São Paulo in 2030

Envisioning 1.5-Degree Lifestyles

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Chulalongkorn University, Thailand
ICLEI Africa, South Africa
Swechha, India

Communications and Outreach Partners
Hot or Cool Institute, Germany
ICLEI Japan
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EXECUTIVE SUMMARY

This report, 'São Paulo in 2030: Envisioning 1.5-Degree Lifestyles', recommends plausible options for 1.5-Degree Lifestyles and measures to support them. This will help put society on a path towards realising the globally unified 1.5°C Lifestyles target of 2.5 tCO_2e/cap/yr, which is compatible with the Paris Agreement's target of limiting global warming to 1.5°C above pre-industrial levels. Based on an assessment of consumption data across housing, food, mobility, goods, services and leisure, it is calculated that the average lifestyle carbon footprint in São Paulo is currently 3.6 tCO_2e/cap/yr.

Our proposed consumption side measures can reduce São Paulo's average lifestyle carbon footprint from 3.6 tCO_2e/cap/yr to 1.6t CO_2e/cap/yr (-56%) if they are given adequate support and enabling conditions are facilitated by the government and business stakeholders. We identified 32 actionable lifestyle change options based on project-wide extensive literature review and estimated their potential to reduce carbon footprints based on consumption amounts and energy intensity for production across the housing, food, mobility, goods, services and leisure domains. Selecting options for 1.5°C Lifestyles is personal, and can vary from one person to another.

Current average per capita lifestyle carbon footprint in Sao Paulo (1994-2019 reference data)	3.6t-CO_2e/capita/year
2030 average per capita lifestyle carbon footprint in Sao Paulo after lifestyles change with assuming no improvements in renewable energy share and environmental efficiency from the current level	1.6t-CO_2e/capita/year

The scenario was created based on a two-step process: 1) a quantitative analysis that provided the current carbon footprint per capita of São Paulo city (the baseline carbon footprint), along with lifestyle carbon footprint reduction options and their reduction potential, and 2) a participatory consultation process composed of two online workshops and a two-week household experiment. This latter part intended to understand citizens' lifestyles, as well as their level of interest and the feasibility and barriers regarding the suggested options, in order to estimate an average

adoption rate and identify supporting measures to enable their implementation.

Among all domains, the major contributors to current emissions were food (38%), with high consumption and intensity levels, mobility (27%), due to significant consumption, and housing (23%), with high consumption and intensity for one specific component (construction). In the food domain, that with the greatest impact, consumption of meat accounted for the highest amount of the carbon footprint per capita, but consumption of beverages was also significant. Citizens expressed a strong interest in adopting most of the suggested actionable lifestyle change options, particularly across the food domain (7 out of 32 possibilities), with four of those bringing significant impact due to their high adoption rate: plant-rich food/diet (50%), eat low-carbon protein instead of red meat (75%), plan food shopping to avoid waste (88%) and reuse food leftovers (88%).

The lifestyle carbon footprint analysed in this report, as well as the carbon footprint reductions associated with citizen behaviour change, assume average consumption values for Sao Paulo. Citizens' carbon footprints are highly variable, corresponding to differences in income, occupation, age, family structure and health. The report argues that it is vital to reduce the average lifestyle carbon footprint of citizens below the 2030 target (2.5tCO_2e/yr per person), even as cities are expected to grow economically and increase consumption in the future. However, it is neither realistic nor desirable to expect all citizens to take the carbon footprint reduction actions described in the report, regardless of their different standards of living and diversity of needs such as mobility, housing and food.

This report emphasizes that a 1.5°C Lifestyle is very ambitious but can be achieved. However, despite the potential impact of one stakeholder alone, in order to achieve the 2.5 tCO_2e/cap/yr target, all stakeholders (government, businesses, and households) must act collaboratively. They need to do their part to promote enabling conditions that likewise support other players in facilitating the consistent adoption of lifestyle carbon footprint reduction options over the long term. While the aim of this report is to provide ideas for a diverse range of citizens towards realising 1.5°C Lifestyles, it notes that adoption rates are only indicative figures, and not future projections or targets.

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1. INTRODUCTION

Debates about climate change have intensified over recent years. In 2015, 196 Parties adopted the Paris Agreement, one of the most well-known international treaties on climate change, with the goal of limiting global warming to well below 2° C, and preferably 1.5° C (UNFCCC, 2021). In 2018, the Intergovernmental Panel on Climate Change (IPCC)'s Special Report on Global Warming of 1.5 °C reinforced the need to urgently and drastically reduce GHG emissions in order to achieve the 1.5 °C target (IPCC, 2018) and, in 2021 the IPCC stated that human influence has unequivocally warmed the atmosphere, ocean and land (IPCC, 2021). This context raises the importance of addressing the impacts of lifestyle changes while seeking solutions to mitigate climate impacts.

The analysis of individual lifestyles offers the possibility of a comprehensive assessment of consumption-related carbon emissions in different areas of life such as housing, food, mobility, goods, services and leisure, as well as the links between these areas (Institute for Global Environmental Strategies, Aalto University and D-mat Ltd, 2019). Lifestyle carbon footprints can be assessed at national or city levels. Given availability of consumption data, the city where an individual resides provides the appropriate geographical setting to account for carbon emissions across production, distribution, use, and disposal of purchased products and services, including those embedded in trade.

This scenario provides recommendations on how to substantially reduce consumption-based carbon emissions through 1.5-Degree Lifestyles (1.5°C Lifestyles), developed in consultation with the citizens of São Paulo, who were selected by Akatu Institute based on their existing network and practical considerations for project implementation. This scenario highlights how the adoption of a low-carbon lifestyle options relies on supporting measures by governments and businesses to facilitate individual efforts, and emphasises the importance of collaborative efforts by all stakeholders.

1.1 Background

One of the main financial, corporate and commercial centres in South America, São Paulo is the most influential and populous Brazilian city (WRI, 2021), with an estimated population of 12.4 million people (IBGE, 2021), and a greater metropolitan area that reaches up to 21 million inhabitants (IBGE, 2019). Due to its massive population, the city faces enormous challenges regarding current lifestyles, e.g. subway and train lines are not enough to attend commuting needs (Rede Nossa São Paulo, 2021); bicycle paths are quite scarce and often do not provide the security needed for cyclists (ITDP, 2015); car traffic is very intense; there is an overconsumption of high-calorie foods and an underconsumption of fruits and vegetables (IEA, 2011) and; a significant amount of food is wasted (USP, 2018). Given this range of issues, and the city's importance, it is fundamental that São Paulo ensures there are paths towards a sustainable future, based on changes in citizens' lifestyles, and responsible businesses and government.

The Municipal Policy on Climate Change of São Paulo was promulgated by Law No. 14933/2009 (São Paulo, 2009) to ensure actions in response to the United Nations Framework Convention on Climate Change. Based on this, the city collaborates to reduce GHG emissions into the atmosphere in order to prevent dangerous anthropogenic interference in the climate. The Law obliges the development of anthropogenic emissions inventories and documentation on the capture of

GHG by carbon sinks every five years (CETESB, 2011). São Paulo also relies on the programme PROCLIMA (Proclima, 2020), coordinated by the Division of Climate Change and Multilateral Agreements of CETESB (Environmental Company of São Paulo State). The programme's activities include dissemination of information to present the problem of GHG emissions and discussion of technologies that enable their reduction; training of personnel to provide necessary assistance to help society prevent GHG emissions; collaboration with the Federal government to support and implement international agreements, and; elaboration of the state's GHG inventory.

More recently, in 2020, the Municipality of São Paulo launched the Climate Action Plan 2020-2050 (PlanClimSP), an initiative that demonstrates how the city of São Paulo will align its actions with commitments to the Paris Agreement. It has two main goals (Prefeitura do Município de São Paulo, 2020):

- Take necessary political actions to reduce, by 2030, 50% of GHG emissions of the Municipality of São Paulo, compared to 2017 levels, the last year of data for the current emission inventory.
- Implement necessary measures to strengthen the Municipality's resilience, reducing the social, economic and environmental vulnerabilities of the São Paulo population and increasing its adaptive capacity.

To summarize, São Paulo has many ongoing policy initiatives to reduce GHG emissions, and has the opportunity to take on the role of a steward for climate action. The proposal is in line with initiatives for reducing GHG emissions, especially São Paulo's City Climate Action Plan 2020-2050, which envisions a zero-carbon city in 2050 (Prefeitura do Município de São Paulo, 2020). Along with these initiatives, the measures and alternatives proposed in this scenario can play an important role by strengthening ongoing efforts in civil society participation, which is currently still limited. Despite the city's efforts to engage and mobilize citizens to participate in climate strikes (FOLHA SP, 2019), limited number of young people from São Paulo joined such events (AKATU, 2020). As another way to try to engage all of society to reduce climate change, São Paulo became the first city in Latin America to enact a law declaring a Municipal Day for the Fight Against Climate Change (ICLEI, 2021).

1.2 The Scenario

Co-created with citizens, this scenario—São Paulo in 2030—recommends options and their supporting measures to reduce lifestyle carbon footprints and realise 1.5°C Lifestyles, defined as sustainable lifestyles that are compatible with the 1.5°C target of the Paris Agreement, limiting global warming to 1.5°C above pre-industrial levels.

