Cape Town in 2030

Envisioning 1.5-Degree Lifestyles

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Partner Organisations (Listed in alphabetical order)

Project Implementation Partners
Akatu Institute, Brazil
Chulalongkorn University, Thailand
ICLEI Africa, South Africa
Swechha, India

Communications and Outreach Partners
Hot or Cool Institute, Germany
ICLEI, Japan
Science Communication and Research Institute (SCRI), Japan

Advisory Partners
D-mat, Finland
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EXECUTIVE SUMMARY

This report, 'Cape Town in 2030', recommends some plausible options for 1.5-Degree Lifestyles and measures to support them. This will put society on a path towards realising the globally unified 1.5-Degree Lifestyles target of 2.5 t-CO_2e/capita/year, 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 Cape Town is currently 9.2t-CO_2e/capita/year, comparable to South Africa's national average, and well above the global average of 4.3t-CO_2e/capita/year. The domains, in order of highest climate impact in Cape Town are food (45% contribution), housing (22%), mobility (12%), goods (12%), services (5%) and leisure (4%).

Reducing the lifestyle carbon footprint is only feasible through a combination of measures on both the production and consumption side. Our proposed consumption side measures can reduce Cape Town's average lifestyle carbon footprint from 9.2t-CO_2e/capita/year to 3.0t-CO_2e/capita/year (-69.7%), assuming no changes in renewable energy share and no changes in environmental efficiency improvement. However, uptake of these consumption side measures is highly dependent on enabling infrastructure, which make such activities attractive and possible for citizens. This project identified 37 actionable lifestyle change options and estimated their potential to reduce the carbon footprint based on consumption amounts and energy intensity for production across the housing, food, mobility, goods, services and leisure domains. Selecting options for the 1.5°C Lifestyles is personal, and can vary from one person to another. Through participatory workshops with Cape Town's citizens, the feasibility and desirability of the identified options were evaluated. Workshop participants conducted a two-week household experiment to confirm the viability of the options selected in the workshop. This household experiment enabled identification of obstacles to implementing the options and what supporting measures are needed to overcome them. Based on these interactions it is suggested that the current likelihood of adopting these options is low, suggesting that a reduction to only 8.4 t-CO_2e/capita/year (-7.8%) is likely right now if these options were advertised and promoted without investing in enabling systems.

Current average per capita carbon footprint in Cape Town (2012 - 2016 reference data)	9.2 t-CO_2e/capita/year
2030 average per capita lifestyle carbon footprint in Cape Town after lifestyles change with assuming no improvements in renewable energy share and environmental efficiency from the current level	3.0 t-CO_2e/capita/year
Potential average per capita lifestyle carbon footprint in Cape Town after lifestyle change as indicated in workshop	8.4 t-CO_2e/capita/year

In Cape Town, the food domain accounts for the maximum carbon footprint, followed by housing, mobility, goods, services and leisure. For food, red meat is responsible for a significant impact, and shifts in diet could offer large reductions in carbon emissions, while also supporting good health. Cape Town citizens shared that reduction in meal size or meat consumption was feasible. For housing, the high carbon intensity of the nation's electricity mix, and the dependence on electricity for most household energy needs makes reducing carbon emissions through lifestyle change difficult. Here, installing technologies to reduce use of hot water, or to provide solar electricity would enable large reductions. Promoting a shift, at the national and local levels, from a 95% coal-based electricity system, and investing in low-carbon transportation represent vital ways for goods, services and leisure to holistically reduce their carbon intensity. COVID-19 lockdowns represented a direct low-carbon experiment with increased telecommuting for many Cape Town residents working in service or knowledge industries, which has reduced private vehicle traffic and associated carbon emissions in the city.

Some of the 37 lifestyle change options, particularly related to low-carbon mobility, decentralized energy systems and conscious consumption of goods are already being promoted by the City of Cape Town through its Carbon Neutral 2050 Commitment. It also provides a comprehensive guide to accelerate the transition towards carbon neutrality by 2050. Through group discussions between the authors and citizens, it was confirmed that 1.5°C Lifestyles can have multiple co-benefits in addition to limiting global warming. Some of the co-benefits include revitalisation of local economies, strengthened communities, reduction of air pollution, and creation of vibrant neighbourhoods, potentially leading to a better quality of life.

Citizens identified various obstacles to implementing these 1.5°C Lifestyles options, including a lack of infrastructure (particularly renewable energy & public transport infrastructure), products and services; limited awareness about existing infrastructure, and products and services; high costs to implement some options; low accessibility; conflicts with personal needs or cultural expression; conflicts with other people's needs; and conflicts with societal norms. Participants emphasized the importance of habit-making in order to shift the ways that people think. Key challenges that they expressed included a lack of infrastructure enablers to support new habits as well as an understanding of the impact that their lifestyle choices have on the wider system. They therefore expressed a keen interest in understanding what the mitigation potential of their lifestyle options would be, and emphasised the need to make such information accessible and digestible to others. It was realised that lifestyle changes cannot be achieved without systemic changes. Supportive measures by government and businesses can enable households to implement the recommended options for effective transition to 1.5°C Lifestyles, and conversely, awareness of and willingness by households to take action can encourage government and businesses to provide supporting measures.

The lifestyle carbon footprint analysed in this report, as well as the carbon footprint reductions associated with citizen behaviour change, are expressed in terms of the per capita average of Cape Town. 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 emphasises that a 1.5°C Lifestyle of 2.5 t-CO_2e/capita/year target is very ambitious but can be achieved in Cape Town if all the stakeholders take adequate actions in a collaborative manner. It aims to provide ideas for a diverse range of citizens to realise 1.5°C Lifestyles, while noting that adoption rates are only indicative figures, and not future projections or targets. Reducing the carbon footprint from 9.2 tCO_2e/person/year in 2020 to 2.5 tCO_2e/person/year in 2030 and 0.7 tCO_2e/person/year in 2050 will require radical changes to energy systems, enabling infrastructure and behaviours. With growing commitment from the City of Cape Town, the scenario for achieving a 1.5°C lifestyle in Cape Town revolves around the point where the residents' will and City's support meet.

CONTENTS

1. INTRODUCTION

The urgency to respond to climate change has been articulated by many over the last decades and has now achieved global attention and action. The International Panel for Climate Change report of 2021 made clear that human activities are driving widespread systems changes that will increase global temperatures and alter once-predictable weather patterns in many regions (IPCC, 2021). While the urgency to address climate change is noted, and the need to both reduce greenhouse emissions (GHGs) and improve resilience is understood, the approaches to cut GHGs are either misunderstood or face barriers to effective implementation. Further, approaches to reduce GHGs are often focused on the production side, and do not take a consumption or system-wide lens.

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 et al. 2019). Lifestyle carbon footprints can be assessed through national or city boundaries. Given the availability of consumption data, the city where an individual resides provides appropriate geography 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 (1.5°C) Lifestyles, developed in consultation with the citizens of Cape Town, which was selected by ICLEI Africa based on their existing network and practical considerations for project implementation. This scenario accentuates that the adoption of low-carbon lifestyle options relies on supporting measures by government and businesses to facilitate individual efforts, and emphasises the importance of collaborative efforts by all stakeholders.

1.1 Background

Cape Town is located in South Africa's Western Cape Province. It is administratively served by the City of Cape Town, one of South Africa's 8 metropolitan municipalities. The city's population was estimated to be 4,005,015 people in 2014 (reference year for Cape Town data), based on 2.4% annual growth since the 2011 Census-calculated population of 3,740,025 (StatsSA 2011a). The city covers an administrative area of 2,461 km2. Cape Town is a vibrant city with a growing cultural economy that promotes music, fine dining and art, and many outdoor opportunities for its residents, found in the mountains and oceans. Like many South African cities, Cape Town is still grappling with issues of racial, spatial and economic inequality. South Africa is one of the world's most unequal countries, with a Gini coefficient of 0.61 (World Bank Group 2012). High rates of poverty in the city are evident in the built form, from townships that are far from the city centre, dependent on long commutes by bus or minibus, a growing informal sector population, and limited services in townships and informal settlements. The Housing Development Agency (2013) estimated that approximately 141,765 households in Cape Town live in informal settlements (spanning 378 informal settlements), with a further 74,958 in backyard dwellings, suggesting that 21% of Cape Town's population lives in informal dwellings, and 79% live in formal structures. While most formal neighbourhoods are well serviced, many low-income neighbourhoods experience a lack of resources, basic infrastructure and lifestyle amenities, increasing their vulnerability. In South Africa, the majority of consumption of most goods and services is concentrated in the country's upper-middle class (StatsSA 2011b). This is illustrated through income-expenditure reports which indicate which expenditure deciles consume above the median (typical person's) consumption level. For food, it is evenly distributed, with 50% of people consuming more than the typical person's consumption level. For alcohol and tobacco,

as well as clothing, 40% of people consume above the typical person's consumption level. On housing, energy and water services, communication, education, restaurants and hotels, and miscellaneous goods and services, only 33% of people consume more than the typical person's level, and for recreation, furniture, health, and transport only 20% of people consume at a level higher than the typical person. This speaks to the difficulty of using a single per person carbon footprint to reflect the whole of the city.

Gasson's (2002) Ecological Footprint of Cape Town (128,264 km2) suggested that the city would need 52 times its administrative area or 116 times its built area (774 km2) to support its consumption levels. Hoekman and van Blottnitz's (2016) material flow analysis of Cape Town suggests that the city consumes 13.4 megatonnes of material or 3.5 tonnes per person. Cape Town has been experiencing an increase in the consumption of materials, goods and services, which is placing strain on the available resources and existing infrastructure. Increased consumption is attributed to growing population and increasing levels of affluence in the city.

