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## Carbon neutral lifestyles and NDCs: advice and policy perspectives

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April 2023



# Working Paper

07.2023

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## **Carbon Neutral Lifestyles and NDCs: Advice and Policy Perspectives**

**Laura Cavalli, Chiara Boeri**

# Carbon neutral lifestyles and NDCs: advice and policy perspectives

By **Laura Cavalli** (Fondazione Eni Enrico Mattei)  
**Chiara Boeri** (Fondazione Eni Enrico Mattei)

## Summary

Climate change is one of the most important challenges for the present generation, which is living in decades characterized by a drastic increase in greenhouse gas emissions, especially in the most developed countries: not only the production realities – for which policies already largely provide for mitigation measures – contribute to emissions; but also, individual citizens to whom only a small part of the envisaged measures are addressed. Among the policies in which the demand side is little addressed are the Nationally Determined Contributions, which embody the efforts of each country to reduce national emissions and adapt to the impacts of climate change, as stated in the Paris Agreement signed in 2015 between the Member States of the United Nations Framework Convention on Climate Change (UNFCCC). Integrating advice on carbon neutral lifestyles in NDCs and long-term strategies could have positive implications in both social, economic, and environmental terms, paving the way for more holistic and inclusive policies, fundamental elements to pursue a development that is sustainable in the short and above all in the medium-long term. Taking this into account, the present work, which forms an integral part of the studies of WP 7 within the Horizon 2020 Project CAMPAIGNers- Citizens Acting on Mitigation Pathways through Active Implementation of a Goal-setting Network<sup>1</sup>, aims to understand what the consequences deriving from the inclusion of carbon neutral lifestyle advice in the Nationally Determined Contributions and national climate strategies would be, and to operationally implement practical examples and ways to include behavioural aspects of the carbon neutral lifestyle in the sectors studied, based on national data and statistics from the countries participating in the Project<sup>2</sup>. The innovative aspect of the Project lies in integrating the quantitative aspects deriving from the scientific evidence of official statistics with qualitative aspects generated by the collaboration between partners and stakeholders, in the form of surveys and focus groups: in this way it is possible to effectively overlap the spheres of economic and environmental analysis with that of policy making, providing a tool capable of directing strategies and international agendas.

**Keywords:** Public Economics, Government, Environmental, Regional Household Behavior

**JEL Classification:** D1, H7, R2

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# Carbon neutral lifestyles and NDCs: advice and policy perspectives

Laura Cavalli\*, Chiara Boeri\*

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## Abstract

*Climate change is one of the most important challenges for the present generation, which is living in decades characterized by a drastic increase in greenhouse gas emissions, especially in the most developed countries: not only the production realities - for which policies already largely provide for mitigation measures – contribute to emissions; but also, individual citizens to whom only a small part of the envisaged measures are addressed. Among the policies in which the demand side is little addressed are the Nationally Determined Contributions, which embody the efforts of each country to reduce national emissions and adapt to the impacts of climate change, as stated in the Paris Agreement signed in 2015 between the Member States of the United Nations Framework Convention on Climate Change (UNFCCC). Integrating advice on carbon neutral lifestyles in NDCs and long-term strategies could have positive implications in both social, economic, and environmental terms, paving the way for more holistic and inclusive policies, fundamental elements to pursue a development that is sustainable in the short and above all in the medium-long term. Taking this into account, the present work, which forms an integral part of the studies of WP 7 within the Horizon 2020 Project CAMPAIGNers- Citizens Acting on Mitigation Pathways through Active Implementation of a Goal-setting Network<sup>1</sup>, aims to understand what the consequences deriving from the inclusion of carbon neutral lifestyle advice in the Nationally Determined Contributions and national climate strategies would be, and to operationally implement practical examples and ways to include behavioural aspects of the carbon neutral lifestyle in the sectors studied, based on national data and statistics from the countries participating in the Project<sup>2</sup>. The innovative aspect of the Project lies in integrating the quantitative aspects deriving from the scientific evidence of official statistics with qualitative aspects generated by the collaboration between partners and stakeholders, in the form of surveys and focus groups: in this way it is possible to effectively overlap the spheres of economic and environmental analysis with that of policy making, providing a tool capable of directing strategies and international agendas.*

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<sup>1</sup> CAMPAIGNers Grant agreement ID: 101003815, <https://cordis.europa.eu/project/id/101003815>

<sup>2</sup> Project's countries: Austria, Azerbaijan, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Peru, South Africa, Sweden, Turkey,

# 1. Introduction

Climate change is one of the most important challenges of the present generation, who must deal with the consequences of the unsustainable choices of past generations, and the sometimes-disastrous repercussions of present choices on the Planet. For these reasons, climate commitment is a common denominator of all countries, which over recent years have adopted various policies aimed at avoiding the most severe repercussions of climate change by setting regulatory and operational provisions by governments, public bodies, and private entities: these measures have been addressed to different population targets at a demographic and geographical level, and differ in terms of time extension, mandatory nature and operational aspects; however, only in recent years a wave of awareness of the importance of behavioural switches arose, which was declined with the use of digital tools and smart meters to facilitate the monitoring of emissions from households. Today, therefore, policy makers are called to take a further step in this direction to amplify the scope of change.

In fact, over the years, especially in fast growing countries, individuals tend to adopt increasingly carbon-intensive lifestyles, just think of how the wealthiest population tends to live in larger apartments which therefore involve greater energy expenditure, or how often the most expensive means of transport are also the most polluting ones (such as the plane or the private car). For all these reasons, including aspects linked to human lifestyle in climate-related policies is pivotal: with targeted actions, citizens themselves are collectively able to reduce emissions and pave the way towards sustainable and just development.

As a matter of facts, to date most of policies that aim to tackle climate change are based on a reduction of emissions from the production side with measures related for instance to electricity production, while only a minority concern the demand side and the final energy users: consumers. These demand-driven emissions do not increase only because of economic factors as an increase in income which often leads to an increase in per-capita emissions triggered by unsustainable lifestyles as explained in the above paragraph; but also because of temporal factors, especially in fast-growing countries where lifestyle tends to become increasingly environmental harmful over years because of the rapid population growth over years.

Therefore, in principle, the demand-driven emissions should have the same weight as the production-oriented measures within the carbon emission reduction policies, however for the vast majority of scenarios this does not occur: with this in mind, it is fundamental to understand first the theoretical foundations and then the policy consequences deriving from the inclusion of carbon neutral lifestyles in the Nationally Determined Contributions and more broadly in the long term strategies at national and supranational level.

In this regard, it is fundamental to inform policy makers and the society, which constitutes the ultimate stakeholder of the implemented policies, on the importance of incorporating lifestyle advice into the Nationally Determined Contributions (NDCs) of the countries adhering to the Project, to highlight the feasibility and potential impact that these policies would have in selected sectors<sup>3</sup>. In fact, it is now known that consumer-led transitions positively contribute not only to the reduction of greenhouse-gas (GHG) emissions, but also to the achievement of wider Sustainable Development Goals (SDGs) (Andreas Andreou, 2022), and therefore it turns out to be essential to operationally improve the contribution that citizens can have to reach the climate and sustainability objectives.

## 1.2 Related literature

The carbon neutral lifestyle and its integration into policies aimed at reducing emissions are gaining increasing relevance in scientific research, both for the impact that a lifestyle switch can have on emissions, and for the importance of issues as awareness and education of citizens to a responsible lifestyle.

Indeed, despite the ever-increasing technological focus on energy efficiency, overall energy consumption has continued to grow in advanced economies (Stephen Axon, 2018), and as much as a

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<sup>3</sup> Selected sectors: transport, diet, housing, other consumption

third of CO<sub>2</sub> emissions in developed countries derive from energy consumption by households. It is therefore clear that individuals play a key role in the transition towards a low-impact society, however few models have been developed to date to incorporate this aspect, and therefore the policies in this sense are lagging behind.

An example of an experimental model to embed behavioural advice within policies is provided by the Personal Carbon Allowances (PCTs), which have been proposed as a policy instrument for emissions mitigation in England and consist of creating individual “allowances” which cover personal carbon emissions, and can be negotiated, so that “high-energy users” find themselves having to purchase “carbon credits” to carry out their activities (Seyfang, Lorenzoni, & Nye, 2007). The proposed PCT system would therefore lead consumers to develop a sustainable attitude not only in financial terms, but also in terms of resources, leading to an increase in the motivation of individuals to reduce emissions and use materials in a conscious way. In practical terms this system would ensure that in making a choice as to the means of transport to get to work, a commuter would include in the evaluation aspects the market value of the permits to be obtained for the purchase of petrol and compare these to the price of the train ticket.

Beyond these models to reduce demand-side emissions, the difficulty of including behavioural aspects in NDCs and more broadly in long term strategies for emissions reduction also lies in the fact that the population does not consider global warming a primary concern when compared to other social, personal and environmental risks (Richard J. Bord, 2000); and therefore, not being considered a serious threat to the individual there is less incentive to change one's lifestyle to make it more “carbon neutral”.