The lifestyle carbon footprint targets are set at 2.5 tCO_2e/cap/yr by 2030, 1.4 tCO_2e/cap/yr by 2040, and 0.7 tCO_2e/cap/yr by 2050 (Institute for Global Environmental Strategies, Aalto University and D-mat Ltd, 2019). This scenario focuses on the 2030 target.

Since the choice of a decarbonised lifestyle is personal, and can vary from one person to another, it is crucial to select low-carbon lifestyle options that suit individual preferences and needs. Before considering specific lifestyle options, it is necessary to benchmark an individual carbon footprint, and identify hotspots for footprint reduction across the domains of housing, food, mobility, goods, services and leisure.

Analysis of the average lifestyle carbon footprint for a São Paulo citizen, and its related hotspots, provides both policymakers and citizens with a measure of carbon footprint benchmarking, and a hotspot analysis along with 32 actionable lifestyle change options, specific to São Paulo's culture and socio-economic context. These options are also in line with a conceptual city vision, developed based on a participatory workshop to define the desired future of the city and its lifestyles. Citizens preferences for these 32 options are indicated through their adoption rates. Through a two-week household experiment, they were able to identify obstacles and the required supporting measures from government and businesses to effectively mainstream the decarbonised lifestyles options. Thus, this policy report aims not only to encourage citizens to make environment-friendly choices every day, but also to solicit actions by other stakeholders, including government and the business sector, to enable and facilitate citizens to make such choices. In other words, our objective is both to inspire citizens, governments and businesses to embrace and promote conscious living, and to broaden the narrative of taking action beyond policymakers to every citizen and resident of São Paulo regardless of their age, gender, nationality or socio-economic status.

The next section details the methodology used to develop this scenario. Then, Sections 3, 4, and 5 introduce the project findings for the baseline carbon footprint in São Paulo, the desired future city vision, and low-carbon lifestyle options across the housing, food, mobility, goods, services and leisure domains. Section 6 identifies supporting measures for different low-carbon lifestyle options and recommends actions for various stakeholders to facilitate transition towards 1.5°C Lifestyles.

2. METHODOLOGY

The construction of the scenario consisted of two steps: a quantitative analysis and a participatory process.

2.1 Quantitative Analysis

The quantitative analysis aimed to provide the current average carbon footprint in São Paulo (the baseline carbon footprint); identify the domains and lifestyle options of greatest reduction impact (hot spots), and; estimate their potential to reduce their respective carbon footprint.

Step 1: São Paulo's Baseline Carbon Footprint

- The baseline carbon footprint considers the average consumption amount and carbon intensity for production of different items across the domains with the highest consumption levels: food, mobility, housing, goods, services and leisure.
- The total emissions per capita was calculated by aggregating the carbon footprint of 186 consumable items (although a few were not considered due to lack of data),[1] grouping the items according to their previously referred domains.
- For carbon intensity data, the software SIMAPro, in addition to the databases Ecoinvent and EXIOBASE, were the main sources of information. They were used based on a mix of reference data depending on their availability (1994-2019).

Step 2: Hot Spot Analysis

- The assessment of carbon footprints across domains (food, mobility, housing, goods, services and leisure) enabled comparison between them, based on their carbon intensity and, therefore, identification of the domains with maximum carbon footprints.
- In addition to the overall hot spots across domains, the analysis also provided identification of hot spots within those categories.
- The hot spots represent the domains or individual items that have either a high consumption amount, a high carbon intensity in production, or both.
- Based on the analysis, it was possible to identify lifestyle options that have the biggest potential to reduce the carbon footprint of an individual.

1 Despite not being considered, the majority of those options referred to subcategories of items (e.g. less common types of products) and services that were infrequently used.

Step 3: Lifestyle Carbon Footprint Reduction Options

- Through desk research, literature review and the hot spot analysis for all domains, 32 lifestyle carbon footprint reduction options were identified and chosen.
- The proposed lifestyle carbon footprint reduction options were selected by authors taking into account the most common sustainable practices adopted (or willing to be adopted) by Brazilians.
- In order to efficiently communicate the options and make them more understandable, they were graphically illustrated with their carbon footprint reductions.
- A catalogue of the illustrations and the carbon footprint reduction potentials of all 32-lifestyle options were used to implement a puzzle game.

Step 4: Estimation of Aggregated-Reduction Interactions

Each option had its respective mitigation potential based on an extensive literature review, though some required aggregation since there could be many interactions among those options. In other words, in order to better estimate the mitigation potential of the domain it was necessary to aggregate the options that overlapped. This aggregation resulted in a lower carbon footprint reduction potential than simply summing the options, but it was more realistic.

2.2 Participatory Consultative Process

The participatory consultative process consisted of two online workshops and a household experiment. These aimed to understand citizens' current lifestyles, as well as their interests and barriers regarding the suggested options, while also assessing the options' feasibility and identifying supporting measures to enable their implementation.

The details of the citizen project participants were the following. Sixty (60) citizens, with diverse backgrounds, participated in the online workshops and household experiment.[2] Approximately two-thirds were women and one-third were men, all aged 18 or above. The majority of the citizens were from the middle class (in terms of income), based on the Brazilian categories of social classes (IBGE, 2010). The status of their home ownership included fully paid or still in acquisition and rented, while car ownership included both owned and rented.

Step 1: First Online Workshop

The recruitment of participants was conducted through an online questionnaire coordinated by a survey company. The company contacted about 100 citizens, among them 16 participated in the online workshop held in November 2020. A presentation was made by the Akatu Institute, including topics such as climate change, carbon footprints and how individuals already contribute to climate change but can also reduce their negative impacts. Then, the following activities were conducted by Akatu Institute members:

- After being divided into groups, participants were presented with lifestyle options and an interactive board where all mediators showed the notes taken during the discussion.
- The participants were asked to select lifestyle carbon footprint reductions that they were already implementing, or were willing to implement in the future, and to select three terms to define 'the future we want for our city'.
- The lifestyle carbon footprint reduction options were selected according to different degrees of implementation (100%, 75%, 50%, 25% or 0%).
- After the selection, the participants took part in a puzzle game, which consisted of a graph showing if the participants could reach the 2.5 tCO_2e/cap/yr target based on their responses during the workshop.
- After the discussion session, all participants returned to the main room where they synthesized what they discussed in their groups, along with the mediators.
- The participants were given a detailed explanation about the household experiment, and then were asked about their willingness to take part in it. Interested participants were provided with recording sheets to mark the options they adopted during the experiment and were informed about how to carry out the recording.

2 Despite efforts to have a heterogeneous sample of São Paulo city, the workshop participants should not be considered as a representative sample because of the size of the city. However, the sample is diverse to provide a variety of contexts, resulting in assorted outputs.

Step 2: Household Experiment

Seven (7) participants out of the 16 attendees took part in the household experiment that spanned a four-week period: a two-week trial and then two more weeks for the actual experiment. The household experiment was held between December 2020 and January 2021. Due to COVID-19 restrictions, the follow up activities of the household experiment were conducted online. The objective of the household experiment was to identify the obstacles in implementing 1.5°C lifestyles and apply this analysis in the recommendations for multi-stakeholder collaboration.

- The recording sheet provided the participants with 32 lifestyle carbon footprint reduction options.
- The participants were asked to report the degree of daily implementation (e.g. 100%, 75%, 50%, 25%, or 0%) of the chosen option during each day of the four-week period.
- Since the implementation period conflicted with festivities (Christmas and New Year's Eve), participants were asked to write if any of those dates influenced the experiment (e.g. changing the routine, as an exception, due to celebrations).
- The participants were asked to write freely about the household experiment overall, how they felt during the implementation, their difficulties and obstacles, and other information that they thought relevant.

Step 3: Second Online Workshop

The second workshop was held online in March 2021, with 44 participants. Invitation was sent to the attendees of first workshop and other citizens.

- The second workshop implemented the same process that was used in the first workshop.
- After all discussions, the participants were asked to define the future in three words or sentences, providing a word cloud (Figure 14) about what they wanted the future to look like.

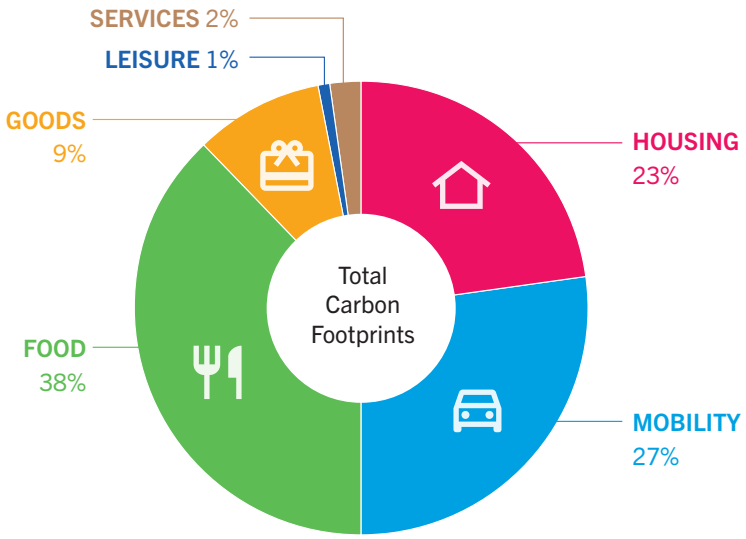
Sections 5 and 6 provide all details related to the identified lifestyle carbon footprint reduction options and the supporting measures.

