet its target of a 55% reduction in emissions by 2030 (Spain & European Commission, 2023). The upcoming NDCs for the period 2025-2030 are expected to be submitted between November 2024 and February 2025, following the guidelines of the Paris Agreement (European Commission, 2023; G. B. Olesen & A. Vikkelsø, personal communication, 2024; Richter et al., 2024).

The FULFILL project is a comprehensive research initiative focused on understanding and promoting lifestyle changes as a key strategy for achieving the goals of the Paris Agreement. By centring on the concept of sufficiency, the project aims to explore how reduced consumption and resource utilization can contribute to a decarbonized Europe while enhancing societal well-being.

The project objectives are several:

1) Characterize lifestyle change: The project seeks to define and categorize lifestyle changes, particularly those aligned with sufficiency principles, through a thorough review of existing literature.

2) Identify promising areas: By conducting prospective studies, FULFILL aims to pinpoint sectors and behaviours where sufficiency-based interventions can have the most significant impact on reducing energy demand and greenhouse gas emissions.

3) Develop a conceptual framework: The project will create a framework outlining the relationship between lifestyle change, sufficiency, and decarbonization, providing a foundation for future research and policy development.

4) Explore societal implications: FULFILL investigates the potential effects of sufficiency-oriented lifestyles on various aspects of society, including health, gender equality, and social cohesion. To achieve its objectives, the FULFILL project employs an interdisciplinary approach, combining social sciences, humanities, and techno-economic studies. Key research methods include, literature review, prospective studies like scenario-based modelling to assess the potential impact of different sufficiency-oriented pathways, and case studies with in-depth examinations of successful sufficiency initiatives and their underlying factors, in addition to surveys and interviews to gathering data on public perceptions, attitudes, and behaviors related to consumption and sustainability.

The outcomes of FULFILL are valuable insights into the feasibility and effectiveness of sufficiency as a strategy for climate mitigation. The project's findings inform the development of policies and interventions that support individuals and communities in adopting more sustainable lifestyles. Additionally, FULFILL's work contributes to a broader understanding of the complex interplay between consumption, well-being, and environmental impact (*FULFILL – Fundamental Decarbonisation through Sufficiency by Lifestyle Changes*, 2024).

1.3. Literature on the impact of sufficiency on GHG emissions in NECPs.

Some, but not much literature on the impact of sufficiency on the GHG emissions in in NECPs have been found. These are briefly presented here.

The draft paper "Sufficiency in European Climate Policies" by Olesen and Vikkelsø (personal communication, 2024 under review) examines the integration of sufficiency measures into the National Energy and Climate Plans (NECPs) of Denmark, France, Germany, and Italy. Recognized by the IPCC but often excluded from climate strategies, sufficiency involves creating conditions that reduce energy demand and greenhouse gas emissions by changing lifestyles. As part of the FULFILL project, the paper analyses sufficiency policies and their integration into NECPs through a comparative analysis focusing on buildings, mobility, products and packaging, and diets. The findings reveal that Denmark has implemented some sufficiency policies, such as smart electricity meters and promoting lower indoor temperatures, with recommendations to promote collective housing and reduce parking requirements. France embraces sufficiency ("sobrietë" in French) with policies like carpooling, promoting public transport, and reducing light pollution, with further recommendations to promote plant-based diets and reduce food waste. Germany's policies include dynamic electricity tariffs and promoting public transport, with recommendations to promote carpooling and reduce value-added tax (VAT) on public transport. Italy focuses on public transport and promoting smart working, with recommendations to ban short-haul flights and promote plant-based diets. The paper concludes that there is significant potential to enhance climate mitigation through sufficiency policies, and each country can learn from others and local initiatives to strengthen their NECPs, emphasizing the need for stronger integration of sufficiency into climate policies to meet emission reduction targets and promote sustainable lifestyles. However, the quantification of the sufficiency measures and their impact on NECPs and the investigation of the Latvian NECP are left out for further research (Olesen & Vikkelsø, 2024 under review).

Based on the work of the Finnish climate change panel, Nyfors et al. (2020) presents how ecological sufficiency could be implemented in policies in order to recomposing consumption. The article explores the concept of ecological sufficiency as a complementary approach to ecological efficiency in climate policy. It emphasizes the need to recompose consumption to achieve climate targets, focusing on shifting from high-carbon to low-carbon options. Nyfors et al. (2020) address several sufficiency measures also investigated in the FULLFIL projects:

Regulatory instruments, like banning luxury cars, flights and meats; **Economic instruments** like *taxes* on meat and flights or *subsidies* on vegetables on the workplace and school canteens, *tax relief* for leasing cars, machines and electronic in order to share products instead of owing, *removing subsidies and tax exemptions* on high-carbon options like air travel and commuter subsidies; **Nudging**, like canteens that offers vegetarian dishes as the default option (making it easier to reduce meat consumption); **Framing**, like in product information requiring total cost of ownership information for new cars; **Cooperation**, like setting up facilities for product sharing and finally **Information**, like warnings, similar to those on cigarettes, for red meat and flights. Even though the article (Nyfors et al., 2020) gives an overall framework and practical examples to implement it, the article does not mention explicitly NECP. However, Nyfors et al. (2020) call for coordinated political initiatives to meet the emission reduction challenges which the NECPs are examples of. The study is from Finland, but the sufficiency policies could as well be implemented in other European countries. The study does not quantify the GHG emission potential of the different sufficiency policies suggested, but mention that the average Finn needs to at least quarter its GHG emission by 2030 to reach a global per capita carbon footprint target of 2.5 tCO2e/year in 2030 (Nyfors et al. 2020).

Zell-Ziegler et al. (2021) evaluate the role of energy sufficiency in European NECPs and Long-Term Strategies (LTSs), highlighting that sufficiency measures are present but underrepresented compared to efficiency and renewable energy measures. The analysis of the NECPs and LTSs identified a total of 230 sufficiency-related policy measures. These measures are predominantly found in the transport sector (124 measures), with fewer in the buildings sector (12 measures). The study categorised these measures into three types: reduction (30%), substitution (50%), and general sufficiency-supporting (20%). The policy instruments used include economic (e.g., taxes), fiscal (e.g., subsidies), voluntary agreements, regulation, information, education, research and development, and other. The findings highlight a significant focus on fiscal and economic instruments, but in the transport sector also modal shift policies are used, while the few in the building sector primarily relies on information campaigns. Significant differences exist between countries in the adoption of sufficiency measures, with France and Austria noted for their unique approaches. Zell-Ziegler et al (2021) conclude that sufficiency should be more integrated into policy frameworks to achieve climate targets effectively, but the article leaves the impact and quantification of how much sufficiency could contribute to the climate targets up to further research.

A later scoping report by Zell-Ziegler et al. (2023) for the European Environmental Agency (EEA) provides a comprehensive overview of the concept of sufficiency and its potential operationalisation within EU and national policymaking contexts. It identifies open questions for future research and discusses them throughout the report. The first part introduces and explains the concept of sufficiency, its importance in future policymaking, and its mitigation potential. The second part examines energy consumption trends, compares them with EU targets, analyses EU processes regarding sufficiency, and presents implementation examples from France and other policy approaches. The paper reviews extensive literature and conducts data analysis, concluding with key findings: sufficiency extends beyond behavioural change, is crucial for deep sustainability, offers multiple benefits, has high mitigation potential, is inadequately addressed in the EU, is not yet mainstream in politics, is demanded by citizens, would benefit from a budget approach, requires more modelling and indicators, and lacks studies on its economic dimension (Zell-Ziegler et al., 2023) .

The study by Lage et al. (2023) compares the recommendations of citizen assemblies on climate change mitigation in ten European countries and the EU with those found in NECPs. It finds that citizen assemblies propose significantly more sufficiency-based policies, especially regulatory measures, than NECPs. These findings suggest that the lack of sufficiency in existing climate policies is not due to public opposition but rather reflects political reluctance, institutional constraints, and competing interests. The study highlights the need for more ambitious NECPs, improved coordination, and enhanced stakeholder engagement to effectively address climate change (Lage et al., 2023).

Vita et al. (2019) examine how sustainable lifestyles, defined as living within Earth's ecological limits, contribute to achieving the UN's Sustainable Development Goal of responsible consumption and production in a European context. The research assesses the environmental impact of green consumption and sufficiency-oriented lifestyles through scenarios based on stakeholder input. The study finds that local and sharing economies, plant-based diets, reduced reliance on motorized transport, and energy-efficient housing can significantly decrease environmental burdens like carbon footprints. An Environmentally Extended Multi-Regional Input-Output analysis is used to model these scenarios and assess their domestic and international environmental implications, however the reference year is 2007 (Vita et al., 2019) so quite long time ago. Therefore the results should be handled carefully and can not be applied directly to todays situation or future projections

The IPCC (2022) states with high confidence that a substantial share of the population in low emitting countries lack access to modern energy services, but that eradicating such extreme economic and energy poverty, and providing decent living standards to all can be achieved without significant global GHG emissions growth (IPCC, 2022, Summary for policymakers). In this regard, the chapter five of the IPCC report (2022) explores how changes in consumption patterns and service provision systems can significantly reduce greenhouse gas emissions, especially on the other side of the scale where the rich, large emitters are. The IPCC chapter five divides the options into Avoid, Shift and Improve (ASI), where typically the two formers (Avoid & Shift) fall into our energy sufficiency definition. The chapter further emphasizes the role of social norms, individual choices, and technological advancements alongside collective action in driving climate action. The report explores various aspects like household consumption options, behavioural interventions, and strategies to accelerate low-carbon transitions, while highlighting the importance of social equity and well-being in achieving a sustainable future. Many of those factors falls under our definition of sufficiency measure. Three examples from IPCC with global avoidance potential [quantified where available], the two first of type “Avoid” and the third of type “Shift are; 1) reducing long haul aviation (flying less), and shift to train – 10 – 40 % reduction of total long haul flight global GHG emissions, 2) providing short distance low-carbon urban infrastructure (where our *more biking* sufficiency measure fall within) and 3), change in diets i.e. shifting to a sustainable healthy one. Altogether, these three examples can reduce GHG emissions by 0.5–8 GtCO2-eq globally, where a shift from ruminant meat and dairy to other protein sources, improved agricultural practices, and reducing food waste is a key strategy. This has impact on land use as well, which substantially could lead to benefits in the land-use sector, such as reduced deforestation and land degradation (Creutzig & Roy, 2022) .

2. Materials and methods

The data used in this study are derived from four different sources; 1) the European Commission, DG Energy statistics on historical emissions (European Commission DG Energy, 2024) and our linear forecast based on these historical data, 2) the EEA forecast of future emissions, provided by the EU member state based on their policy (EEA, 2023), 3) the input output model Mario with further adjustment (Golinucci et al., 2024) and 4) the NECP reports from the five FULFILL countries Denmark, France, Germany, Italy and Latvia (European Commission, 2024). These data and the method applied are illustrated in Figure 1 and further described below.

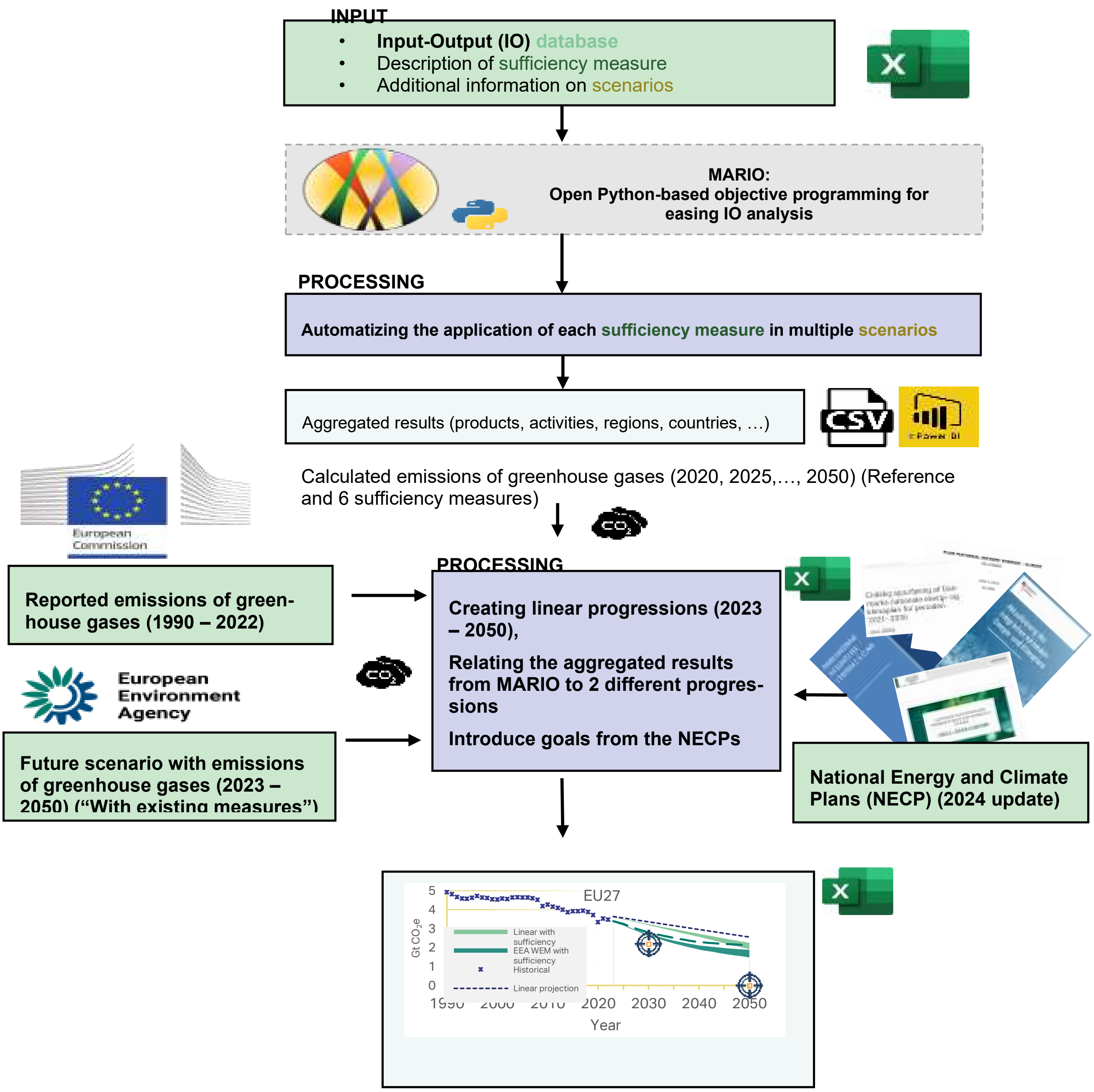

Figure 1: From data sources and input and processing to the results visualization

2.1. Historical GHG emissions

GHG emissions were directly sourced from Energy Statistics of the European Commission, DG Energy, Unit A4 (European Commission DG Energy, 2024). Data are expressed in CO_2equivalent, including CO_2, N2O, CH_4, HFC, PFC, SF_6, and NF_3.