The feasibility and impact of consumption-side lifestyle change has already been demonstrated effectively through the Cape Town water crisis, in which an unprecedented drought reduced the level of rainfall by half over 3 years. This meant that the city effectively had to halve its consumption from 1.2 billion litres per day to 500 million litres per day, a goal it reached through widespread awareness and education, direct restrictions on water consumption by industry, agriculture and many residents, as well as punitive and incentivising measures to encourage compliance. The crisis is an interesting demonstration of how the burden to reduce water consumption was placed quite directly on residents, which made sense given they are the largest consuming sector. However, differential consumption levels were not necessarily considered. The effectiveness of a widespread community, stakeholder and government movement to reduce water consumption speaks to the possibilities of effectively reducing carbon emissions if the right conditions are met and the right enabling environments are developed, but is also a reminder that differentiated approaches are needed.

This project aims to understand the current challenges facing Cape Town, and the opportunities to reduce carbon emissions through changes in the habits of everyday residents. This project explored alternative lifestyle habits that residents of the city could adopt to mitigate the impacts of activities that currently contribute to climate change, while proffering a number of potential co-benefits.

1.2 The Scenario

Co-created with citizens, this scenario—Cape Town in 2030—recommends options and their supporting measures to reduce lifestyle carbon footprint 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. Choice of a decarbonised lifestyle is personal, and can vary from one person to another, hence 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 Cape Town citizen's average lifestyle carbon footprint and its related hotspots provide both policymakers and citizens with an indicative carbon footprint benchmarking, and a hotspot analysis along with 37 actionable lifestyle change options that were identified based on a project wide extensive literature review, and are specific to Cape Town's culture and socio-economic context. These options are also in line with a conceptual city vision, developed based on a participatory workshop about the desired future of the city and lifestyle. Preferences made by citizens in terms of these 37 options are indicated through their adoption rates. Through household experiments, citizens were able to identify obstacles and required supporting measures from government and businesses to effectively mainstream the decarbonised lifestyles options. Thus, this policy report aims to not only encourage citizens to make environmentally friendly choices every day but also solicit other stakeholders, including government and the business sector, to enable and facilitate citizens to make such choices. In other words, our objective is not only to inspire citizens, government and businesses to embrace and promote conscious living, but also to broaden the narrative of taking action from policymakers to every citizen and resident of Cape Town regardless of their age, gender, nationality or socio-economic status.

The next section details the methodology involved in developing this scenario. Sections 3, 4, and 5 introduce the project findings for the baseline carbon footprint in Cape Town, the desired future city vision, and low-carbon lifestyle options across the housing, food, mobility, goods, services, and leisure domains. Section 6 identifies the supporting measures for different low-carbon lifestyle options and recommends actions for various stakeholders to facilitate transition towards a1.5-Degree Lifestyles.

2. METHODOLOGY

The lifestyle carbon footprints targets are set at 2.5 t-CO_2e/capita/year by 2030, 1.4 t-CO_2e/capita/year by 2040, and 0.7 t-CO_2e/capita/year by 2050 (Institute for Global Environmental Strategies et al., 2019). This scenario focuses on the 2030 target.

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

2.1 Quantitative Analysis

TThe quantitative analysis aimed to provide the current average carbon footprint in Cape Town (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: Cape Town'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, housing, mobility, goods, services and leisure.
- The total emission per capita was calculated by aggregating the carbon footprint of 147 consumable items (although a few were not considered due to lack of data),[1] grouping the items according to their previously referred domains. These data were sourced as follows, by domain:
  - Food: Hoekman and von Blottnitz 2016; Hoekman 2015; WWF 2017; Esterhuizen and Torry 2015; Cape Town Open Data Portal (https://web1.capetown.gov.za/web1/opendataportal/); Metabolism of Cities – City Data
  - Housing: City of Cape Town 2011; Sustainable Energy Africa 2017
  - Mobility: Kane 2016; Transport for Cape Town 2015; Cape Town International Airport Aircraft Movements: International & Domestic (https://www.airports.co.za/StatisticsLib); scaled to account for Cape Town residents' contribution
  - Leisure, Goods & Services: Income/Expenditure data for Western Cape Province, estimated to city of Cape Town scale (StatsSA 2011a)

1 Metabolism of Cities – City Data (https://data.metabolismofcities.org/dashboards/cape-town/)

- For carbon intensity data, national-level data were sourced from the Exiobase database, and some city-level data were found in appropriate reports (Western Cape Government 2013, Kane 2016; Kumalo 2019).

- Data points and datasets were chosen based on a trade-off between completeness across domains (for comparability), recency and perceived accuracy.

Step 2: Hot Spot Analysis

- The assessment of carbon footprint 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 (domains), the analysis also provided the identification of hot spots within those categories.

- The hot spots represented the domains or individual items that have either a high consumption amount, a high carbon intensity in production, or both.

- Based on that analysis, it was possible to identify lifestyle options that have the biggest potential to reduce the carbon footprint of an individual.

Step 3: Lifestyle Carbon Footprint Reduction Options

- Through desk research, literature review and the hot spot analysis for all domains, 73 lifestyle carbon footprint reduction options were identified; 37 of these options were chosen on the basis of having enough evidence to indicate they could be effective in reducing greenhouse gas emissions, be feasible for uptake, as well as link with the 147 lifestyle consumable items (that were used to calculate total emissions per capita).

- In order to efficiently communicate the options and to make them more understandable, they were graphically illustrated with their carbon footprint reduction in a catalogue.

- A catalogue of the illustrations and the carbon footprint reduction potentials of all 37 lifestyle options were used to guide conversation in the participatory discussions.

Step 4: Estimation of Aggregated-Reduction Interactions

Given that a number of options overlap or interact, aggregating the effect of the proposed lifestyle options required accounting for their interactions, and resulted in a smaller carbon reduction than if it was assumed that all options could be taken on by residents. For example, choosing plant-based diets (removing all animal products from a diet) is an extension of choosing vegetarian diets (removing only meat), and therefore, is a stronger lifestyle option for reducing carbon impact. If a resident also chooses to reduce their typical portion size, this would also have implications for either choice.

2.2 Participatory Consultative Process

The participatory consultative process consisted of a series of online workshops and interviews and a household experiment. These aimed to understand citizens' 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. Twenty-eight (28) citizens filled out the consumption survey and fourteen participated in the online workshops and household experiment. The participants in the workshop were mostly from the city's upper-middle class cohort, with household incomes between ZAR 12,000 and ZAR 102,400 (±800 – 7,000 USD).[2] More specifically, this is broken down to 7% between ZAR 3,201 – 12,800, 7% between ZAR 12,801 – 25,600, 38% between ZAR 25,601 – 51,200, 45% between ZAR 51,201 – 102,400, and 3% higher than ZAR 102,401. Approximately 2/3 were women and 1/3 men, and they were between the ages of 24 and 65. Fifty-five per cent (51%) live in freestanding houses, 21% in apartments, 21% in semi-detached houses, and 7% in a cottage behind a house.

Step 1: First Online Workshop

The recruitment of participants was conducted through emails to networks and deployment of a survey. Twenty-eight (28) Cape Town residents filled in the survey, but due to the nature of COVID-19 related lockdowns, it was difficult to host them together in a single online workshop. It was therefore decided to break the first workshop into a series of smaller workshops held at different times and days of the week, and complement them with short interviews with interested people. The first set of engagements were held during February 2021.

2 Despite the efforts to have a heterogeneous sample of Cape Town, the workshop participants should not be considered as a representative sample because of the size of the city, and the ability to offer time and join through virtual platforms. However, the sample offers some useful reflections and thematic ideas for what may be possible in Cape Town.

- A presentation of 1.5°C Lifestyles was made by ICLEI Africa, to provide a basis for the conversation.
- Participants were invited to add their ideas in text and imagery to a MURAL board (an online whiteboard for brainstorming), and to reflect on what their vision for Cape Town would be in 2030.
- Lifestyle options for reducing carbon impact were presented and participants were asked to vote for those that they thought they could take on.
- A discussion was facilitated about what residents felt would be needed in their city to undertake these lifestyle activities – and what would enable them to successfully do so.
- The participants were given a detailed explanation about the household experiment, asked about their willingness to participate, provided with recording sheets to mark the options they adopted during the experiment, and informed about how to carry out the recording.

Step 2: Household Experiment

Five (5) participants took part in the household experiment that spanned two weeks in March 2021.

- Participants were asked to choose a number of lifestyle options they would undertake.
- Participants were provided a recording sheet on which they would note, on a daily basis, which lifestyle activities they were attempting, how well they managed to do them, and their reflections.
- 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 set of workshops and interviews were held online in April 2021.

In these discussions, participants were requested to reflect on the household experiment, and reflect on the degree to which other residents in Cape Town might adopt these activities. Key themes for what the future of Cape Town should be were voiced and agreed upon with different participants, and these were woven together by the ICLEI Africa team.

Due to low sample numbers in the Cape Town workshop and survey processes, future city scenario recommendations should be understood to be thematic and not representative of the whole population.

Sections 3 and 4 provide all of the details related to the identified lifestyle carbon footprint reduction options and supporting measures.

3. OVERVIEW of BASELINE DATA

The total carbon footprint for Cape Town was estimated at **9.2 tCO_2e/person/year**. This is an average figure, which will be higher for some, particularly high-income residents, and lower for others, particularly those in low-income neighbourhoods. Below, statistics used to further understand the breakdown of carbon-impact by activity and provide explanations are therefore based upon middle-income data or proxies.