To overcome this social phenomenon, over the last decade a branch of behavioural economics has established within the academic environment, namely that of “nudging” (Stuart Capstick I. L., 2014), which aims to push people to follow a specific direction on environmental issues, aiming to reduce the direct emissions generated by the individual, such as at domestic or in the transport choices. The concept underlying this theory lies in the fact that citizens have incomplete information and are not able to process all the sources of information they would have at their disposal, and therefore make their choices on a sub-category of the same; thus, providing the decision-making processes underlying the choices can be influenced by providing “positive reinforcements”: however, the effectiveness of this theory is not universally recognized with results that sometimes deviate from what was theorized.

Finally, a tool adopted in the literature for the assessment of the impacts of alternative pathways - including that of the inclusion of lifestyle changes - consists of the Integrated Assessment Models (IAMs) : in this way it is possible to understand the impact on emissions of the shift towards a more environmentally friendly behavioural attitude that entails for instance a switch to more plant-based diets, or changes in transport habits and reduction of domestic heating/cooling levels, motivated both by environmental and health (Al. D. P., 2018). Similarly, a study implemented by Utrecht University took a number of lifestyle change measures to residential energy consumption, mobility and waste management using the IMAGE Integrated Assessment Model (Al. M. A., 2015), and the results showed how the adoption of these measures would allow a reduction of emissions in the transport sector equal to 35% compared to the baseline emissions, i.e. those that assume a “Business As Usual” scenario, evidence of the high potential for mitigating emissions deriving from these types of policies.

The graph below shows the trajectories of CO<sub>2</sub> emissions by 2100 based on the different scenarios pursued, according to the study with IMAGE methodology mentioned above:

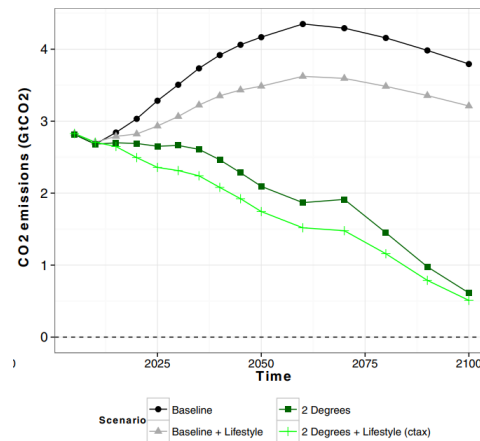


Figure 1: CO2 emissions trajectories (in GtCO<sub>2</sub>). Retrieved from: <https://www.sciencedirect.com/science/article/pii/S0040162515002607>

As emerges from the graph above, both the "2-degrees" scenarios, with or without the inclusion of lifestyle change measures, are the most effective in reducing the current level of emissions: both perspectives "2 degrees" involve in fact cost-optimal mitigation scenario with primarily price-based mitigation measures to be in line with the stabilization targets for 2100, however it is also evident that the addition of lifestyle change measures in the short and medium term entails a significant benefit in reducing emissions, as proof of the importance of including these aspects in emission reduction policies.

In this context, the novelty of the work carried out within the Horizon EU Campaigners Project consists in providing a "goal setting network" in which to promote empirically validated carbon neutral lifestyles that modify the daily routines of the citizens of the Lighthouse Cities, cities that are actively engaged in promoting change towards zero emissions: in fact, lifestyle and "patterns of consumption" are undoubtedly responsible for climate-changing gas emissions, as also emerges from the latest IPCC Report (Hoesung Lee, 2023), which investigates how urban areas are particularly responsible for emissions, given that around 67- 72% of the global share of emissions in the last five years. In this sense Campaigners, which sees the participation of European and non-European cities that act as "Lighthouses" of change, has a high potential to substantially reduce human-caused emissions thanks to the action and responsibility of individuals, and thanks to the participatory nature of the Project it will be possible to generate an echo effect that leads to the dissemination and implementation of behavioural advice in the participating countries.

## 2. Why to incorporate lifestyle-related pathways and actions into NDCs?

The Nationally Determined Contributions (NDCs) represent the commitment that individual countries intend to adopt to reduce emissions, as required by the Paris Agreement, a legally binding international treaty on climate change adopted by 196 Parties in 2015. NDCs are a government obligation under the Paris Agreement, are presented by the member countries of the UNFCCC<sup>4</sup> and updated before the annual Conference of Parties, an annual global climate summit on tackling climate change.

The presentation of the first NDCs took place following the United Nations conference held in Warsaw in 2013, then in 2015 the European Union presented its NDCs, and the other adhering countries did the same. From 2015 onwards, the adhering countries must submit every 5 years an update with a periodic enhancement of the proposed measures and targets, regardless of the implementation time horizon of the previously presented NDCs. However, in the latest update of the NDCs, lifestyle-related mitigation pathways have not

<sup>4</sup> United Nations Framework Convention on Climate Change

been adequately incorporated and neither are embedded in national climate policies, and this is undoubtedly a theme to be addressed for the drafting of the next ones.

To date, in fact, some Project's countries have included the importance of local communities in their commitments or have taken into due consideration the specific vulnerabilities for parts of the population; however, the greatest space has been left for the description of general actions to be undertaken in carbon-intensive sectors targeting mostly the production side of supply chains and neglecting the importance of the use and disposal phase, which belongs to the consumers of the goods produced.

## **2.1. To raise the awareness of every citizen**

A first motivation for including behavioural advice in national climate policies aimed at reducing GHG emissions consists in spreading the idea that the actors involved in the fight against climate change are not only large energy companies and productive realities in general, but that even an individual citizen has tangible responsibilities towards the planet. Considering that since 1990, the energy consumption in the residential sector of some developed countries has exceeded that in the industrial sector, highlights the role of households as an important source of carbon emissions (Chen, Lin, & Wang, 2022). Moreover, carbon emissions from household consumption practices are not only generated directly, for example through the transportation of people or the residential heating, but also indirectly, for example in the products or foods purchased: therefore, it is essential to raise awareness also of these indirect emissions (e.g. emissions to produce electricity required by the households), so that individual citizens can make informed choices in their everyday lives.

From an operational point of view, this might be implemented by giving practical advice to promote sustainable consumption, which for example in the fashion sector, highly emissive, could lead to tangible benefits: choosing products manufactured with eco-sustainable materials, or preferring those with natural fibres or recycled materials to primary raw ones are only few of the many changes that can be implemented in this area of intervention. Another pattern that characterizes current society and has negative repercussions at an environmental level is the phenomenon of "*one person households*", i.e. the increasingly high frequency of individuals who live alone, and who do not share domestic heating, or food and appliances with other subjects, being therefore responsible for a higher level of emissions given that the economies of scale that would allow for a better distribution of per capita emissions do not occur.

Indeed, in principle lies the urgency of informing consumers about potential ways to take action against climate change, given that according to a survey, more than a third of consumers would like to take action to reduce their environmental impact, but do not know how to carry on this idea (Sheila Bonini, 2018). Therefore, education is essential for spreading sustainable consumer practices and making people understand how these permeate all aspects of consumption, from clothing, where it would be for example advisable to encourage the purchase of second-hand products; to electronics, where the appliance's energy efficiency is often not considered in the purchase decision and the life cycle of the product is very short, as it is often cheaper to replace than to repair.

## **2.2. To protect natural resources**

The behaviour of the individual has a tangible influence on the planet and on the state of conservation of natural resources, and it is therefore essential to act responsibly, with the awareness that acting sustainably is the only way "*to meet the needs of the present without compromising the ability of future generations to meet their own needs*", as indicated in the World Commission on Environment and Development's 1987 Brundtland report as definition of Sustainable Development (United Nations, s.d.).

To successfully pursue this important mission, it is essential to uptake and disseminate circular economy practices, given that through this model it is possible to increase the efficiency of resources, without compromising the level of services provided (Andreas Andreou, 2022). In fact, today, with the growing globalization and the availability of low-cost raw materials, the manufacturing industry is highly resource-intensive and makes extensive use of primary raw materials; meanwhile, consumers are increasingly driven to adopt non-sustainable consumption practices, leading to a very short product lifetime and sales prices that do



not embody environmental costs: all this results in an unmanageable quantity of waste, high rates of pollution and the impoverishment of the quality of the soil, deprived of its resources. Therefore, it is necessary to match social and environmental sustainability, through the promotion of behavioural policies that affect the lifestyle of consumers, making them more environmentally friendly.

The culture of the circular economy should form the foundation of the societies both in terms of production and consumption: the graph below shows the "*Circular Material Use Rate*", also known as "*circularity-rate*"<sup>5</sup>: this expresses the share of recycled materials fed back into the economy-thus saving extraction of primary raw materials.