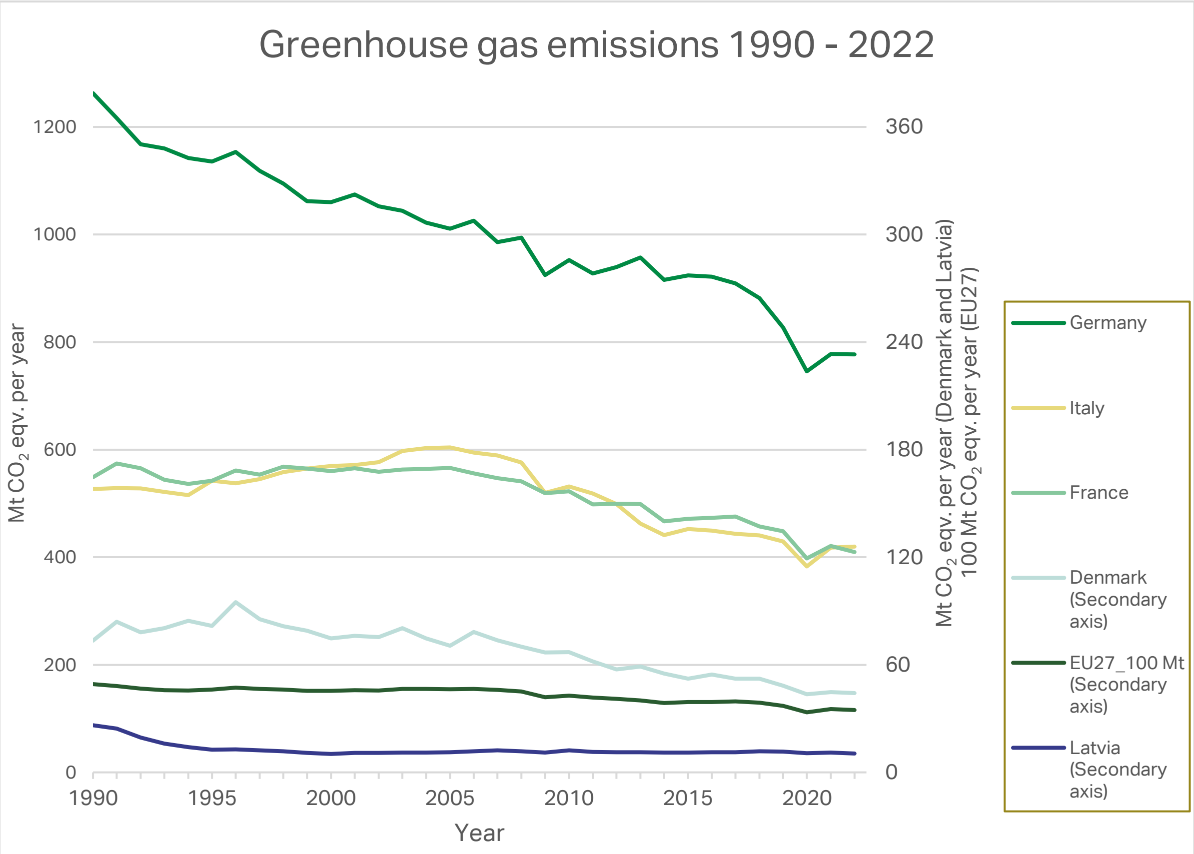

Figure 2: Greenhouse gas emissions 1990 – 2022 for the 5 FULLFIL countries and EU27. Note the different axis and scales (Data source: European Commission, DG Energy, 2024)

Denmark:
Denmark's greenhouse gas emissions peaked in 1996 at 94.9 Mt CO_2e, followed by a consistent reduction, reaching 44.2 Mt CO_2e. in 2022. This decline is driven by Denmark's ambitious renewable energy policies, particularly the expansion of wind power, and significant energy efficiency measures.

France:
France has experienced a steady decrease in emissions, from 548.9 MtCO_2e in 1990 to 409.7 MtCO_2e in 2022. The reduction is gradual, influenced by national efforts towards energy efficiency and nuclear power's significant share in the energy mix, contributing to lower carbon output compared to fossil fuel-dependent countries.

Italy:
Italy's emissions peaked at 604.1 MtCO_2e in 2005, then steadily declined to 419.5 MtCO_2e by 2022. This reduction stems from energy efficiency improvements and the increasing adoption of renewable energy sources like solar and wind.

Germany:
Germany's emissions dropped from 1262.8 $MtCO_2e$ in 1990 to 777.4 $MtCO_2e$ in 2022, largely due to energy transition initiatives (Energiewende), focusing on renewable energy, energy efficiency, and transportation sector reforms. The decline in the early 1990s is also partially attributed to the economic restructuring post-reunification, leading to a closure or modernisation of many heavy, coal-based industries in the former GDR (Thriene, 1992).

Latvia:

Latvia's GHG emissions have significantly decreased from 26.3 $MtCO_2e$ in 1990 to 10.6 $MtCO_2e$ in 2022. The most notable decline occurred in the early 1990s, reflecting the economic transition after the Soviet Union's dissolution. After this, the GHG emissions has been relatively stable around 11 MtCo2e per year.

EU27:

The EU27's emissions have decreased from 4921.9 $MtCO_2e$ in 1990 to 3484.5 $MtCO_2e$ in 2022. This overall reduction reflects the combined efforts of member states to transition to cleaner energy sources and to improve energy efficiency, but also globalisation where production is moved out of the European Union.

2.2. Projections

Linear projections

The historical (1990 – 2022) data presented in Figure 2 was used to provide a linear forecast of GHG emissions towards 2050. This represents a business as usual scenario, without considering any specific goals or policies in place or planned. These linear projections were employed in our study due to their ability to project the historical trend without any specific additional policy measures or goal and are important for enhancing the interpretability of the results. The linear projections are also computationally efficient, making them suitable for easy replications. Their mathematical foundation ensures that the transformations are consistent and reproducible, which is crucial for the validation and comparison of findings across different studies. Thus, the use of linear projections not only streamlines data analysis but also strengthens the understanding of our conclusions.

EEA WEM projection

The EEA publishes detailed projections of GHG emissions for its member states (EEA, 2023). These projections aim to provide early indications of future emissions trends and assess the effectiveness of policies and measures implemented. These projections up to the year 2050 are crucial for policymakers to understand the trajectory of GHG emissions and to plan accordingly to meet targets for 2030 and 2050.

There are two different scenarios in the EEA projections, the WEM (With Existing Measures) and WAM (With Additional Measures) scenarios. WEM projections consider only the policies and measures that are already implemented and enforced. They provide a baseline scenario to understand the impact of current policies on future emissions and are useful for assessing whether existing measures are sufficient to meet future emission targets. On the other side, the WAM projections include both existing measures and additional planned measures that are not yet implemented but are intended to be in the future. They offer a more optimistic scenario, showing the potential impact of additional policies and measures on reducing emissions (EEA, 2015).

As a conservative approach and without too much overlap with our sufficiency measures, we apply the WEM projections as one additional reference for our results.

2.3. Mario input-output model (FULFILL D6.2)

The input-output model (MARIO) has been used for calculating greenhouse gas (GHG) emissions. A detailed description can be found in (Golinucci et al., 2024). The model uses supply-use input-output tables (SUT) to trace commodity inputs and outputs by industrial activities. It includes matrices for production, consumption, and environmental transactions. Direct environmental impacts are captured in the environmental transactions matrix in physical units, which is normalized to create specific environmental footprint matrices, like for GHG emissions.

The model can be extended by adding new activities and commodities, integrating them into the existing economic structure. The model simulates various interventions, such as changes in household consumption, technological efficiency, and supply shifts, to assess their impacts on GHG emissions and other factors (Golinucci et al., 2024).

This approach relies on comprehensive databases that include data on emissions, economic activities, and resource use, considering various impact categories such as cumulative GHG emissions, gross domestic product (GDP – an economic measurement), and employment. A detailed reference scenario has been developed to serve as a baseline for comparison, incorporating assumptions about future economic growth (OECD, 2023), technological advancements (like in the energy, transport and residential sectors), and policy developments under business-as-usual conditions (Golinucci et al., 2024).

A clustering analysis was employed to extrapolate the results from the five FULFILL countries to the other 22 EU member states. The input data from the detailed, country-specific analysis of the five FULFILL countries was extended to the remaining EU countries by Politechnico di Milano and EURAC Research. Different data sets were used for clustering each sufficiency measure. Once each non-FULFILL country was assigned to a corresponding FULFILL-country cluster, the data was extended accordingly. This approach relies on intensive indicators, enabling the data to be scaled appropriately for countries with varying population sizes. For further details, see (Golinucci et al., 2024).

The method for quantifying GHG emissions reduction potentials from sufficiency measures involves comparing *sufficiency scenarios* with *reference scenarios*, using input-output analysis to assess the impact of lifestyle changes on overall GHG emissions.

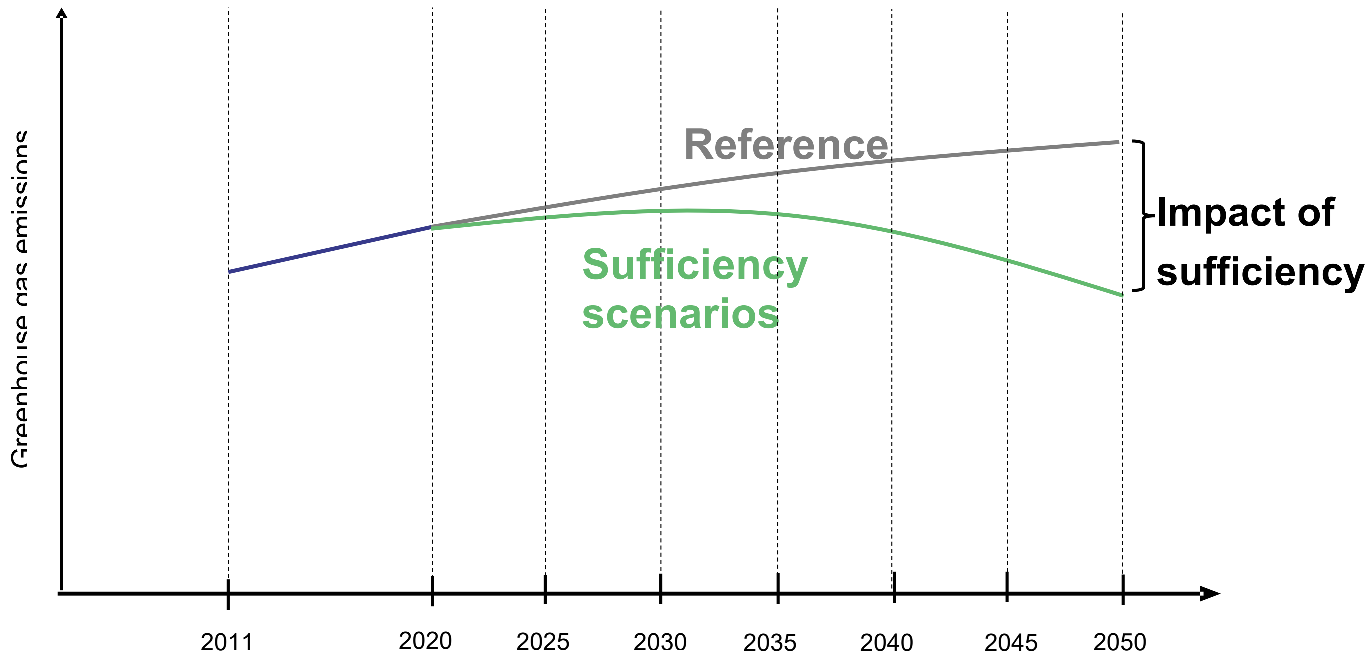

Figure 3: Representation of reference and sufficiency scenarios in the FULFILL project. The example is applied to the indicator "GHG emissions" (based on (Golinucci et al., 2024)).

In more mathematical detail, the approach for comparing reduction potentials in the *sufficiency measurements* against overall emissions in the reference scenario, is to calculate the delta; *reference scenario* minus *sufficiency scenario* for each of the year 2020, 2025, …, 2050

$$E_{Delta} = E_{REF} - E_{SUF} \quad (1)$$

Since, however, the linear trend from the historical data and the EEA projections both show a decreasing trend, whereas the Mario Reference showed a stable or light increasing trend, we decided in addition to also use the factor (GHG emissions with sufficiency measures divided by the Mario reference GHG emissions):

$$E_{Factor} = E_{SUF}/E_{REF} \quad (2)$$

These two different ways of calculating the savings from the Mario model (E_{Delta} and E_{Factor}) are applied and give an upper and lower bound for a possible area of emission reduction due to sufficiency measures. These two boundaries, the savings in absolute number (E_{Delta}) and the savings as a factor (E_{Factor}) then represent respectively the lower (maximum savings) boundary and the upper (minimum savings) boundary in relation to the two reference projections (linear and EEA WEM) in figures 6 – 11

2.3.1. Results from the Mario model used as input

Figure 3 shows the calculated potential savings in greenhouse gas emissions due to all six sufficiency measures in the five fulfil countries shown individually and the rest of the EU (22 countries) from year 2020 to 2050. The scale is million tonnes of CO_2 equivalent (Mt CO_2-eqv). The overall trend is an increased potential savings over time, the most significant growth occurring in the later years of the projection period. The largest potential savings are expected in the Rest-EU(22) region, followed by Germany, France and Italy, which is expected due to their relative size. Denmark and Latvia are very small countries, almost not showing up in the summary figure. In 2030, the overall savings for all EU countries could be 171 Mt CO_2-eqv. reaching 649 in Mt CO_2-eqv. in 2050, everything else equal. Overall, the graph suggests that sufficiency measures could contribute significantly to reducing greenhouse gas emissions in the EU and its FULFILL countries and other member states.

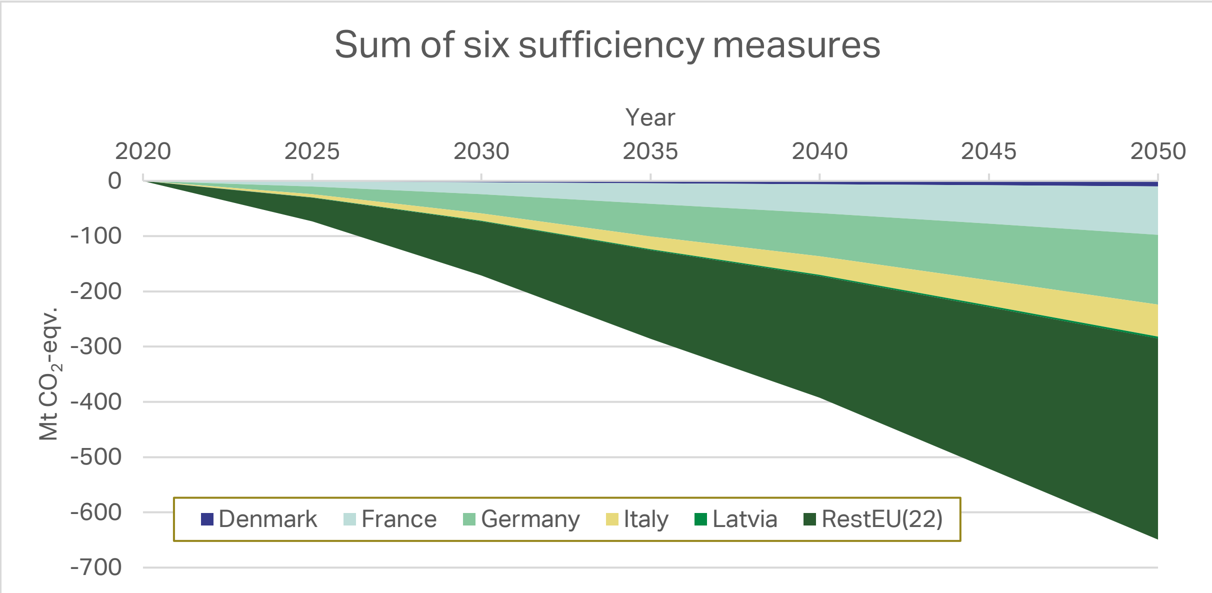

Figure 4: Potential saving in GHG emissions from the sum of all six sufficiency measures towards year 2050 (based on Golinucci et al., 2024).