The total annual per capita lifestyle carbon footprint for Cape Town was estimated at **9.2 tCO_2e/person/year**. We can compare this to a few other footprint estimates:

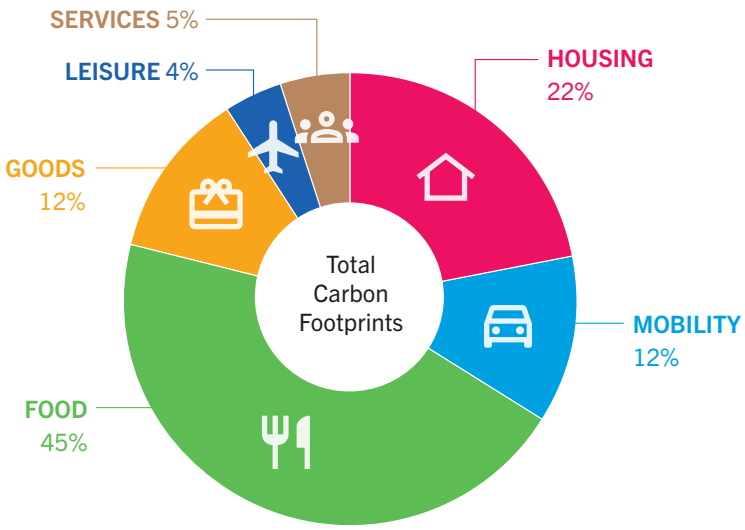
- South African average of 9.5tCO_2e/person/year in 2015 (Department of Environmental Affairs 2015)
- Cape Town average of 7.8tCO_2e/ person/year in 2012 (Sustainable Energy Africa 2014),
- Cape Town Average of 5.8tCO_2e/ person/year[3] in 2016 (City of Cape Town 2021). This is the value submitted in the CDP-ICLEI official reporting platform for disclosing greenhouse gas emissions and climate actions at a global level.

As noted above, there are a variety of available carbon footprint estimations, many of which focus on energy-related emissions. Some other estimates may broaden beyond fossil fuel emissions to include wider greenhouse gas emission activities, but may still rely on the use of a direct emissions methodology. The proposed reason why the estimation of Cape Town's carbon footprint is closer to the national estimate and much higher than officially reported sources is twofold: firstly, estimates for commodities and energy are typically more available and accurate, while services and food are not consistently tracked, which may explain low estimates produced for Cape Town (national estimates will typically account for production-related emissions, given that they will track industry energy consumption all across the country); secondly, it is taking a lifecycle perspective, which not only considers the direct and indirect emissions from within the Cape Town Metropolitan area, but also emissions related to the external production and transportation of all goods and services that are consumed by residents within Cape Town. Curiously, given that this estimation is consumption-based, it does not account for production of goods within the City of Cape Town that are consumed by those outside of the city.

Figure 1 shows the proportion of greenhouse gas emissions that come from different groups of activities. These are the domains of Food, Housing, Mobility, Goods, Services and Leisure. What is instantly notable is that food-related emissions make up almost half of the total footprint at 45%. Housing (22%), Mobility (12%) and Goods (12%) are the next most impactful domains, with Services (5%) and Leisure (4%) contributing minimally to the overall footprint. What this means is that for most Cape Town residents, changing what or how much they eat can have the largest impact.

3 https://data.cdp.net/

Figure 1 Cape town lifestyle carbon footprint by domain (kgco2e/capita/year, %). Data source dates range from 2012 to 2016.



The figures below give more detail about the specific activities or items in each domain.
The skyline images show the amount of consumption and the carbon intensity for each item.

3.1 Food

The food domain represents food consumed at home only, with restaurant food reflected under services. For food, the largest emissions come from meat consumption (43%), mostly beef (23% of food-related emissions; 10% of total emissions in Cape Town), followed by dairy consumption (19%). Consumption of processed beverages such as juices, sodas and alcoholic beverages is responsible for 14% of food emissions, with eggs (6%) and fish (4%) following this. Untreated organic waste is responsible for 8% of food-related emissions. The overall size of the food domain is likely because food is a central need for all residents, and is thus not reduced by averaging its footprint, and since South Africans generally have a strong cultural association with meat as a central feature of meals, and as a sign of success or affluence. There are also large beverage and alcohol industries, whose advertising makes strong associations with success or social standing. The form of livestock grazing and distances the meat is transported once butchered are responsible for the high carbon-intensities of meat consumption, which are much greater in this estimation than for most other countries. In addition, there are large cereal-, vegetable- and fruit-growing industries in the country, and while these foods are highly consumed, their carbon-intensities are quite low.

Figure 2 Proportion of carbon footprint by component for food domain (kgco2e/cap, %). Date of data is 2013.

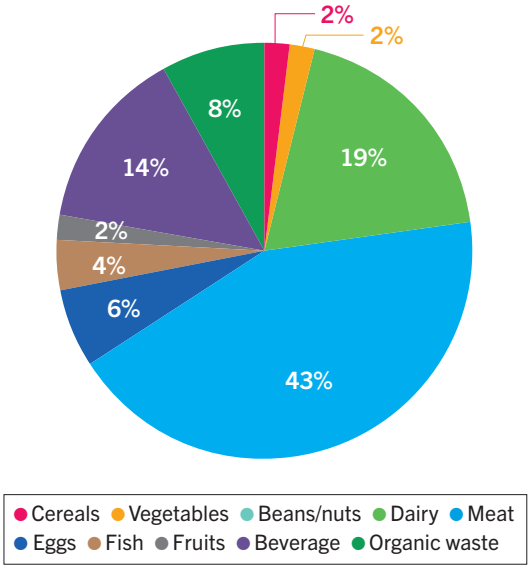
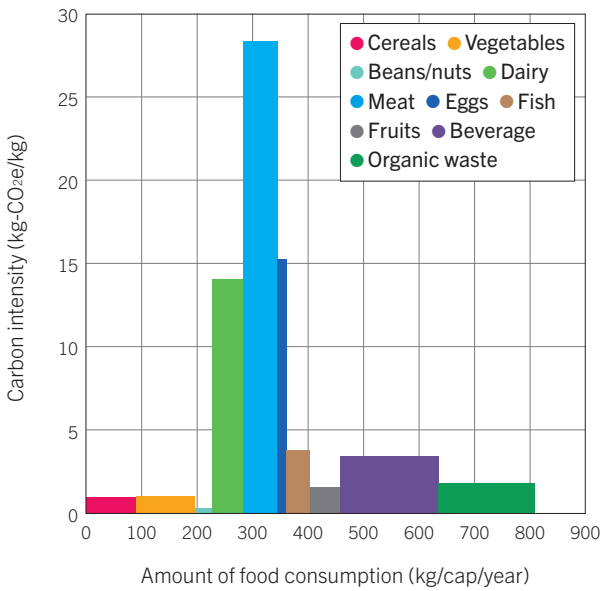


Figure 3 Skyline chart of Food domain consumption amounts and carbon intensity



3.2 Housing

Housing is the next most impactful domain, with the majority coming from electricity consumption (59%), and most of the rest due to construction of living areas (38% - calculated based on new building stock added to Cape Town). Most households are electricity dependent for all of their energy needs, suggesting that changes to this mode would be most effective. A study of Cape Town households' electricity consumption behaviours further breaks down the activities associated with this electricity use. A typical middle-income household will use energy for water heating (29% of energy consumption), cooking (28%), entertainment (12%), space heating (4%), lighting (4%), refrigeration (3%), and other low-energy needs (Strydom et al. 2020). The dependence on coal-based electricity is the main contributor to high household carbon footprints.

Figure 4 Proportion of carbon footprint by component for Housing domain (kgCO_2e/cap, %). Date of data is 2012.

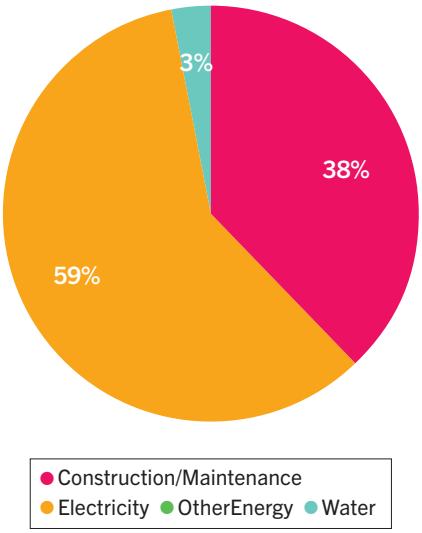
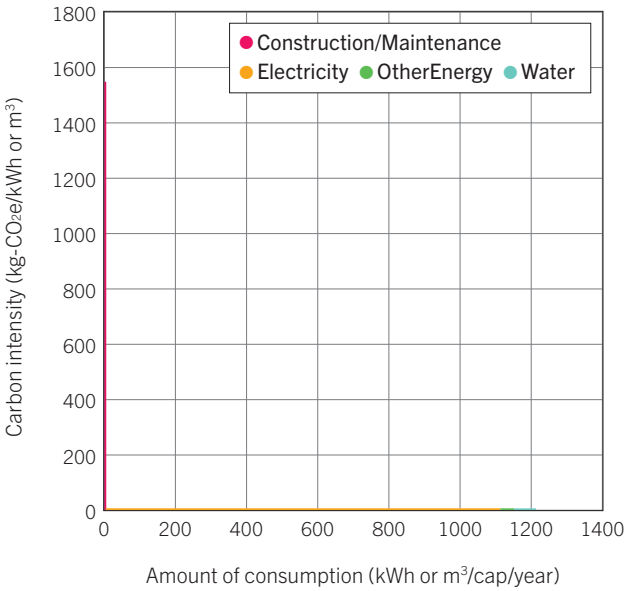


Figure 5 Skyline chart of Housing domain consumption amounts and carbon intensity



3.3 Mobility

Mobility is the next most impactful domain, and is dominated by cars (67% of mobility-related emissions; 8% of total emissions in Cape Town), followed by airplane travel (21%) and buses (10%), which includes large buses and the more-used minibus taxis. Despite many citizens walking, this and cycling have zero value as these activities are not dependent on energy that produces carbon emissions. The dominance of car use matches the aspirations of residents who view private vehicles as a sign of success, and mirrors the dominance of road-based transport infrastructure. Improvements to public transport infrastructure are being made for buses and other paratransit, such as demarcating lanes and developing stations for rapid embarking and disembarking, but these are still road-based. In addition, such paratransit is still held captive by existing private vehicle traffic, reducing the efficacy of public transport as a convenient and fast option. Investment in bicycle lanes has been minimal and investments in the train network have stalled given that the infrastructure is not owned by the city. Cape Town has been growing as an air-travel hub with more direct flights being offered at the city's airport. There are large numbers of South African domestic fliers between Johannesburg, the financial centre, Pretoria, the executive capital city and Cape Town, the country's judicial capital city. These weekly commuters may be responsible for the high airline contribution to mobility emissions. In addition, the increase in airline carriers, globally and regionally, has reduced the cost of international flights and increased people's ability to take holidays. While on hiatus due to COVID-19-related lockdowns, this trend is likely to return and increase afterwards.