3. OVERVIEW of BASELINE DATA

In São Paulo, consumption habits are responsible for the annual emissions of about 3.6 tCO_2e/cap/yr, above the national average of 2.8 tCO_2e/cap/yr (Institute for Global Environmental Strategies, Aalto University and D-mat Ltd, 2019).

The domain categorization allowed the identification of hotspots, either between the domains or within each of them, based on the carbon footprint data. In São Paulo, food was clearly the domain with greatest impact, followed by mobility, housing, goods, services and leisure. The carbon footprint of all domains can be seen in Figure 1.

Figure 1 Carbon footprint per domain



3.1 Food

In the food domain meat accounts for, by far, the maximum carbon footprint (45%), due to the significant amount consumed and its very high carbon intensity (Figure 2). Other types of food like beverages (28%) and dairy (11%) have a considerable impact too. Reduction in the consumption of these foods, or even a substitution by a lifestyle carbon footprint reduction option can result in a significantly lower carbon footprint, especially with regard to meat or beverages.

Figure 2 Carbon footprint of food domain by component

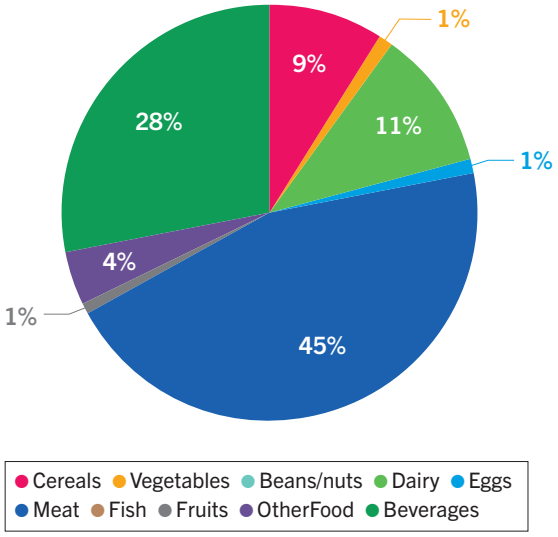
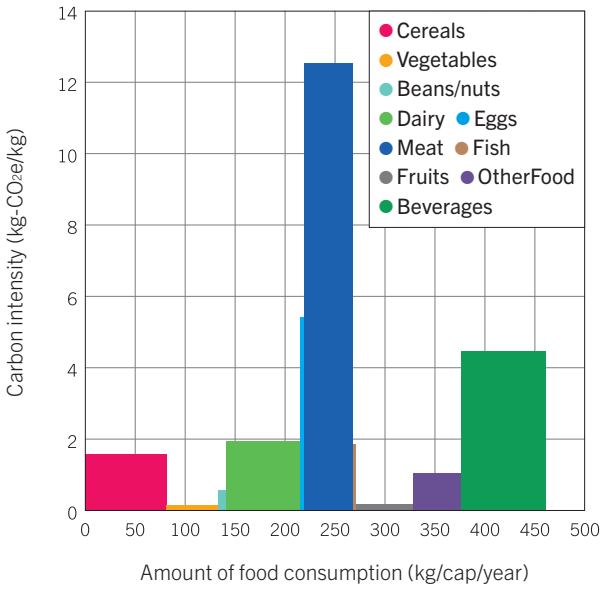


Figure 3 Skyline chart of food domain carbon footprint



3.2 Mobility

In the mobility domain, car use, either for commuting or for other activities, is responsible for the greatest share of the carbon footprint (50%), due to its frequency (the highest, but not way above the others) and especially due to its intensity (Figure 4). This result is influenced by the type of fuel, since almost 98% of cars run on gasoline[3] or flex-fuel (for vehicles that can run on either gasoline or ethanol), meaning that gasoline still makes up the greatest share. Brazil's scenario shows that ethanol and biodiesel are responsible for just 20.1% and 4.5% respectively, of the energy consumption by road transport, while gasoline represents 27.6% and diesel 45.2% (Superintendência de Derivados de Petróleo, 2019). Substitution for this mode of transport can be impactful, particularly if they are zero-emission options like using a bicycle or even walking when possible (bus or train, which are two other common options with lower carbon footprints, still have the second and third highest level of impacts in the domain). Another alternative to reduce the carbon footprint is ride sharing, with emissions similar to a one-person ride, but a lower impact since the carbon footprint is also shared. As an intrinsic need, mobility is one of the main areas that needs whole-system improvement by key players, enabling its development through provision of infrastructure.

3 Gasoline has a share of ethanol by law, and the intensity of that fuel was calculated taking this into consideration.

Figure 4 Carbon footprint of mobility domain by component

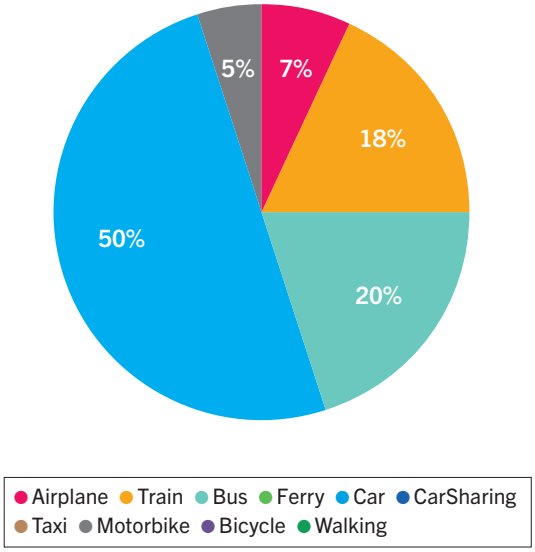
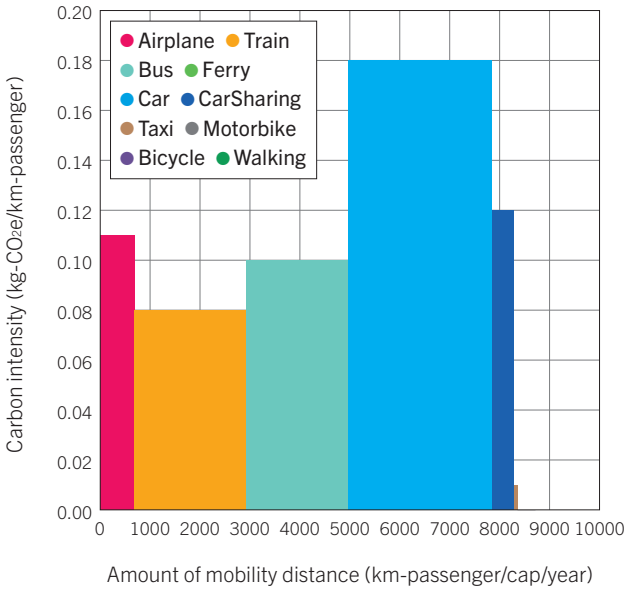


Figure 5 Skyline chart of mobility domain carbon footprint



3.3 Housing

The high carbon footprint of construction and maintenance (63% of the domain's carbon footprint) represents a big challenge to be tackled in the upcoming years, especially by the civil construction sector (Figure 6). Electricity also has a considerable impact (16%) when it comes to carbon emissions, due to its significant level of consumption, and even though the composition of Brazil's electricity matrix is 83% renewable sources (EPE, 2020). While a shift in energy sources is still needed at a systemic level, especially within housing, a lot can be done at the level of individual households to mitigate that impact. The carbon footprint can be reduced by saving energy and water in general, using appliances adequately and opting for more energy efficient ones when possible.

