Consumption-Based GHG Emissions Policy Framework for Cities

CNCA
CARBON NEUTRAL CITIES ALLIANCE

gaia
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Prepared for

The Carbon Neutral Cities Alliance

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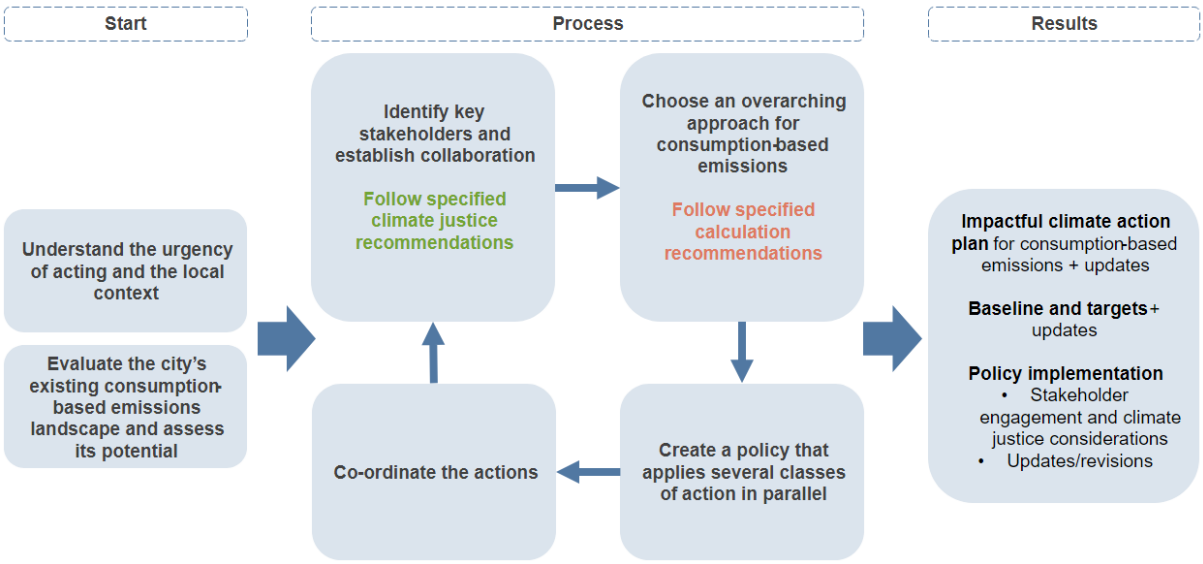
Gaia Consulting team

Executive summary

This policy framework supports cities' holistic and systematic reduction of their consumption-based greenhouse-gas emissions (CBE), with climate justice as a guiding principle. CBE refers to consumption-based scope 3 emissions – all GHG emissions that occur outside the city boundary as a result of activities, i.e., consumption, taking place within the city boundary. Though substantial, these emissions have not yet received major attention in many cities. To fill the knowledge gap and leverage C40 cities' prior research highlighting those consumption sources that hold the greatest potential for significant emission reductions at city level, the policy-framework working group chose foods, textiles, and electronics and household appliances as the consumption-categories to focus on.

Cities' pathways to reducing CBEs is not linear but a continuous iterative process of doing, learning, and adjusting considering the evolution of information gathered, the tools and technology available, and stakeholders' input. The policy framework suits both the cities whose efforts have progressed further (e.g., those that have developed a consumption-based emission inventory (CBEI) and have a plan for decreasing these emissions, and those cities taking their first steps (for instance, investigating the topic, to develop greater understanding). Though iterative, the policy-framework process is modelled in terms of several distinct steps to address CBEs, outlined in the diagram below.



Step 1: Preparing. The city should understand the urgency of acting, commit to decreasing its CBEs, know what is already being done by and within the city in this regard (many cities already engage in related activities), and develop the city organisation's relevant internal capacities. In this stage, cities identify stakeholders with a crucial role in reducing the emissions.

Step 2: Integrating climate justice. Climate justice is not following a set of steps but genuinely committing to a way of working that leads to more inclusive and, hence, effective climate

actions. Incorporating climate justice into city policies entails developing a solid understanding of the city-specific priority communities and the burdens they currently bear, then focusing on three key endeavours informed by that awareness: 1) bringing equity to the core of policymaking (e.g., via a central commitment or a dedicated climate-justice working group); 2) empowering priority communities and cultivating their engagement with policymaking by means of such solutions to minimise possible engagement barriers as provision of multiple accessible channels for participation and compensation for the participants' time; and 3) assessing the policies' and strategies' potential impacts on priority communities.

Step 3: Choosing the approach and actions for emissions' mitigation and inventorying. When deciding on the granularity of their approach, cities should consider the purpose, the outputs' use, and any possible barriers – such as resource-scarcity or data-availability issues. For systematically addressing the emissions, **a deeper approach** is advised, which entails creating a CBE action plan that includes a regularly updated CBEI. On this basis, cities can either develop an umbrella strategy, covering consumption of all kinds, or adopt several strategies, each tuned to a particular consumption category (such as food, textiles or electronics and appliances). However, neither an action plan nor a CBEI is required for progress toward emission reductions – cities taking **a lighter approach** can develop actions focused on consumption categories and specific products that research has identified as emission-heavy (e.g., food and meat, respectively). Monitoring a few indicators for these can serve as a steppingstone toward a more comprehensive CBE action plan and regularly updated CBEI.