Figure 6 Proportion of carbon footprint by component for Mobility domain (kgCO_2e/cap, %) Date of data is 2015.

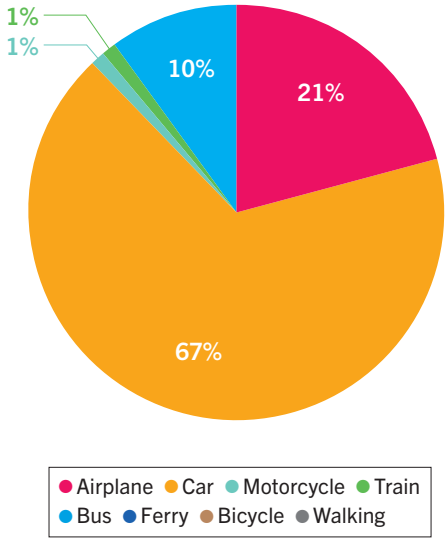
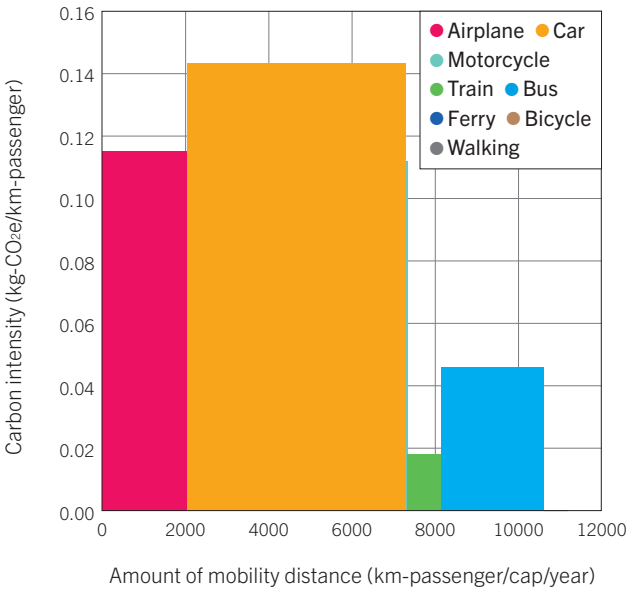


Figure 7 Skyline chart of Mobility domain consumption amounts and carbon intensity



3.4 Goods

Consumption of goods is the next most impactful domain, and is evenly distributed among sanitation products or medicine (18%), other goods (13%), electronics (12%), and clothes (12%). Repair has a large carbon impact, despite low spending on this in much of the city —attributable to a high per-unit carbon intensity, likely due to the high-energy process for repairing electric goods and machinery, and the lower costs associated with clothing repair. The processing of non-organic wastes is included under goods, given their associated nature, and is a large contributor due to their collection, processing (recycling or scrapping) and landfilling. Conversely, there is an emissions impact from a positive initiative to reduce material impact, and while this shows up as direct emissions, the upstream benefit of reducing the processing of raw materials into new products is not accounted for here. Purchase of household and personal goods differs substantially across the city's population, given that the city has a small number of households with disposable income. As the middle class grows and purchasing power increases, the city will likely see an increase in these goods. While the amount of goods consumption represented here is rather low, given it is averaged over a large population, the per unit carbon intensity of goods is quite high, given that in South African they are produced using coal-based electricity and transported using fossil fuel energy. What this means is that as the middle class grows, and more goods are purchased, this will become a more important domain for lifestyle change. Thinking now about lifestyle options for reducing goods-related carbon emissions will be beneficial for the future.

Figure 8 Proportion of carbon footprint by component for Goods domain (kgCO_2e/cap, %). Date of data is 2012.

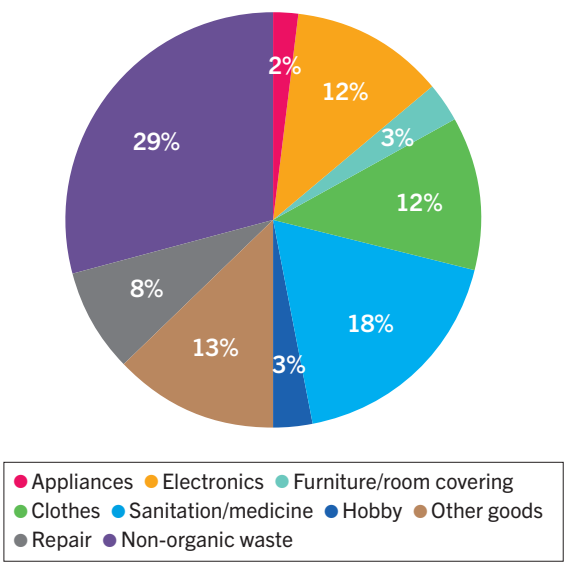
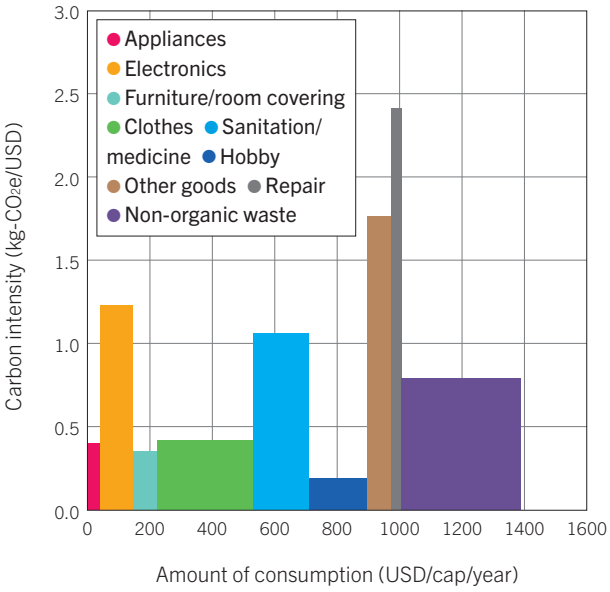


Figure 9 Skyline chart of Goods domain consumption amounts and carbon intensity



3.5 Services

Services contribute 5% of total lifecycle emissions in Cape Town, which is dominated by education (33% of service-related emissions) and communication services (29%), followed by financial or insurance services (11%) and medical or welfare services (10%). These service-related emissions are estimated based on a lifecycle assessment that includes emissions for office space, energy and materials consumed to provide this service, and emissions associated with bringing staff to, and supporting them at, work. This reflects a strong participation in education-related services, which makes sense given the national Schools Act of 1996 requirements that all children attend school between age 6 and 15. It also shows an uptake of information communication technologies, particularly mobile phones, and an associated increase in internet access. Given that this consumption data is from 2012, it is expected that communication might actually be a larger proportion of services now. The lower proportion of welfare/medical services suggests that this is not necessarily used by all in the city – as discussed above, only 20% of consumers are spending more than the typical Cape Town resident on health. Finance and insurance services constitute a large portion of expenditure on services, but have a low carbon intensity. Similar to the discussion about the goods domain, as purchasing power increases, making sure that low-carbon intensive services are available will enable growth of the service economy while preventing an increase in the environmental threat.

Figure 10 Proportion of carbon footprint by component for Services domain (kgCO_2e/cap, %) Date of data is 2012.

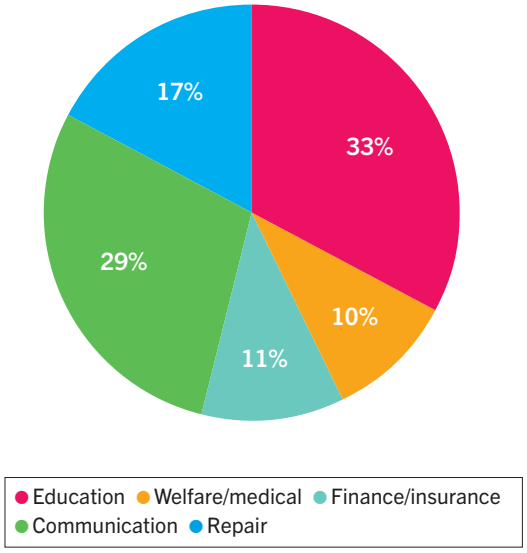
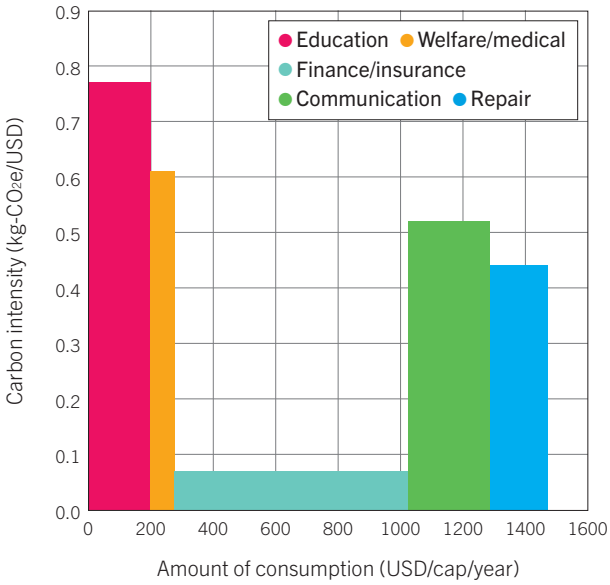


Figure 11 Skyline chart of Service domain consumption amounts and carbon intensity



3.6 Leisure

Finally, leisure contributes 4% to overall emissions in Cape Town and is predominantly made up of restaurant related emissions (66%), with hotel and tourism (19%) as the next main contributor. Cultural (7%) sporting (6%) or other leisure (2%) related emissions contribute minimally to emissions. This may speak mainly to Cape Town's strong food culture, as well as the fact that most social and tourist activities are associated with either dining and environmental exploration, such as visiting the mountains, beaches or waterfronts.