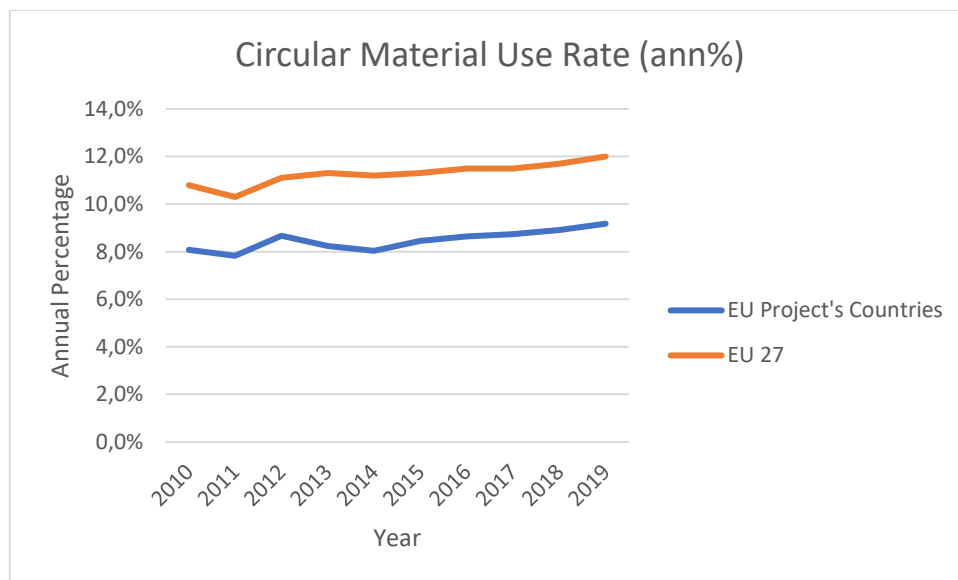


Figure 2: Circular material use rate for EU's Project Countries and the EU 27 (in annual percentage). Retrieved from: [https://ec.europa.eu/eurostat/databrowser/view/env\\_ac\\_cur/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/env_ac_cur/default/table?lang=en)

By comparing the "*Circular Material Use Rate*" of the European countries adhering to the Project with the EU 27, the countries involved in the Project have a recycling rate which is on average 2,8% lower than Europe: this means that the European countries adhering to the Project use on average more raw materials for the production of the goods placed on the market, and therefore it is essential to take an action to stop this trend and increase the circularity rate.

The extent of a switch to circular economy within the textile industry, for instance, would actually make the difference, given that the 10 % of global GHG emissions are caused by clothing and footwear production, and 73% of clothes (Souchet, 2019) end up in landfills at the end of their rather short lifecycles: to stem this scenario it is essential first of all to adjust production regulations, but also to promote among consumers the importance of responsible consumption, as proposed in the SDG 12 of the 2030 United Nations Agenda for Sustainable Development. This Goal requires the implementation of the 10-Year Framework of Programmes on Sustainable Consumption and Production (10YFP) (Stefanie Chan, 2018), which aims to generate impact through multi-stakeholder partnerships, which develop, replicate and scale up SCP policies and initiatives at all levels: the programs pursued by 10YFP also include one dedicated to "*Consumer Information for SCP*" and "*Sustainable Lifestyles and Education*", therefore to be addressed to final consumers (UN environment programme, s.d.).

To do so, it is necessary to promote a "*pro-environmental*" mindset for the purpose of resource conservation (Stuart Capstick I. L., 2014): a fundamental element of the circular economy is waste recycling, and especially

<sup>5</sup> The circularity rate derives from the ratio between: the *circular use of materials*, approximated by the amount of waste recycled in domestic recovery plants, minus imported waste destined for recovery, plus exported waste destined for recovery abroad; and the *overall material use*, measured by summing up the aggregate domestic material consumption and the circular use of materials.

taking into consideration that in many of the adhering countries the culture oriented towards the circular economy and recycling is not particularly rooted, it is even more important to learn this mentality. Just think of how in Peru, although around 60% of the waste is organic and 20% is plastic or other recyclable materials (Huisman, Keesman, & Breukers, 2021) that could be reinserted into the production cycle through recycling or used as compost improving soil quality; only the 1% of the total amount of waste is valorised, and this involves of course a substantial amount of discarded waste. Similarly, other environmentally beneficial practices include all those related to shared mobility, such as car-pooling and car-sharing, which can lead to a decrease in new car registrations, thereby affecting the activity in car manufacturing industries and ultimately reducing the sector's emissions.

To date, in the Nationally Determined Contributions of the adhering countries, the advice on the circular economy is focused on the production side, pointing out the importance of recycling in production processes in order to reduce the use of primary raw materials and exploit them as energy sources; therefore, an integration of behavioural advice aspects targeting lifestyle changes towards sustainability that can be implemented by the individual citizen could constitute a turning point in these policies.

In fact, the climate change generated by human behaviour is responsible, among other things, for the increase in droughts, which can compromise crops and the efficiency of the agricultural sector, as well as causing disruption to the whole ecosystem: these issues have acquired increasing priority on international agendas especially given the increase in population, which interacts negatively with climate change leading to a decrease in the availability of water, known as "*water scarcity*". Being a precious resource, the protection of water is also the subject of SDG 6 - *Ensuring the availability and sustainable management of water and sanitation for all*- with which the United Nations intends to guarantee water access for all by 2030. Target 6.B of this Sustainable Development Goal aims precisely at "*Support and strengthen the participation of local communities in improving water and sanitation management*" (United Nations, s.d.), and in this perspective Campaigners and the awareness generated in the citizens of the Lighthouse Cities about the importance of using water resources in a conscious way are a step towards achieving this Goal.

### **2.3. To move from an individualistic logic to a collective approach**

The objective of CAMPAIGNERS, and of Deliverable 7.2, is in line with the Sustainable Development Goal 17- *Partnership for the Goals*, which aims to strengthen the means of implementation and renew the global partnership for sustainable development. Thanks to the Project it is possible to achieve an active collaboration from a plethora of heterogeneous actors, such as national authorities, local governments, agencies, businesses, and individuals; and each of these stakeholders are responsible for a part of the process of change, creating a common vision and shared goals that put the planet at the centre.

This "*collective approach*" is not only generated by the citizen, who thanks to the challenges available in the Campaigner's app adopts more eco-friendly lifestyles and by being part of a community that acts to mitigate climate change feels more engaged to pursue sustainability with its own means; but it is also generated by policy makers, who with a system of strategic governance shared on a supranational scale are able to better frame their national policies in the larger international framework, observing not only their own path, but also that of the other countries participating in the Project.

Thanks to this approach it is possible to pursue a polycentric transformation, in the sense that it originates simultaneously in several countries by several stakeholders; and this allows, compared to conventional approaches, to modulate the scope based on the specific conditions of the unit of analysis taken into consideration, thus increasing the effectiveness of the policies. The effectiveness of this approach is supported by the literature, which demonstrates how to organize "*multi-scale activities*" generate benefits to those who do it, ranging from families, farms and towns on a local scale to regions within a state, states, regional units and the globe (Ostrom, 2010). Furthermore, a study on the adoption of Voluntary Agreements in China as a policy tool for achieving energy efficiency targets (Zhang, Cui, Avest, & Dijk, 2017) shows how a bottom-up approach focused on the will of the individual can lead to a holistic implementation of green policies, and by

offering citizens a platform for dialogue it is possible to increase interactive learning and change the behaviour of target groups.

The common denominator of these approaches therefore lies in entrusting communities and individuals with greater responsibility for the environmental repercussions of their consumption and lifestyle choices, and in this context, Campaigners allows us to find a connection between these aspects and those already implemented today from the countries adhering to the Project, thus allowing a change of approach from Business As Usual to more holistic and bottom-up policymaking approaches.

### **3. Purpose of the work**

#### **3.1. Understand where to focus efforts to reduce emissions**

This Policy Brief, and the work that is being carried out within the Work Package 7 - *Multi-Level Policy Advice and EU Strategy Support* - aims to understand the areas of intervention in which it is most urgent to act at the policy level, based on their potential for reducing carbon emissions or the effort level required by individuals in implementing the policies. In this regard, a precise methodology<sup>6</sup> was developed, which consisted first in assessing the economic and social conditions of the selected countries, evaluating their most significant differences: to do so, the countries adhering to the Project were divided according to the NDCs presented - therefore European Union was considered in a unitary way as it has adopted a common NDC, while the other countries were considered independently as the presentation of their NDCs is not linked. Secondly, for each sector covered in Deliverable 1.3 - namely transport, diet, housing, other consumption - the behavioural measures on carbon neutral lifestyles that are most recommended to be included in each of the NDCs have been highlighted, on the basis of both their effectiveness in mitigating emissions and in terms of consistency with the policies currently included in the Nationally Determined Contributions and Long-Term Strategies. The next logical milestone consisted in understanding whether the adhering countries had already included some behavioural policy advice in the NDCs currently in force, and in this case how to best implement the current state of the art.

Therefore, from this point of view, the work carried out makes it possible to offer the countries included in the Campaigners Network a spectrum of behavioural measures tailored on the basis of specific economic and social parameters, which can be proposed or included in future emission reduction strategies.