Step 4: Selecting a baseline and conducting the CBEI. Cities can anchor their inventory in any of three calculation approaches, as contextual elements such as the city's targets and availability of local data dictate: 1) **a top-down approach** that takes national averages as the starting point for describing local consumption patterns; 2) **a bottom-up approach** with tracking of local consumption by means of surveys and local consumption data, such as waste services' data on food-waste quantities; or 3) **a hybrid approach** that brings together large-scale national statistics and locale-specific details. Each has its pros and cons. With the top-down approach, obtaining the data is simpler (if a national data pool exists), but it serves broad informational aims and cannot inform local policy-impact evaluations, while a bottom-up approach can guide a city's policy development but is rendered more resource-intensive by the data-acquisition efforts required. Finally, a hybrid approach aims to find a balance, typically by complementing a top-down approach with, where needed, acquisition of more precise bottom-up data to enable policy-design guidance. To pin the CBEI results against a set of historical data. Often, a city's emissions are tracked over time against emissions from a certain year. The baseline year chosen should represent the usual emission levels from consumption (hence, 2020–2021 might not be a good choice, on account of the SARS-CoV-2 pandemic).

Step 5: Setting targets. Cities' targets may be based on quantities measured in the inventory and tracked correspondingly, but targets can be set in line with other means of tracking and addressing CBEs also, depending on the chosen approach. Just as CBEI approaches do, targets differ in the purposes they serve. For example, setting quantitative targets for certain emission indicators can inform corresponding policy actions, while more qualitative targets suit

educational or inspirational aims. Both have value. The city's chosen CBEI approach might support quantitative targets for overall levels well (e.g., a 30% reduction in sum-total CBEs) and/or favour more qualitative targets specific to high-emission consumption categories (e.g., reduced meat consumption). Qualitative targets, that are easier to set, can aid in 'getting things moving' before the groundwork has been laid for quantitative ones.

Step 6: Designing a policy mix to decrease CBEs. The most effective policies cover actions of multiple kinds, so cities should design a dynamic mix of actions. Through activities as engagement campaigns, a city can **encourage** by creating an appropriate culture and informing about sustainable choices; it can **enable** by means of resources such as subsidies or provision of sustainable-lifestyle advisers for residents; it can apply restrictions and mandate measures that **enforce** the desired outcomes (via urban/zone planning, emission regulations, etc.); and, with the various means at its disposal, it can actively **advocate** such that legislators and markets are more likely to support a sustainable lifestyle. The local context and the city's chosen ambition level dictate the most suitable recipe of actions.

Step 7: Monitoring the progress. Systematically tracking CBEs and how consumption patterns are developing requires regular updates to the CBEI (for instance, checking all the data every 2–5 years). This work must account for any advances in calculation methods and changes in data availability. Key indicators for emission-intensive products can function in place of a CBEI, in addition to it, or as proxies in monitoring progress that might be difficult to detect otherwise. The city must ensure a solid foundation for gauging its progress and responding to changes.

The framework presented here offers versatile tools for this seven-step journey. It can assist with cities' first practical steps on the path to addressing CBEs, or facilitate retrospective validation of steps already taken and making of prospective adjustments. Likewise, cities can apply it for a universal foundation or to inform a subset of their actions, such as tackling of sector-specific climate-justice concerns.

This report is split into four sections. The first presents **climate justice** as an integral guiding principle for engagement with priority communities to co-create just climate policies and actions. The second section, on the team's analysis of 16 city and organisational strategies for reducing CBEs, gives **a review of consumption-related strategies** that offers ideas, thus serving as a catalogue for inspiration. It identifies measures by which cities can ensure the comprehensiveness and coherence of their actions. With the next section, on **baselines and targets**, we present a step-by-step guide to organising a CBEI, setting a baseline and targets, and monitoring progress. Lessons drawn from all these sections are compiled in the final section, which directly articulates **the policy framework** for addressing CBEs. The framework, composed of 18 recommendations, possible considerations, and cities' examples, forms a direction for a city's consumption-based emission journey.

1 Introduction

1.1 Background

While cities are deeply woven into the fabric for responsibly addressing today's climate challenges, their climate action plans often focus on greenhouse-gas (GHG) emission chains directly arising from production within their administrative boundaries. Hence, this might lead to the omission of climate impacts from consumption of products and services produced elsewhere. Those emissions are clearly significant; however the volume of consumption-based emissions[1] often is twice or even threefold that of production-based emissions, and an estimated 85% of the GHG emissions associated with goods and services consumed in C40[2] cities is generated outside city limits.[3]

The sheer magnitude of these emissions is prompting cities to ask what actions they could take to reduce consumption-based emissions. Though many cities have begun advocating more sustainable consumption and tackling emissions that are less directly under their control, the associated tools, measures, and even knowledge available remain limited. Accordingly, members of the Carbon Neutral Cities Alliance (CNCA) identified a need for a consumption-based policy framework that cities can employ as a tool for developing and applying appropriate emissions policies.

In response, this project designed a policy framework to support the development of city-level actions for reducing consumption-based emissions. The policy framework is rooted in the principles of circular and sustainable consumption and in pursuit of climate justice. The project work, carried out between March 2022 and February 2023, was facilitated by Gaia Consulting.

1.2 The scope of the study

The study was designed to examine the ways in which cities can advance climate actions to reduce their consumption-based emissions. Climate-justice considerations were embedded as a key focus of this project to acknowledge and better understand the disparity

[1] For consumption-based emissions, we use the definition of the GHG Protocol: "all other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary". The definition is on page 11 at Global Protocol for Community-Scale Greenhouse Gas Inventories – an Accounting and Reporting Standard for Cities, version 1.1 (2021), available at https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf.

[2] C40 is a network in which mayors of nearly 100 cities collaborate on concrete action necessary for tackling the climate crisis.

[3] For details, see the report 'The Future of Urban Consumption in a 1.5°C World', produced as a C40, Arup, and University of Leeds joint initiative in 2019.

of burdens and benefits that various climate actions can have on specific communities and distinct groups of people.