Figure 6 Carbon footprint of housing domain by component

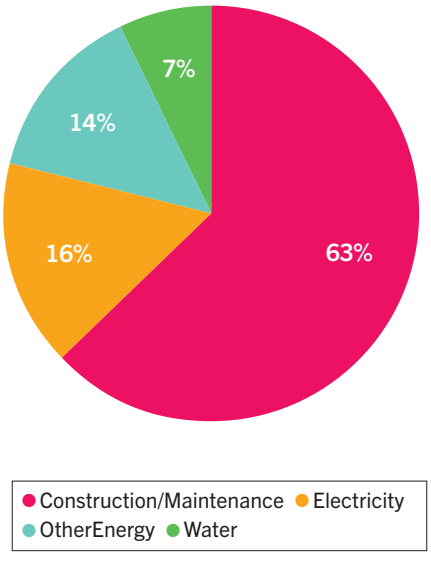
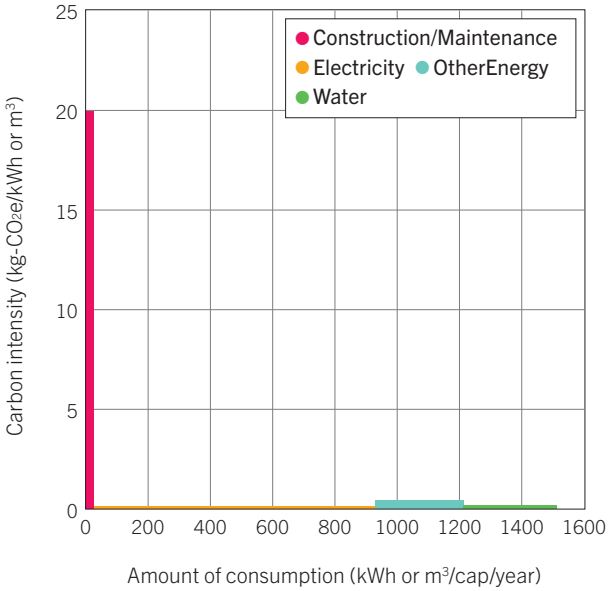


Figure 7 Skyline chart of housing domain carbon footprint



3.4 Goods, Services and Leisure

In the goods domain, the carbon footprint has a well-balanced distribution across the components. Sanitation/medicine (19%) and clothes (16%) are responsible for the highest carbon footprint in the domain, with similar amounts and intensity (Figure 8). Repair includes mainly the repair of furniture and household appliances. Despite looking significant (third largest in the domain), the carbon footprint is still low, especially when compared to other domains. Since new furniture/appliances have a greater impact, repair is an important solution to reduce carbon footprints. Because of their equal distribution in the carbon footprint, any changes in the consumption of various goods (especially reducing or choosing low-carbon ones) can bring about an important reduction in the domain.

Figure 8 Carbon footprint of goods domain by component

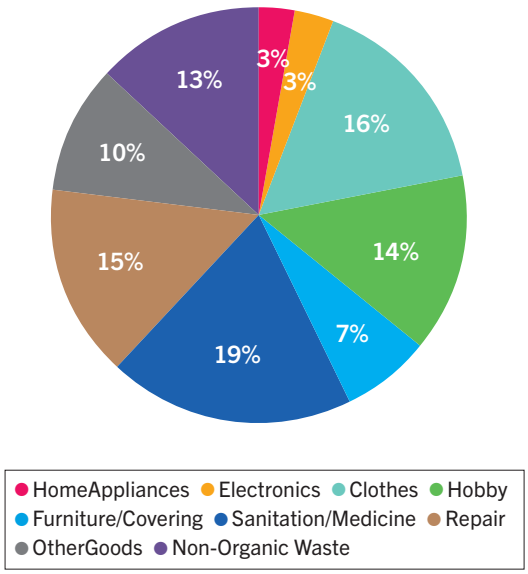
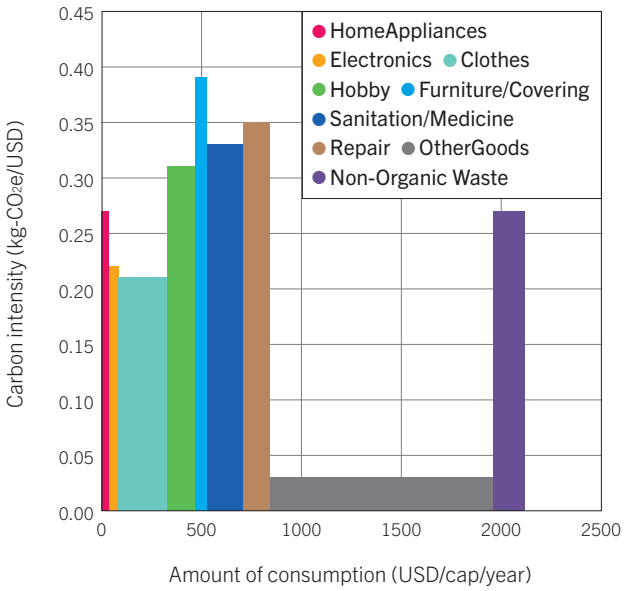


Figure 9 Skyline chart of goods domain carbon footprint



For the service domain, personal care (e.g. domestic and household services, hairdressing salons and other health/social services) is the component with the highest carbon footprint (54%), with considerable amount and the highest carbon intensity (Figure 10). The low amount of consumption of other categories is fundamental to their low carbon footprint within the domain.

Figure 10 Carbon footprint of services domain by component

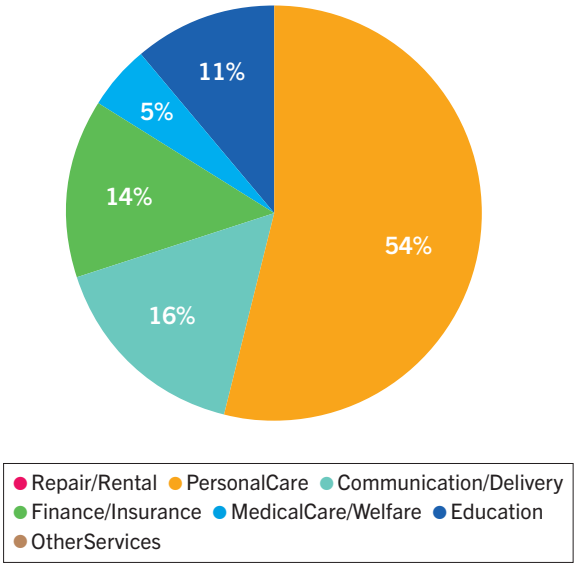
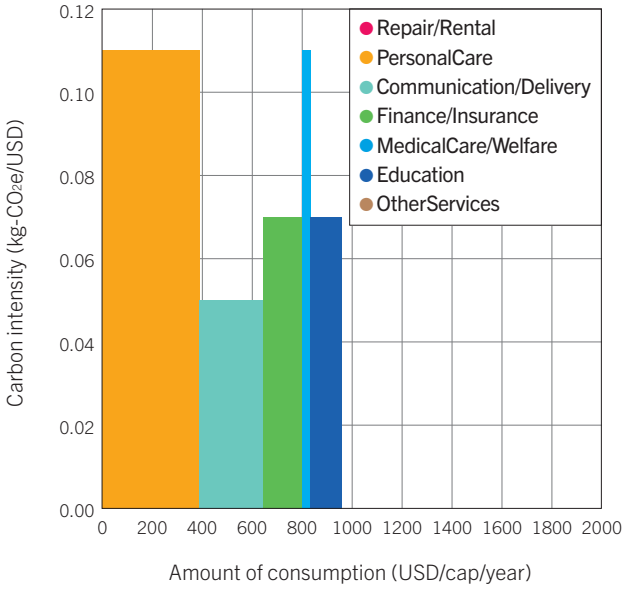


Figure 11 Skyline chart of services domain carbon footprint



For the leisure domain, hotspots are represented by hotels/travels (71%) and restaurants (29%). Despite having the lowest carbon footprint compared to the other domains, rethinking travel, such as by looking for closer destinations and taking more sustainable forms of transportation, can significantly reduce the carbon footprint (Figure 12). Regarding restaurants, evaluating the possibility of cooking at home or favouring local restaurants are ways of lowering the emissions of that category.

Figure 12 Carbon footprint of leisure domain by component

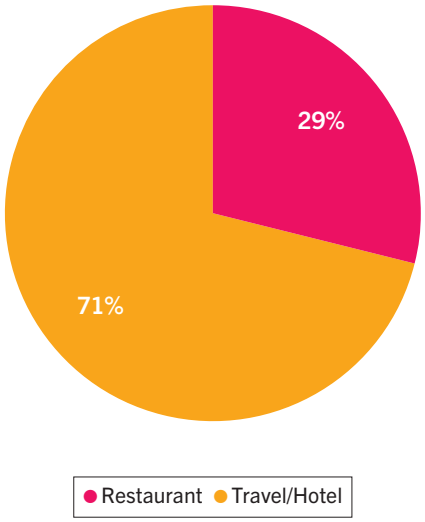
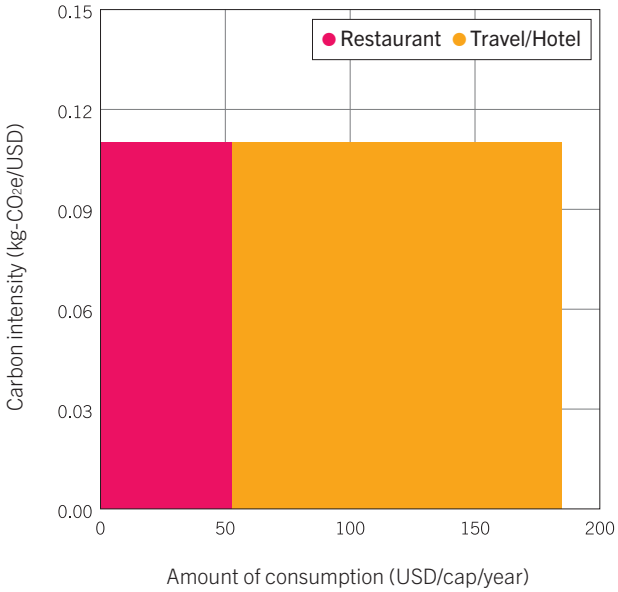


Figure 13 Skyline chart of leisure domain carbon footprint



4. CITY VISION

4.1 Development of City Vision

The city vision was developed in order to provide an overall view of the future desired by the participants, aiming for a 1.5°C Lifestyle and, therefore, a reduction in the per capita carbon footprint and a better quality of life. For that purpose, the year of 2030 was used as a target.