#### **3.2. Provide scientific support to address lifestyles in NDCs**

Another pressing issue that the work conducted with Campaigners aims to eradicate is to offer a scientific and quantitative perspective for including behavioural advice in policies: to date, in fact, lifestyles are not adequately integrated in the Nationally Determined Contributions (NDCs) and long term strategies of the countries participating in the Project, even though, as also reported in the literature, non-pecuniary strategies are able to effectively influence individual decision-making (Paul J. Ferraro, 2011). In fact, especially for less price sensitive households, the adoption of norm-based behavioural incentives is particularly effective (Mansur and Olmstead, 2007); and furthermore, to pursue the energy transition and comply with the objectives outlined by the Paris Agreement, it is essential to reduce energy production, and consequently the demand for energy, so as not to cause misalignments between supply and demand which would generate excessive prices and market crises. Therefore, while, for example, to reduce the production of energy from non-renewable sources regulatory instruments may suffice, to reduce energy consumption by citizens - and consequently their impact on the emission of climate-changing gases - it is necessary to include behavioural advice in policies.

Moreover, often, the individuals who are least sensitive to price signals are also those who pollute the most: just think that the use of a private car for a single passenger is often less convenient in terms of traffic congestion, costs more than public transport and pollutes more; or to red meat that costs more than the vegetable proteins that could replace it; or at the thermostat set point for space heating which is often kept high despite high energy costs. Therefore, it is even more fundamental to adopt targeted behavioural policies related

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<sup>6</sup> extensively described in paragraph 3.2.

to lifestyles for all and with a particular focus to these social groups, who are responsible for most of the emissions and often opt for comfort without taking into consideration the environmental externalities of their choices.

In this regard, evidence demonstrates that the richest 1% of the worldwide population is responsible for the 15% of cumulative emissions (Oxfam, 2020), and from the GDP of the adhering countries it can be observed how the countries belonging to the European Union have a higher GDP per capita (expressed in current US\$) than the Project's countries outside the European Union (The World Bank, s.d.). At the same time the gap between the GDPs per capita of the European and non-European countries is closing over time, suggesting a convergence in the long term, also due to the new balances on the world chessboard and the high growth rates of emerging countries.

Therefore, given the positive relationship between GDP growth and emissions, it is essential to understand how to intervene at a regulatory level towards balancing economic, environmental, and social aspects to pursue a sustainable growth: in fact, the growth of per capita GDP and population are driving forces behind climate-changing gas emissions, and make sustainable development, i.e. inclusive development that can "leave no one behind" an increasingly complex challenge from a societal point of view.

The scientific aspect of this Project lies in the fact that policy advice is substantiated by a quantitative and data-driven approach, which has made it possible to carry out first a preliminary analysis of the countries adhering to the Project: the data of *the Report on Target Lifestyles* from WP 1.3 were processed, evaluating the CO<sub>2</sub> intensity of the energy mix of the countries participating in CAMPAIGNers, and from this it was possible to understand the fuels and energy sources used in the respective countries for the production of electricity and to further proceed with the analysis.

The pie chart below presents the electricity mix of the countries adhering to the Project:

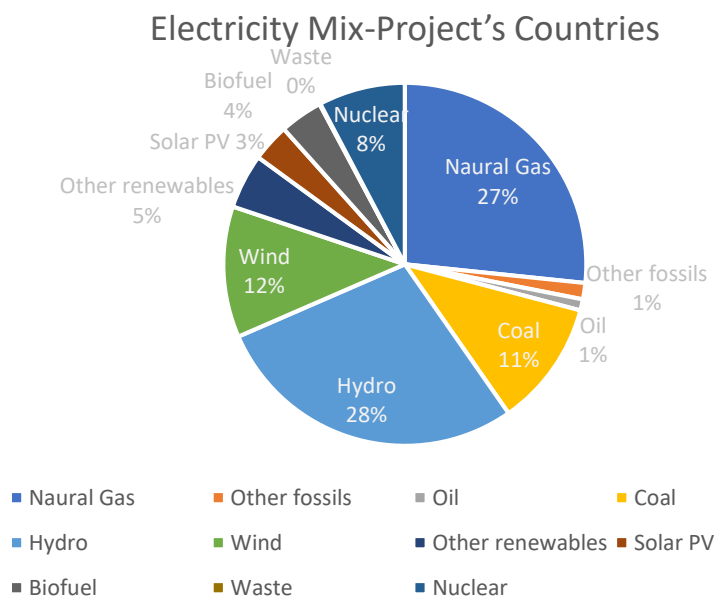


Figure 3: Electricity mix - Project's Countries. Own elaboration from: Philippe COPINSCHI et al. (2022). Report on Target lifestyles. Deliverable 1.3 of the CAMPAIGNers Project (Grant Agreement ID: 101003815)

From the data on the primary energy sources used for the production of electricity (in percentage), it emerged how some countries have a very carbon-intensive energy mix, as Azerbaijan where natural gas constitutes the 96% of its energy mix; or South Africa, where coal accounts for the 88% of the mix (Philippe Copinschi, Report on Target lifestyles. Deliverable 1.3 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022). Other countries as Austria or

Canada have instead a mix oriented towards renewables: in these countries, therefore, even households are responsible, with their activities, for a lower level of emissions, thanks to the underlying renewable sources.

As regards the European countries adhering to the Project, which make up the majority of the participating countries, their electricity mix is rather heterogeneous, with countries such as France where the dominant energy source is nuclear (66%), or countries such as the 'Austria where the main source of energy is water (and hydro constitutes 63% of the electricity produced), ending with Ireland where half of the production is made up of natural gas, a non-renewable source: in the coming decades, also as a result of the Russo-Ukrainian war, substantial changes to the energy structure are expected, with a reduction in the production of hydrocarbons (such as oil, coal and methane), which will give way to renewables, more resilient to external shocks.

The table below investigates, with reference to Europe, which type of fuel is used in final energy consumption in the residential sector based on the type of end use: in 2020, households and the residential sector in Europe accounted for 27.4% of final energy consumption, and most of the sources are derived from natural gas and electricity. Italy, for example, has relied on natural gas for more than 50% of residential uses, and this is undoubtedly a point of attention and to be improved on the production side (Eurostat, 2022).

	energy use	space heating	space cooling	water heating	cooking	lighting and electrical appliances	other end use
Solid fossil fuels, peat, peat f	2.9	91.0	0.0	7.8	1.1		0.0
Natural gas	32.0	74.6	0.0	19.3	6.1		0.0
Oil and petroleum products	12.5	78.2	0.0	14.6	6.5		0.7
Renewables and biofuels	19.2	87.9	0.0	10.3	1.2		0.7
Electricity	25.1	13.1	1.5	12.0	12.5	57.9	3.0
Heat	8.3	77.0	0.0	23.0	0.0		0.0
<b>Total</b>	<b>100.0</b>	<b>62.8</b>	<b>0.4</b>	<b>15.1</b>	<b>6.1</b>	<b>14.5</b>	<b>1.0</b>

Figure 4: Share of fuels in the final energy consumption in the residential sector by type of end-use, EU 2020. Source: Eurostat (online data code: nrg\_d\_hhq)

The interesting fact that emerges from the table above is that for Europe the most energy-consuming domestic end-use is space heating, which requires as much as 62.8% of residential energy: then combining this with the fact that 87.9% of renewables and biofuels is used precisely for space heating, it is understood how the potential for the adoption of renewables for this use is high.

Therefore, on the production side it is necessary to work on increasing the share of energy from renewable sources to be dedicated to this sector; on the demand side to adopt behavioural measures to increase awareness of the energy expenditure deriving from space heating and to encourage responsible and sustainable behaviours such as those proposed in the paragraph on housing<sup>7</sup>.

The graph below shows the per capita electricity domestic consumption for EU Project's countries and Non-EU Project's countries:

<sup>7</sup> See paragraph 4.3 Housing from pag. 15

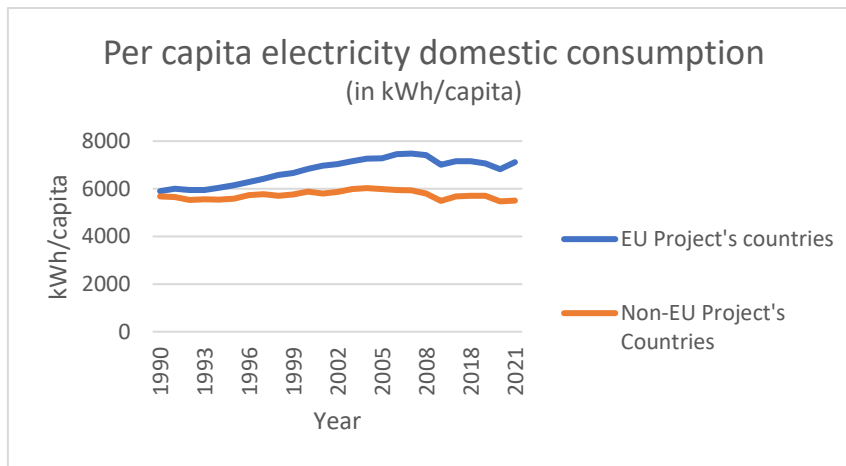


Figure 5: Per capita electricity domestic consumption (in kWh/capita), source: own elaboration from Enerdata

First of all, it is necessary to clarify the distinction between energy and electricity, given that this second term indicates a specific type of energy generated by exploiting the light energy of the sun, the chemical energy of natural materials or the mechanical energy of the movement of the wind or water (MCECleanEnergy, s.d.). Having said this, what emerges from the graph above is that while in 1990 there was a substantial alignment between EU and non-EU countries in terms of domestic electricity consumption, over time the gap has widened, suggesting the need for the inclusion of behavioural advice in the carbon reduction policies of the participating countries. This is therefore an example of how the adoption of quantitative data can substantiate the policy proposals to be suggested in the Guidebook for incorporating lifestyle related pathways and actions into NDCs and long-term strategies, deliverable 7.2 of the Campaigners Project.