To that end, the authors conducted a review of prior research and best practices, then enriched this via additional discoveries and concrete guidance on what cities can do to reduce consumption-based emissions. Particular attention was given to life-cycle emissions from food, clothing and textiles, and electronics and household appliances. The resulting synthesis is informed by awareness that the systems involved display inherent overlap. Just as the boundaries of the three areas of focus are porous, the operations involved extend naturally beyond scope 3 (though we refer primarily to that scope in the delineation here). This report draws together varied actions, tools, guidelines and learning from pre-existing material (strategies and action plans) to offer a fresh perspective.

The goal behind the framework is to guide cities in their future work to mitigate consumption-based emissions, for solid progress. The framework acknowledges that cities' actions are at various stages and could benefit from a broader perspective while recognising the value of understanding the various local perspectives. While this framework highlights a range of potential actions, the specific policies relevant to each city should be honed on the basis of local resources and considerations and in consultation with local stakeholders. For example, while acting on consumption-based emissions cities must likely at some point prioritise between carbon reduction and other objectives (e.g., climate justice) where they are not aligned.

Analysis conducted among C40 cities determined that those consumption sources with the greatest potential for significant emission reductions at city level are food, buildings and infrastructure, clothing and textiles, electronics and electrical appliances, private transport, and aviation[4]. The consumption categories emphasised in this framework were chosen in consideration of the associated emissions-reduction potential and the opportunity to fill a knowledge gap not already explored by other studies (e.g., CNCA work addressing embodied carbon[5]). Therefore, the following consumption-based emission categories were selected for this framework:

- **Food**

  In 2017, researchers estimated that food-linked emissions account for 13% of total consumption-based emissions in the C40 cities. They connected approximately 3/4 of these emissions with consumption of animal-based foods.[6]

- **Clothing and textiles**

[4] Details are provided in 'The Future of Urban Consumption in a 1.5°C World'.
[5] See the CNCA Embodied Carbon policy framework at Embodied Carbon Policy Framework – CNCA (carbonneutralcities.org).
[6] Per 'The Future of Urban Consumption in a 1.5°C World'.

Per the same analysis, emissions from clothing and textiles account for 4% of the C40 cities' consumption-based emissions.[7]

- **Electronics and household appliances**

  In 2017, emissions from electronics and household appliances made up 3% of all consumption-based emissions in the C40 cities. For our purposes, 'electronics' denotes consumer products such as mobile phones and computers, and household appliances are refrigerators, dishwashers, etc. The use of these goods has increased markedly, with that trend only expected to continue.[8]

1.3 Stakeholder engagement

The policy framework emerged via close co-operation between the Gaia Consulting team, the Carbon Neutral Cities Alliance, representatives from CNCA member cities, and the C40 Cities.

Table 1. The project's steering group members

City	Representative persons
Adelaide (Australia)	Andrea Bassett, Principal Climate Change Advisor
Boulder, Colorado (USA)	Yael Gichon, Project Manager Ben Katz-Moses, Data Analyst
Copenhagen (Denmark)	Cassia Simons Januario, Special Advisor Vedushan Ratnasingam, Climate Officer
Glasgow, Scotland (UK)	Gavin Slater, Head of Sustainability Emma Morton, Assistant Group Manager
Helsinki (Finland)	Johanna af Hällström, Team Leader
New York City (USA)	Ross MacWhinney, Senior Advisor
Oslo (Norway)	Guro Watten Furu, Climate Advisor

[7] Per 'The Future of Urban Consumption in a 1.5°C World'.
[8] Ibid.

San Francisco (USA)	Richard Chien, Senior Climate Program Specialist Stephanie Lee, Climate Program Assistant Coordinator
Stockholm (Sweden)	Charlotta Porsö, Project Manager
Vancouver (Canada)	Cathy Pasion, Manager Leslie Ng, Specialist Andrea McKenzie, Project Engineer
C40 Cities	Klaus Bundgaard, Senior Project manager

The process behind the framework's development was adaptive and participatory — designed to support cities in advancing their strategy work. This process, presented in the next section of the report, featured steering-group members' involvement in facilitated workshops, tasks and interviews. Throughout the project, the authors sought stakeholder viewpoints through discussions with city representatives who are in close contact with priority communities (e.g., black, Indigenous and people of colour and low-income individuals). This project benefited from this engagement, which included individual interviews and workshop discussions.

1.4 Methods

1.4.1 Foundations from a desk study

The mapping conducted as the first major phase of the project took the form of a desk study probing state-of-the-art, best practices, and complicating factors identified in relation to existing consumption and climate justice-related elements of city, company or organisational strategies. This research entailed studying existing national and city-level strategies, strategies of inter-city networks and intra-city organisations, other private-consumption-related action plans and campaigns, and associated academic research. The desk study revealed limited guidance to inform city efforts to address consumption-based emissions. Hence, to build on this emerging body of knowledge, this report looked beyond existing city climate actions and included examples of best practices, innovative ideas, and tools from other sectors. The participating cities assisted with the collection of material for the analysis, thus affording a more multifaceted perspective.

1.4.2 Interviews

In the next stage, interviews with members of the city organisations mentioned in the Acknowledgements fleshed out the understanding gained from the desk study. The aims with these complementary interviews were 1) to gain understanding of policy tools and strategies suited to influencing consumption-based emissions; 2) to cultivate insight related to the conditions of calculating consumption-based emissions, and setting baseline and targets , along with the learnings from existing strategies and the collaboration opportunities presented; 3) to understand the state of the art in various city milieux; and 4) to gain a profound sense of best practice for climate justice.

1.4.3 Workshops

The final key input to the policy framework consisted of the facilitated workshops held in collaboration with the project steering group members. The aim here was two-pronged: 1) to provide information and learning space for the cities and 2) to foster mutual dialogue through which the cities could readily exchange knowledge of challenges and best practice. The project implemented four workshops, considering, in turn, 1) consumption-based emission mitigating strategies, 2) baselines and targets, 3) climate justice, and 4) the policy framework and its real-world implementation.