During the participatory process discussions, citizens' statements provided sufficient input to develop a vision of the desired future city, giving an overview of which main themes need to be addressed in order to achieve it. In the first main theme, the participants expressed which activities they wanted to start or do more of in the future (based on the lifestyle carbon footprint reduction options), and therefore, what the city needed to provide in order to enable those actions. After that, the participants were asked the question 'How do you want the world to be in 2030?', as a way to understand what they wanted in the future and/or generally expected to exist over the long-term (beyond ideas arising from the lifestyle carbon footprint reduction options).

Considering the willingness to adopt more lifestyle carbon footprint reduction options and therefore transition to a low-carbon society, three characteristics were selected to create the 'desired city', and based on areas where more investments and improvements are needed. These characteristics were selected during the online workshops, in a roundtable discussion after the group debate, so that all participants could contribute freely and evaluate if they agreed with the key points raised:

- better infrastructure (particularly in the mobility domain),
- increase in recycling systems, and
- collaboration between stakeholders (such as governments, companies, NGOs and civil society).

In addition to these three characteristics, and to ensure that change by 2030 is possible, participants also indicated that citizens and the government have an important role enabling society to achieve sustainable development in the future. Public policies are considered key, since governments can provide infrastructure subsidies. However, they must also discourage and forbid practices which do not contribute to low-carbon lifestyles or sustainable outcomes.

When specifically talking about the Sustainable Development Goals (SDGs), a topic that was brought up by some citizens, participants found them too complex due to too many targets and few clear or measurable indicators. Regarding the government, there is also a need for more

targeted laws that reward those who do what is right for a sustainable society and encourage the others (who do not do so yet) to rethink their attitudes.

The participants also expressed a strong positive vision around entrepreneurship and innovation as an approach to provide impactful solutions, but that it requires investment and commitment so they can deliver those results in the upcoming years. They also noted that each citizen needs to do what they can, given their own reality and context, while it is also society's role to pressure the government (which was elected by the people) and the companies (whose products they buy).

Moreover, it is important that the population becomes more conscious (or conscious at all) so that a movement can emerge to 'change' people's mindsets away from mistrust and apathy and towards better understanding, more empathy and greater collective effort. In addition, it is fundamental to address inequality and make sustainable lifestyles more accessible for all (especially when it comes to the costs and geographic distribution of products and services).

As a complement to the points discussed above, the participants were asked to define the future in 3 words or phrases, which resulted in a word cloud shown in Figure 14. To indicate how often each word was mentioned, bigger words represent greater mentions by participants.

Figure 14 Word cloud of participants' definition of the future

The participants saw three words as most important for heading towards a desired future: empathy, commitment and conscience. Some other answers were: abundant, accessible, challenging, circularity, democracy, engagement, equity, healthy, inclusion, love, nature, respect, responsibility, sharing, sustainability and technology. The exercise showed citizens' soft-hearted side, turning the focus to a more personal approach that prioritized emotional and social values before material ones, such as technology or infrastructure. According to the participants, many of the words/values they shared are lacking in present-day society (they do not see these values very often), and the need to express them is becoming even more urgent with each passing day as they seem to be forgotten.

4.2 Key Themes of the Future City Vision

As explained above, three key areas which, according to the participants, have the greatest need for investment and improvement were identified during the participatory process to develop the Future City Vision (4.1): better infrastructure, increase in recycling systems and collaboration between different stakeholders.

In other words, better infrastructure would have a huge impact on mobility, enabling people to avoid individual use of cars, choose between different types of transportation that can reach all parts of the city, and move closer to work or have the possibility of living near their workplace instead of spending hours commuting each day. Increased bicycle

use is an option that participants strongly desire, but it is not only up to them, since the lack of infrastructure for bicycle paths is a huge barrier almost everywhere. In addition to mobility, better infrastructure can also be seen in different types of products, with people being able to choose between foods produced locally or elsewhere, and avoiding food delivery services.

Improvement of recycling systems is fundamental to the function of its entire chain, especially when it comes to people separating recyclable and organic waste. It is worth pointing out that despite lifestyle carbon footprint reduction options of 'purchase food that would otherwise be thrown away' and 'reuse leftovers', overall waste is not shown to be a major threat to carbon footprint reduction. However, recycling itself can help people rethink their behaviours, such as consumption and disposal. These are reflected in other areas within or outside the household, and can influence their perspectives about sustainability and low-carbon lifestyles. As a result, people may become more aware of how much waste they generate while also reflecting on how they can avoid creating it in the first place. Therefore, they can reduce the waste they produce and, in addition, be more confident that their recyclable waste is actually being recycled. On the other hand, excess packaging is difficult to avoid since many types of products are shipped this way. Although tackling over-packaging is one of the main goals of waste management, a better recycling system is another approach that can and needs to be implemented simultaneously, providing an adequate destination for that waste.

As a society that is composed of many different actors, one of the most important issues, above any individual decision, is collaboration between stakeholders (government, businesses, NGOs and civil society). Each has a role to play in order to improve how society functions, and if they do not collaborate, this goal is far from being reached. Practically speaking, to become a reality almost all options discussed during the participatory process require, in some form or another, a partnership or collaboration between two or more actors. While some measures can be taken by an actor alone, like citizens changing their consumption behaviour regarding some products or services, the biggest impacts will come via systemic change, which includes collaboration between all stakeholders. This is the most reliable way to sustainably address society's urgent needs.

4.3 Overview of the Future City Vision

The participatory process showed that if major issues (such as infrastructure, access and collaboration between parts) are properly solved, in the future we can come closer to achieving the 'desired city'. In summary, there are two key areas of focus: one where there is currently a lack of investment and need for improvement, and the other associated with roles and commitments to change the way society responds to demands (such as the need to seek sustainability in order to have a healthy community). As mentioned above, the city vision demands high-quality infrastructure across all domains but especially for mobility and recycling systems. Infrastructure in the mobility sector requires various transport alternatives to private cars. An increase in recycling systems is especially important to get the majority of waste that can be in fact recycled to the proper destination, but also favours the reduction of waste generated and the effective collaboration between all parts of society towards common goals.

When it comes to food, the largest footprint among the domains, citizens see feasible changes in cultural values related to eating, such as reduction in consumption (meat and milk) and sporadic substitutions using foods with lower carbon footprints. The access to alternatives, such as local or organic food, is expected to increase, making them more available so that people can actually choose what to consume.

Regarding the city's values and responsibilities, the participants expect a more united society in the future, where all stakeholders, such as governments, businesses, NGOs or citizens, among others, have their own role to play. As mentioned more than once, it is critical that all actors address these issues together, finding a common path that includes everyone.

Illustration: Tania Vicedo

5. LIFESTYLE CHANGE TOWARDS 2030

5.1 Highlights of São Paulo in 2030

The adoption of lifestyle carbon footprint reduction options in different domains will result in the following:

- Average carbon footprint per capita will be reduced from 3.6 tCO_2e/cap/yr to 1.6 tCO_2e/cap/yr.
- Red meat will be largely substituted by other proteins with lower carbon footprints, showing citizens' acknowledgment of the impacts of different types of food, especially of their emissions.
- Food waste will be significantly reduced due to reuse of leftovers and better food shopping planning.
- Use of home offices will be intensified.
- Public transport and rideshares will be more frequently chosen. Moreover, if stakeholders contribute together to provide a better mobility infrastructure, public transport and bicycle use will increase significantly.
- Resource use at home will become more efficient (energy and water), either because of better practices or better appliances.
- Based on increased availability and accessibility for citizens, there will be an increase in preference for durable goods and repair services instead of replacing items.
- Across domains, transparency is expected to increase due to more information being provided (either about food, mobility types, goods and services); reluctance to change behaviour due to cultural practices may soften as improvements in different areas (as alternative types of food and mobility) result in less resistance to new sustainable practices (e.g. public transport, dairy products, low-carbon protein) and; there might be an increase in accessibility and affordability.

5.2 Lifestyle carbon footprint reduction options and adoption rates

Six main strategies were used to categorize the nature of each option (classified into the domains of food, housing, mobility, or goods): (1) shifting types, (2) efficient products, (3-4) using/disposal behaviour, (5) reduction and (6) durable infrastructure.

Those strategies were created based on three previous approaches for reducing a lifestyle carbon footprint,

proposed by IGES in the 1.5-Degree Lifestyle technical report (Institute for Global Environmental Strategies, Aalto University and D-mat Ltd, 2019):

- Absolute reduction: in general, reduction of physical amounts of goods or services consumed.
- Efficiency improvement: decrease the emissions by changing the technology (intensity), keeping the amount at the same level, thereby resulting in a lower carbon footprint.
- Modal shift: changing from one consumption mode to a less intensive one, regarding transportation, diet, energy, among others.

With these three approaches and the list of options, a new, more specific categorization was created. In particular, it took into account the consumption stage (use and disposal), providing a better understanding on the approach of each option and how they could result in a lower carbon footprint. Absolute reduction and modal shift were maintained as 'reduction' and 'shifting types', respectively, efficiency improvement was classified as 'efficient products' and 'durable infrastructure', and 'using/disposal behaviour' was added to include the consumption phase.