To define the proposed policies, data on the urban population were also analysed, since this has an influence on the potential uptake of public transport and active transport, given that transport is associated with a substantial carbon footprint and has the highest potential for mitigating emissions (Ivanova, 2020) and in general population growth is considered a driving force for climate-altering emissions. Thus, it is important to understand in which countries the population is more concentrated in cities to understand the effectiveness and potential uptake of building a dense urban public transport network. In fact, the issue of sustainable urban mobility has acquired increasing importance at an international level, and it is therefore necessary to adopt integrated policies to reduce dependence on car travel and move towards the "post-car city".

Likewise, data on the sectors of interest - as agriculture - were analysed, given that this industry is at the basis of emissions linked to diet: in this regard it emerged that the European countries adhering to the Project and those outside the OECD have a higher level of emissions linked to agriculture compared to the European average, both for the non-advanced agricultural techniques adopted and for the high quantity of livestock emissions, given that livestock is responsible for at least 16.5% of global greenhouse gas emissions (Humane Society International, s.d.).

By systematically applying this approach to all sectors covered, we have provided an empirical and statistical justification for the proposed policies, detailed in the dedicated sections.

### 3.3. Create a network between lighthouses cities

The objective of CAMPAIGNers, as explained in the denomination of the Project itself, is to create a "Goal-setting Network", i.e. a dense network between the Lighthouse Cities adhering to the project, which aims to generate collaboration and participation by all citizens and stakeholders. This makes us understand how the environmental mission of each of the realities adhering to the Project is so interconnected that they all pursue the same broad objective with different operational tools. The structural setting of the Project in fact allows to pursue broader tasks that go beyond the simultaneous actions of independently operating actors (Hall, 2009).

With WP7.2- *Operationalizing scientific support for addressing lifestyles in NDCs*, the goal is precisely to create and enhance structured interactions with the relevant policy makers, jointly assessing where the national contacts see information deficits related to lifestyle pathways integration into their Nationally Determined Contributions so as to cooperatively decide how CAMPAIGNers can best provide and disseminate the solutions found to the entities involved in preparing the next NDCs within each CAMPAIGNer's partner country (EU and non-EU) (Philippe Copinschi, Report on Target lifestyles. Deliverable 1.3 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022).

#### **4. Methodology and lessons learned**

After assessing the general economic and social conditions for the selected countries and making relevant comparisons where possible, potential policies were drawn up to integrate lifestyle advice in the NDCs within each research sector, mapping carbon neutral lifestyle-related measures. To do so, the latest version of the NDCs presented by the Project's countries were analysed, highlighting whether there are provisions relating to behavioural aspects or, if they are missing, in which cases and how to integrate them.

To date, these documents do not present a homogeneous structure, with different thematic extensions and focuses: some, for example, present both GHG mitigation measures and adaptation to climate change, while others only mitigation measures; and each country in the introductory part declines the principles and context at the basis of the document in a different way. The methodology adopted by countries for the definition of NDCs is that proposed by the 2006 IPCC guidelines (Anke Herold, 2006), that identifies the key categories on which to focus, and the mitigation policies of each greenhouse gas emitted by the identified categories. However, the categories identified concern the industrial sectors and are defined according to quantitative criteria linked to level assessment, trend assessment and Monte Carlo Analysis, with which it is possible to determine the dynamic scenarios of MtCO<sub>2</sub>eq emissions. The qualitative criteria for determining the categories of intervention come into play only if the quantitative ones have not identified all the categories to prioritize: this factor could have a negative impact on the inclusion of behavioural policies in the Nationally Determined Contributions, given that it is an ancillary criterion to the quantitative one and, in any case, taking into consideration only the envisaged key categories (therefore linked to production), it leaves no room for behavioural aspects.

Therefore, the policy proposals presented in the following paragraphs assume that the bodies in charge of drafting the NDCs of the countries belonging to the Campaigners network review the current criteria for determining the policies to make room for the inclusion of behavioural advice, to be addressed to the individual citizen and not the industrial sector of reference. Considering this, the reference sectors on which the research focused were those already taken into consideration in the Report on Target Lifestyles, deliverable of Work Package 1.3 (Philippe Copinschi, Report on Target lifestyles. Deliverable 1.3 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022) with which, for 4 reference sectors (transport, diet, housing, other consumption), the alternatives with the greatest decarbonisation potential that do not require the adoption of new technologies have been brought into focus.

Consistent with this Report and with the objectives of Work Package 7.2, the aim is to outline proposals for behavioural measures that can be included in the next NDCs to be drawn up by the countries adhering to the Project, and to establish interactions with policy makers so as to jointly assess where the related information deficits are to the lifestyle in the NDCs: in fact, the added value of this project consists precisely in the interaction and co-design of the trajectories that can lead countries to include lifestyle-related considerations in their emission reduction policies, both with specific regard to Nationally Determined Contributions, and with regard to other long-term strategies such as Low Emissions Development Strategies (LEDS).

The following paragraphs therefore present policy indications based on the scientific evidence that emerged from the data collection phase, by adopting equal weighting for each sector of intervention, given that the prioritization part of the objectives will be outlined with the key contacts of the project. Since the participating

countries are rather uneven in economic and environmental terms, summary grids are also presented for each sector of interest which list the interventions recommended for each country, providing evidence of the operational aspect of the proposed policies. These policy proposals have been designed on the basis of quantitative considerations deriving from official statistical data on socio-economic conditions such as the percentage of the population residing in urban areas out of the total, or access to clean fuels and technologies for cooking and the GDP per-capita; as well as on the carbon footprint of the various sectors of interest such as transport and the characteristics of use and emissions of the various modes of transport used by citizens (where there is a greater propensity to use private or public transport, average number of people per vehicle etc).

## 4.1 Transport

The transport sector has a high potential of emissions reduction through lifestyle changes, as the implementable behavioural measures could be more effective in reducing sectoral energy demand and the associated CO<sub>2</sub> emissions compared to those, for example, adopted in the residential sector (Philippe Copinschi, Advice for a citizen-centred and climate-supportive utilisation of the COVID-19 Recovery Fund. Deliverable 7.5 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022).

In particular, although the CO<sub>2</sub> emissions in the transport sector of OECD and non-OECD countries are overall similar, the growth curve is the most significant data to pay attention to: in fact, while for OECD countries the curve is not very steep, thanks to the laws that impose limitations on emissions for circulating vehicles; in non-OECD countries this curve is much steeper, suggesting the urgency of mitigating emissions at industrial and individual level. This is a logical deduction because of the rise in private car ownership in non-OECD developing countries with growing income and finds empirical confirmation in Project's countries as South Africa, where public transport is currently under-used and most of the population travels by private cars; or Azerbaijan and Peru, where the growing urbanization and the population highly concentrated in large cities lead to urban traffic and high emissions levels. So, in these countries, given the low number of passengers per vehicle and the high propensity to use private transport compared to public ones, the priority is to encourage the adoption of public transport or shared mobility practices (such as car-pooling and car-sharing) so as to reduce the use of private cars, or at least increase the number of passengers per vehicle, ultimately decreasing the emissions per capita deriving from road transport.

Instead, for the countries belonging to the OECD, such as Canada and Europe, the policy focus may be different, given that the public infrastructure is overall already at a good degree of development, just think of the ever-greater diffusion of high-speed trains: here therefore, given that especially in the European countries adhering to the Project and in Canada there is a high propensity to use air transport instead of land transport (The World Bank, s.d.), it would be useful to include incentives for the use of land transport (especially high-speed trains) rather than air transport, at least for distances under 500 or 1000 km. In fact, air flights are responsible for a high level of emissions, and for distances of less than 1000 km they can be successfully replaced by rail solutions, as high-speed trains.