Figure 5 presents the GHG emission reduction potentials for each sufficiency measure by country. Note the scale, (y-axis) which is not the same for the different sufficiency measurements a-f due to the large variety of the potential savings. The 5 countries investigated and the rest of EU (22 countries) gives in total the EU27. Latvia and Denmark are usually so small that their contribution is difficult to see. The exact numbers can be found in Annex A & Annex B.

The 'biking more' sufficiency measure is depicted in figure 4a. By 2030, there is a noticeable increase in biking values across all countries, with the total for the EU27 reaching 7.8 Mt CO_2-eqv. Germany (1.0 Mt CO_2-eqv) and Italy (0.7) and the rest of the EU (22) have the highest growth in potential toward 2030 and then flattening out. Figure 4b shows the GHG potential savings for the sufficiency measure with a diet change towards less meat and dairy products. A large and growing potential towards year 2030 and 2050 is projected. Germany, France and Italy have the highest potential. In total, the potential reduction potential in 2030 is for the European Union 515 Mt CO2e in year 2050.

Figure 5 c shows the 'flying less' sufficiency measure, with a slow growth in GHG emission reduction potential towards 2025, then a large growing potential until 2035 when the growth in the emission savings stabilize at a high level. In total for the EU, the potential reduction from flying less is 31 Mt CO_2e in 2030 and 101 Mt CO2e in year 2050.

Figure 5 d shows the 'moderate car sizing' sufficiency measure showing a similar pattern as Figure 5c (flying less) but on a much lower level, reaching 21 Mt CO_2e in year 2050 for EU as a total.

FULFILL

Figure 5 e illustrates the sharing products exemplified with washing machines. The potential savings are so small in the beginning that they do not show up in the graph before 2025 with a stepwise increasing curve reaching a total potential GHG for EU in 2030 of 0.15 Mt CO_2e and 1.8 Mt CO_2e in year 2050.

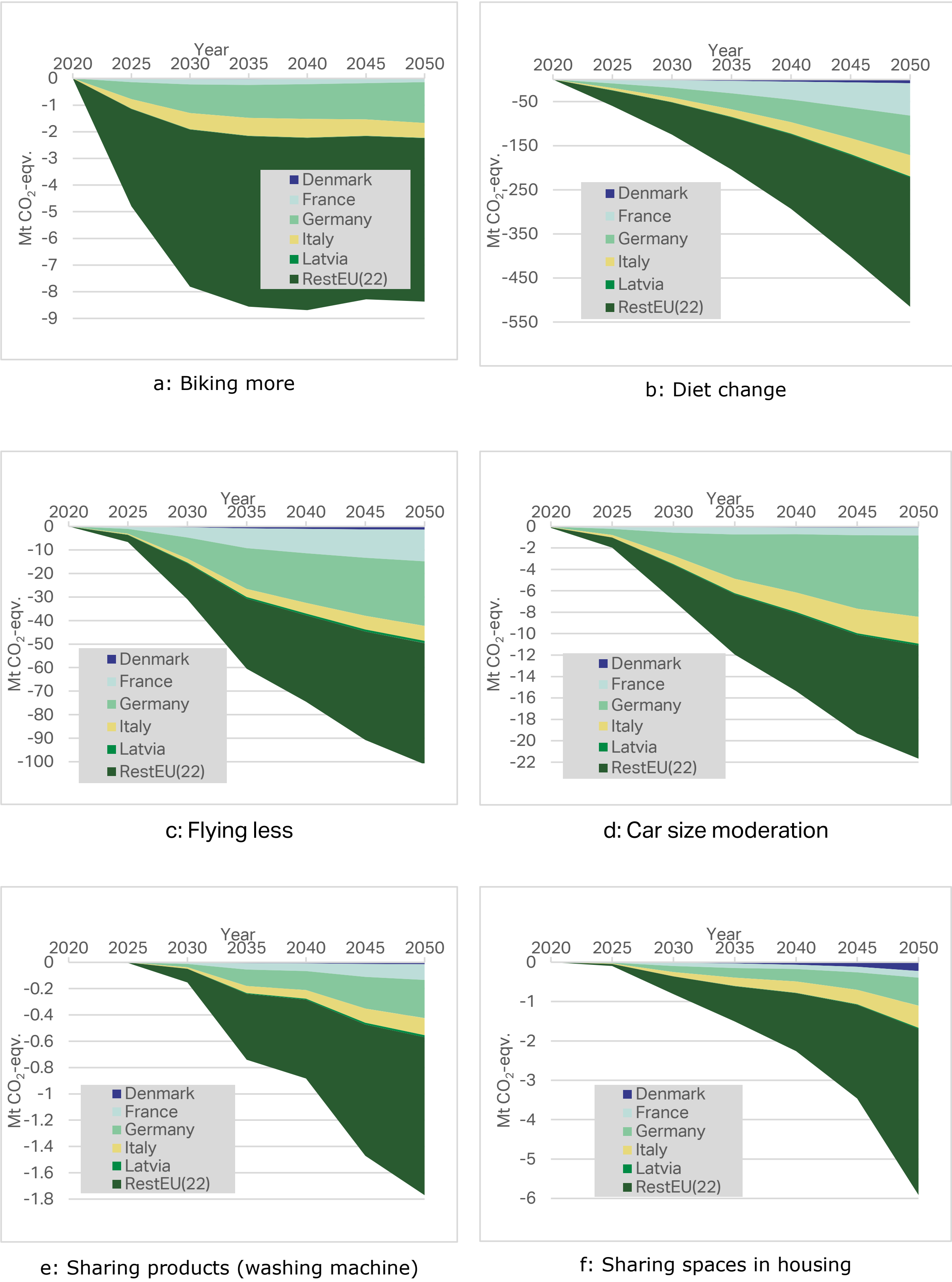

Figure 5: GHG emission reduction potentials by country for each sufficiency measure a to f. (based on Golinucci et al., 2024)

As illustrated in Figure 5, the sufficiency measures related to dietary changes and flying less exhibit the most significant potential for reducing greenhouse gas (GHG) emissions. These measures outperform others due to several key factors. Firstly, the agricultural sector, particularly meat and dairy production, is a major contributor to GHG emissions. Livestock farming generates substantial methane emissions, a potent greenhouse gas with a global warming potential many times greater than CO2. Methane is produced during digestion in ruminants (enteric fermentation) and from manure management, where especially methane from enteric fermentation is difficult to capture. Despite advancements in renewable energy, the emissions from livestock remain a significant challenge due to the biological processes involved. Secondly, the air transport industry is notoriously difficult to decarbonize. Most of the time, aircraft emissions occur at high altitudes, where they have a more pronounced warming effect compared to ground-level emissions. Even bio-based aircraft fuels have a considerable global warming potential as much of these emissions occur at high altitude.

Also, from figure 5, it is clear that the difference between how the sufficiency measures could impact the different countries investigated varies. For example, *biking more* could potentially have a relatively larger impact in Germany and Italy and the other 22 EU countries as a group, than in Denmark and France. For *car size moderation,* this could have a large impact on Germany.

It is also worth mentioning that of the several product groups used by consumers, we only investigated the washing machine as an example of a product that could be shared.

Therefore, of the set of sufficiency measures investigated, dietary changes, such as reducing meat consumption and increasing plant-based foods products, and flying less have the most significant GHG reductions potentials in this study.

2.4. NECPs for 5 European Countries

The National Energy and Climate Plans (NECPs) for the 5 FULFILL countries (Denmark, France, Germany, Italy and Latvia) were investigated. We used the latest available versions of the NECPs at the time of this study (July – August 2024). Here we describe the NECPs and provide an overview with the focus on GHG emissions reduction targets and eventually sufficiency measures. This section also profits from earlier investigations of different versions of the NECPs in the FULFILL projects, especially the work of (G. B. Olesen & A. Vikkelsø, personal communication, 2024). Therefore, the aim is not to give a detailed overview of the NECPs (that has been done in other studies like (Zell-Ziegler et al., 2021)), but rather to see how much overlap there might be between our investigated sufficiency measures and already in place sufficiency policies in the NECPs.

Common patterns in all NECPs investigated are the focus on expanding renewable energy, especially solar and wind, and improving energy security by reducing dependency on fossil fuels. In addition, some NECPs have included some sufficiency policies in varying degree.

2.4.1. Denmark

The final update of the Danish NECP from June 2024 (NECP Denmark, 2024) outlines Denmark's ambitious climate goals, including a 70% reduction in GHG emissions by 2030 compared to 1990 levels, climate neutrality by 2045, and a 110% reduction in emissions by 2050. To achieve these targets, the NECP focuses on expanding renewable energy sources, aiming to quadruple electricity production from renewables by 2030 through significant investments in offshore wind projects and energy islands. Additionally, the plan emphasises improving energy efficiency across various sectors, such as private homes, businesses, and public buildings, through economic incentives, regulatory measures, and informational campaigns. Energy security is another key component, with the plan aiming to ensure a stable and secure energy supply by reducing dependency on fossil fuels and enhancing cooperation with neighbouring countries for energy interconnectivity.

Sufficiency measures include promoting **biking** through state budget allocations for bicycle paths, co-funding municipal bicycle infrastructure, and establishing a national advisory centre for bicycle promotion. Although not directly mentioned in the NECP, the Official **Dietary Guidelines** (Ministry of Food, Agriculture and Fisheries of Denmark, 2021) aim to reduce the climate impact of nutrition, highlighting Nordic cooperation. Furthermore, a passenger tax on **air travel**, averaging DKK 100 by 2030, will be implemented starting in 2025 to encourage less air travel, projected to reduce aviation by 4% (NECP Denmark, 2024) However, a portion of the revenue from this tax will support smaller Danish airports, facilitating short-haul flights within Denmark, which somewhat contradicts the overall reduction objective (G. B. Olesen & A. Vikkelsø, personal communication, 2024).

2.4.2. France

The NECP for France (NECP France, 2024) outlines ambitious goals for reducing greenhouse gas emissions, aiming for net zero by 2050 and a 40% reduction compared to 1990 levels by 2030. The French National Low Carbon Strategy (SNBC 2) sets carbon budgets for five-year periods, with targets of 357 Mt CO_2eq per year for 2024-2028 and 299 Mt CO_2eq per year for 2029-2033. These budgets are key to meeting the emission reduction targets.

The Mobility Guidance Act supports bicycling through various measures, such as a sustainable mobility package for employers to subsidise commuting costs, co-funding for the purchase of electrically assisted and cargo bikes, and a conversion premium for scrapping old vehicles in favour of electric or cargo bikes. Secure bicycle parking is mandated for new buildings, and tax reductions are offered to companies providing bicycles for commuting. The creation of cycling routes and the promotion of cycling culture in schools are also emphasised, with the first cycling plan from 2018 being extended and strengthened as part of the 2022-2027 cycling and active mobility plan ((NECP France, 2024; G. B. Olesen & A. Vikkelsø, personal communication, 2024).

Further, the French NECP promotes reduced meat and dairy consumption through various initiatives, including Territorial Alimentation Plans (TAPs – In French: Plans d'Alimentation Territoriaux; PAT) mandated by the Climate and Resilience Law, achieving at least one TAP per department by January 2023, with nearly 430 TAPs recognised by April 2023. These TAPs, supported by a national network, are mostly in an emerging phase needing substantial support. Environmental labelling on food products, initiated by the Anti-Waste Law for a Circular Economy (AGEC; in French; Anti-Gaspillage pour une Économie Circulaire) and Climate and Resilience Laws, aims to integrate carbon storage and production models, allowing comparisons of environmental impacts across product categories and within the same category. The policy also introduces vegetarian meals in public canteens and includes initiatives like reducing food waste, targeting 8% of agricultural land for legumes by 2030, and doubling leguminous crop areas under the National Plan for Plant Protein. The National Food and Nutrition Programme (2019-2023) supports re-balancing plant and animal proteins in diets, mandating weekly vegetarian menus for mass catering services and daily vegetarian options for voluntary local and regional authorities, state, and university canteens. The Climate and Resilience Law also calls for a new National Strategy for Food, Nutrition, and Climate (SNANC) to establish comprehensive food governance through broad stakeholder consultation (Olesen & A. Vikkelsø, personal communication, 2024).

Additionally, The NECP includes sufficiency policies to promote less flying by taxing air tickets and limiting short-haul flights where train travel is available within 2 hours and 30 minutes (Breucker & Defard, 2023; G. B. Olesen & A. Vikkelsø, personal communication, 2024) . France is a forerunner in long distance high-speed train transport, "with 757 km of additional new high-speed lines put into operation between 2015 and 2020" (NECP France, 2024, p. 176) relevant for the model shift from air transport to more energy efficient and less polluting train transport.

2.4.3. Germany

The NECP of Germany (BMWK, 2024) shows ambitious national climate targets, aiming to reduce GHG emissions by at least 65% by 2030 compared to 1990 levels, 88% by 2040, and achieve GHG neutrality by 2045. Additionally, the federal administration aims to achieve climate neutrality by 2030. These targets reflect Germany's commitment to addressing climate change and transitioning to a sustainable future.

The German Federal Government aims to enhance cycling infrastructure and safety through the National Cycling Plan 3.0 (NRVP 3.0), targeting a doubling of cycling kilometres by 2030. Key initiatives include funding for everyday and tourist cycling infrastructure, flagship projects, bicycle parking, and research. The plan also addresses the shortage of skilled workers in the local municipalities, which is being countered with a training offensive, the course "Inviting Cycling Networks," and further training and networking events for civil engineers, traffic and urban planners. Additionally, relevant for more biking, the Germany user-friendly, app-based digital services are being developed to simplify sharing options for cars, bicycles, electric scooters, and e-scooters, promoting more sustainable mobility solutions. The seven endowed professorships for cycling are also an important pillar to permanently secure education and research on sustainable mobility. Cycling-friendly policies are supported through amendments to the Road Traffic Act, promoting climate and environmental protection, health, and urban development (BMWK, 2024).