Figure 12 Proportion of carbon footprint by component for Leisure domain (kgCO_2e/cap, %). Date of data is 2012.

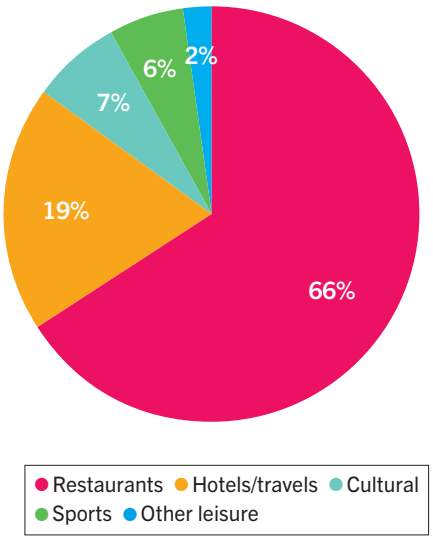
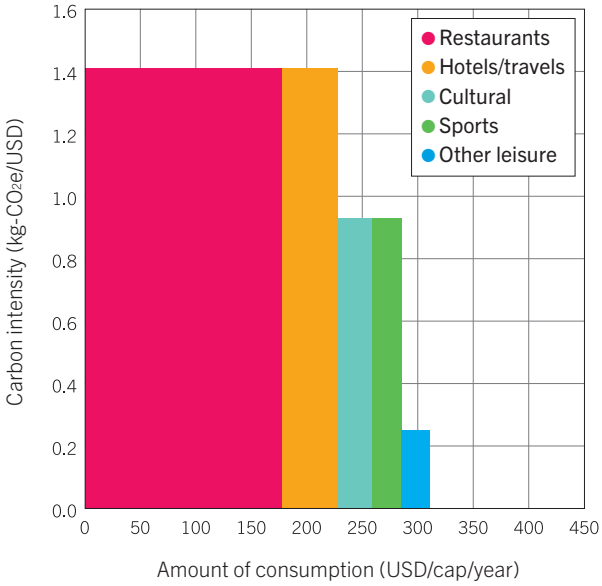


Figure 13 Skyline chart of Leisure domain consumption amounts and carbon intensity



3.7 Key Impact Areas

As explored above, the key hotspots for Cape Town's emissions are food, housing, mobility and goods, with meat, cars and home electricity consumption as the largest individual contributors to greenhouse gas emissions. The fact that every type of good or service is produced or transported by coal-based electricity or fossil fuel-based transport means that it is very difficult for anyone to entirely disconnect from the carbon economy. Even by installing renewable energy or taking public transport, most daily needs and recreational activities still come with a carbon impact. Nevertheless, given that transitioning energy systems takes a long time, that the City of Cape Town and its residents do not have full agency to drive an energy transition, that some lifestyle activities are not energy-related, and that building consciousness about lifestyle impact has social and environmental co-benefits, it is worth contemplating how lifestyle changes can help to bridge the climate mitigation gap.

4. CITY VISION

4.1 Development of a Future Vision

Through workshops and interviews with fourteen (14) Cape Town residents, as well as 153 survey responses from Cape Town residents during the Rise Africa 2021 Action Festival[4], participants were asked what vision they had for the future of their city. Participants expressed that the future of Cape Town is inclusive, about people, sustaining, safe, full of opportunity and equal, amongst other important needs and priorities for the city (see Figure 14).

Figure 14 RISE Africa Action Festival responses to a vision for Cape Town in 10 years

4 https://riseafrica.iclei.org

The adoption of Future Lifestyles for Cape Town is a means towards inclusive and safe urban spaces that are integrated with nature, all while supporting the need to urgently respond to challenges such as urban poverty, urbanisation and inequity in the city. As such, the vision proposed by participants for Cape Town in 2030 is one that should be **inclusive**, **environmentally sustainable** and **climate resilient**. To achieve a vision of an environmentally- and people-friendly city, middle- and upper-class urban residents (the high-consumers) need to take on personal lifestyle changes, with the government simultaneously supporting low-emission infrastructure such as: recycling, organic waste diversion and treatment, public transport, and sustainable energy options. All citizens in Cape Town could contribute to reducing carbon emissions by changing their dietary patterns to low-carbon foods, many of which are also in line with improving dietary nutrition. To support individual efforts, there need to be systems in place that ease the transition to less carbon-intensive 1.5°C lifestyle options. If these infrastructure are implemented effectively, they will contribute to changing aspirations towards low-carbon lifestyle options that could be perceived as more convenient, affordable, and culturally resonant. This is important as low-consumers transition into a consumptive class with more purchasing power – what aspirations are driving their choices?

The vision presented in this document is to reduce Cape Town's average annual carbon impact significantly, by up to 6.2 t-CO_2e/capita/year. The actions that could support this reduction require drastic changes in food consumption to take on plant-based diets, use of public transport, investment in net-zero energy homes and opting for online services and long-lasting goods. At this time, these actions are perceived to be unlikely to be adopted by all residents in the city (low-adoption rates). This vision acknowledges the need for infrastructure systems to also change to enable and support low carbon activities. An absolute reduction by 6.2 tons per person means the city would arrive at 3.0 tons per person, still short of 2.5 ton/person goal by 2030. The scenario does not consider the complete transformation of national energy production away from coal, nor the uptake of 100% electric vehicles (presuming a renewable electricity grid) for food and goods transportation, as these are not within Cape Town residents' nor the government's capabilities to enact. Nevertheless, these two changes are noted by the City of Cape Town (2020) as vital for the effective reduction of climate impacts, and will contribute to reducing the carbon footprint and narrowing the gap to be filled by households to achieve the 1.5°C Lifestyles target of 2.5 t-CO_2e/capita/year by 2030.

Cape Town is still grappling with social and spatial equality challenges, which means citizens are emitting carbon dioxide at varying levels, with higher earning individuals contributing significantly to the city's carbon dioxide per person quota. The relationships between income and carbon emissions are not all linear: the spatial reality of the city is such that most low-income residents live farther from the city centre and associated employment opportunities. This means, for example, that they must travel farther during their workday. The carbon-intensity of these distances is reduced as the modes of transport more typically used by low-income residents are buses or minibuses. The tension posed by trying to reduce carbon emissions while undoing spatial exclusion and improving overall income in the city is a central theme of Cape Town's scenario, and can be summarised effectively as **promoting attractive low-carbon lifestyles (and enabling these) while not placing restrictions on people's aspirations or right to a quality life**. The vision for Cape Town in the year 2030 is largely concerned with individual and institutional initiatives in the name of social equity, but several carbon-related themes have been expressed and emphasised. These include:

- An interconnected city where citizens can live, work and play within a 15-minute radius – compact communities with fast cross-city transit lines.
- Incorporating the natural environment into the built form with greenery and permaculture.
- Sustainably sourced and affordable food options.
- Adequate recycling systems.
- The adoption of sustainable technology solutions.
- Investment in locally sourced products.

There are many lifestyle options that are carbon neutral. Through a collective effort from high-consuming citizens, it is expected that the city can encourage a culture of low-carbon intensive activities that can be paralleled with systemic changes that support carbon neutrality. Participants listed activities, hopes and vignettes for the city and clustered them together. Through this process, a vision for Cape Town emerged that could be expressed as 3 key themes:

- **Social Justice** - A Just Transition is vital for a city that has high inequality and many residents who do not have adequate access to resources, let alone the option to choose what types of public and household services they would prefer. Approaching sustainability in Cape Town means ensuring that every activity contributes to improving the quality of life for all, and recognising the underlying legacies which hinder environmental justice.

- **Environment** – Much of Cape Town's economy and social amenities are based around the city's unparalleled natural beauty. The city is home to a biodiversity hotspot and has many ecologically sensitive areas which need protection and consistent regeneration. These natural areas are used by residents and visitors alike, which is important for socialising, and staying physically and mentally healthy. The negative impacts of human's interaction with nature must be mitigated.

- **Climate Resilience** - Climate change shows how interconnected everything is, and low-carbon lifestyles draw attention to the collective effort needed to achieve a just transition for people and nature. If, by taking on low-carbon lifestyles, residents are able to be more thoughtful and purposeful about how they choose to live, both as individuals and as part of multiple communities, then the value of these chosen activities can go far beyond climate mitigation, and enrich lives and strengthen communities.

In voicing how this vision could manifest, Cape Town participants reflected further and crafted a few future-statements for the city. The first implies that to improve climate resilience, residents could purchase electric vehicles or adopt activities such as using public transport as the main mode of transport, opt for virtual forms of meeting rather than commuting and flying between cities, cycle safely in and between compact communities, and compost food waste while having home gardens.