Furthermore, at a transversal level and above all in Europe, where the distances to be covered for urban transport tend to be limited and it would thus be possible to decongest urban traffic and reduce emissions, it would also be advisable to encourage active mobility in the form of walking or using the bicycle. Including these behavioural measures would be not only beneficial from a climate and health point of view, but also an effective structural way to reduce dependence on imported oil (Philippe Copinschi, Advice for a citizen-centred and climate-supportive utilisation of the COVID-19 Recovery Fund. Deliverable 7.5 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022).

In addition to the aforementioned differences and characteristics of the mobility sector in OECD and non-OECD countries, it is essential to go and understand which policies are most suitable for each specific country



adhering to the Project, since each of them, beyond the formal criteria of belonging to a certain geographical economic reality, has peculiarities that make the tailoring of policies fundamental.

For some European countries such as Italy for example, from the second half of the 19th century there was a shift in population from the more central to the peripheral areas: this was also determined by the reduction in the price of transport and by the diffusion of the automobile as private means of transport (Mariangela Scorrano, 2021). Such a historical scenario has inevitably led to an increase in emissions deriving from the transport sector, thus making a behavioural switch to more sustainable forms of transport, such as active mobility and sharing mobility, essential today.

To date, according to a study (Anna Kustar, 2022), only 13% of NDCs include targets to shift travel to more sustainable modes, such as preferring public transport over private means of transport; however, by promoting the so-called "*avoid-shift-improve*" approach also in NDCs it would be possible to reduce the dependence on vehicle travel, significantly reducing emissions from the sector, and thus we recommend to adopt this approach for the next NDCs. This would of course give rise to various challenges at the public and private level, given that in order to effectively pursue behavioural shifts at the transport level, it would be necessary to find levers to incentivize the switch to more sustainable means of transport as well as educating citizens so that they become responsible for the benefits for themselves and for the environment.

The table below shows the behavioural switch proposals to be included in the next NDCs and long-term strategies with reference to the transport sector:

OECD Non OECD	Country name	Transport Policy 1	Transport Policy 2	Transport Policy 3	Transport Policy 4
OECD	EU	Reduce private cars usage	Enhance active mobility	Increase sharing mobility	Discourage short-haul flights
Non OECD	Azerbaijan	Encourage public transport	Increase sharing solutions for road transport	Increase the n. of passengers per vehicle	Increase average transportation distance for railway passengers
OECD	Canada	Encourage electric mobility	Increase metro lines	Increase sharing mobility	Discourage short-haul flights
Non OECD	Peru	Increase railway density	Reduce train ticket prices- incentivize trainline	Increase electric or hybrid buses	Discourage short-haul flights
Non OECD	South Africa	Increase the n. of passengers per vehicle	Incentivize bus over taxis	Encourage train usage	Increase sharing solutions for road transport
OECD	Turkey	Reduce private cars usage	Increase railway density	Enhance high-speed trains usage	Discourage short-haul flights

Figure 6: Proposed policies for the transport sector, own elaboration

The policies presented strongly depend on the existing transport infrastructure of the countries considered, and for an adequate implementation it is necessary that the national governments also pursue a system of expansion and modernization of the railway networks, of incentives for the use of car-sharing and electric vehicles: in this sector, therefore, it is crucial that the behavioural advice that can be promoted in NDCs and long-term strategies go hand in hand with centralized and structural interventions.

Overall, including the policies proposed in the above paragraphs could prove to be truly effective in reducing Project's countries emissions and would be a game changer in the current policy landscape, given that today most of the transport measures in the NDCs are linked to the production and technology side. Also, with respect to the minority of countries that have already included behavioural aspects in their Nationally Determined Contributions, such as Azerbaijan where the use of "*environmentally friendly*" forms of transport is encouraged, the proposed policies would allow for a better operational declination which would ultimately lead to an increase in effectiveness from an emission reduction perspective.

The theme of urban transport is in fact the starting point for modifying the urban layout by reducing its emissions of climate-altering gases: therefore, on the one hand, it is necessary to adopt policies to support proximity and accessibility, so as to make services closer in time; and on the other hand to promote the de-synchronization of urban times - for example by encouraging smart-working - with the aim of reducing the intensity of urban travel. This can be pursued by creating intermodal nodes, which allow for example to make use of public transport to go from the airport to train stations and more peripheral areas of the city, allowing the capillarity of the service and the reduction of private means of transport. To make these structural changes effective, it is necessary to start from the citizens, leveraging on the change in habits and pursuing a transformation in a community and network sense: this is why Campaigners constitutes a game changer in the current environmental policy landscape.

## 4.2 Diet

Diet is also responsible for a significant level of emissions, especially in high-income households: just think how in Europe food makes up about 30% of the household carbon footprint (Ranganathan, 2016). In particular, the two European countries with the highest emissions related to food and agriculture are Germany and France, since they produce and consume high quantities of red meat (Roser, 2017): it would be enough to reduce the consumption of red meat per capita to significantly reduce emissions from the sector. Moreover, red meat and dairy products are also linked to a greater number of cardiovascular problems and obesity and thus, in this context, the promotion of low-meat diets could have a significant positive impact also from a health-point of view. This is valid and should be enacted especially for Europe and Canada, where the average daily consumption of protein of animal origin is very high (75.7 g/capita/day and 58.7 g/capita/day respectively) and reducing meat consumption should be a priority.

Undoubtedly a promotion of behavioural switches in diet may not lead to large emissions reduction, given that sustainable mobility for example could have a greater impact; however, it should be emphasized the importance of including food-related measures in the NDCs for not strictly quantitative reasons. In fact, in the first place it must be considered that the effort for the individual citizen to change eating habits making them more sustainable is often less than that required for other behavioural switches: by assessing the lifestyle domains of the rejected challenges from Campaigner's App it emerges that those related to food habits show a lower rejection rate compared to those related to Mobility or Housing & Energy. Furthermore, from the data collected by the Campaigner's App, it emerges that the CO<sub>2</sub> avoided (in kg CO<sub>2</sub>-eq) deriving from the challenges related to food is significantly higher than the levels achieved with the challenges in other sectors: an explanation for this may lie in the fact that although transport switches such as living car-free and reducing flights have a reduction potential of more than 1.7 tCO<sub>2</sub>eq/cap; the switches in the diet, despite the lower reduction potential (with an average and median mitigation potential of 0.9 and 0.8 tCO<sub>2</sub>eq/cap) (Ivanova, 2020) are more immediate to implement and therefore cumulatively are currently responsible for the highest level of CO<sub>2</sub> avoided (equal to 11 034, 174kg) (Climate Campaigners, s.d.).

That this type of policies should be included in the NDCs of the countries participating in the Project is also corroborated by the FAO data (Food and Agriculture Organization of the United Nations, s.d.) which analysing the nutritional composition of the diet for the Project's countries demonstrates how their consumption of proteins of animal origin is on average 68.75 g/capita/day; while, for example, that of the Gulf countries<sup>8</sup> stands at 26.75 g/capita/day. A final piece of evidence in this regard is given by the share of dietary energy

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<sup>8</sup> Bahrein, Kuwait, Iraw, Oman, Qatar, Saudi Arabia and United Arab Emirates

supply derived from cereals, roots, and tubers (kcal/cap/day) which for the countries participating in the Project is half compared to the Gulf countries. At present, no diet-related policies have been included in the Project's countries NDCs, although many of them could prove to be effective empirically, and beneficial not only for the environment, but also for individual's health.

In addition to changing eating habits, citizens could contribute also by enhancing the consumption of seasonal and local products, which in this case would entail a reduction in CO<sub>2</sub> deriving from the transport of products and from the refrigeration systems used for the product preservation in stock. Today, in fact, food is often imported so as to guarantee all year long the widest variety of products on the shelf, but this turns out to be detrimental to the environment – impoverishing the natural resources - and the local economy of the exporting countries (European Commission, 2021).

In general, it is necessary to promote the so-called "*sustainable consumption patterns*", which are all those daily practices that if consistently integrated into every day's lifestyle can lead to a reduction in emissions. These include for example the reduction of food waste, which favours the sustainability of the production chain: here, the implementation priority lies in those countries where the level of malnutrition is higher, such as Azerbaijan, or in those where, on the contrary, the purchase of excessive quantities of food is higher, such as Canada. In operational terms, this would also cause a decrease of food waste in the markets, which, as happens in Peru and in all countries, discard tons of unsold food every day. Finally, it would be advisable to eat "*from top to tail*", avoiding packaged or already cut fruits/vegetables.