All workshops were conducted remotely, with facilitation via the virtual collaboration platform Howspace[9], whereby participants engaged in tasks of several types.

1.4.4 Development of the final framework

The framework was an outgrowth from the material, data and understanding that the Gaia Consulting team obtained by means of the desktop study, interviews, and workshops, including insight and comments from CNCA representatives and participating city entities.

1.5 Definitions

For this report, we understand a **strategy** as an action plan that guides organisations' actions. Hence, our identification of city-level 'existing strategies' focused on implemented city and other relevant organisations climate action plans that, alongside some other types of action plans related to consumption-based emissions, could serve as inspiration and inform best practice.

[9] Presented at https://www.howspace.com/.

We use the concept of **policy** to refer to general action principles that guide policymaking and describe the future direction desired for development. Accordingly, policy can be understood as guidance, or a set of guidelines, that serves as a platform for future actions.

A **policy framework**, in turn, is a tool intended to guide future strategy work, by cities in the case considered here. It is a collection of several distinct policies, actions, tools, and guidelines that together constitute a source of inspiration and best practice for cities. The goal behind the framework developed is to share principles, inspiration, and knowledge as a foundation on which cities can build solid strategies and local action plans.

GHG emissions consist of the releasing of GHGs into the atmosphere, where seven GHGs specified by the UNFCCC[10] are taken into consideration: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).

Consumption-based emissions captures the life cycle GHG emissions of goods and services (e.g., food, clothing, electronics and appliances etc.) and allocates them all to the final consumer[11]. When referring to consumption-based emissions in this framework**,** our primary focus is on consumption-based **scope 3 emissions,** defined by GHG Protocol as "all other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary".[12] This choice of focus is due to the nature of the chosen consumption categories in which the bulk of emissions occur outside city borders[13].

We employ the vital concept of **climate justice** to encompass both the distribution of the benefits and burdens of climate action and the full participation of community members, with special attention to those facing the most formidable barriers to meeting their needs and thriving. Among its elements are recognising and redressing the disproportionality of burdens and of the benefits of the fossil-fuel economy by giving precedence to climate action that advances the well-being of low-income persons, Indigenous peoples, communities of colour, immigrants and refugees, and other historically marginalised groups/communities. These often-vulnerable entities worthy of special focus, denoted here as **priority communities**, were identified on the basis of guidance frameworks that highlight the most relevant issues and phenomena[14].

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[10] Per the 'Global Protocol for Community-Scale Greenhouse Gas Inventories'.
[11] As presented by C40, available at: https://resourcecentre.c40.org/resources/consumption-based-ghg-emissions.
[12] Per 'Global Protocol for Community-Scale Greenhouse Gas Inventories'.
[13] Portland area's Sustainable production and consumption report and two-year work plan, available at https://www.portland.gov/sites/default/files/2021/sustainable-consumption-and-production-report-and-two-year-workplan.pdf.
[14] The CNCA Climate Justice Statement, from 2020, presents a useful outline of many relevant issues in this domain. The statement is available at http://carbonneutralcities.org/wp-content/uploads/2020/07/CNCA-Climate-Justice-Statement.pdf.

2 Creating policies with climate justice at their core

This section describes why and how cities should consider climate justice and at-risk communities when collaborating and engaging with citizens and stakeholders.

2.1 The nature of climate justice and why taking priority communities into account is vital

The concept of climate justice is grounded in keen awareness of the disparities in benefits/burdens of the fossil-fuel economy across communities and between individuals, typically wrought along lines of income, citizenship status, race, gender, age, ability, and/or ethnicity.[15] Climate justice requires 'reshaping of climate action from a technical effort to cut emissions into an approach that also addresses human rights and social inequality'[16], a vision whose actualisation requires climate action to function firstly and most fully for those in our communities who face the greatest barriers to meeting their needs and thriving.

To integrate a climate-justice lens into this study and, thereby, the policy framework, the authors employed the concepts of distributional and procedural equity. The former refers to those who benefit from the given action (wealth creation, creation of job opportunities, etc.) and who is burdened by it (e.g., through pollution, cost impacts, etc.). Procedural equity, in turn, directs one's attention to who holds the reins – where the power resides in the process of defining the problem and developing, implementing, and evaluating potential solutions.

To be truly successful, climate policy must address climate justice. This cannot be safely left to chance. Any policy under consideration should be evaluated for its potential to create/reinforce inequitable distribution of benefits or to exacerbate disparities in burdens imposed on one community vs. the next and for its potential to mitigate the accordant risk. For example, policies aimed at a low-carbon economy may create greater employment or education opportunities only for few if the development process has not intentionally considered the full spectrum of conditions and communities influenced. The distributional inequalities from low-carbon policies can be caused, for example, in situations where the city provides information and engagement campaigns (or e.g., energy efficiency counselling, energy efficiency solutions for small businesses, job opportunities etc.) that are advertised or offered only to a range people or communities excluding, for example, people with language barriers or disability.

[15] Per the CNCA's Climate Justice Statement.
[16] Carbon Brief, from 2021, Available at: https://www.carbonbrief.org/in-depth-qa-what-is-climate-justice/.

To ensure inclusion, the city must ask itself questions such as these:

- Under this policy, how are the burdens and benefits from climate policies distributed within the city (e.g., across communities, geographical areas, and sectors)?
- Who should bear the financial or other burdens arising from the climate policies?

Engaging citizens is nothing new for cities. However, not all means of encouraging engagement contribute to equitable participation and meaningful involvement of priority communities. Active engagement with priority communities, if handled well, helps one build mutual trust and design genuinely effective climate policies that reduce emissions, maximise benefits, and limit burdens – across all communities.