In the realm of nutrition (relevant for the less meat and diary products sufficiency measures), the German Federal Ministry of Food and Agriculture is focused on promoting sustainable and healthy consumption. This involves creating an integrated food policy that uses a mix of instruments to design food environments that facilitate sustainable diets. The government is preparing a national nutrition strategy to support these goals, emphasizing the importance of making it easier for consumers to choose healthy and sustainable food options.

To strengthen rail passenger transport – which can help **reduce air travel**, Germany reduced the VAT on long-distance rail tickets from 19% to 7% as of January 1, 2020, while increasing the air transport tax from April 1, 2020. This was intended to correct the pre-pandemic situation where flights were often cheaper than rail travel, which was counterproductive for climate goals. However, the government also subsidizes domestic air transport energy products through an unlimited tax relief that in 2023 amounted to €504 million. (BMWK, 2024; G. B. Olesen & A. Vikkelsø, personal communication, 2024).

2.4.4. Italy

"There will therefore be a need for a substantial shift in lifestyles and consumption patterns towards more energy-efficient behaviour and lower emissions, to which new generations are certainly more sensitive, acting through the sources of public training and information, together with ways of promoting/discouraging behaviour according to their sustainability."

(Italian Ministry of the Environment and Energy Security, 2024) p. 5)

Italy's NECP (called Integrated National Plan for Energy and Climate - INECP) from June 2024 outlines the strategy to achieve energy sufficiency and reduce greenhouse gas emissions. Italy aims to decrease emissions, increase renewable energy use, enhance energy efficiency, and ensure energy security. To accomplish these goals, Italy focuses on promoting renewable energy sources such as solar, wind, geothermal, and others. Additionally, the plan emphasizes energy efficiency through building improvements, electric and hybrid heating/cooling systems, and energy-saving appliances. While exploring the potential role of nuclear power, the strategy prioritizes hydrogen development for domestic production and infrastructure. Low-emission mobility is encouraged through electric vehicles, alternative fuel infrastructure, and sustainable transportation options. To support these initiatives, Italy is implementing environmental tax reforms that favour clean energy sources. Monitoring and evaluation are crucial components of the plan to track progress towards energy and emission reduction targets. Overall, Italy's approach to energy decarbonization involves a multifaceted strategy encompassing renewable energy, efficiency, technological advancements, and policy reforms (Italian Ministry of the Environment and Energy Security, 2024).

The updated NECP from June 2024 highlights that the objectives set in the INECP 2019 have not been fully met. By 2030, the penetration of renewable sources is projected to be 26% (target was 30%) and final energy consumption is projected to amount to 111 Mtoe (target was 104 Mtoe). According to the Italian NECP, these gaps are attributed to the overly optimistic goals of the 2019-plan, incomplete implementation of measures, and changes in context such as the pandemic, economic recovery, and war. To address these gaps, sufficiency measures are needed as the Italian government has only included such measures to a certain extent so far.

Similar to our sufficiency measure of **biking** more is the Italian plans to develop cycling in the country. In accordance with the law from 2018, municipalities with populations over 100,000 and metropolitan cities must create and adopt urban cycling plans, known as 'bicibility plans,' as part of their Sustainable Urban Mobility Plans (SUMP). Guidelines published in October 2020 provide useful advice for drafting these plans, helping local administrations of all sizes to develop effective cycling infrastructure. These guidelines were partially integrated into the Master Plan for Cycling adopted in August 2022. (Italian Ministry of the Environment and Energy Security, 2024).

2.4.5. Latvia

The Final Updated Latvian NECP 2024 (Klimata un enerģētikas ministrija, 2024) outlines ambitious goals, including a 65% reduction in emissions by 2030 compared to 1990 levels and achieving climate neutrality by 2050. Regarding the set of sufficiency measures analysed in this report, relevant policies for more biking includes the installation of slow charging stations for e-bikes near apartment buildings and parking lots, financial support for socially vulnerable households to purchase e-bikes, and the development of micromobility infrastructure, including separate cycling paths. For example, the NECP states that “It is necessary to promote behavioural change in society by diversifying public transport services, developing micro-mobility and transport sharing opportunities, transforming urban planning solutions.” (Klimata un enerģētikas ministrija, 2024, p. 20). Also, the Latvian NECP emphasises optimising the public transport system, prioritising railways and multimodality, with plans to improve public transport routes to facilitate seamless travel by combining different transport options such as trains and buses (that might reduce flying). Although Latvia has three international airports, partially connected by railway lines (Reichert, 2024) the NECP does not specifically mention reducing air transport. Also addressing changes to diets or nutrient intakes, sharing products or spaces are not addressed in the Latvian NECP (Klimata un enerģētikas ministrija, 2024).

3. Results

The figures 6 – 10 illustrate, for each of the five FULFILL countries (Denmark, France, Germany, Italy and Latvia) and EU27 (figure 11), greenhouse gas (GHG) emissions´ trajectories from 1990 to 2050, comparing historical data with two different projections and sufficiency scenarios in relation to the five National Energy and Climate Plans (NECP) targets and the EU NDC. Historical emissions, depicted by blue markers, show a decline from year 1990 to 2022. Projections from 2023 to 2050 include a linear trend (small dashed blue line) and the European Environment Agency's "With Existing Measures" (WEM) prediction (larger dashed green line), both indicating continued reductions. For each of these regions, our sufficiency scenarios, "Linear with Sufficiency" (light green) and "WEM with Sufficiency" (dark green), demonstrate accelerated emission reductions taking into account the sum of our six sufficiency measures. The green shaded areas (light green and darker green) (where the upper boundaries are depicting the sufficiency factor and the lower boundaries are depicting the sufficiency delta, (cf. the data and method section) represent the possible range for future emissions given that either the linear or the EEA WEM projections are followed. With sufficiency measures, the GHG emissions get closer to the NECP/NDC goals marked with blue and orange target. The EEA WEM projections flatten out towards the end of the period, while the linear projections (by nature) have a constant decrease.

3.1. Results by country

Figure 6 shows the results for Denmark. With the EEA WEM projection and sufficiency measure, the target in 2030 is close to be reached. However, in 2045 and 2050 (both linear and EEA WEM), and for the linear projections in 2025, there are large gaps between target and projected emissions. With a linar projections of the sufficiency measures investigated, these could contribute to a

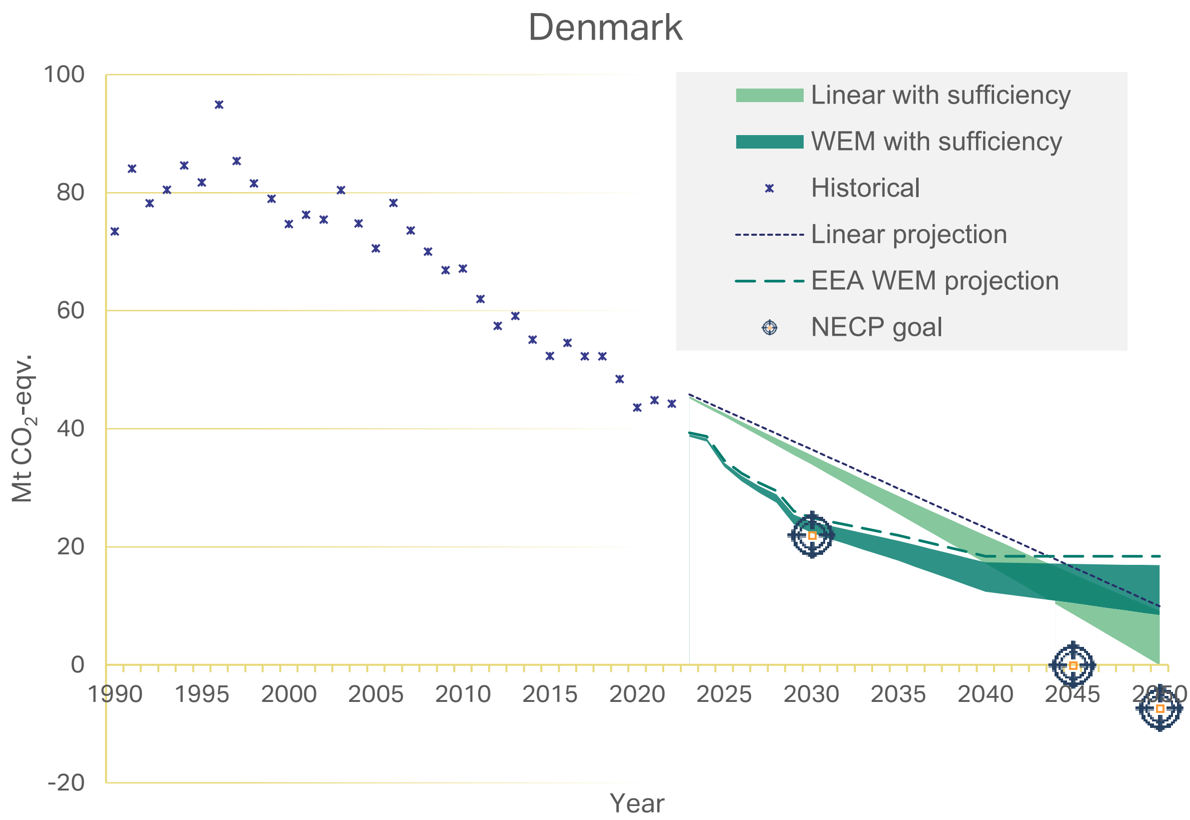

Figure 6:: Denmark: Greenhouse gas emissions; projections and sufficiency measures and NECP- goals

Figure 7 shows the results for France. With sufficiency measures and EEA WEM projects, the target in 2030 could be reached. However, with the linear projections also including sufficiency measures, the targets in 2030 is not reached. The net zero target in 2050 is way far from both projections. This is also the case when including the sufficiency measures.

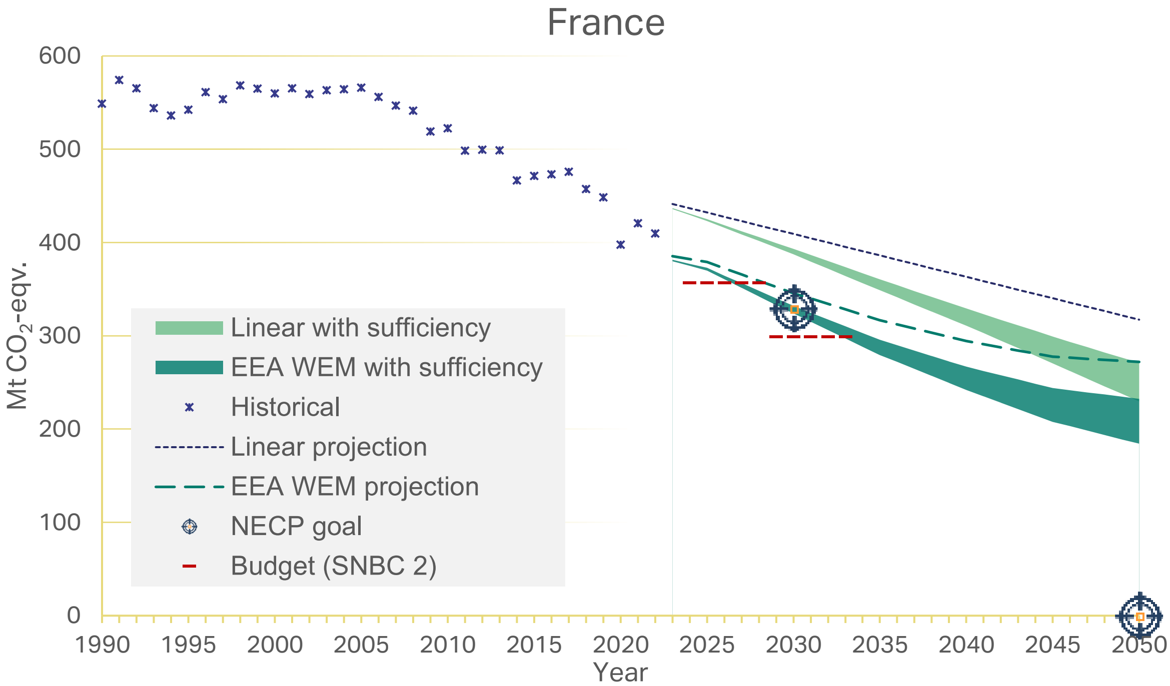

Figure 7: France: Greenhouse gas emissions; projections and sufficiency measures and NECP- goals and -budget.

Germany

Figure 8 shows the results for Germany. The 2030 target could be reached with the EEA WEM projection, but is far away from the linear projection, also if including sufficiency measures. The 2040 target will not be reached with the EEA WEM projections alone, but could be within reach with sufficiency measures. For 2040, with the linear projection and for 2045 net-zero target are out of reach also with the investigate sufficiency measures. Towards 2050, the EEA WEM projection flattens out and reach about 150 Mt CO_2 equivalents. With the optimistic delta approach (c.f. the data and method section) for the sufficiency measures, Germany comes close to climate neutrality, but also here additional measures are needed in 2050.

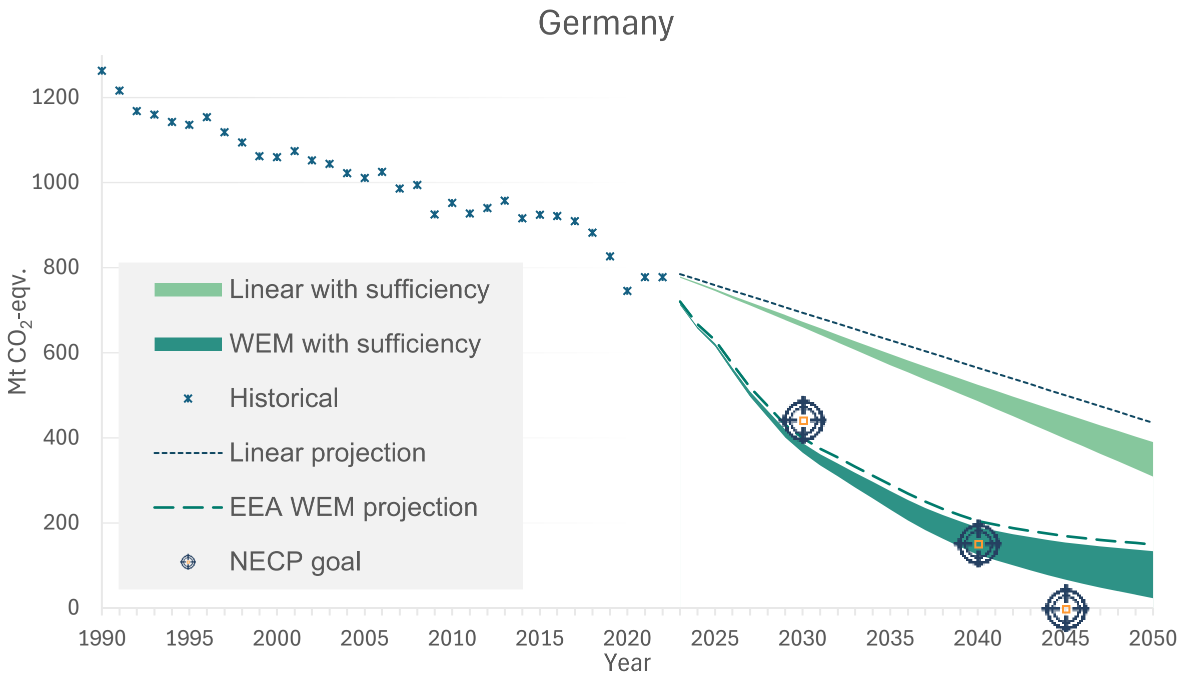

Figure 8: Germany: Greenhouse gas emissions; projections and sufficiency measures and NECP-goals

Figure 9 shows the results for Italy. All NECP goals are out of reach, for both the EEA WEM and the linear projections. This is even more the case for 2030 and 2040. The sufficiency measures helps close the gap, but is not alone enough to reach the NECP goals.