The table below shows policy proposals related to diet specifically designed to address the priorities of each of the countries participating in the Project:

OECD Non OECD	Country	Diet Policy 1	Diet Policy 2	Diet Policy 3	Diet Policy 4
OECD	EU	Reduce red meat consumption	Reduce non seasonal food consumption	Increase consumption of local foods	Enhance consumption of organic food
Non OECD	Azerbaijan	Reduce processed meat consumption	Reduce food waste	Enhance consumption of organic food	Enhance consumption of local food
OECD	Canada	Reduce red meat consumption	Increase plant-based protein consumption (69% obesity rate)	Reduce food waste	Enhance consumption of local food (2/3 is imported)
Non OECD	Peru	Adopt a varied diet	Enhance consumption of organic food	Rescue discarded food from markets	Enhance consumption of local food (14% is imported)
Non OECD	South Africa	Avoid food waste	Eat from top to tail (avoid packaged food)	Enhance sustainable local production	Reduce red meat consumption
OECD	Turkey	Shift to sustainable consumption patterns	Reduce food waste	Increase plant-based protein consumption	Enhance consumption of organic food

Figure 7: Proposed policies related to diet, own elaboration

To favour the dissemination of the proposed policies, it is possible to adopt various systems of incentives and taxes: in this regard, some studies (Springmann, et al., 2018) have calculated the economically optimal tax levels to internalize the health costs associated with the consumption of red meat and processed red meat: a possible step forward in the modelling of environmental policies could consist in internalising in taxation the

environmental cost deriving from the consumption of red meat per capita, given that this food produces from 10 to 50 times more emissions of substitute goods of plant origin. According to the evidence of the aforementioned study, this type of policy would be effective above all in medium-income countries: In this context, the applied Pigouvian tax would include the marginal cost of the environmental damage caused by the consumption of a portion of meat.

There are also in the literature (Marco Springmann, 2018) (Springmann M. C.-D., 2018) some "*established food system models*" which estimate the effects - mainly on health - deriving from changes in diet, technology and food waste, thus evaluating the trajectories for the achievement of the Paris Agreement and the SDG 2-zero hunger: in fact, it is essential that the trajectory of the "*Business-As-Usual*" in nutrition is abandoned, and that one opts instead for technological progress, for the reduction in food waste and for more flexible diets that favour plant-based foods. Only in this way the interventions proposed in the NDCs of the countries adhering to Campaigners will be aligned with the objectives of the Paris Agreement.

### **4.3 Housing**

Housing also has a significant impact on a country's carbon footprint. In most countries, space heating or cooling and domestic hot water are the dominating end uses that contribute to CO<sub>2</sub> emissions.

By evaluating household consumption statistics in OECD and non-OECD countries, it emerges that in OECD countries the energy requirement for space heating has decreased slightly in the last decade, but an effort to further reduce emissions from the building sector remains important. For non-OECD countries, instead, the trend is increasing also due to the rapidly growing building stock which is shaping future energy demand, making mitigation policies fundamental. However, beyond the negative drawbacks at environmental level, this increase can be attributable to improvements in the well-being of people stepping out from poverty, thus positively affecting many SDGs.

As stated, the main categories of activities responsible to produce CO<sub>2</sub> related to housing are space heating, space cooling, water heating, cooking and lightning, but their order of importance varies widely across regions: in Europe for example space and water heating dominate the energy use in buildings, while in countries like South Africa cooling is also relevant. As far as cooking is concerned its use is instead quite stable over countries and not related with wealth. Compared to the data collected to date by the Campaigners App, it emerges that most of the challenges completed are precisely pertaining to the lifestyle domain "*Housing & Energy*", to indicate how these measures are widely undertaken by citizens using the application.

The graph below represents the per capita emissions for the European countries participating in the Project (orange line), the Europe 27 (blue line), and the overall Project's countries (grey line):

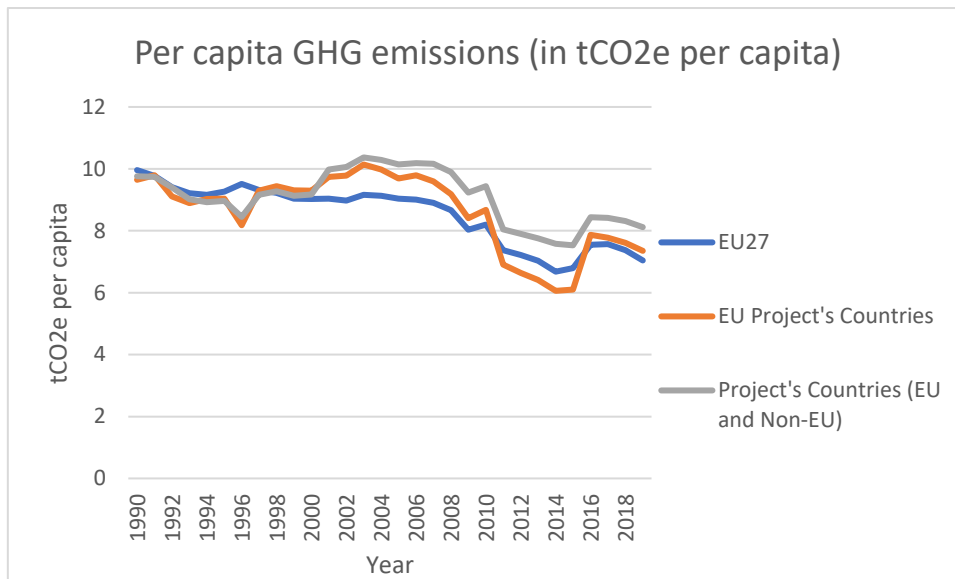


Figure 8: Per capita GHG emissions (in tCO<sub>2</sub>e per capita) for EU27, EU Project's Countries and all the Project's Countries (EU and non-EU). Retrieved from: [https://www.climatewatchdata.org/ghg-emissions?end\\_year=2019&start\\_year=1990](https://www.climatewatchdata.org/ghg-emissions?end_year=2019&start_year=1990)

As emerges from the data analysis, emissions per capita from 2016 onwards show a declining trend for the three realities analysed, however for the Project's countries they are at a higher level, highlighting how it is a priority to include in the Nationally Determined Contributions of these countries' lifestyle-related recommendations to reduce emissions from the residential sector.

As far as Europe is concerned, the literature suggests that warming for space heating and cooking is responsible, on average, for about half of carbon emissions (Ivanova, 2020): in this regard, analysing the heating degree days (HDD), which are an indicator of the severity and duration of cold weather in a country and thus the climatic driver of space heating demand in a certain country, it has been noted that for the European countries adhering to the Project this indicator is high, suggesting the importance of generating more awareness on emissions deriving from heating and avoiding to heat domestic environments when not at home.

Moreover, according to the IEA (International Energy Agency), the heating temperature of buildings in Europe is above 22 degrees (European Commission, s.d.); therefore there is a great potential to lower the set point temperature without losing much comfort: just think that lowering the home temperature by one degree centigrade would save around 7% of the space heating energy, significantly reducing emissions relating to housing without compromising comfort. Given that home temperatures of around 20 degrees are totally in line with medical recommendations, this behavioural measure might turn out to be very effective from both an environmental and health point of view.

In addition to the amount of heating used, which can be decreased with behavioural changes and by spreading practices towards the more conscious consumption of resources, it is necessary to also remedy the problem that underlies the high level of household's emissions, which is given by the technologies adopted and the poor thermal insulation of most buildings. In fact, from an elaboration of FAO data it emerges that for cooking food the countries participating in the Project (EU and non-EU) adopt less clean fuels than the European average, and despite cooking is negligible compared to space and water heating and space cooling, a switch to renewable fuels and electrification could contribute to the reduction of emissions deriving from households. From this point of view, by including incentives for the adoption of renewable, energy-efficient, or low-carbon technologies in residential buildings in the NDCs, greater energy independence would also be achieved, and local resources would be valorised. In fact, in Europe only 22% (Eurostat, 2022) of the energy used for heating comes from renewable sources, and in the other countries adhering to the Project there is also great potential to expand the use of renewables (for example hydroelectric in Canada and Peru, solar and wind in Azerbaijan and South Africa): solving the technological problem would lead to significant benefits at environmental and economic level.

Another class of policies aimed at promoting the adoption of sustainable lifestyles among citizens consists in encouraging responsible housing practices, such as for example by providing incentives to thermally insulate buildings, which especially in colder countries such as Canada and some northern European countries adhering to the Project, could lead to a significant reduction in space heating demand and in the associated emissions. Likewise, with simple domestic solutions such as blackout curtains that can keep the heat out of the house, it is possible to reduce the need for air conditioning systems during the hot periods, especially pivotal for warmer Project's countries such as South Africa and for southern EU Member States like Spain, Italy, or Greece.

Furthermore, a transversal policy to be adopted in all the adhering countries is to encourage the construction of private buildings with local resources, as this allows a reduction of emissions deriving from the transport of imported materials, as well as greater development of the local economy and the adoption of materials that are eco-sustainable. Another measure that would lead to concrete results in the construction sector would be to encourage the use of shared housing, or to promote a reduction in the size of the dwelling after children have left the house: for the effectiveness of these measures, however, a cultural change on the part of citizens is also fundamental since they would require a greater effort, but for now it is important to move towards this direction.

Finally, one of the measures that might require the lowest efforts from a citizen-point of view and that might lead to tangible results in emissions reduction is provided by enhancing the use of eco-mode when using washing machines or dishwashers: in fact, despite the longer time required, this practice could lead to an energy reduction of around 523 kWh over a year providing enough energy for using a light bulb for up to 28 months (Bosch, s.d.). Also, for reducing the demand of hot water it is advisable to reduce showering times or in general adopt more sustainable showering habits.