> *In the Future Cape Town, residents will be able to cycle in the city, reach the majority of goods and services within a short distance, be able to have their recyclable materials and organic wastes collected from their home, compost at home where [food] gardens could benefit from this, be able to enjoy the natural environment around them, and support local tourism.*

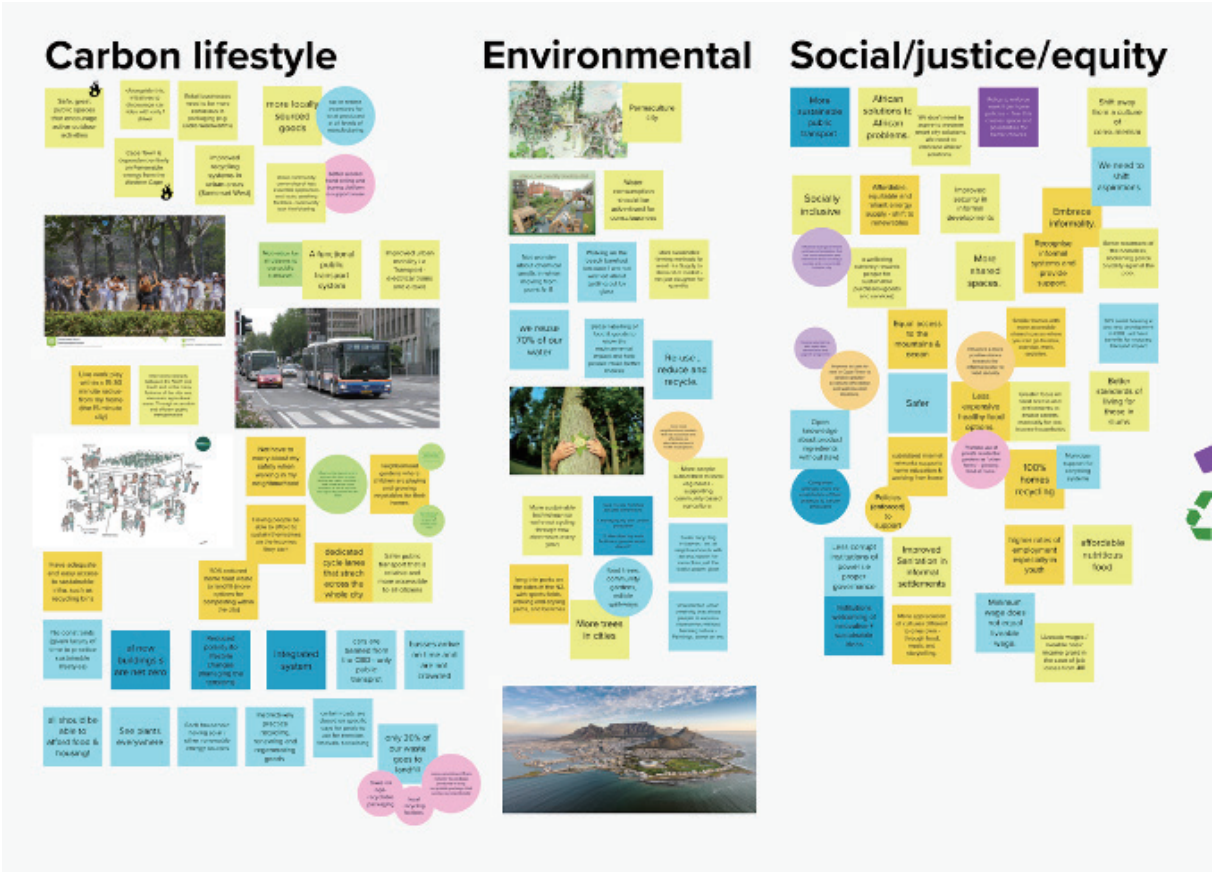
Although there are a number of activities that individuals can incorporate into their home lifestyles, there is evidence that our natural environment needs protection and revitalisation.

> *In the Future Cape Town, residents will be able to enjoy the incorporation of the built environment into the natural environment. The city and residents will invest in adding greenery to the city to restore lost vegetation while also creating spaces where residents can socialise in, and enjoy, outdoor activities.*

Cape Town, as a South African city, has a very high inequality index of 0.61 (based on the Gini Coefficient). The high rates of poverty in the city are evident in the built form, from townships and informal settlements that are far from the city centre and have limited services, to a growing informal sector population. A vision for the future of Cape Town must account for a significant reduction in poverty, improved services in townships and informal settlements, better access to resources and food for marginalised communities, and improved transport systems.

> *In the Future Cape Town there will be no marginalised Cape Town residents - they will have been afforded both physical and economic access to water, sanitation and energy resources. Additionally, residents will be able to access the city centre for jobs and resources through an efficient public transport system. Residents will also be able to access healthy, locally produced food. Cape Town, in the future, will be a socially inclusive city which will welcome all to enjoy its cultural and natural wonders.*

Figure 15 Workshop 1 - Future Cape Town Vision



4.2 Alignment with City of Cape Town Vision

The ideas raised by residents are mirrored in the City of Cape Town's internal visioning process and shared as part of its commitment to becoming net-zero by 2050 (City of Cape Town 2020). The vision notes the aim of poverty reduction, the many policy processes which have been undertaken by the city to set goals, and a number of desires for the Cape Town of 2050 in relation to the economy and waste, transport, buildings and energy sectors. It charts the City's ongoing energy and climate mitigation journey, and lists a series of actions and desires that could be undertaken. These are shared broadly as:

- Economy: Living wage, e-working, digital education, green procurement, carbon negative economy, knowledge economy.
- Waste: waste-energy solutions, recycling, zero waste to landfill, no dirty industries
- Transport: integrated transport system, bicycle networks, quieter city, electric buses and solar trains
- Buildings: high density mixed use, cooler city, safe city, urban gardens and green roofs & farms
- Energy: onsite generation, efficient batteries and storage, clean and affordable energy

It represents the idea of the city as an enabler, and fits with the remarks from residents and the outcomes of this project's quantitative research: choice and behaviour change can only go so far in reducing greenhouse gas emissions, yet the right enabling environment can support residents to do more, in ways that feel easy.

Illustration: Tania Vicedo

5. LIFESTYLE CHANGE TOWARDS 2030

5.1 Highlights of Cape Town in 2030

To get from 9.2 tCO_2e/person/year in 2020 to 2.5 tCO_2e/person/year in 2030 and 0.7 tCO_2e/person/year in 2050 will require radical changes to infrastructure and behaviours. What emerges from exploring the mitigation options is that the choices and actions of residents can only go so far, and that the scenario which will effectively achieve 1.5°C Lifestyles will be about the public and the City meeting halfway.

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

- Reducing meat consumption and substituting it with other food groups, supporting a burgeoning plant-based food industry
- Lowering food waste and composting, and, where possible, using this compost in home gardens to subsidise fresh produce, reducing the external impacts of their purchase
- Installing rooftop solar photovoltaics and solar water heaters will reduce dependence on coal-based electricity for household needs, particularly the large demand needed for water heating
- If solar cannot cover cooking needs, switching to gas stoves (more efficient) as a transition fuel can reduce cooking-related emissions.
- More citizens, who are able to do so, will work from home for all or some of the time, reducing transport-related emissions while also lowering traffic on the roads
- Decreasing the number of flights, particularly for work-related commutes, and in favour of local holidays and tourism can reduce airline-related emissions
- Choosing to purchase quality clothing and equipment, or to rent them, as well as investing in repairing clothing and shoes will challenge a culture of planned obsolescence
- Opting to recreate and socialise outside, and to invest in local tourism opportunities will reduce indoor energy use and the associated carbon impact

5.2 Aggregated Mitigation Potential

A list of 37 1.5°C lifestyle options was created and the mitigation potential (in $kgCO_2e$/cap/year) was estimated for each. The mitigation potential means that if 100% of residents took on this lifestyle option, they could reduce the carbon footprint of Cape Town by the estimated amount. However, there are two points to keep in mind: firstly, not everyone will take on all behaviours – turning off lights is a simpler proposition than going vegan - so an adoption rate for each option must be estimated, based on its ease or desirability; and secondly, many of the options considered overlap in some ways. This section will share the 1.5°C

lifestyle options for each domain, their mitigation potential, their adoption rate,[5] and the ways in which they overlap. Each option has been calculated with attention to potential rebound effects, where possible, within the scope of Cape Town. For example, reducing consumption of meat will necessarily increase consumption of other food groups and; working from home will reduce transport-related emissions yet increase energy associated with communications technology. This will all result in a calculation of the potential reduction in emissions, and an estimated reduction that is based on the proposed adoption rates.

In the food domain, growing vegetables at home, reducing portion size, reducing alcohol consumption and reducing consumption of soda and juices can be done without any overlap. However, reducing portion size will influence the uptake of vegetarianism and the more holistic plant-based diets (no animal products whatsoever). It will also reduce the overall mitigation potential of composting, by reducing wastage (which is a co-benefit of this option), and influence the mitigation options under the Leisure and Services domain, namely taking home leftovers from restaurants or choosing to eat at vegetarian restaurants. Uptake of the four non-overlapping options in the food domain would result in the mitigation of 1,630.3 kgCO_2e/cap/year (a 39% reduction), while uptake of all possible options would result in the mitigation of 4,014.4 kgCO_2e/cap/year, equivalent to a 96.5% reduction of the total emissions impact from food. A 100% uptake would effectively mean that the only greenhouse gas emissions remaining are from reduced portion sizes of cereals, beans/nuts, vegetables, and fruit, with any food wastes effectively composted. However, based on the adoption rates, this scenario is unlikely, and if the top four options were taken on at their adoption rates, the total reduction for food would be 375 kgCO_2e/cap/year.