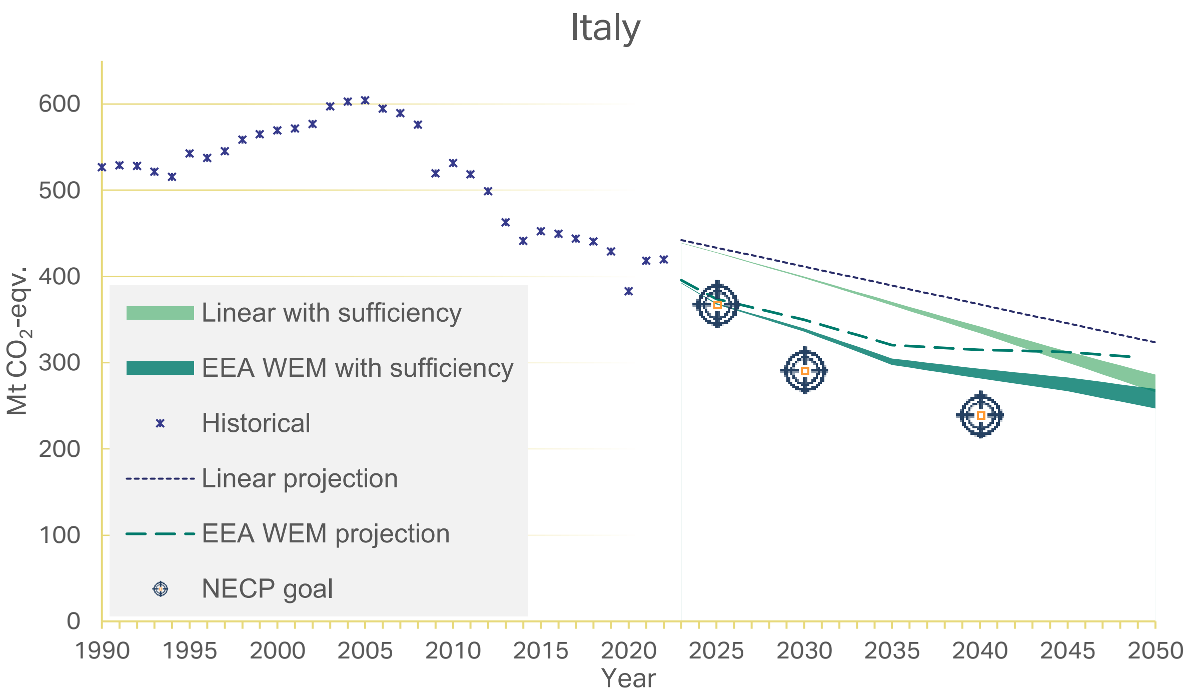

Figure 9: Italy: Greenhouse gas emissions; projections and sufficiency measures and NECP- goals

Figure 10 shows the results for Latvia. In 2030, the target could be easily reached with both linear and EEA WEM projections. For 2050, the carbon neutrality is not predicted to be reached, neither with the linear nor the EEA WEM projections. Also with sufficiency measures as investigated in the report, the 2050 target seems to be difficult to reach.

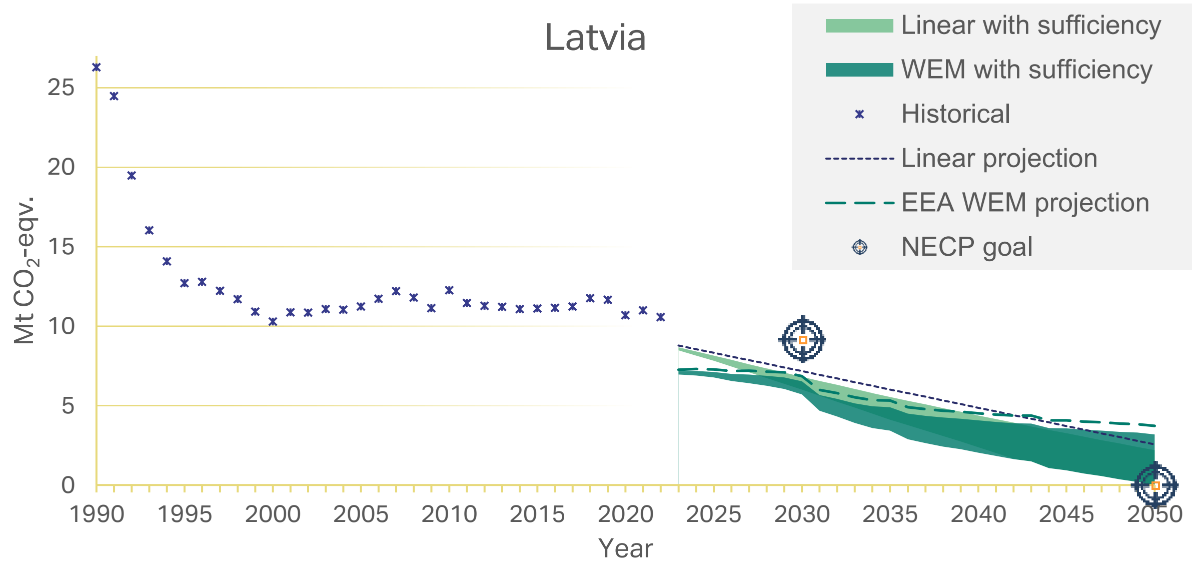

Figure 10: Latvia, Greenhouse gas emissions; projections and sufficiency measures and NECP-goals

3.2. Results for EU27

Figure 11 shows the results for the European Union. Even though the investigated sufficiency measures could help closing the gap between the 2030 and 2050 targets, much stronger policy and measures are needed.

The historical trend of EU GHG emissions reveals a fluctuating pattern, with periods of decline interspersed by overall increases, particularly since the early 2000s. The EU has established ambitious targets for GHG emission reduction, aiming for a 55% reduction by 2030 compared to 1990 levels and climate neutrality by 2050. However, current projections, both linear and EEA WEM, indicate that these goals may be challenging to achieve based on existing trends. Incorporating sufficiency measures into the projections demonstrates a significant potential for GHG emissions reduction compared to baseline scenarios. While the two projections, Linear and EEA WEM, present slightly varying scenarios, both underscore the potential benefits of sufficiency measures. Although these measures can contribute to reducing emissions, the results depicted in Figure 11 suggest that additional strategies or policies are imperative to bridge the gap between the current trajectory and the NDC goal for 2030 and even more for the 2050 goal.

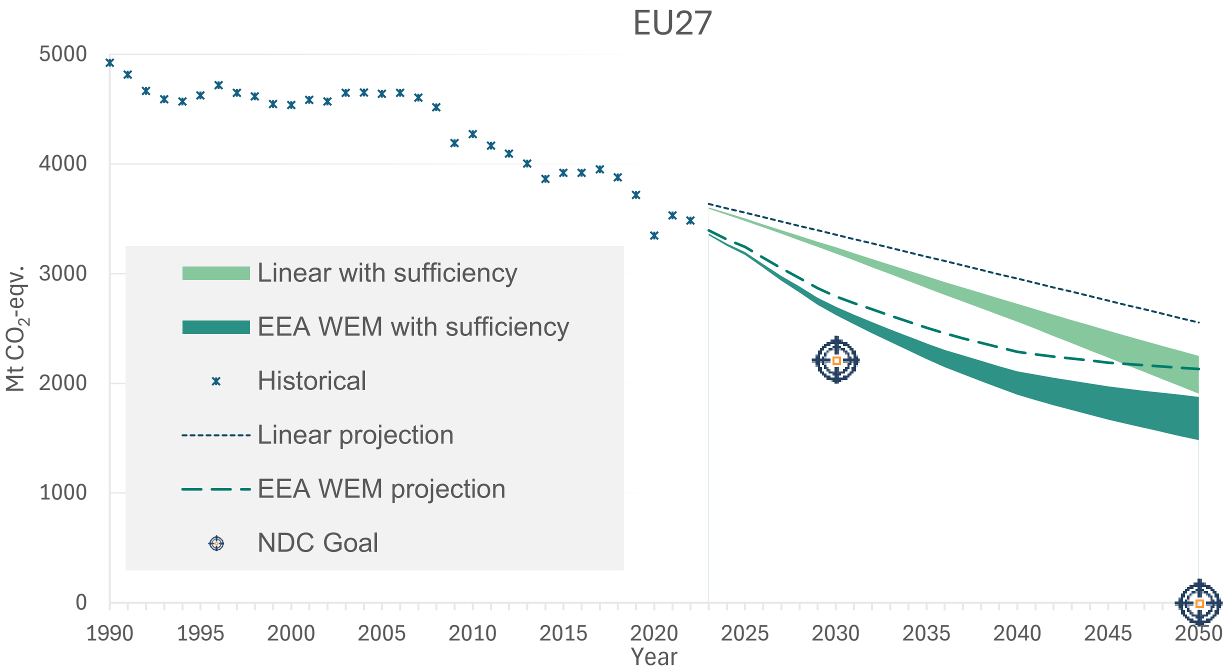

Figure 11: European Union (27), Greenhouse gas emissions; projections and sufficiency measures and NDC goals

3.3. Sensitivity assessment

As a sensitivity analysis, different base years were used for building the linear projections: 2005-2022 (Figure 12) and 2000-2022 (Figure 13). The motivation for choosing different sets of base years for the linear projections is that the historical trends for Italy and Latvia clearly show breaks in year 2005 for Italy and year 2000 for Latvia.

Figure 12 shows the sensitivity analysis for Italy with linear base years from 2005 to 2022 for the linear projections. In the alternative base year 2005, the Kyoto Protocol was ratified, necessitating a substantial reduction in greenhouse gas (GHG) emissions. Historical data demonstrate that Italy successfully reversed the trend of increasing GHG emissions in 2005, exhibiting a clear linear decline towards 50 million tonnes of carbon dioxide equivalent (Mt CO_2e) by 2050. If this alternative linear trend, based on the 2005-2022 period, continues into the future (2023-2050), Italy is projected to achieve not only the 2025 and 2030 targets but also the less ambitious 2040 goal with a comfortable margin. Under this alternative linear projection, sufficiency measures could potentially facilitate Italy's attainment of carbon neutrality by 2050, assuming an optimistic delta approach (see data and method section). However, their effectiveness would be compromised under a more conservative factor approach (see data and method section). Indeed, as anticipated, the potential savings from sufficiency measures diminish when overall GHG emissions are significantly reduced, as observed in the alternative linear projection based on the 2005-2022 period.

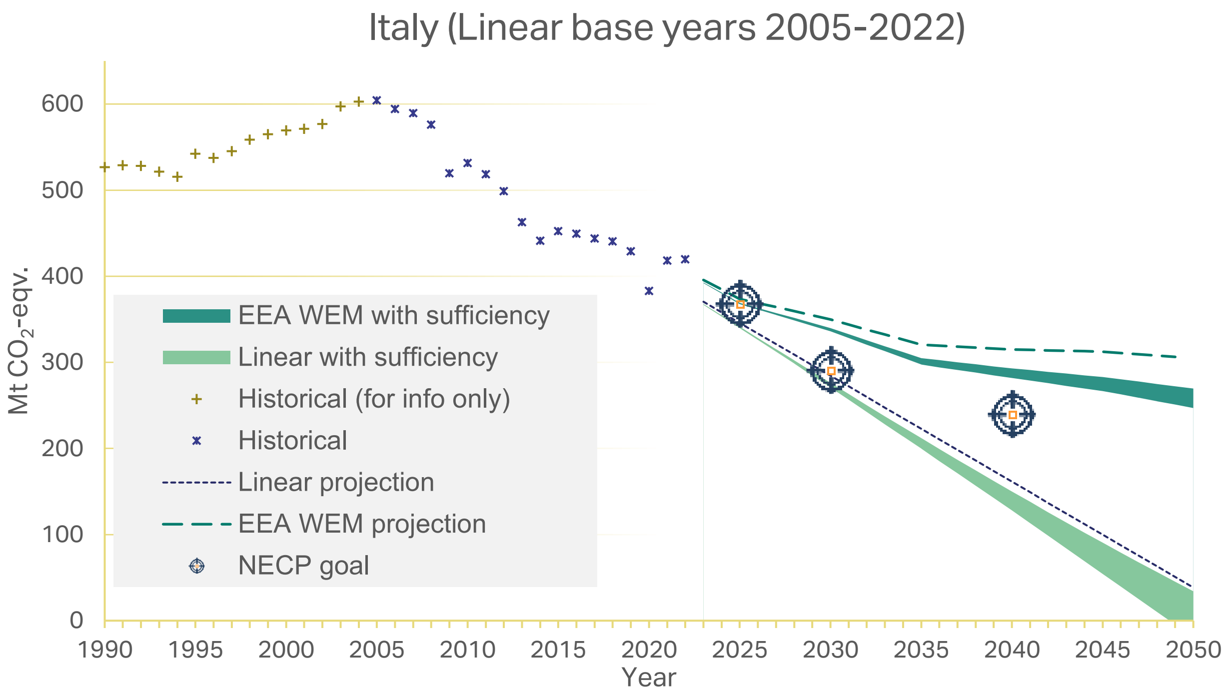

Figure 12**:** Italy, Greenhouse gas emissions; EEA projection and own projection (with alternative base years 2005 – 2022) and sufficiency measures and goals

Figure 13 shows the sensitivity analysis for Latvia with linear projections based on the years 2000 – 2022. The 1990s extraordinary industrial breakdown with the fall of the Soviet Union and the eastern bloc are treated as outliers not included in the linear projections. With this alternative linear projection, Latvia will not reach the 2030 and 2050 NECP goals, even though sufficiency measures could contribute to close the gap.