Below we present 4 policy proposals related to housing for each country adhering to the Project: here the declination of the priorities and recommended policies is influenced by the energy mix of the countries themselves, given that there are some countries that have and make extensive use of renewables, while others who cannot dispose of them need other policies such as waste recycling or the use of local materials for construction.

OECD Non OECD	Country	Housing Policy 1	Housing Policy 2	Housing Policy 3	Housing Policy 4
OECD	EU	Reduce domestic heating where possible	Enhance renewables and biofuels for space heating	Increase waste recycling	Incentivise thermal insulated buildings
Non OECD	Azerbaijan	Replace carbon-intensive heating technologies	Reduce natural gas for cooking (now >90%)	Increase municipal waste recycling	Incentivize sustainable buildings
OECD	Canada	Incentivise thermal insulated buildings	Adopt locally sourced materials for buildings	Replace carbon-intensive heating technologies	Set eco-mode when using washing machines/dishwasher
Non OECD	Peru	Replace carbon-intensive heating technologies	Increase renewables for housing purposes	Waste management and recycling	Adopt locally sourced materials for buildings
Non OECD	South Africa	Reduce coal for housing	Prefer houses built with local resources	Close blinds and curtains during the day to reduce air conditioning	Waste management and recycling
OECD	Turkey	Increase municipal waste recycling	Enhance renewables and biofuels for space heating/cooling	Set eco-mode when using washing machines/dishwasher	Incentivize sustainable buildings

Figure 9: Proposed policies in the housing sector, own elaboration

At the moment, the policies to alter behavioural habits in housing included in the NDCs are scarce, given that among the countries analysed, only Azerbaijan has actually included some aspects such as "*awareness activities on energy efficiency, application of energy-efficient bulbs and modern energy-saving technologies in heating systems*", therefore this sector can undoubtedly be a candidate for the inclusion of behavioural aspects related to carbon neutral lifestyles. Although, inevitably, including policies based on "*awareness and dissemination of information*" is not as effective as the "*command and control regulation*" type of policies in terms of emissions reduction, with "*information and dissemination*" policies it is possible to pursue a complementary purpose to go towards an holistic approach, also if it is more difficult to measure the direct effect on emissions reduction.

#### 4.4 Other consumption

In addition to the sectors previously analysed, there are many additional activities that can be taken into consideration to reduce emissions, related to the wide spectrum of "*responsible consumption practices*". Empirically, this is possible by following the principles of the sharing economy, as well as by increasing the average life of products: taking into consideration the fashion sector, low prices often lead to frequent changes of clothing and this contributes to increasing emissions, which account for the 4% of total EU households emissions (Philippe Copinschi, Report on Target lifestyles. Deliverable 1.3 of the CAMPAIGNers project funded under the European Union's Horizon 2020 research and innovation programme GA No: 101003815., 2022). Therefore, giving advice to opt for second-hand clothes, or making people understand how eco-sustainable fabrics are preferred to non-renewable ones (such as nylon, polyester, and acrylic), can lead to a reduction in emissions in the sector. Likewise, creating greater awareness of the benefits of recycled packaging such as moulded pulp - that comes from wood, bamboo, bagasse, or wheat straw- or "*greener*" oxo-degradable plastics can contribute to reduced demand on landfills and a drop in pollution (Katherine E. Semple, 2022).

This is also valid for electronic devices, which are often thrown away instead of being repaired: extending their useful life by opting for "*repair instead of replacement*" would have a lower environmental impact.

Similarly, in the building construction industry, including policies that encourage the use of local and eco-sustainable materials could significantly lower emissions from construction: this is particularly suitable for those countries, such as Canada, which being naturally rich in timber, a sustainable building material, could include this type of policy in the next NDC. Canada to date is the only Project’s country that has included in its NDC the advice of “*promoting responsible consumption*”: although this statement is rather vague and leaves room for different interpretations and operational translations, given that it does not find an effective declination in a specific sector, it can be effective as it increases awareness of the impact that individual consumption has on emissions.

Below are the recommended policies for each country adhering to the Project with reference to household consumption, i.e. those practices that citizens can adopt and which cannot be included in those already addressed in the previous paragraphs:

OECD Non OECD	Country	Other Policy 1	Other Policy 2	Other Policy 3	Other Policy 4
OECD	EU	Enhance second-hand clothing	Prefer natural over synthetic fibres for clothing	Opt for recycled materials over primary raw materials	Repair broken electronic appliances
Non OECD	Azerbaijan	Promote sustainable consumption	Increase teleworking	Extend product lifetime	Opt for recycled materials over primary raw materials
OECD	Canada	Extend product lifetime	Timber construction for buildings	Compost food leftovers	Promote sustainable consumption
Non OECD	Peru	Compost food leftovers	Opt for recycled materials over primary raw materials	Promote sustainable consumption	Prefer local materials for clothing
Non OECD	South Africa	Compost food leftovers	Promote sustainable consumption	Prefer local materials for clothing	Opt for recycled materials over primary raw materials
OECD	Turkey	Promote sustainable consumption	Compost food leftovers	Prefer natural over synthetic fibres for clothing	Opt for recycled materials over primary raw materials

Figure 10: proposed policies for sustainable consumption, own elaboration

The behavioural advice proposed above pertain to various spheres of individual consumption, and although the magnitude of the reduction in emissions is generally lower than that of the measures pertaining to the transport or other sectors, it is still worth including them, to cover all the main emission factors.

These measures are not related to the key characteristics that determine the emissions of a specific country, as the size of the house and per-capita income, but instead have a transversal and non-specific nature that can be clearly declined in all the realities adhering to the Project and in some circumstances - such as in Canada, where the use of timber, a local resource, is proposed - can favour the local economy.

## 5. Discussion and concluding remarks

The results that emerge from this analysis allow to understand the potential deriving from the inclusion of behavioural advice in the carbon emission reduction policies and in particular in the Nationally Determined



Contributions: addressing policies directly to citizens would in fact create a greater sense of responsibility and awareness for the individual, as well as a sense of "*collective commitment*" towards the carbon neutrality objectives, and this would be beneficial not only for the planet, which would see, among other a reduction in the exploitation of natural resources thanks to a more conscious use of resources; but also for the citizens themselves, who would derive health and social benefits deriving from the various proposed measures.

To achieve these ambitious goals, however, a change in the metrics underlying the proposed policies is essential, given that today the NDCs can be classified according to absolute targets, emission intensity targets, reductions from normal activities etc (Denison & Al., 2019).

In this regard, the adaptation policies proposed in the NDCs also play a fundamental role, for which some scholars (Jérôme Boutang, 2020) have developed a taxonomy and an ex-ante metric to evaluate their effectiveness, using the concept of "*suitability*", based on a table of contingency representing the frequency of a project category. As can be seen, the metrics underlying the definition of NDCs are based on quantitative targets only, and this does not favour the inclusion of behavioural aspects. Moreover, there is nevertheless a wide heterogeneity among the metrics adopted because of a substantial discretion that countries have in elaborating their climate contributions, as enshrined in the Lima Call for Climate Action, and this does not favour the inclusion of behavioural aspects.

A feasible way to harmonize socio-economic aspects with the climatic-environmental ones could be declined in the intersection between the Nationally Determined Contributions and the Low-Emissions Development Strategies, which aim at the identification of Adequate National Mitigation Actions (NAMAs). The term LEDES was coined for the first time by the UNFCCC in 2008, and indicates the national plans and strategies that pursue "*climate-resilient*" economic growth (Clapp, 2010): a salient aspect of these Strategies is that for the design, the LEDES require the analysis and identification of the actors within the institutional framework to be involved, and then they nominate an inter-ministerial body who is responsible for coordinating the stakeholders. This network-approach triggers an ongoing process which is updated according to the data collected in the short and in the medium term, and on the inputs deriving from the stakeholders. In fact, to define policies effectively, it is advisable that the national strategies provide the details of each sector, as well as the social, economic and technological elements that determine them in a transparent and clear way.

Although the LEDES as originally designated are no longer periodically updated, on the occasion of the COP 27 62 member countries of the Paris Agreement were called to present a report of their Long Term LEDES: in this context, 50 percent of the countries indicated "*one close link between LT-LEDES and National Development Plans*", while as much as 71 percent of the respondents indicated a link between LT-LEDES and SDGs (United Nations Framework Convention on Climate Change, 2022).

However, to date, only 8% of the responding countries said they have already aligned their Nationally Determined Contributions with LT-LEDES, while 40% indicated that LT-LEDES will guide the development and drafting of upcoming NDCs: the alignment of the long-term mitigation strategies present in the LEDES with the Nationally Determined Contributions can in fact be the way to pursue a more holistic strategy, which takes into account the synergies and trade-offs among sustainable development, emission reductions and adaptation to climate change, and the Campaigners Project can also in this sense constitute a valuable tool for policy makers and stakeholders.

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