Engaging priority communities increases the effectiveness, legitimacy, and accountability of decision-making. Establishing a just climate policy requires strategies and actions that reduce the burdens on priority communities, increase the benefits they reap, and support them in the transition to a low-carbon economy, and such strategies and actions arise through reciprocal knowledge. In contrast, conditions of insufficient/no meaningful participation of priority communities in climate-policy development may lead to disproportionate negative effects on these communities and missed opportunities to create benefits. How, then, can this crucial engagement be accomplished?

2.2 Engaging priority communities – tools and strategies

Around the globe, cities present their own local contexts and unique communities, so they require locally tailored approaches to designing just policies. Even locale-appropriate principles for identifying priority communities vary. That said, some fundamental principles have universal applicability:

- Place voices from priority communities at centre stage of city climate policies. Enable their full participation through facilitated co-design of policies using participatory processes and by supporting the engagement capacity of community leaders and organisations led by and serving priority communities.
- Collect inclusive data to build equitable policies. Currently data may be excluding a section of the population due to limitations in the collection methods. For instance, homeless people are not likely reached via household surveys[17].
- Design policies that serve those communities ‘first and best’. Creating policies that function to the benefit of the priority communities is fair and also should result in policies that work for more people, thereby increasing those policies’ effectiveness.

[17] For further information see the Inclusive Data Charter, available at: https://www.data4sdgs.org/initiatives/inclusive-data-charter.

- Understand how the existing system affects priority communities and procedural equity. Design policies to address the inequities already present and for both minimising the burdens and maximising the benefits of climate policies.
- Take a 'whole-government' approach. Addressing social equity through climate policy requires collaboration across government functions, encompassing departments that provide for health and human services, jobs and economic development, education, etc.

Consequently, gaining clarity as to existing policy impacts from one community to the next is likely to require mapping the various actions, community engagement methods, and data sources already established, as is identifying gaps and opportunities for future policies.

2.2.1 Considering priority communities in climate policies

Whatever specific form is suggested by the aforementioned mapping, engaging priority communities in the development of city policies necessitates 1) identifying the priority communities in the local context that are relevant in relation to the policy in question and 2) understanding their needs. The variety and geospatial distribution of priority communities vary with respect to different cities, including for example some of the following groups:

- People living with low incomes
- Indigenous peoples
- People of colour
- Immigrants and refugees
- Persons with disabilities
- Other historically marginalised communities (e.g., people of marginalized genders, people of marginalized sexualities, elderly persons or those suffering from chronic diseases)

As the last item listed indicates, this is not a comprehensive catalogue. Also, just as cities vary in their needs and focus, particular policy areas may require attention to certain historically marginalised communities or groups newly at risk of marginalisation.

Because members of priority communities often are severely under-represented in positions of power and may lack the information, time, and other resources (e.g., participation invitations are often designed for majorities) that advocacy and engagement demand, their meaningful engagement requires tackling these engagement barriers created through multiple layers of inequality (past and present) and socio-economic burdens. Since understanding the associated needs, culture, historical background, etc. enables participation on equal footing and can aid in building trust, training for city staff can help shift the power balance in relations with priority communities and transform how the cities design and implement their engagement mechanisms. Competence related to a common understanding of equity, cultural and racial diversity, poverty, and wealth for city staff at all levels is an important basic step toward advancing equitable policy development.

Understanding of the burdens borne and the attendant barriers to engagement is best developed through initiatives alongside communities and representatives such as activists, grassroots organisations, and various advocates. Approaching these relations from the other side, cities might in some cases benefit from the services of community officers, and city employees tasked with acting as a liaison between the city and the priority communities. Such bridge-building with community representatives can be a valuable means to a better shared understanding of both the community's needs and the city's processes/practices.

2.2.2 Barriers and tools for active community engagement

Active engagement is a key action for building city approach for climate justice and developing just policies. Active engagement is here seen as an engagement model or a strategy that aims to overcome the possible barriers that the communities may face with respect to participation on city processes and policy development. Applying this strategy enables equitable participation by reaching out to people across community boundaries to overcome the various barriers to involvement in city processes and policy development. At its heart is ongoing relationship-building with multiple communities and people's lived experiences that have the same value as technical data — no more and no less. Making participation opportunities accessible – both during policy development and throughout the implementation and evaluation processes that follow – is fundamental to designing an equal footing into the processes and designing for the equitable distribution of both benefits and burdens.

Among the major barriers to active engagement are:

- insufficient engagement tools or resources in cities for considering the lack of resources (e.g., time and money) in priority communities;
- city officials lack time due to a sense of urgency to enact policies. This often leads to the utilisation of more traditional and colonial operating and engagement methods
- engagement tools that do not provide sufficient accessibility through their manner of attention to language, socio-economic status, disability, or some other factor(s);
- knowledge gaps between government officials (alongside their outside consultants etc.) and the communities;
- distrust between the communities, on one side, and government entities, on the other, which may well stem from experiences of the communities not being considered or valued;
- the conditions or process for engagement not being approachable even if it is technically accessible – e.g., Web site design that is not culture-sensitive; and
- 'dropping the ball', through a lack of follow-up and the absence of sufficiently agency-respecting tools that facilitate incorporating the community perspective into the ultimate policies.