The six final strategies were defined as:

(1) shifting types: changing consumption mode to a less carbon-intense mode.

(2) efficient products: goods and services that are more efficient, therefore lasting longer, with a lower per-use carbon intensity.

(3-4) using/disposal behaviour: better use and disposal of goods and services.

(5) reduction: reduction in the amount of consumption of a good or service.

(6) durable infrastructure: goods and services that need decent infrastructure but are less carbon intensive than other alternatives.

Each option is listed with its specific strategy in order to give a better idea of what that strategy represents practically.

The puzzle game was used in both workshops (please refer to section 2.2), as a way to collect more inputs from different people, resulting in a higher adoption rate among the participants for the respective options. In the puzzle game, people were given the lifestyle carbon footprint reduction options, and would choose them, based on their routines and willingness to adopt them in the future, giving an overview of their lifestyles now and in the upcoming years. All of the 32 options are listed below according to their domain, with their mitigation potential and adoption rate (based on participant responses regarding adoption in the future). The mitigation potential refers to the maximum amount of carbon footprint that can be reduced from each option, considering an adherence of 100% (full adoption) but not taking into account the interaction with other options (in other words, since some options may overlap, the adoption of one may consequently change another, which would result in a different carbon footprint reduction). The adoption rate represents the average between the answers from both workshops.[4] At the first workshop, participants qualitatively stated their opinion based on difficulty of implementation (easy, average, high) and at the second one they adjusted the number on a scale from 1 to 5. All those values were converted to a percentage scale (0%, 25%, 50%, 75% and 100%).

Food is the domain with the greatest impact (highest carbon footprint), as shown previously in Figure 1. Four options bring significant reduction due to their higher mitigation potential and/or higher adoption rate: plant-rich food, low-carbon protein instead of red meat, planned food shopping to avoid waste, and reuse food leftovers. Together, these options reach the reduction target of 1.1 tons, highlighting their importance. In general, food waste will be dramatically reduced (based on the adoption rate) due to a rise in food shopping planning and reuse of leftovers. There will be a reduction of excess nutrition and dairy products (50%), a considerable adoption of vegetarian diet and a substantial shift from red meat to low-carbon proteins.

4 As detailed in section 2, the sample is not considered representative, but provides and serves as the basis for further discussions on lifestyle carbon footprint reduction options for the city of São Paulo.

Table 1 Food options and their respective mitigation potential and adoption rate

Strategy	Option	Mitigation Potential ($kgCO_2e/cap/yr$)	Adoption rate (%)
1	Plant-rich food (vegetarian diet)	515.73	50
1	Low-carbon protein instead of red meat (poultry, fish)	503.60	75[5]
3/4	Reuse food leftovers	380.22	88
3/4	Better plan food shopping to avoid waste	244.42	88
3/4	Purchase food that would otherwise be thrown away (does not look 'perfect', close-to-expiry-date produce)	230.84	38
5	Reduce excess nutrition (eating moderately)	175.25	50
5	Reduce dairy products (milk)	26.56	50

In the housing domain, as Table 2 shows, some options were not selected due to São Paulo's context and/or lack of answers (which is, either the participants are not willing to adopt them, they are not associated with their routine, or the city context makes it difficult, especially when it demands high investments and/or infrastructure) but they were also listed to show the complete list. Sharing of house space will be mainly a 'consensus' decision (given the fact that the majority of participants live with at least another person), electricity use will be highly reduced, LED lighting and natural lighting will take over and the intensity of appliance use will be more conscious (wash laundry in full loads, reduce laundry frequency and use appliances in energy-saving mode).

Table 2 Housing options and their respective mitigation potential and adoption rate

Strategy	Option	Mitigation Potential ($kgCO_2e/cap/yr$)	Adoption rate (%)
5	Share of housing space	308.69	100
5	Smaller living space	174.26	0
5	Reduce air conditioning needs (optimised room temperature)	88.66	0
3/4	Wash laundry in lower temperature	88.12	50
5	Reduce home electricity use (including monitoring, peak management)	86.32	88
3/4	Use appliances in energy-saving mode	82.32	63
5	Reduce laundry frequency (use clothes for longer before washing them)	79.40	63
2	LED lighting	53.60	75
6	Install renewable energy at home (solar water heater)	48.13	0[6]

5 Despite being considered a difficult option to adopt, based especially on cultural values, some participants demonstrated a significant willingness to gradually change this, following other participants that were already implementing it in their daily routine (already familiar with a less carbon intensive lifestyle).

6 The use of renewable energy at home is still somehow stalled (HELD, 2017), along with the fact that not all participants own their house and can choose to install that type of energy.

Strategy	Option	Mitigation Potential ($kgCO_2e/cap/yr$)	Adoption rate (%)
3/4	Enjoy natural lightning	25.33	63
3/4	Save hot water	24.03	50
3/4	Wash laundry in full load	13.76	63

According to Table 3, in the mobility domain, despite the relatively low adoption rate of many options, the home office trend will continue, the use of public transport will replace a significant share of car use, which will be more shared (rideshare), and there will be a small reduction in travelling, especially by plane.

Table 3 Mobility options and their respective mitigation potential and adoption rate

Strategy	Option	Mitigation Potential ($kgCO_2e/cap/yr$)	Adoption rate (%)
6	Use bicycles	219.57	13
1	Use a home office	213.90	63[7]
1	Move closer to services	140.46	25
6	Use public transport (reduction of car use)	105.92	63
3/4	Rideshare	69.88	50
2	Vehicle fuel efficiency	48.46	13
1/5	Travel less often/closer destination	18.48	25
5	Reduce flights[8]	17.14	25

In the goods domain, the lowest mitigation potential and short list of options shortened the possibility of a significant reduction, but they can occur, as shown in Table 4.

Electronics consumption will be largely reduced, clothes will last longer, and disposable pads/tampons will be halved, being substituted by durable alternatives.

Table 4 Selected goods and leisure related options

Strategy	Option	Mitigation Potential ($kgCO_2e/cap/yr$)	Adoption rate (%)
2	Buy longer-lasting clothes	13.16	63
5	Reduce smoking	9.81	38
5	Reduce electronics consumption	0.80	75
2	Prefer alternatives to disposable pads/tampons	0.25	50
3/4	Avoid unnecessary printing	0.15	38

7 The home office option did not take into account the rebound effect (reduction in carbon footprint from commuting, but increase due to more energy use at home).

8 Considers domestic flights for leisure purposes only.

Regarding the citizens' overall view, it is important to clarify that the adoption rates are based on participants' willingness to implement them, and they are mainly based on their own reality, context and lifestyle (see more on the participants' backgrounds in Section 2). The scenario provides possibilities and alternatives for all citizens to implement options related to low carbon lifestyles, disregarding any type of excluding or selective criteria like specific age, condition, access, or background. Therefore, considering the diversity of people's contexts and situations, and also unrealistic expectations, the scenario should not be considered as a recommendation or prescription to all citizens, which can lead to value judgments and comparisons.

Lifestyle changes take time (e.g. low-carbon protein instead of red meat and plant-rich food), so the important thing is that citizens pursue feasible changes that best suit their needs, desires and context. In other words, since the results represent indicative figures related to participants' expectations and also an attainability evaluation for 2030 (or the future in general), they should not be seen or interpreted as targets, commitments, projections or predictions.

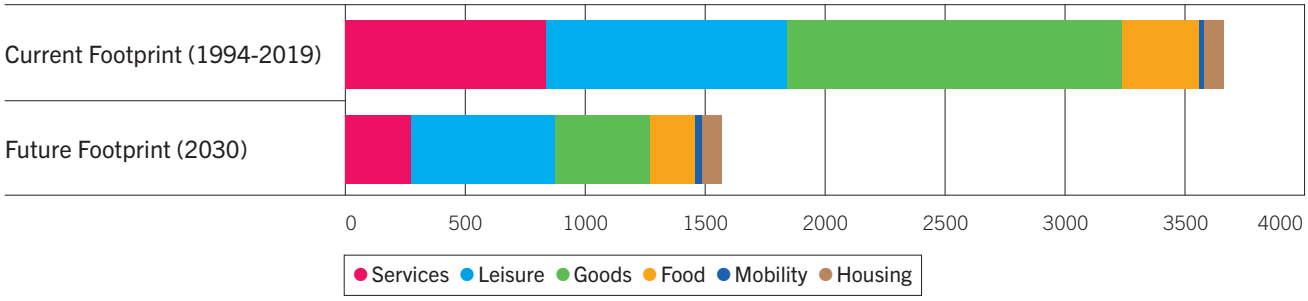
The low willingness to adopt some options can be understood either as a lack of interest by the participant, or as a lack of currently available infrastructure or enabling conditions (e.g. smaller living space, reduce air conditioning needs, install renewable energy at home, use bicycles and rideshare). This offers an opportunity to reflect on what can be done to increase the adoption of those options, providing any necessary means to make them attainable. In this way, adoption rates may improve with the right interventions by the government, private sector and other stakeholders.