Table 1 Mitigation potential and adoption rate by option for Food

Domain	Option	Mitigation Potential (kg-CO_2e/cap/year)	Adoption rate (%)
FOOD	Reduce Portion Size	1,024.0	14
FOOD	Follow a Vegetarian Diet (predominantly vegetables, with some animal products, but not meat)	930.7	46
FOOD	Eliminate Consumption of Soda and Juices	470.4	50
FOOD	Compost Kitchen Waste	320.4	64
FOOD	Reduce Alcohol Consumption	129.3	NO DATA[6]
FOOD	Follow a Plant-Based Diet (no animal products whatsoever)	3,083.4	14
FOOD	Grow Vegetables at Home	6.6	57

In the Housing and Goods domains, which are combined for ease of seeing the interrelations, there are three options which can be taken up without overlap: invest in a net-zero energy house, maintain and repair electronics and repair clothing. The choice to repair clothing is a complementary option to purchasing quality clothing, but both make use of similar calculations about the lifetime of clothing. Thus, repair clothing has a higher mitigation potential than purchasing quality clothing as a standalone. Investing in a net-zero energy home effectively renders all of the other energy-related technologies or behaviours unnecessary (or at least drastically reduces their impact). Therefore, the 100% uptake mitigation potential for home and goods could be seen as the sum of the three primary options, and would total 1,144 kgCO_2e/cap/year or a 37.6% reduction to the baseline footprint of the combined Housing and Goods domains. If this calculation is based on the perceived adoption rates, the figure is only 337.7 kgCO_2e/cap/year.

5 The adoption rate for each option was calculated based on the perceptions of residents who participated in this project. They were asked to vote (in surveys and workshops) for the options that they thought could and would be adopted by all in Cape Town; the votes for each option were divided by the total number of participants, resulting in a percentage adoption rate. Some options which were not included in the exercise or survey, and therefore do not have adequate data about adoption rates, are noted as 'NO DATA'.

6 Some options which were not included in the exercise or survey, and therefore do not have adequate data about adoption rates, are noted as 'NO DATA'.

Table 2 Mitigation potential and adoption rate by option for Housing & Goods

Domain	Option	Mitigation Potential (kg-CO_2e/cap/year)	Adoption rate (%)
HOUSING & GOODS	Invest in a Net-Zero Energy House (Solar PV)	742.0	21
HOUSING & GOODS	Install a Solar Water Heater	289.4	50
HOUSING & GOODS	Halve Shower Time or Bathwater Level	226.7	36
HOUSING & GOODS	Switch to Gas Cooking (from current coal-based electricity)	202.5	57
HOUSING & GOODS	Water-Saving Shower Heads and Taps	127.4	50
HOUSING & GOODS	Repair Clothing	114.8	48
HOUSING & GOODS	Maintain & Repair Electronics	109.1	36
HOUSING & GOODS	Purchase High-Quality Clothing	85.7	71
HOUSING & GOODS	Reduce Geyser Temperature	45.3	29
HOUSING & GOODS	Install EE Light Bulbs	38.5	NO DATA
HOUSING & GOODS	Use Solar Lighting	22.3	NO DATA
HOUSING & GOODS	Task Lighting	17.4	86

There are two groups of options under the mobility domain: those related to air travel and those related to commuting and intra-city transport. While working from home may represent the largest potential mitigation, it is only feasible for those doing knowledge work or providing services that can be offered at a distance (estimated as 20% of the population). The lockdowns related to the COVID-19 pandemic effectively stopped all work, except for emergency responders and vital services such as food and grocery logistics; they also grounded any leisure flights.

Assuming 5% of the population was commuting for vital services, what this represents in relation to the mobility emissions baseline is a mitigation of 1,076 kgCO_2e/cap/year, or a 95.9% reduction in the mobility domain. Assuming a 'commuting as usual' state in the city, and taking only the two most impactful mitigation options of stopping all flying and shifting to public transport, a 100% uptake would represent mitigation of 805.4 kgCO_2e/cap/year or 71.8% reduction from baseline. Using the proposed adoption rates, the total reduction is only 179.8 kgCO_2e/cap/year.

Table 3 Mitigation potential and adoption rate by option for Mobility

Domain	Option	Mitigation Potential (kg-CO_2e/cap/year)	Adoption rate (%)
MOBILITY	Use Public Transport	570.6	29

Domain	Option	Mitigation Potential (kg-CO_2e/cap/year)	Adoption rate (%)
MOBILITY	Use An Electric Vehicle (With the means to charge it using renewable energy – i.e. Solar Power)	469.1	14
MOBILITY	Carpool	376.6	29
MOBILITY	Cycling To Work	265.8	36
MOBILITY	Stop Flying	234.7	7
MOBILITY	Work From Home	126.6	48
MOBILITY	Halve Local And International Flights	117.4	38
MOBILITY	Use An Electric Vehicle (With Current Electricity Mix)	86.2	21
MOBILITY	Walk To Work	17.7	36

Most of the options in the Leisure and Service domains do not overlap and can therefore be simply summed. However, choosing vegetarian restaurants, taking leftovers from restaurants and reducing portion size (from the food domain) are interrelated. Sharing books and using the public library render the use of eBooks negligible. Relaxing outside assumes that residents are entertained without electric devices, yet this option is rendered unnecessary if the house is using renewable energy (net-zero energy home). The use of eServices, while reducing the direct impact of having multiple branches open, also reduces the need to use transport, and is thus connected to the mobility options. Summing a 100% uptake of primary options that are not in conflict results in a mitigation potential of 345.2 kgCO_2e/cap/year, or a 40.8% reduction from the baseline of both the Leisure and Services domains. Using the perceived adoption rates to calculate reductions, the reduction is only 201.4 kgCO_2e/cap/year.

Table 4 Mitigation potential and adoption rate by option for Leisure & Services

Domain	Option	Mitigation Potential (kg-CO_2e/cap/year)	Adoption rate (%)
LEISURE & SERVICES	Relax Outside	139.5	79
LEISURE & SERVICES	Halve the Time on Mobile Phones and Computers	116.0	NO DATA
LEISURE & SERVICES	Choose Vegetarian Restaurants	80.1	NO DATA
LEISURE & SERVICES	Go Camping	58.4	36
LEISURE & SERVICES	Take Leftovers From Restaurants	52.6	NO DATA
LEISURE & SERVICES	Share Books & Public Library	13.5	21
LEISURE & SERVICES	Share and Repair Small Tools and Equipment	7.0	NO DATA
LEISURE & SERVICES	eBooks	0.1	50

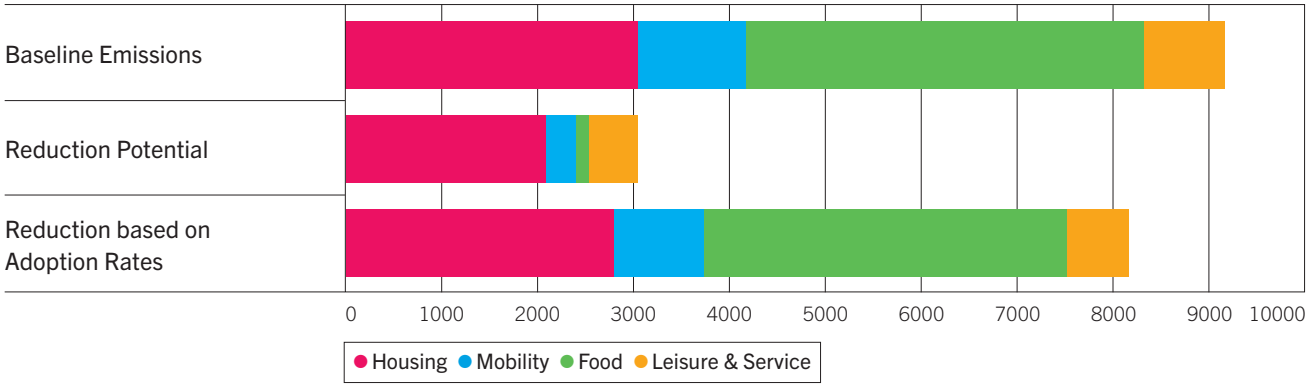
5.3 Expected Changes in Lifestyle Carbon Footprints from 2020 to 2030

Based on the discussion in Section 5.2, an overall mitigation potential for Cape Town can be estimated by avoiding certain options entirely or calculating what the overlaps could mean. Summing the 100% uptake values from each of the above domains, the total mitigation potential is 6,363.7 $kgCO_2e$/cap/year or a 69.7% reduction from total baseline emissions. However, based on the current articulated adoption rates, the calculated reduction is 718.8 $kgCO_2e$/cap/year or 7.8% of the total emissions. What this means is that the lever for reducing more than 7.8% of total emissions requires improving individuals' adoption rates, raising the reduction potential towards 69.7%.

Figure 16 shows baseline emissions, the reduction potential with 100% uptake of low-carbon lifestyle options, and the calculated reduction based on the current perceived adoption rate. This figure may starkly represent the limited readiness of Cape Town residents to take on the 1.5°C lifestyle options.[7] However, it does demonstrate that large reductions are possible under the right circumstances, and therefore the focus for policy makers should be how to increase the adoption rates for these options, and improve their uptake.

Almost every engagement with residents included the need for physical, social and economic support systems so that it is not a burden for residents to take on low-carbon lifestyle options. These include education, guidance, or the right incentives to drive uptake, as well as physical infrastructure that substitutes carbon-intense processes or makes low-carbon options easy, convenient, reliable, safe, affordable and the obvious choice. It will require a concerted effort to bridge the gap between a current reduction potential to 8.15 tCO_2e/cap/year, based on current adoption rates, and the potential reduction to 3.03 tCO_2e/cap/year.

Figure 16 Baseline Emissions, potential reductions if all residents take on all practices, and a current reduction potential, based on estimated current adoption.



7 It is worth reiterating that due to low sample numbers in the Cape Town workshop and survey processes, future city scenario recommendations should be understood to be thematic and not representative of the entire population.