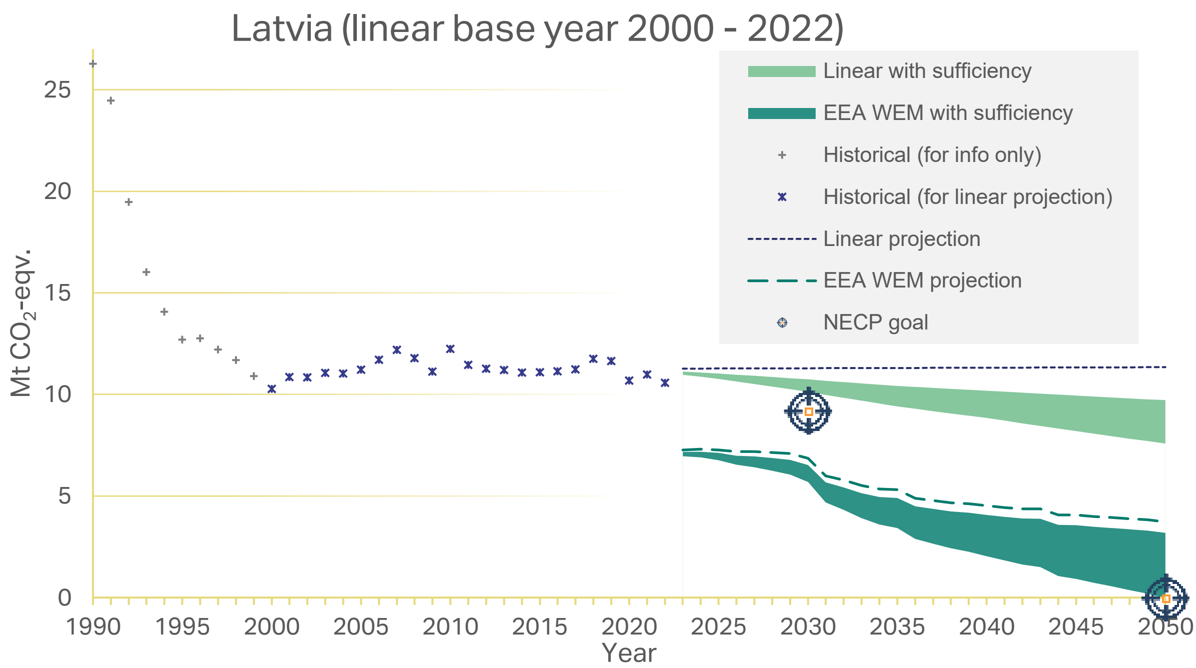

Figure 13**:** Latvia, Greenhouse gas emissions; EEA projection and own projection (with alternative base years 2005 – 2022) and sufficiency measures and goals

4. Interpretation and discussion

4.1. Interpretation of the results in the context of current NDCs and NECPs

There is still a large gap between the NECP goals and the projections, especially for the year 2050. Especially the agricultural sector (important for the GHG emissions of diets) and international air transport show only very moderate decrease in GHG (agriculture) if not an increase (international air transport) (e.g. German NECP, 2024, Italian NECP).

The projections for the large countries in this study, namely France, Germany and Italy do not reach carbon neutrality in 2050. This has significant implications for the EU as a whole. These countries represent a substantial portion of the EU's total population and economy, and their GHG emissions contribute significantly to the bloc's overall carbon footprint. Without these countries reaching their climate targets, it will also be impossible for EU as a whole to reach their targets. However, the results also present opportunities for these countries to learn from other countries, like Denmark and to take a leadership role in the transition to a low-carbon future. By implementing ambitious climate policies including sufficiency measures, these countries can set an example for other EU member states and thereby contribute to the EU's overall efforts to achieve carbon neutrality.

4.2. Implications for policymaking and the potential for inclusion in NECPs updates

Policymakers need to balance the urgency of climate action with public acceptance. Measures that require significant lifestyle changes, such as dietary shifts or reduced air travel (the two most impacting sufficiency measures of those six we investigated), may face resistance. However, framing these changes as beneficial for health and well-being, as seen in Denmark for dietary change in the form of nutrition recommendations, can enhance public acceptance (Teubler et al., 2024).

Given that the emissions from aviation also occur at high altitude, where they have a more pronounced warming effect compared to ground-level emissions, alternative fuels might also have a significant impact on aviation GHG emissions. However, reducing GHG emissions from aviation will require substantial investments in alternative technologies and infrastructure. This includes indeed developing sustainable aviation fuels, with a lower GHG emissions. Furthermore, the production of biofuels will also be limited in a context of very strong competition between the decarbonisation needs of the different modes of transport. Therefore, **flying less** could be a less costly policy option in the short and medium term, promoting virtual meetings, neighbourhood tourism and enhancing rail networks and night trains as alternative to short and medium-haul flights.

> *"Reaching net zero CO_2 or GHG emissions primarily requires deep and rapid reductions in gross emissions of CO_2, as well as substantial reductions of non- CO_2 GHG emissions (high confidence). … However, some hard-to-abate residual GHG emissions (e.g., some emissions from agriculture, aviation, …) remain […] (high confidence). As a result, net zero CO_2 is reached earlier than net zero GHGs (high confidence)."*

(IPCC, 2023-Summary for policymakers, p. 21)

4.3. Contributions of sufficiency measures towards NDCs and NECPs

While the near term (2025 – 2030) NECPs goal for the five FULFILL countries Denmark, France, Germany, Italy and Latvia could be within reach, especially with the EEA WEM projections, the EU as whole seems to have much more difficulties reaching the NDC goal. The five selected FULFILL countries are important for EU, but still account for less than half of the total GHG emissions. The five selected FULFILL countries are also among the most ambitious in the EU when it comes to policies and measures for GHG emissions reduction.

The delta approach applied in this study often leads to higher projected savings from the sufficiency measures. This is because the reference scenario in the calculation of sufficiency savings is based on OECDs projection on economic growth. Also the underlying input output model does not seem consider decoupling of GHG emissions from economic growth. Therefore, with the delta approach, the difference between the reference and the reference with sufficiency calculations are also growing towards year 2050. The delta approach thereby represent a (over) optimistic maximum sufficiency effect. Therefore, when this optimistic maximum sufficiency effect are subtracted from the linear or EEA projections, the effect of sufficiency is probably overestimated.

4.4. Challenges and opportunities for implementing sufficiency measures

Policymakers are generally careful not to implement measures that requires change of lifestyle of their voters. Therefore, the implementation of sufficiency measures faces several significant challenges, but also opportunities. These has been analysed and discussed in (Teubler et al., 2024). Firstly, **behavioural and cultural resistance** is a major obstacle. Consumption habits and lifestyles are deeply ingrained and influenced by cultural norms, making it difficult for individuals to adopt changes that promote sufficiency. Secondly, **economic structures** present a formidable challenge. Current economic systems often prioritise growth and consumption, which are at odds with the principles of sufficiency that emphasise reduced consumption. Additionally, **policy and regulatory barriers** can hinder the adoption of sufficiency measures. Existing policies and regulations may not support, or may even actively obstruct, efforts to implement these measures. Lastly, there is a **lack of awareness and education** about the benefits and necessity of sufficiency measures, which further complicates their implementation.

Despite these challenges, there are numerous opportunities associated with sufficiency measures. **Environmental benefits** are among the most significant, as implementing sufficiency measures can substantially reduce environmental impacts, including carbon emissions, other air pollution and resource depletion. Furthermore, adopting sufficiency lifestyles can enhance **health and well-being** by promoting more sustainable and healthier consumption patterns. **Community building** is another opportunity, as sufficiency measures can foster stronger community ties and social cohesion by encouraging local production and consumption. Finally, sufficiency measures can enhance **economic resilience** by reducing dependency on global supply chains and promoting local economies. These insights from (Teubler et al., 2024) suggest that while there are significant hurdles to overcome, the potential benefits of implementing sufficiency measures make them to be considered in future NECPs and NDC.

4.5. Comparing findings with other relevant studies or projections

Vita et al. (2019) found similar results for the 'Healthy Vegan,' 'Vegan,' and 'Vegetarian' diets, which showed a reduction of 15.7%, 13.9%, and 6.4% in the total European household carbon footprints in 2007, respectively. However, a substantial portion (approximately 50–70%) of this reduction occurred outside Europe. A notable difference in our sufficiency scenario with less meat and dairy products is that it still includes some meat, whereas the vegan and vegetarian lifestyles examined by Vito et al. (2019) are entirely meat-free. Notably, the 'Only Bike and Walk' lifestyle was the most effective in reducing carbon footprints among all those investigated by Vito et al (2019), achieving a 26% reduction, with the majority of savings occurring within Europe. Conversely, the 'No Flying' lifestyle had a modest reduction potential of just 2.3%. These two results for transport are in contrast to our findings related to more biking and flying less. However, the difference is difficult to explain, but could be related to different scope or method.

5. Conclusions

The EU as a whole and the FULFILL countries (Denmark, France, Germany and Latvia) have a growing gap between their GHG emissions target and their projected emissions. This gap is growing towards 2050, when climate neutrality should be reached. We have investigated six out of a range of possible sufficiency measures and quantified how these could help close this gap.

The sufficiency measure changing diets and flying less are the most important, the other sufficiency measures investigated play a minor role compared to these two.

Sufficiency measures play a small role in decarbonisation in the first part of the period, but growing up to year 2050. This is because implementation and adoption is slow. In year 2030, they play a small but not negligible role in closing the gap between the projected emissions and the target. In 2050, the sufficiency measures could play a substantial role in closing the gap, but this varies with countries. Of the investigated countries, only the small countries Denmark and Latvia are projected to be close to the net-zero climate neutrality goal in 2050 with maximum sufficiency savings.

The results have high uncertainties, growing towards the end of the study period and highly dependent on critical assumptions. Our lower bound of emissions with sufficiency measures (i.e. maximum savings due to sufficiency) assumes growing economies (increasing GDPs according to OECD).

5.1. Role of Sufficiency Measures

The investigated sufficiency measures are crucial for achieving climate targets by reducing energy consumption and promoting sustainable lifestyles. They help close the gap between projected emissions and targets, especially towards 2050, but are not alone enough to reach net-zero in 2050.

Our analysis examined a limited set of sufficiency measures in a scenario where EU GHG emissions are projected to decline towards 2050 due to decarbonization efforts in industry, transport, and energy production, but are not expected to reach net-zero. The agricultural sector, particularly meat and dairy production, presents significant challenges for decarbonization due to its reliance on biological processes. Air transport, too, is lagging behind other modes of transportation in terms of emissions reduction. In this landscape, we identified sufficiency measures related to dietary changes and reduced air travel as having the greatest potential to bridge the gap between projected emissions and the EU's net-zero target. These measures could contribute to a 13% reduction in greenhouse gas emissions by 2050 compared to a scenario without sufficiency. In an extreme case, where other sectors achieve complete decarbonization, sufficiency measures in food production and air transport could contribute up to 31% to closing the emissions gap.
However, the impact of sufficiency measures varies significantly across different EU countries. Denmark and Latvia, for example, have relatively large remaining gaps to the net-zero target that could be closed primarily through sufficiency interventions. In contrast, larger countries like Italy and France have less reliance on sufficiency measures, even though the absolute emissions reduction potentials for sufficiency measures are much higher.

5.2. Limitations and future research

This study has several important limitations and a scope that led to some work left to further research. First, the sufficiency measurements only investigated a limited set of all potential sufficiency measures. For example, clothing is not addressed, even though Vita et al. (2019) found it to be quantitatively more important (measured as carbon footprint) than food, with an 86% lower carbon footprint compared to the average, versus 43% for food. The different measurements are also different internally in their scope. For example, for the sharing product sufficiency measure, only one product group, namely washing machines, is considered in the sharing products measurement. On the other hand, the change in diet to less meat and dairy products included all food products and thereby covering large part of the agricultural sector.

Second, even though analysed NECPs have a focus on energy efficiency and technological improvement, some sufficiency measures investigated have some overlap with the NECP policies. Like in the road transport sector, as several countries (e.g., Germany, Denmark) already include measures to promote biking in their NECPs. However, due to the small share of GHG emissions of these transport-focused sufficiency measures compared to diet change and reduced flying, this does not alter the conclusions.

A third limitation is the geographical scope; this study only considers EU27 and member states' national GHG emissions. This is relevant as sufficiency measures also contribute to GHG emissions reduction outside the EU27 and outside each of the member states analysed. This supply chain effect is quantified in (Golinucci et al., 2024), but is not taken into account in this study, as it is less relevant for the NECPs. The analysis shows that GHG emissions savings outside the EU27, as a result of the investigated sufficiency measures, are about 50% of the internal EU27 savings. This is roughly equal to 1% of global emissions (Golinucci et al., 2024),. It is reasonable to assume that for the individual countries investigated, the external effects not included here are even larger, as more of the value chain is outside the country, depending on the size and sectoral structure, especially mining, of the country. Hence, the sufficiency measures would also help other countries' abilities to reach their NDCs and, internally in the EU, the other member states' NECPs through supply chain effects.

A fourth limitation of our analysis stems from the reliance on future projections extending to the year 2050. These projections are inherently subject to uncertainty, as technological advancements, policy changes, and unforeseen global and local events could significantly alter the trajectory of GHG emissions and the effectiveness of sufficiency measures. Moreover, the long-term impacts of these measures on societal behaviour, economic structures, and environmental systems are difficult to quantify accurately. For example, the maximum savings due to sufficiency imply slow decarbonisation of the food sector, especially meat and dairy products, where emissions of methane and other GHGs (besides CO_2) are significant sources. While innovations like lab-grown meat could reduce emissions, their adoption towards year 2050 remains uncertain. Similarly, the aviation industry faces substantial challenges in reducing climate change impacts. Although electric aircraft and sustainable aviation fuels are being developed, their scalability and effectiveness in reducing emissions towards 2050 are still in question and therefore not yet taken into account in future predictions. Another related assumption about the future development is that of economic growth. The underlying model (based on Mario) assumes a strong continuous growth in GDP per capita and overall GDP for the different FULFILL countries and the EU based on OECD projections. This assumption is crucial because economic growth typically correlates with increased GHG emissions. If economic growth slows or declines, either through the effects of the sufficiency measures, climate change impacts or other factors, the projected savings due to our sufficiency measures might be overestimated.

5.3. Recommendations for policymakers and stakeholders

Given the urgency of climate change, rapid implementation of sufficiency measures is crucial for reducing GHG emissions. This is particularly relevant considering the short timeframe (only six years until 2030) and the slow reaction of large systems. However, our results of a set of sufficiency measures show that additional strategies or policies are imperative to bridge the gap between the current trajectory and the NDC goal for 2030 and even more for the 2050 goal.

Among the sufficiency measures investigated, dietary changes and reduced air travel emerged as having the greatest potential to bridge the GHG emissions gap. Policymakers and stakeholders should prioritize these measures when formulating GHG mitigation policies, such as those outlined in the NECPs.

Recommendations for policymakers and stakeholders from the FULFILL project have been developed in (Breucker et al., 2024). We build on this and adding the insight from the analysis presented in this study:

To effectively address the challenges of climate change and sustainability, policymakers and stakeholders should officially recognise and integrate sufficiency alongside energy efficiency and renewable energy. This involves systematically incorporating sufficiency into sectoral scenarios, statistics, and wealth indicators to facilitate informed policymaking. Promoting dietary shifts towards less meat-based diets is crucial, which can be achieved through agricultural legislation, pricing structures that reflect environmental and health costs, the promotion of plant-based meals in public canteens, and improved dietary education including nutrient and environmental labelling schemes for food products. Taxation and investment policies should be reoriented to discourage carbon-intensive behaviours, including the introduction of levies on aviation (e.g., frequent flyers) with consideration for a kerosene tax at the European level for aviation. Supportive infrastructures and services should be enhanced to make sustainable choices the default option, such as improving public transport, biking infrastructure, and digital sharing services. Additionally, trans-European mobility programmes should focus on enhancing and interconnecting high-speed and night train networks, while suppressing flight routes where viable train alternatives exist.