5.3 Change in lifestyle carbon footprints

With the adoption rate established according to participants' responses, the mitigation potential for each lifestyle carbon footprint reduction option can be accounted for in the current footprint (1994-2019)[9], providing the estimation for the future scenario (2030). It is important to point out that the following estimate does not consider systemic change, that is, changes that occur along with decarbonisation such as technological advancements and a cleaner energy matrix (renewables). They may happen in the future and bring many positive aspects to a low-carbon lifestyle path (as the city has many initiatives aiming to mitigate climate change, shown in section 1.2), but the scenario does not include that possibility, since it is impossible to predict.

The comparison between the current footprint (1994-2019) and the one based on the adoption of the lifestyle carbon footprint reduction options (2030) is shown in Figure 15, with the current footprint in the left column, and the future one in the right column, resulting in a meaningful reduction from 3.6 tCO_2e/cap/yr to 1.6 tCO_2e/cap/yr, within the target of 2.5 tCO_2e/cap/yr.

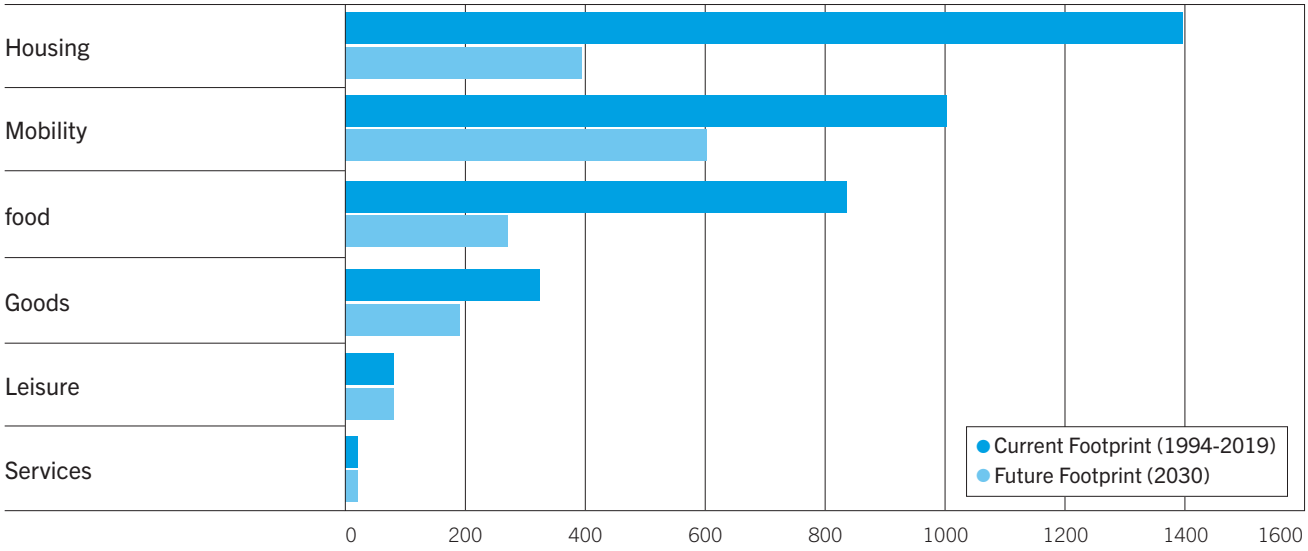
Figure 15 Current carbon footprint (1994 - 2019) vs Future carbon footprint (2030)



For a better comparison, the change in the carbon footprint in each domain is shown in Figure 16. The food domain clearly has the most intense reduction, showing that despite having the highest carbon footprint of all domains, it is also the one where some changes in lifestyle could have a huge mitigation potential. The housing domain is also considerably reduced, while the mobility domain has a moderate reduction, staying relatively high in 2030. The goods domain has a slight shrinkage, while the leisure and services domains maintain their carbon footprint at the same level.

9 The intensity calculation is a general representation of the process, with adaptations considering Brazil's energy matrix. It relies on current available data for each item considered.

Figure 16 Changes in lifestyle carbon footprint



5.4 Co-benefits of 1.5°C Lifestyles

In general, the proposed lifestyle change efforts will improve based primarily on overall household consumption. At first this will occur due to the options that are less dependent on systemic shifts and infrastructure investments (that require deep changes within the society and all its stakeholders), but over the long term they will also change lifestyles in a broader way, especially when it comes to society and community roles. Different shifts can be expected either by citizens or the community, given that many options adopted by a considerable number of people, may lead to necessary changes. They can happen either for retailers and manufacturers (adapting to meet consumers' demands), or for consumers (e.g. provision of infrastructure that allows more efficient services, resulting in their growing interest).

There is no way to predict all possible benefits, given the fact that one co-benefit might facilitate or lead to another (e.g. efficiency improvement can result in cost reduction during operation, which results in a lower cost for the consumer, thereby reducing the expenditure). Considering the options that were selected and/or adopted during the participatory process, some qualitative benefits can be present in the future, as described below.

In the food domain, once moderate nutrition is achieved and less food can be purchased, the reduction of excess nutrition may result in increased well-being through reduction of obesity, and even of waste generated. Better use of food (plan shopping, reuse leftovers, purchase food that would be thrown away) can lead to better community relationships, especially between the consumer and seller, but also can result in a cultural change where food waste is severely reduced. The substitution of one type of protein by another can also generate cultural changes related to common diets. In addition, many of those options can lead to financial savings, as a result of better use of money.

In the housing domain, the reduction or better use of appliances and consequently, resources (energy and water), can reduce energy and water bills, as well as extend the lifetime of this equipment, also saving money in the long term. However, it is important to assess the 'rebound effect' since the reduction of resource consumption can lead to higher consumption levels in other areas, as a sort of compensation (thus higher carbon footprint) or the consumption of better quality products (thus lower carbon footprint). Besides this, good relationships and social interaction can be achieved by sharing housing space (or also via rideshare and other options that are based on cooperation).

In the mobility domain, reduction of city pollution, especially air pollution that is usually intensified by transportation, is one of the clearest benefits. Beyond this, traffic jams are significantly reduced as a result of less car use, people moving closer to services, better fuel efficiency, rideshare, greater bicycle use and an increased preference for public transport. Improved health through exercise, such as riding bicycles or walking is an added benefit. As another co-benefit, shorter commutes that result from using a home office can result in more time for family, exercising, focusing on health, and other key life areas.

In the goods domain, the focus is on consumer behaviour regarding purchases. Avoiding what is unnecessary and changing the disposable for the durable can have financial, environmental and social benefits, besides the possible shift in businesses that follow consumer demands. Longer-lasting materials can also dramatically alter the clothing sector, especially the fast fashion business model in which rapidly changing trends stimulate intensive consumption and discarding of outdated styles. Those behavioural changes can cultivate a conscious mindset wherein the consumer seeks the essential and the durable, as opposed to the superfluous and disposable.

In general, many of the options have a financial benefit (in terms of cost savings) by, for example, reducing food waste, saving energy, lessening water use at home and sharing/ giving preference to smaller spaces.

6. STAKEHOLDER RECOMMENDATIONS

In summary, any change related to lifestyles, especially those with a lower carbon footprint, can have a positive impact on the environment and society. However, it is important to clarify what is necessary for lifestyle carbon footprint reduction options to be adopted. Some of them may be implemented voluntarily by many citizens, without requiring that much effort (e.g. plan food shopping to avoid waste, use appliances in energy-saving mode, reduce home electricity use, including monitoring and peak management, or avoid unnecessary printing). On the other hand, many of the lifestyle options are strongly influenced by the socioeconomic context, infrastructure, policies, accessibility, and overall situation. This is the case when stakeholders must fulfil their roles in providing the conditions to facilitate the adoption of lifestyle carbon footprint reduction options. This study clarified some obstacles or barriers related to the implementation of the lifestyle carbon footprint reduction options through a participatory approach, and also suggested enabling contexts and opportunities (or measures) for all stakeholders (government, companies and civil society).

6.1 Challenges (barriers and obstacles) identified through workshops and experiments

During the discussions, and mainly in response to the workshop question 'What are the main barriers for you to adopt this option?', participants pointed out some obstacles or barriers to their implementation, especially within the food and mobility domains. These answers provide very useful input for sharing a broader view of São Paulo's context, and what can be done to start tackling the challenges over the short, mid or long term. All options for which barriers or obstacles were mentioned are detailed in Table 5.