Overcoming these barriers requires considering them thoroughly and designing the engagement process and its opportunities accordingly, so bringing in the communities or their

representatives is advised. Based on city and stakeholder interviews and relevant literature[18], we identified the following additional principles as valuable for generally guiding comprehensive design of active engagement and meaningful involvement opportunities:

- Understand the various priority communities relevant in relation to the locale and the policy area, recognise their differences, and consider their needs
- Arrange accessible opportunities for engagement, and support seizing them (e.g., groups comprising many single mothers may benefit from day-care arrangements, and elderly persons might need multiple options for participation)
- Benefit from prior work by organising an engagement process aligned with recognised guidelines, such as the Jemez Principles for Democratic Organizing[19] and principles such as Kirwan institute´s Principles for Equitable and Inclusive Civic Engagement[20]
- Consult priority communities on the preferred ways of working prior to the engagement
- Ensure that any knowledge gap that might influence engagement is addressed (e.g., involving community leaders, community-based organisations, and community advocates; engaging with them; and providing accessible information may be vital)
- Reimburse community members who participate in the policy-development process for their time and insight
- Follow up with the participants, and consider how one might increase the decision-making power and influence of the priority communities
- Shift increasingly from consulting toward co-creation of policies, thereby cultivating a sense of ownership that is consistent with participatory democracy[21]

The principle uniting all of these efforts should be to employ a **do–learn–adjust** approach when engaging with priority communities. This requires being open-minded, flexible, and ready to adjust; an iterative approach enables homing in on the best path forward for all parties.

[18] Kip Holley, 2016, The Principles for Equitable and Inclusive Civic Engagement: A Guide to Transformative Change (*Columbus, OH: The Kirwan Institute for the Study of Race and Ethnicity at the Ohio State University*), available at https://organizingengagement.org/models/six-principles-for-equitable-and-inclusive-civic-engagement/; Jemez Principles for democratic organizing, 1996, available at https://www.ejnet.org/ej/jemez.pdf.
[19] This core Jemez output can be found at https://www.ejnet.org/ej/jemez.pdf.
[20] These principles, from 2016, can be found at https://organizingengagement.org/models/six-principles-for-equitable-and-inclusive-civic-engagement/.
[21] Movement strategy presents one possible technique, available at: https://movementstrategy.org/resources/the-spectrum-of-community-engagement-to-ownership/.

Box 1: Cities show rich variety in how they engage their priority communities:

Copenhagen has formed a climate task force to break silos and to render city representatives approachable by citizens. In one technique employed, designated climate officers spend four days a week in a specific local neighbourhood and the remaining workday in the central office, thereby forming a community–city link.

Glasgow has set up a Just Transition Commission to ensure the burden of climate impacts is shared equitably and that everyone has equitable access to opportunities in the low carbon economy. The progress in just transition is ensured through a Just transition implementation plan. The progress is measured through various indicators that include e.g., number of local young people accessing green job opportunities, number of people supported to retrain and transfer skills to access green job opportunities and number of people with access to good quality open and green space.

New York City is working to identify barriers to engagement, and opportunities for improvement in City environmental decision-making processes as part of a comprehensive city-wide report on environmental justice. This data driven report and accompanying a web-portal, will inform an Environmental Justice Plan to embed equity and environmental justice into the City's decision-making processes.

Oslo has formed citizen councils whereby a portion of the population takes part in discussion of the city's development. The aim is to move from consultation to co-creation with the city's communities.

Vancouver has adopted an equity framework adhering to high standards: the core goal is to give decision-making power directly to the communities. One clear conclusion derived from that framework's development is that city personnel must learn a new way of working and devote more resources to climate-justice considerations. Moreover, equity will become a section in Council reports meaning that all reports to Council will need to show how they are addressing equity.

2.3 Climate justice is integral to City Governance

True climate justice cannot be 'bolted on'. Integrating it and equity into the core of climate policy is a considerable endeavour but a crucial one. Effective integration of climate-justice actions into city governance requires elevating climate justice to the top of the political agenda, deconstructing practices and policies to highlight those that sustain and perpetuate inequalities, and building policies jointly with priority communities through active engagement and meaningful involvement. Climate justice 'on the ground' in cities calls for both the tools and the capacity required for participatory design, assessment, and development of policies. Hence, cities should consider their actions for climate justice at policy level in terms of two categories: internal capacity-building and just development of policy.

Internal capability development is directed toward shared understanding of the topic and establishment of goals for the climate-justice work. Internal capacity-building may encompass internal training or adoption of internal equity policies (e.g., a guiding equity framework or a climate-justice statement). Naturally, the input of local communities or at least their representatives is a vital component of the capacity-building. For example, Vancouver´s climate-justice charter guides all of the city's climate-related efforts and was developed by a working group comprising of representatives from priority communities[22].

Just policy development, proceeding from the capacity cultivated, applies suitable mechanisms for 1) understanding the disproportionate and inequitable impacts that may arise from climate policies and 2) preventing or at least mitigating them through community engagement.

Strategic and operational examples on equitable and inclusive consumption-based policies are given in Box 2. Among its key elements are increasing marginalised communities' greater representation in positions of power, community engagement throughout the policy process's various steps (including support for co-creation of policies), evaluation of the policies' possible impacts and where they may be felt across the communities, and room for iteration and adaptability if disproportionate or inequitable effects of practices/policies emerge. The iterative aspect is vital for learning by doing, from the very outset.

[22] More details on the city of Vancouver's Climate Justice Charter available at: https://vancouver.ca/green-vancouver/an-equitable-plan.aspx.

Box 2: How cities address consumption-based policies from a climate-justice angle

San Francisco has developed the Racial and Social Equity Assessment tool (R-SEAT) to address climate justice in the multiple strategies under its climate action plan. Currently, R-SEAT is used to evaluate six sectors of 1) responsible production and consumption, 2) transportation and land use, 3) energy supply, 4) building operations, 5) housing and 6) healthy ecosystems. In essence, the R-SEAT tool is a set of questions that help city officials assess climate justice and priority communities in their policymaking. Moreover, for integration of climate justice into the very heart of their governance, city leaders have incorporated both a climate metric and an equity metric into their climate action plan. Additionally, they apply bespoke processes to consider climate justice in decision-making and are currently discussing how to translate equity-prioritisation opportunities into actions.