6. RECOMMENDATIONS FOR STAKEHOLDERS

6.1 City of Cape Town Commitment to Climate Neutrality

The City of Cape Town has already expressed a strong, non-punitive commitment to achieve carbon neutrality by 2050. It is notable that Cape Town's recommendations are mostly technological, possibly influenced by the knowledge that encouraging behaviour change is difficult, and noting that many lifestyle changes to reduce consumption may not be possible because of existing low consumption levels of many of its residents. With this in mind, while a strong technological approach takes the burden off residents, it may be important to develop a strategy whereby certain lifestyle choices are valued by residents and easy for them to uptake. Here, lessons from the Cape Town water crisis could be used. The crisis revealed that in order to see water consumption behaviours change, residents must understand:

- How the system works
- How they interact with the system – how their actions influence the system
- Why they should change their behaviours
- How they can change their behaviours – what steps they could take on pragmatically

The City of Cape Town's Climate Neutral Commitment (City of Cape Town, 2020) outlines a number of activities that residents can do to contribute to reducing greenhouse gas emissions. Their suggestions include:

- carpooling when e-hailing and commuting
- installing energy efficient appliances
- installing rooftop solar
- using an electric vehicle
- recycling
- travelling by bus
- taking trains
- planting trees

Most of these are technology-based options, rather than driven by specific behavioural change. The City of Cape Town notes other key drivers of climate neutrality as 'motivating citizens to make localized, responsible consumption choices that are better for their well-being and the environment, and also minimize embedded carbon in the production and transport of goods and services', and 'low-carbon development and service delivery models' (City of Cape Town 2020).

What the above suggests is that Cape Town does not wish to place the burden for carbon neutrality on residents, and

where possible make the transition to climate neutrality predominantly through technical, rather than social changes. This is a promising approach, as the findings of this research suggest that while there is potential to drastically reduce greenhouse gas emissions through lifestyle changes, many of these are highly dependent on availability of the appropriate supporting infrastructure. Further, the current perception is that few residents would adopt low-carbon lifestyle options, suggesting limited readiness for a drastic change in lifestyle. Leading such a change may be possible through technical improvements in buildings, energy systems, transport and waste infrastructure.

6.2 Stakeholder Roles in Overcoming Barriers to Low-Carbon Lifestyles

Engagements with Cape Town residents, and reflections on household experiments with low-carbon lifestyle options revealed a few types of obstacles to the uptake of these options. These include:

- Limited awareness of how personal actions impact climate
- Lack of appropriate infrastructure, goods or services
- Lack of availability and accessibility to low-carbon options
- Coal-based electricity & fossil fuel-based transport
- Cultural resistance

As expressed throughout the report, there are multiple key stakeholders that have the potential to play transformative roles in Cape Town's journey towards a low carbon future. In order to achieve the vision presented in this report, new ways of thinking and doing will be required in both the short and long term. The table below highlights high-level responsibilities that local government, businesses, citizens and civil society can adopt in working towards the Cape Town City Vision. The proposed recommendations for stakeholders to enable lifestyle changes and realise the desired future given the above obstacles is summarised in Table 5.

Table 5 How government, business and community stakeholders can contribute to overcoming 5 obstacles to low-carbon lifestyles

Obstacles	Enabling environments	Recommendations for Stakeholders		
		National & local government	Businesses	Community based organisations & citizens
Limited awareness of how personal actions impact climate	Public education and awareness	• Collecting consistent data on consumption-based greenhouse gas emissions and their interactions with household activities • Encouraging new habits through government programmes targeted at households • Coupling new infrastructure with education on how that infrastructure contributes to social and environmental benefit, and encourages residents to use it • Installing smart meters to monitor usage and ensure these data are available to citizens (it should be noted that smart meters should not be used in a punitive manner)	• Offering new services that are low carbon • Adopting business models that incentivise residents to take on low-carbon approaches • Providing technology / innovations that allow monitoring of resource use or uptake of low-carbon activities	• Creating learning opportunities such as workshops and information emails to advise other citizens on best practices for adopting new low carbon actions • Creating information and accountability groups fosters solidarity in adopting low-carbon options

Obstacles	Enabling environments	Recommendations for Stakeholders		
		National & local government	Businesses	Community based organisations & citizens
Lack of appropriate infrastructure, goods or services	Provision of infrastructure	• Government needs to develop and provide infrastructure that supports low carbon lifestyles, such as more widespread public transport, opportunities to start community gardens, and recycling centres • Use sustainable public procurement to support creation of a market for low-carbon infrastructure	Businesses can collaborate with government to support the provision of affordable goods and services	Cbos and communities should be proactive in community forums to voice community needs and effective solutions that respond to community challenges while ensuring care for their environment Individuals in communities can commit to supporting local businesses
Availability and accessibility to low-carbon options	Products are designed to be regenerative, reusable, redesigned, and recoverable	• Government can support locally produced goods and service providers • Government uses sustainable procurement processes to ensure that they are procuring goods and services that contribute to carbon mitigation. Doing so also creates a market for such goods and services, often reducing their cost • Additionally, government should take on the responsibility of influencing the production of sustainable goods, infrastructure and services through incentive programmes	• Local businesses have the opportunity to offer low-carbon products to their communities • Prioritising low-carbon manufacturing and distribution processes • Develop business models that reduce waste and take whole of life perspectives for goods manufacture and dismantling	Individuals in communities can commit to supporting local businesses
Coal-based electricity & fossil fuel-based transport	Renewable energy incentives	• National government must immediately invest in a renewable energy transition, in which coal is phased out and renewable energy is fast-tracked • Incentivise renewables independent power producers with guaranteed purchasing agreements • Promote transformation of vehicle fleets to electric vehicles - increased renewable electricity reduces the carbon-impact of electric transportation	• Pressure government to decommission coal power plants and support renewable energy production • Invest in embedded renewable energy generation for businesses or industry • Hybridize petrol stations to offer electric charging ports	• Coal mining unions should equip their members with skills for new jobs • Community organisations should pressure government to decommission coal power plants and support renewable energy production, particularly citing health and environmental impacts

Obstacles	Enabling environments	Recommendations for Stakeholders		
		National & local government	Businesses	Community based organisations & citizens
Cultural resistance	Make low-carbon cool	• Government can partner with influencers to encourage uptake of low-carbon lifestyles • Offering incentives or rebates for the installation of low-carbon technologies	• Advertising should centre on how low-carbon lifestyle choices are good for individuals and communities, shifting away from equating high-consumption with success, but rather, demonstrating how high-quality, low impact products are more enjoyable and make you cool	• Communities can work together to raise local awareness of the various low carbon options, and normalise them in conversation and practice

7. CONCLUSIONS

The lifecycle carbon footprint of Cape Town was estimated to be 9.2 tCO_2e/person/year, with 45% of this due to consumption of food (with meat having the highest impact). Housing (22%), Mobility (12%) and Goods (12%) are the next most impactful types of consumption, with Services (5%) and Leisure (4%) contributing minimally to the overall footprint. What this means is that for most Cape Town residents, changing what or how much they eat can lead to the greatest reduction in carbon footprints. It is worth noting that while goods, leisure and services are low contributors at the moment, as Cape Town's middle class grows, these domains will become more impactful, unless low-carbon approaches are taken up.

A set of 37 low-carbon lifestyle options was developed. Each option has a calculated mitigation potential (in $kgCO_2e$/person/year) by which it could reduce the city's carbon footprint if all residents adopted it. For example, the mitigation potential for switching to a plant-based diet is 3,083 $kgCO_2e$/person/year, carpooling is 376 $kgCO_2e$/person/year and repairing clothing instead of purchasing new clothing is 293$kgCO_2e$/person/year. If all options were adopted (ignoring those that overlap or are contradictory, such as taking public transport versus carpooling), Cape Town's carbon footprint could be reduced to 3.03 tCO_2e/person/year. However, based on project participants' perceptions of realistic current adoption rates (i.e. what proportion of residents would adopt each option), the current reduction is more closely estimated to reach only 8.15 tCO_2e/person/year. This low readiness to adopt low-carbon options is arguably due to five key obstacles:

- Limited awareness of how personal actions impact climate
- Lack of appropriate enabling infrastructure, goods or services
- Limited availability and accessibility to low-carbon options
- Coal-based electricity & fossil fuel based transport, that may undermine the impact of a low-carbon choice
- Cultural resistance

The City of Cape Town articulates its role driving carbon neutrality to be about enabling solutions in a number of sectors, including Buildings, Energy, Spatial planning, Transport, Waste generation and management, and Agriculture and land use. The City notes other key drivers of climate neutrality as 'motivating citizens to make localized, responsible consumption choices that are better for their well-being and the environment, and also minimize embedded carbon in the production and transport of goods and services', and 'low-carbon development and service delivery models' (City of Cape Town 2020). What this suggests is that the City of Cape Town does not wish to place the burden for achieving carbon neutrality on residents, and where possible make the transition to climate neutrality predominantly through technical, rather than social changes. This is an important approach, as the findings of this research suggest that while there is great potential to reduce greenhouse gas emissions drastically through lifestyle changes, many of these are highly dependent on availability of the appropriate supporting infrastructure and incentives to use them. That said, the themes and options explored in this report suggest that many consumption side contributions can be made by Cape Town residents, and this should not be overlooked. Reducing the carbon footprint from 9.2 tCO_2e/person/year in 2020 to 2.5 tCO_2e/person/year in 2030 and 0.7 tCO_2e/person/year in 2050 will require radical changes to energy systems, enabling infrastructure and behaviours. With the growing commitment from the City of Cape Town, the scenario for achieving a 1.5°C Lifestyle in Cape Town revolves around the point where the residents' will and City's support meet.

Further research to expand the list of lifestyle options and update the representation of their potential adoption rates across different socio-economic groups would support a strategy for promoting appropriate lifestyle options based on consumption profiles. This research can also connect the lifestyle options with the types of available infrastructure in different neighbourhoods or parts of the city. Improving the consistency of data collection and evaluation by the City of Cape Town could ensure that changes are tracked consistently and that current carbon reporting considers more than energy-related emissions.

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