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Annex

Annex A: Raw data for the figures 6-11

Potential savings due to different sufficiency measurements by year and country, rest of EU (22 countries) and Total EU-27. Quantities are in Mt CO_2-equivalent

Biking

Year	Denmark	France	Germany	Italy	Latvia	RestEU(22)	**TotEU27**
2020	0	0	0	0	0	0	**0**
2025	2.07E-02	1.17E-01	6.39E-01	3.61E-01	7.23E-03	3.65E+00	**4.79E+00**
2030	3.25E-02	1.92E-01	1.07E+00	6.09E-01	1.14E-02	5.89E+00	**7.81E+00**
2035	3.03E-02	2.14E-01	1.23E+00	6.79E-01	1.15E-02	6.39E+00	**8.56E+00**
2040	2.21E-02	1.94E-01	1.30E+00	7.00E-01	1.33E-02	6.46E+00	**8.69E+00**
2045	1.53E-02	1.59E-01	1.37E+00	6.13E-01	1.39E-02	6.11E+00	**8.28E+00**
2050	1.30E-02	1.22E-01	1.54E+00	5.54E-01	1.45E-02	6.13E+00	**8.37E+00**

Diets

Year	Denmark	France	Germany	Italy	Latvia	RestEU(22)	**TotEU27**
2020	0	0	0	0	0	0	**0**
2025	9.63E-01	7.85E+00	1.05E+01	5.00E+00	3.77E-01	3.52E+01	**6.00E+01**
2030	2.03E+00	1.68E+01	2.21E+01	1.03E+01	7.61E-01	7.30E+01	**1.25E+02**
2035	3.32E+00	2.82E+01	3.58E+01	1.75E+01	1.20E+00	1.18E+02	**2.04E+02**
2040	4.80E+00	4.11E+01	5.07E+01	2.60E+01	1.67E+00	1.69E+02	**2.93E+02**
2045	6.51E+00	5.68E+01	6.96E+01	3.65E+01	2.20E+00	2.30E+02	**4.01E+02**
2050	8.32E+00	7.35E+01	8.98E+01	4.78E+01	2.72E+00	2.93E+02	**5.15E+02**

Flying less

Year	**Denmark**	**France**	**Germany**	**Italy**	**Latvia**	**RestEU(22)**	TotEU27
2020	0	0	0	0	0	0	**0**
2025	9.51E-02	9.37E-01	2.10E+00	4.34E-01	1.10E-01	2.91E+00	**6.59E+00**
2030	4.23E-01	4.29E+00	8.91E+00	1.71E+00	3.42E-01	1.53E+01	**3.09E+01**
2035	8.67E-01	8.32E+00	1.74E+01	3.42E+00	6.13E-01	2.99E+01	**6.05E+01**
2040	1.05E+00	1.03E+01	2.11E+01	4.53E+00	7.10E-01	3.68E+01	**7.45E+01**
2045	1.21E+00	1.21E+01	2.47E+01	5.85E+00	8.25E-01	4.61E+01	**9.08E+01**
2050	1.35E+00	1.35E+01	2.74E+01	6.39E+00	9.01E-01	5.15E+01	**1.01E+02**

Moderate car sizing

Year	Denmark	France	Germany	Italy	Latvia	RestEU(22)	**TotEU27**

2020	2.53E-03	1.45E-02	4.25E-02	1.19E-02	2.59E-04	4.83E-02	**1.20E-01**
2025	2.40E-02	1.94E-01	5.75E-01	2.22E-01	1.47E-02	9.35E-01	**1.96E+00**
2030	5.31E-02	5.09E-01	2.16E+00	7.98E-01	5.61E-02	3.34E+00	**6.91E+00**
2035	7.43E-02	6.55E-01	4.16E+00	1.35E+00	8.93E-02	5.63E+00	**1.19E+01**
2040	9.63E-02	6.24E-01	5.44E+00	1.83E+00	1.09E-01	7.25E+00	**1.53E+01**
2045	1.10E-01	6.99E-01	6.86E+00	2.30E+00	1.35E-01	9.23E+00	**1.93E+01**
2050	1.07E-01	7.35E-01	7.58E+00	2.52E+00	1.59E-01	1.06E+01	**2.17E+01**

Sharing products (washing machines)

Year	Denmark	France	Germany	Italy	Latvia	RestEU(22)	**TotEU27**
2020	0	0	0	0	0	0	**0**
2025	5.23E-04	9.95E-05	8.33E-04	1.10E-04	7.54E-06	2.74E-03	**4.31E-03**
2030	1.79E-03	9.85E-03	2.59E-02	1.06E-02	1.62E-03	1.04E-01	**1.54E-01**
2035	6.27E-03	4.91E-02	1.25E-01	5.31E-02	6.73E-03	5.00E-01	**7.40E-01**
2040	7.89E-03	5.87E-02	1.45E-01	6.43E-02	8.18E-03	6.00E-01	**8.84E-01**
2045	1.19E-02	9.84E-02	2.41E-01	1.08E-01	1.35E-02	9.98E-01	**1.47E+00**
2050	1.45E-02	1.19E-01	2.90E-01	1.30E-01	1.61E-02	1.20E+00	**1.77E+00**

Sharing spaces in housing

Year	Denmark	France	Germany	Italy	Latvia	RestEU(22)	**TotEU27**
2020	0	0	0	0	0	0	**0**
2025	2.08E-03	8.33E-03	1.90E-02	1.28E-02	3.14E-04	5.49E-02	**9.75E-02**
2030	1.49E-02	8.09E-02	1.52E-01	1.10E-01	2.23E-03	4.49E-01	**8.09E-01**
2035	3.15E-02	1.19E-01	2.44E-01	2.11E-01	4.62E-03	8.97E-01	**1.51E+00**
2040	6.13E-02	1.10E-01	3.19E-01	2.86E-01	8.06E-03	1.47E+00	**2.26E+00**
2045	1.14E-01	1.44E-01	4.42E-01	3.67E-01	1.37E-02	2.39E+00	**3.47E+00**
2050	2.23E-01	1.69E-01	7.12E-01	5.65E-01	2.49E-02	4.22E+00	**5.91E+00**

Annex B: Output from WP6.2

Region name	Denmark							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference
Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing products	Sharing spaces in housing	No measure
2020	92.2	92.2	92.2	92.2	92.2	92.2	92.2	92.2

Agriculture	17.7	17.7	17.7	17.7	17.7	17.7	17.7	17.7
Manufacturing	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
Power	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Residential	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Services	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
Transport	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
2025	93.5	94.6	93.7	94.5	94.6	94.6	94.6	94.6
Agriculture	17.9	18.6	17.9	18.6	18.6	18.6	18.6	18.6
Manufacturing	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Services	24.7	24.8	24.7	24.8	24.8	24.8	24.8	24.8
Transport	38.2	38.4	38.3	38.3	38.4	38.4	38.4	38.4
2030	96.4	98.9	96.9	98.5	98.9	99.0	98.9	99.0
Agriculture	17.8	19.4	17.8	19.4	19.4	19.4	19.4	19.4
Manufacturing	12.8	12.8	12.8	12.8	12.8	12.9	12.9	12.9
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0	0	0	0	0	0	0	0
Services	25.8	26.0	25.8	26.0	26.0	26.0	26.0	26.0
Transport	40.0	40.6	40.5	40.3	40.6	40.7	40.7	40.7
2035	98.8	103.0	99.8	102.2	103.0	103.1	103.0	103.1
Agriculture	17.6	20.2	17.6	20.2	20.2	20.2	20.2	20.2
Manufacturing	13.6	13.7	13.6	13.7	13.7	13.7	13.7	13.7
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0	0	0	0	0	0	0	0
Services	26.7	27.1	26.8	27.0	27.0	27.1	27.0	27.1
Transport	40.9	42.0	41.7	41.2	42.0	42.0	42.0	42.0
2040	102.1	108.1	103.3	107.1	108.0	108.1	108.1	108.1
Agriculture	17.2	21.0	17.2	21.0	21.0	21.0	21.0	21.0
Manufacturing	14.6	14.8	14.6	14.7	14.8	14.8	14.8	14.8
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0	0	0	0	0	0	0	0
Services	28.1	28.6	28.3	28.6	28.6	28.6	28.6	28.6
Transport	42.2	43.7	43.2	42.7	43.6	43.7	43.7	43.7
2045	106.0	113.9	107.4	112.7	113.8	113.9	113.8	113.9
Agriculture	16.7	21.9	16.7	21.9	21.9	21.9	21.9	21.9
Manufacturing	15.6	15.9	15.7	15.9	15.9	15.9	15.9	15.9
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0	0	0	0	0	0	0	0
Services	29.4	30.1	29.6	30.1	30.0	30.1	30.0	30.1
Transport	44.3	46.0	45.4	44.9	46.0	46.0	46.0	46.0
2050	110.3	120.3	112.0	119.0	120.2	120.3	120.1	120.3
Agriculture	16.2	22.7	16.2	22.7	22.7	22.7	22.7	22.7
Manufacturing	16.8	17.2	16.9	17.1	17.2	17.2	17.2	17.2
Power	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residential	0	0	0	0	0	0	0	0

Services	30.6	31.6	30.9	31.6	31.5	31.6	31.4	31.6
Transport	46.7	48.8	48.0	47.5	48.7	48.8	48.8	48.8
Region name	France							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference
Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing products	Sharing spaces in housing	No measure
2020	556.8	556.8	556.8	556.8	556.8	556.8	556.8	556.8
Agriculture	172.0	172.0	172.0	172.0	172.0	172.0	172.0	172.0
Manufacturing	122.2	122.2	122.2	122.2	122.2	122.2	122.2	122.2
Power	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
Residential	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3
Services	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1
Transport	117.1	117.1	117.1	117.1	117.1	117.1	117.1	117.1
2025	542.7	551.7	544.0	550.9	551.6	551.8	551.8	551.8
Agriculture	175.7	182.2	175.7	182.2	182.2	182.2	182.2	182.2
Manufacturing	128.5	129.1	128.6	129.0	129.1	129.1	129.1	129.1
Power	15.0	15.1	15.0	15.1	15.1	15.1	15.1	15.1
Residential	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2
Services	88.4	88.9	88.4	88.9	88.9	88.9	88.9	88.9
Transport	106.8	108.1	108.0	107.3	108.1	108.2	108.2	108.2
2030	537.3	558.9	542.3	554.8	558.6	559.1	559.0	559.1
Agriculture	177.1	190.9	177.1	190.9	190.9	190.9	190.9	190.9
Manufacturing	137.1	138.4	137.3	138.2	138.3	138.4	138.4	138.4
Power	16.7	16.9	16.7	16.9	16.9	16.9	16.9	16.9
Residential	21.3	21.4	21.4	21.4	21.4	21.4	21.3	21.4
Services	92.1	93.3	92.1	93.2	93.2	93.3	93.2	93.3
Transport	93.1	98.1	97.8	94.2	97.8	98.3	98.3	98.3
2035	527.3	564.5	536.5	556.4	564.0	564.6	564.6	564.7
Agriculture	176.8	200.1	176.8	200.0	200.1	200.1	200.1	200.1
Manufacturing	145.4	147.7	145.8	147.4	147.6	147.7	147.7	147.7
Power	17.8	18.3	17.9	18.2	18.2	18.3	18.3	18.3
Residential	11.9	12.0	12.0	12.0	12.0	12.0	11.9	12.0
Services	95.9	97.9	96.0	97.8	97.9	97.9	97.9	97.9
Transport	79.4	88.6	87.9	80.8	88.2	88.7	88.7	88.7
2040	508.0	560.0	519.1	549.9	559.5	560.1	560.0	560.2
Agriculture	175.5	209.7	175.5	209.7	209.7	209.7	209.7	209.7
Manufacturing	148.8	151.9	149.3	151.6	151.9	151.9	151.9	151.9
Power	10.0	10.4	10.1	10.4	10.3	10.4	10.4	10.4
Residential	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Services	99.5	102.4	99.7	102.3	102.4	102.4	102.4	102.4

Transport	69.6	80.9	79.9	71.2	80.7	81.1	81.1	81.1
2045	509.9	579.5	522.9	567.6	579.0	579.6	579.6	579.7
Agriculture	172.3	219.4	172.3	219.4	219.4	219.4	219.4	219.4
Manufacturing	157.9	162.3	158.5	162.0	162.2	162.3	162.3	162.4
Power	10.5	11.1	10.7	11.1	11.0	11.1	11.1	11.1
Residential	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Services	103.7	107.8	104.0	107.7	107.8	107.8	107.8	107.8
Transport	62.8	76.2	74.7	64.7	75.9	76.3	76.3	76.3
2050	513.4	601.1	527.7	587.8	600.5	601.1	601.1	601.3
Agriculture	168.5	229.1	168.5	229.1	229.1	229.1	229.1	229.1
Manufacturing	167.4	173.3	168.1	172.9	173.2	173.2	173.3	173.3
Power	11.1	11.8	11.3	11.8	11.7	11.8	11.8	11.8
Residential	0	0	0	0	0	0	0	0
Services	108.3	113.7	108.7	113.6	113.6	113.7	113.6	113.7
Transport	58.2	73.3	71.2	60.5	73.0	73.3	73.3	73.3
Region name	Germany							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference
Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing products	Sharing spaces in housing	No measure
2020	1046.8	1046.9	1046.9	1046.9	1046.8	1046.9	1046.9	1046.9
Agriculture	137.5	137.5	137.5	137.5	137.5	137.5	137.5	137.5
Manufacturing	272.8	272.8	272.8	272.8	272.8	272.8	272.8	272.8
Power	176.2	176.2	176.2	176.2	176.2	176.2	176.2	176.2
Residential	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6
Services	131.5	131.5	131.5	131.5	131.5	131.5	131.5	131.5
Transport	259.3	259.3	259.3	259.3	259.3	259.3	259.3	259.3
2025	1127.9	1141.1	1131.2	1139.7	1141.2	1141.8	1141.8	1141.8
Agriculture	136.8	142.7	136.8	142.7	142.7	142.7	142.7	142.7
Manufacturing	317.4	319.1	317.6	319.1	319.1	319.1	319.1	319.1
Power	235.1	236.8	235.2	236.8	236.8	236.9	236.9	236.9
Residential	53.3	53.4	53.4	53.4	53.4	53.4	53.3	53.4
Services	139.3	140.0	139.3	140.0	140.0	140.0	140.0	140.0
Transport	246.0	249.2	249.0	247.8	249.3	249.7	249.7	249.7
2030	1102.9	1136.1	1115.1	1128.3	1135.1	1137.2	1137.1	1137.2
Agriculture	134.0	146.4	134.0	146.4	146.4	146.4	146.4	146.4
Manufacturing	351.7	355.9	352.5	355.7	355.8	356.1	356.1	356.1
Power	221.1	224.8	221.9	224.8	224.5	225.0	224.9	225.0
Residential	29.7	29.8	29.8	29.8	29.8	29.8	29.7	29.8
Services	146.1	147.7	146.2	147.6	147.7	147.7	147.7	147.7
Transport	220.3	231.5	230.6	224.0	230.9	232.3	232.3	232.3
2035	1065.5	1122.9	1088.3	1106.7	1120.0	1124.0	1123.9	1124.2