Oslo has implemented guidelines to evaluate all policy measures and budget proposals through the lens of both climate effects and distribution factors. The analysis of the latter highlights how the cost and benefits of climate measures are spread between different groups.

In 2018, Vancouver adopted a strategy for reducing waste from single-use items. The strategy included a proposed by-law that would prohibit businesses from using plastic straws. During consultation with stakeholders on the proposed by-law details, City staff learned that a proposed by-law completely prohibiting businesses' use of plastic drinking straws could cause significant harm to people with disabilities, many of whom rely on flexible plastic straws to safely consume beverages and nutrition. Under the final version, adopted in 2019 and entering force in 2021, restaurants and cafés must make flexible plastic straws available on request, but no other types of plastic straws[1].

New York has put an emphasis on environmental justice by establishing the Mayor's Office for Climate and Environmental Justice to develop city policymaking with an equity and justice perspective. To gather data on environmental and climate justice impacts across different communities, New York is conducting a comprehensive environmental justice (EJ) study to identify environmental justice areas[2], analyse EJ concerns and they City's contribution, and review City inclusivity and engagement with respect to environmental decision-making to inform a formal EJ Plan that will embed EJ considerations into City policy and decision-making.

[1] See more at Vancouver Single-use item information for businesses, charities, and not-for-profits - Plastic straws, available at: https://vancouver.ca/green-vancouver/plastic-straws.aspx.

[2] See more at New York Climate Justice Areas, available at: https://nycdohmh.maps.arcgis.com/apps/instant/lookup/index.html?appid=fc9a0dc8b7564148b4079d294498a3cf.

2.4 Climate justice considerations regarding consumption categories

2.4.1 Food

Food choices and diets are commonly shaped by trends, culture and norms, as well as personal preferences. However, for some individuals and communities medical restrictions, economic status and/or rooted cultural traditions may play a crucial role in defining their diet, making them less able to adapt to changes in food prices or availability that are increasingly driven by global developments such as global supply chain issues and extreme events exacerbated by climate change[23].

Food policies may have direct or indirect effects on priority communities caused, for example, by impacts on food availability, accessibility, and price[24]. On the other hand, active engagement and just food policies have the potential to correct existing food-related equity challenges (such as low accessibility of healthy, un-, or minimally processed and low-emissions food) and supports new sustainable ways of food production (e.g., community gardens).

Food policies should be designed with consideration and understanding of the broader context of food, for example, its social and cultural meanings to different communities as well as future global changes in food systems. Just food policies are created by collaborating with community members, prioritizing those who have the greatest barriers to access affordable, healthy and culturally relevant food. The work with priority communities should support the envisioning, design and implementation of actions as well as designing methods and criteria for evaluation of actions and strategies.

Relevant considerations for making food policies include:

- Does the policy increase or decrease the overall cost of food? If yes, what kind of equity impacts it has and to whom?
- Does the policy impact availability or cost of culturally relevant foods? If yes, what kind of equity impacts it has and to whom?
- Does the policy increase the accessibility of affordable and healthy food choices?
- Does the policy foster the social connectivity and community resilience?

[23] The World Bank, What You Need to Know About Food Security and Climate Change, from 2022, available at: https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change.

[24] See 'City of New York Mayor Eric Adams. Food forward NYC: a 10-year food policy plan', available at: https://www.nyc.gov/assets/foodpolicy/downloads/pdf/NYC_FoodReport_18_CB_interactive.pdf.

- Does the policy support or create job and business opportunities for priority communities?
- How does the policy address the potential equity risks located in the countries of production, such as human rights issues? What kind of actions can be taken to address these risks (e.g., information campaigns, procurement criteria development, advocacy on state level)?

2.4.2 Textiles, electronics and household appliances

Compared to food, with textiles and electronics the most visible equity issues are often located outside the city borders in the countries of production where raw material acquisition and production may lead to, for example, the exploitation of the lands, resources, and labour, environmental degradation and pollution of local water sources, and even human rights violations. For example, cotton industry in Uzbekistan has in recent years been connected to forced labour and other human rights violations[25]. Similarly in the case of electronics and appliances, mining of minerals contributes to a large share of corporate-related human rights violations[26].

In addition, both textiles and electronics may involve specific equity issues also within the city borders. For example, emission intensive fast fashion is often among the least expensive and most convenient options compared to sustainable textiles that are often not accessible due to their high price. Equity issues with electronics and household appliances are here supposed to involve similar equity issues with respect to acquiring of raw minerals and other materials for the electronic components. However, equity issues around electronics may also, for example, revolve around enabling equal access to electronic devices in schools or in public spaces (e.g., libraries).

As with other consumption categories, communities, groups, and individuals contribute unequally to emissions and waste from textiles and electronics. This should be considered, for example, in city actions towards encouraging residents to donate clothes to people with low incomes as this may also shift the responsibility and costs of waste management from

[25] The Cotton Campaign, Uzbekistan: Independent Monitoring Shows Human Rights Risks Remain in the Cotton Industry Despite Reforms that Ended State-Imposed Forced Labor, from 2022, Available at https://www.cotton-campaign.org/news/uzbekistan-independent-monitoring-shows-human-rights-risks-remain-in-the-cotton-industry-despite-reforms-that-ended-state-imposed-forced-labor.

[26] Maximilian Spohr, Rüdiger Wolfrum, Åsa Borssén, Johannes Danz, and Sven Renne in the 2016 publication 'Human Rights Risks in Mining - A Baseline Study' Commissioned by the German Federal Institute for Geosciences and Natural Resources (BGR) and prepared by the Max-Planck-Foundation for International Peace and the Rule of Law. Available at: https://www.bgr.bund.de/DE/Themen/Zusammenarbeit/TechnZusammenarbeit/Downloads/human_rights_risks_in_mining.pdf?__blob=publicationFile&v=2.

the people causing the waste or overconsumption to non-profit or governmental organizations[27], or even to developing countries[28].