Table 5 Options and their respective barriers and obstacles identified during the participatory process

Domain	Option	Barriers / Obstacles
Food	Plant-rich food diet (vegetarian)	• Living with many non-vegetarian people • Vegetarian foods are generally more expensive • Need to cook more than one type of food

Domain	Option	Barriers / Obstacles
Food	Low-carbon protein instead of red meat (poultry, fish)	• Cultural factors (e.g. Brazil's South Region consumes a lot of red meat) and taste or cultural preference prevents reduction • Personal preferences and taste
Food	Purchase food that would otherwise be thrown away (does not look 'perfect', close-to-expiry-date produce)	• There is a fear that the food will not last long and spoil quickly when it is brought home, generating waste
Food	Reduce excess nutrition (eating moderately)	• Cultural issue of overeating • Relationship with food, which is often emotional and not just for nourishment • Self-discipline; little and difficult access to the relationship between food and its carbon footprint
Food	Reuse food leftovers	• Prevent some fruits from spoiling • Aversion to leftovers
Food	Better plan food shopping to avoid waste	• Use of food as a relief valve (to compensate for a spontaneous feeling, such as anger, sadness, anxiety and excitement)
Food	Reduce dairy products (milk)	• Cultural factors • Not having any prior knowledge on the subject
Housing	Share housing space	• Symbol of success: having your own assets (ownership) • Challenges due to living together • Increasingly individualistic society (own space) • Need for privacy
Housing	Wash laundry in full loads	• Insufficient use of clothes by a small family - delay in filling the laundry basket • Need to wear clothes soon (few pieces, e.g. uniforms) • Need to wash floor cloth (small pieces of cloth used for cleaning) - does not give enough volume to have a full load • Increased need to wash clothes to avoid contamination by COVID-19 • Lack of water reuse scheme (building structure)
Mobility	Use a home office	• Feeling of loneliness • Delay in resolving work issues • Some things can be solved more quickly if done in person
Mobility	Rideshare	• Not feeling comfortable sharing the car with strangers, and want to share rides only with close people • Preference for using public transport
Mobility	Use bicycles	• Area far from downtown • Discomfort due to very hot weather • Lack of infrastructure • Lack of security
Mobility	Use public transport (reduction of car use)	• Local reality (it is not always available, or has quality) • Cultural barrier for those in the "higher" classes • Fitting schedules in the school-work routine

Domain	Option	Barriers / Obstacles
Mobility	Reduce flights	• Travel destination and logistics • Cost-benefit related to the exchange of flights for other means of travel • Professional demand (need to travel to work) • Poor condition of Brazilian roads • Wide expanse of the Brazilian territory
Mobility	Travel less often/closer destination	• Limited tourist infrastructure nearby • Mentality (being used to travel to destinations that are not always close, and with some frequency) • Desire to explore new and distant places • Culture of the dream, of the imaginary
Goods	Buy longer-lasting clothes	• Everyday temptations • Price • Lack of information - not always clear what is durable when it comes to clothing • Many more options for new clothes (fast fashion) than thrift stores, making access to seasonal items much easier
Goods	Reduce electronics consumption	• Software update • Do not imagine the impact of buying devices • Need for consumption • Need for frequent exchange (obsolescence)

6.2 Recommendations to Stakeholders

Overall, all obstacles can be summarized in seven different categories:

- Lack of accessibility
- Higher prices
- Lack of information / knowledge
- Lack of infrastructure
- Planned obsolescence of goods
- Cultural resistance
- Conflict between needs

All of these obstacles serve to ‘paint a picture’ and represent what could be the clearest opportunities for stakeholders to take action. These opportunities / recommendations to stakeholders and the enabling contexts, as well as the barriers / obstacles presented by the participants, were discussed internally by the Akatu team, which then made suggestions based on them, while also taking into consideration all the insights provided during the participatory process (especially the workshops).

The enabling contexts describe a brief scenario in which conditions for overcoming the obstacles are available. In Table 6 below, the opportunities or recommendations to stakeholders detail some measures that each of these actors (governments, companies and civil society) can or must play in order to make the enabling contexts a reality. It is important to emphasize that despite the impact of each stakeholder, they must act together, collaborating in order to catalyse the changes needed to promote low carbon lifestyles. The enabling contexts are also listed in the table.

Table 6 Recommendations and opportunities for stakeholders based on the obstacles discussed during the participatory rocess

Barriers / Obstacles	Enabling Contexts	Recommendations to Stakeholders		
		Governments	Companies	Citizens and Civil Society Organizations
Lack of access (e.g. Limited availability of longer-lasting clothes; Use public transport)	Goods and services become more accessible, enabling and facilitating the purchase or use of that good or service	Invest in urban mobility infrastructure policies, and grant benefits to businesses capable of providing access / accessible goods or services	• Improve the geographic reach of goods and services • Provide technologies to locate or search for goods or services	• Demand support from government and companies • Help the community to locate the goods or services wanted • Identify what lacks access and cooperate with other citizens and local businesses
Higher prices	Goods and services related to low carbon lifestyles become more affordable	• Fiscal incentives • Invest in research and development • Support for low-carbon initiatives that result in more affordable goods, as a competitive marketplace which can lower costs	• Provide more affordable goods and services • Enhance transparency to raise awareness about goods or services and their price (not always high)	• Demand more competitive prices • Demand and actively search for information that justifies (or not) the good / service price
Lack of information / knowledge (e.g. Buy longer-lasting clothes; Reduce dairy products (milk); Purchase food that would otherwise be thrown away)	Information should be provided in a widespread, clear and accessible way	• Pass laws that demand transparency and information provision from companies • Institute an efficient, co-created label • Support for initiatives that counter misinformation or lack of information	• Provide information about goods and services • Get data to reach transparency in the entire supply chain • Create a channel for consumers to request the information they miss • Explore the use of ecolabels	• Demand information from governments and companies • Be open to discussing the issue with other stakeholders • Spread knowledge to others • Promote purchase of goods and services with approved labels, among the community
Lack of infrastructure (e.g. Poor condition of Brazilian roads; Use public transport; Use bicycles)	Better infrastructure should be provided	Develop infrastructure for alternative mobility through national and local policies, investment	• Support infrastructure development (e.g. In the community where the company is located) • Provide mobility sharing services • Invest in innovation to develop mobility solutions	Demand improvements based on the services used

Barriers / Obstacles	Enabling Contexts	Recommendations to Stakeholders		
		Governments	Companies	Citizens and Civil Society Organizations
Planned obsolescence of goods (e.g. Electronics consumption)	Planned obsolescence of goods becomes no longer acceptable	• Pass laws that prohibit planned obsolescence of goods (partnerships with specialists, since this is a complex practice) • Punish companies that practice planned obsolescence	• Create well-designed products which last longer • Ensure good reparability to extend the product lifetime even more • Provide manuals about fixing and spare parts for replacement • Invest in new business models which do not incentivise new products, but rather the remanufacture or return of old products	• Support companies that are not linked with programmed obsolescence and report the ones that are • Share equipment-fixing instructions
Cultural resistance (e.g. Use public transport; Reduce dairy products; Low-carbon protein instead of red meat)	Information, knowledge, programmes and events (through celebration of the practices) that raise awareness and self-reflection regarding cultural habits	• Invest in educational policies that embed sustainability issues • Promote awareness campaigns • Invest in provision of reliable information	• Raise awareness through products and services • Provide accessible alternatives that can weaken resistance and increase reflection	• Share own positive experiences • Encourage healthy and open cultural discussions to broaden people's perspectives
Conflict between needs (e.g. Wash laundry in full loads; Use public transport)	Alternatives enable conflicting options to be implemented together without impairment	Provide support to companies and citizens for finding alternatives	• Develop alternative goods and services • Improve understanding the consumers' issues and finding solutions	• Support cooperation between people of the community to find solutions • Share knowledge

7. CONCLUSIONS

The scenario presents a future where the target of 2.5 tCO_2e/cap/yr can be achieved with household adoption of identified lifestyle carbon footprint reduction options, specifically reducing it from 3.6 tCO_2e/cap/yr to 1.6tCO_2e/cap/yr in São Paulo by 2030 (-55%). But, if on one hand some domains and options are essential and can help citizens achieve the target in a significant way, on the other all actors must collaborate in order to further promote permanent and sustainable lifestyle changes. Governments can support businesses and households by reviewing regulations, providing infrastructure and incentives. Meanwhile, companies can provide adequate and innovative goods and services to households, seeking sustainability in their business models. And citizens, beyond individual actions, can raise their awareness and act to support governments and businesses in fulfilling their roles. Basically, enabling contexts will only become a reality once all stakeholders are moving towards a mutual goal, cooperating and supporting each other along the way.

The proposed alternatives and measures are based on participants' preferences and envisage the assimilation and adoption of low-carbon lifestyles in the short, mid and long term, resulting not only in GHG emission reductions, but also a better quality of life across different domains. It is common to focus on quantitative aspects when discussing carbon footprints, but alongside changes meant to reduce emissions, numerous qualitative benefits can occur, such as: increase in well-being, reduction of city pollution, health improvements, better relationships, financial benefits and many more.

Although the 2.5 tCO_2e/cap/yr target can be achievable, it is important to clarify that the scenario does not assume systemic changes, such as general efficiency improvements and variations in the energy mix. That said, this scenario does not provide an 'equation' or a strict step-by-step process. It provides a roadmap, an example of how implementing a co-creation process with citizens, and addressing the specifics of the city context, can help to envision and develop more solid and feasible pathways to a decarbonized and sustainable future. It shows citizens' importance in carrying out the lifestyle carbon footprint reduction options and also demanding support from governments and businesses, which can lead to open discussions on how to provide means to realize 1.5°C Lifestyles in the upcoming years. There will be barriers, obstacles and challenges along the way, and which can only be overcome by collaboration between all stakeholders, providing mutual support and nurturing a society based on union, empathy, inclusion and sustainability.

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