Agriculture	129.6	150.3	129.6	150.3	150.3	150.3	150.3	150.3
Manufacturing	383.7	391.6	385.7	391.1	390.9	391.7	391.8	391.8
Power	189.9	195.6	192.0	195.6	194.6	195.9	195.8	195.9
Residential	12.4	12.5	12.5	12.5	12.5	12.5	12.4	12.5
Services	153.3	155.9	153.5	155.8	155.9	155.9	155.9	155.9
Transport	196.6	217.1	215.0	201.4	216.0	217.7	217.7	217.7
2040	1031.7	1108.8	1059.5	1089.0	1104.7	1110.0	1109.8	1110.1
Agriculture	124.4	154.5	124.4	154.5	154.5	154.5	154.5	154.5
Manufacturing	386.0	396.7	388.6	396.2	395.6	396.9	396.9	397.0
Power	166.4	173.7	169.4	173.9	172.0	174.2	174.1	174.2
Residential	5.2	5.2	5.2	5.2	5.2	5.2	5.2	5.2
Services	160.7	164.5	161.1	164.4	164.4	164.6	164.5	164.6
Transport	189.1	214.2	210.7	194.8	212.9	214.6	214.6	214.6
2045	1057.2	1158.1	1089.9	1134.8	1152.6	1159.2	1159.0	1159.5
Agriculture	117.5	158.8	117.6	158.8	158.8	158.8	158.8	158.8
Manufacturing	408.3	423.1	411.9	422.6	421.6	423.4	423.4	423.6
Power	174.4	184.7	178.8	185.0	182.1	185.3	185.1	185.4
Residential	0	0	0	0	0	0	0	0
Services	169.0	174.3	169.6	174.2	174.2	174.3	174.3	174.4
Transport	187.9	217.1	212.0	194.3	216.0	217.4	217.4	217.4
2050	1090.2	1214.9	1126.6	1189.0	1208.8	1216.1	1215.7	1216.4
Agriculture	110.0	163.0	110.1	163.0	163.0	163.0	163.0	163.0
Manufacturing	430.4	449.4	434.7	448.8	447.4	449.7	449.7	449.9
Power	181.1	194.3	186.7	194.8	191.0	195.1	194.8	195.2
Residential	0	0	0	0	0	0	0	0
Services	176.8	183.6	177.5	183.5	183.4	183.7	183.6	183.7
Transport	191.9	224.6	217.7	198.9	224.0	224.7	224.7	224.7
Region name	Italy							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference
Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing products	Sharing spaces in housing	No measure
2020	486.4	486.4	486.4	486.4	486.4	486.4	486.4	486.4
Agriculture	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5
Manufacturing	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1
Power	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
Residential	32.5	32.5	32.5	32.5	32.5	32.5	32.5	32.5
Services	70.2	70.2	70.2	70.2	70.2	70.2	70.2	70.2
Transport	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6
2025	493.9	499.5	494.9	499.4	499.7	499.9	499.9	499.9
Agriculture	76.1	79.0	76.1	79.0	79.0	79.0	79.0	79.0
Manufacturing	133.6	134.4	133.6	134.4	134.4	134.4	134.4	134.4

Power	85.2	85.9	85.2	85.8	85.9	85.9	85.9	85.9
Residential	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6
Services	76.2	76.7	76.2	76.7	76.7	76.7	76.7	76.7
Transport	93.3	94.0	94.2	94.0	94.1	94.3	94.3	94.3
2030	465.5	478.4	468.7	477.3	478.2	479.0	478.9	479.0
Agriculture	74.0	80.4	74.0	80.4	80.4	80.4	80.4	80.4
Manufacturing	135.9	137.7	136.1	137.7	137.7	137.7	137.7	137.8
Power	67.1	68.2	67.2	68.2	68.1	68.2	68.2	68.2
Residential	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
Services	78.1	79.2	78.2	79.1	79.2	79.2	79.2	79.2
Transport	91.5	94.0	94.1	93.0	93.9	94.5	94.5	94.5
2035	453.1	475.6	458.7	472.8	474.9	476.2	476.0	476.2
Agriculture	71.1	81.9	71.1	81.9	81.9	81.9	81.9	81.9
Manufacturing	143.3	146.5	143.7	146.3	146.4	146.5	146.5	146.5
Power	67.0	69.0	67.5	69.1	68.8	69.1	69.1	69.1
Residential	13.5	13.6	13.6	13.6	13.6	13.6	13.5	13.6
Services	81.9	83.9	82.2	83.7	83.8	83.9	83.9	83.9
Transport	76.3	80.7	80.6	78.3	80.4	81.3	81.3	81.3
2040	442.7	475.3	450.0	471.5	474.2	475.9	475.7	476.0
Agriculture	67.4	83.5	67.4	83.5	83.5	83.5	83.5	83.5
Manufacturing	150.9	155.6	151.5	155.4	155.4	155.6	155.6	155.7
Power	66.0	69.0	66.9	69.0	68.5	69.1	69.0	69.1
Residential	6.6	6.7	6.7	6.7	6.7	6.7	6.6	6.7
Services	86.0	89.0	86.4	88.8	88.9	89.0	89.0	89.1
Transport	65.8	71.6	71.1	68.1	71.2	72.0	72.0	72.0
2045	438.8	483.7	447.9	478.5	482.1	484.2	484.0	484.4
Agriculture	62.4	84.8	62.4	84.8	84.8	84.8	84.8	84.8
Manufacturing	159.4	166.1	160.3	165.9	165.8	166.1	166.1	166.2
Power	68.8	73.2	70.3	73.3	72.4	73.4	73.2	73.4
Residential	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Services	89.1	93.4	89.7	93.1	93.2	93.4	93.4	93.4
Transport	56.1	63.2	62.1	58.4	62.8	63.5	63.5	63.5
2050	442.7	499.9	452.6	494.1	498.0	500.4	499.9	500.5
Agriculture	56.9	86.0	57.0	86.0	86.0	86.0	86.0	86.0
Manufacturing	168.5	177.3	169.5	177.1	177.0	177.3	177.3	177.4
Power	72.0	77.9	74.1	78.0	76.7	78.1	77.9	78.1
Residential	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Services	92.8	98.4	93.5	98.1	98.2	98.4	98.3	98.4
Transport	50.8	58.6	56.9	53.1	58.3	58.7	58.7	58.7
Region name	Latvia							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference

Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing pro-ducts	Sharing spaces in housing	No measure
2020	21.9	21.9	21.9	21.9	21.9	21.9	21.9	21.9
Agriculture	5.7	5.7	5.7	5.7	5.7	5.7	5.7	5.7
Manufacturing	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Power	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Residential	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Services	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6
Transport	5.3	5.3	5.3	5.3	5.3	5.3	5.3	5.3
2025	23.2	23.7	23.3	23.6	23.7	23.7	23.7	23.7
Agriculture	5.5	5.8	5.5	5.8	5.8	5.8	5.8	5.8
Manufacturing	3.3	3.4	3.3	3.4	3.4	3.4	3.4	3.4
Power	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Residential	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Services	7.1	7.2	7.1	7.2	7.2	7.2	7.2	7.2
Transport	5.0	5.1	5.1	5.0	5.1	5.1	5.1	5.1
2030	22.8	23.9	23.2	23.6	23.9	24.0	24.0	24.0
Agriculture	5.2	5.8	5.2	5.8	5.8	5.8	5.8	5.8
Manufacturing	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6
Power	2.2	2.3	2.2	2.3	2.3	2.3	2.3	2.3
Residential	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Services	7.4	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Transport	4.2	4.6	4.6	4.3	4.6	4.6	4.6	4.6
2035	22.3	24.2	23.0	23.6	24.1	24.2	24.2	24.2
Agriculture	4.9	5.8	4.9	5.8	5.8	5.8	5.8	5.8
Manufacturing	3.8	3.9	3.8	3.9	3.9	3.9	3.9	3.9
Power	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Residential	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Services	7.7	7.8	7.7	7.8	7.8	7.8	7.8	7.8
Transport	3.5	4.2	4.1	3.6	4.2	4.2	4.2	4.2
2040	22.3	24.8	23.1	24.1	24.7	24.8	24.8	24.8
Agriculture	4.6	5.8	4.6	5.8	5.8	5.8	5.8	5.8
Manufacturing	4.1	4.2	4.1	4.2	4.2	4.2	4.2	4.2
Power	2.3	2.4	2.3	2.4	2.3	2.4	2.4	2.4
Residential	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Services	8.0	8.1	8.0	8.1	8.1	8.1	8.1	8.2
Transport	3.3	4.2	4.0	3.5	4.1	4.2	4.2	4.2
2045	22.4	25.5	23.3	24.7	25.4	25.5	25.5	25.5
Agriculture	4.3	5.9	4.3	5.9	5.9	5.9	5.9	5.9
Manufacturing	4.4	4.5	4.4	4.5	4.5	4.5	4.5	4.5
Power	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Residential	0	0	0	0	0	0	0	0
Services	8.2	8.4	8.3	8.4	8.4	8.4	8.4	8.4
Transport	3.1	4.1	3.9	3.3	4.1	4.1	4.1	4.1
2050	22.5	26.3	23.5	25.4	26.1	26.3	26.2	26.3

Agriculture	3.9	6.0	4.0	6.0	6.0	6.0	6.0	6.0
Manufacturing	4.6	4.8	4.6	4.8	4.8	4.8	4.8	4.8
Power	2.5	2.7	2.7	2.7	2.7	2.7	2.7	2.8
Residential	0	0	0	0	0	0	0	0
Services	8.4	8.7	8.5	8.7	8.6	8.7	8.7	8.7
Transport	3.0	4.1	3.8	3.2	4.0	4.1	4.1	4.1
Region name	EU27							
Sum of Emissions GHGs (Mton_CO2eq)	Measure							Reference
Sector & Year	All measures	Biking	Diets	Flying less	Moderate car sizing	Sharing products	Sharing spaces in housing	No measure
2020	4765.7	4765.8	4765.8	4765.8	4765.7	4765.8	4765.8	4765.8
Agriculture	888.3	888.3	888.3	888.3	888.3	888.3	888.3	888.3
Manufacturing	1107.5	1107.5	1107.5	1107.5	1107.5	1107.5	1107.5	1107.5
Power	706.2	706.2	706.2	706.2	706.2	706.2	706.2	706.2
Residential	265.8	265.8	265.8	265.8	265.8	265.8	265.8	265.8
Services	787.6	787.6	787.6	787.6	787.6	787.6	787.6	787.6
Transport	1010.4	1010.5	1010.5	1010.5	1010.4	1010.5	1010.5	1010.5
2025	4905.9	4974.4	4919.3	4972.6	4977.2	4979.2	4979.1	4979.2
Agriculture	890.3	926.5	890.3	926.4	926.5	926.5	926.5	926.5
Manufacturing	1221.4	1229.5	1222.1	1229.5	1229.6	1229.8	1229.8	1229.8
Power	731.3	736.8	731.7	736.8	736.8	737.0	736.9	737.0
Residential	229.1	229.2	229.2	229.2	229.2	229.2	229.1	229.2
Services	850.7	855.3	850.9	855.3	855.3	855.4	855.4	855.4
Transport	983.0	997.1	995.1	995.4	999.8	1001.5	1001.5	1001.5
2030	4840.0	5003.2	4886.1	4980.1	5004.1	5010.9	5010.2	5011.0
Agriculture	879.9	956.3	879.9	956.3	956.3	956.3	956.3	956.3
Manufacturing	1305.0	1323.4	1307.4	1322.7	1323.3	1323.8	1323.8	1323.9
Power	682.9	694.0	685.3	694.3	693.6	694.7	694.6	694.7
Residential	170.0	170.5	170.5	170.5	170.5	170.5	170.0	170.5
Services	899.4	909.6	900.4	909.3	909.6	909.8	909.7	909.8
Transport	902.8	949.4	942.7	927.1	950.8	955.8	955.9	955.9
2035	4747.7	5025.4	4829.6	4973.4	5022.0	5033.2	5032.4	5033.9
Agriculture	859.8	986.5	859.9	986.4	986.5	986.5	986.4	986.5
Manufacturing	1390.6	1422.6	1395.7	1421.0	1421.8	1422.9	1423.2	1423.3
Power	623.6	641.3	629.6	642.3	639.5	642.8	642.6	642.9
Residential	126.1	126.9	126.9	126.9	126.9	126.9	126.1	126.9
Services	946.8	964.1	948.9	963.4	963.9	964.3	964.2	964.4
Transport	800.9	883.9	868.6	833.5	883.5	889.8	889.9	889.9
2040	4660.5	5044.5	4759.8	4978.7	5037.8	5052.3	5050.9	5053.2
Agriculture	833.3	1018.0	833.5	1017.9	1018.0	1018.0	1018.0	1018.0
Manufacturing	1439.4	1485.0	1446.0	1483.0	1483.5	1485.3	1485.6	1485.8

Power	551.8	575.0	561.2	576.9	571.8	577.5	577.1	577.6
Residential	93.3	94.4	94.4	94.4	94.4	94.4	93.3	94.4
Services	992.1	1017.4	995.4	1016.7	1016.8	1017.8	1017.4	1017.9
Transport	750.5	854.7	829.3	789.9	853.3	859.4	859.4	859.5
2045	4714.7	5227.3	4834.3	5144.8	5216.2	5234.1	5232.1	5235.5
Agriculture	796.6	1049.0	796.8	1048.9	1049.0	1049.0	1049.0	1049.0
Manufacturing	1518.7	1581.8	1527.5	1579.3	1579.4	1581.9	1582.4	1582.8
Power	578.5	611.5	592.6	614.3	606.0	615.0	614.4	615.2
Residential	70.6	72.1	72.1	72.1	72.1	72.1	70.6	72.1
Services	1035.9	1070.8	1040.6	1069.9	1069.7	1071.2	1070.6	1071.4
Transport	714.4	842.1	804.7	760.3	839.9	844.8	845.0	845.0
2050	4797.5	5438.4	4931.4	5345.7	5425.1	5445.0	5440.9	5446.8
Agriculture	756.1	1079.4	756.3	1079.3	1079.4	1079.4	1079.4	1079.4
Manufacturing	1598.6	1680.4	1609.0	1677.7	1677.5	1680.5	1681.0	1681.6
Power	603.8	647.0	622.7	651.0	639.7	651.7	650.5	651.9
Residential	57.2	59.7	59.7	59.7	59.7	59.7	57.2	59.7
Services	1079.7	1124.9	1086.0	1124.0	1123.4	1125.5	1124.4	1125.7
Transport	702.0	847.0	797.7	754.0	845.4	848.2	848.4	848.4

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