Relevant policies such as city textile or other consumption strategies should be designed with consideration on the equity impacts both in and outside city borders. Relevant considerations for cities low-emission textile and electronics policies include:

- How does the policy address the potential equity risks located in the countries of production, such as human rights issues? What kind of actions can be taken to address these risks (e.g., information campaigns, procurement criteria development, advocacy on state level)?
- Does the policy provide equal rights regarding accessibility or price (e.g., are electronic devices provided equally for all, for example, in schools?)
- Does the policy address specific materials or products that could have more significant or severe equity risks?

[27] Stakeholder interview with representatives from the City of Vancouver, September 15, 2022.
[28] According to some estimations about one fourth of the recycled clothing materials bought by textile recycling companies ends up to developing countries, where it may cause environmental problems (e.g., ending up to landfills) or disturb local markets. For more information, see for example: https://borgenproject.org/the-international-impact-of-donated-clothing/.

3 Review of consumption-related strategies

This section summarises the results from the desk study and interviews with steering group city representatives that informed our understanding of city-level strategies and actions for reducing consumption-based emissions in the three focal areas, alongside cities' work to address climate justice in them. Because these efforts are still emerging, we sought further guidance by extending our consideration to best practice, innovative ideas, and tools in sectors beyond food, textiles, and electronics and electrical appliances. Also, we strove for a more comprehensive picture by including numerous types of sources, spanning academia, regional and city governments both, the private sector, NGOs, and industry organisations.

Via the review, we selected 16 strategies for further examination. The team evaluated their general emission-reduction potential and the feasibility of their implementation by a typical city government. We judged the potential of each by conducting qualitative assessment of the following factors:

- The strength of its focus on at least one of the three consumption categories chosen
- The initiative's ambitions and the breadth and depth of the opportunities for the city to exert an influence through it
- Actual performance on consumption-based emissions (innovative actions with significant outcomes inform best practice)

3.1 Analysed strategies

Because of the inherently *ad hoc* nature of cities' proactive efforts to reduce consumption-based emissions today, we applied a consistent template to all 16, to impose structure. The template, presented below, aided in capturing each policy in outline form. In the sections that follow, the end of each policy outline offers a source of specifics (e.g., the complete policy in its original form). It is our hope that this systematic approach contributes to a framework that speaks to cities' need for a coherent and well-planned strategic approach to consumption-based emission mitigating measures.

The template for the analysis of each policy strategy within the consumption-based emissions-policy framework is the following:

- Strategy name
- Brief description
- Objectives
- User(s) i.e., entities whose actions are included in the strategy
- Content
- Strengths

- Climate justice
- Opportunities for development

The strategies chosen encompass all three consumption categories selected for attention, with many of the strategies being dynamic ones that address more than one category.

3.1.1 Amsterdam Circular Strategy 2020–2025

Name	Amsterdam Circular Strategy 2020–2025
Brief description	An outline of why and how Amsterdam will grow into a circularity-rich city that ensures a good life for all while staying within Earth's natural boundaries, with economic significance, ecological and climate impact, and the potential for the city to exert an influence dictating the choice of focus (food and organic-waste streams, consumer goods, and the built environment)
Objectives	Become an entirely circular city by 2050 and halve the use of virgin raw materials by 2030
Users	The city's government, residents, businesses, and visitors

Content	**For food and organic-waste streams:**
	Shorten food supply chains, for a robust and sustainable food system
	• Ensure sustainable urban food production
	• Instruments: urban/zone planning, collaboration platforms and associated infrastructure for urban food production[29]
	• Give preference to locally produced food in city procurement
	  ○ Instruments: direct financial support (procurement)
	• Collaborate along the entire supply chain to increase the representation of locally sourced food in the mix
	  ○ Instruments: collaboration platforms and infrastructural support
	Provide healthy and sustainable food for the people of Amsterdam
	• Promote a general shift toward more sustainable and health-friendly eating habits (food consumed).
	  ○ Instruments: knowledge, awareness campaigns, and advice
	• Reduce food waste across the board

[29] A more thorough description of the instruments is provided in Table 2, as per the 'Amsterdam Circular Strategy 2020–2025', at https://www.amsterdam.nl/en/policy/sustainability/circular-economy/.

	- Instruments: regulation, economic incentives/frameworks, awareness/advice/engagement campaigns - Support initiatives countering food waste and supporting more efficient production of food - Instruments: fiscal frameworks, direct financial support (fund projects), awareness/advice/engagement campaigns, collaboration platforms and associated infrastructure Ensure high-quality processing of organic-waste streams - Collaborate with people, businesses and institutions to guarantee taking the best approach for each district - Instruments: regulations, urban/zone planning, direct financial support (infrastructure investments), awareness/advice/engagement campaigns, collaboration platforms and associated infrastructure - Set a solid example at city level - Instruments: direct financial support (purchase waste management capacity) - Make the residents aware that separating waste is crucial for uncontaminated waste streams - Instruments: awareness/advice/engagement campaigns - Create both room and opportunities for reusing waste streams via city-level actions - Instruments: urban/zone planning, direct financial support (designate locations and infrastructure for waste reuse projects), economic incentives/frameworks, collaboration platforms and associated infrastructure **For consumer goods, especially electronics, textiles, and furniture:** Set a good example by reducing city entities' consumption - Favour new products less in city procurement, adopting a policy of access in preference to ownership - Support the development of new circular product and service systems Use existing natural resources more sparingly - Work together for better products in Amsterdam (e.g., stimulate dialogue)

	• Increase awareness of the need to consume less and share more
	• Make sharing and repairing easy, accessible, and affordable
	Get the most from discarded products
	• Establish joint collaboration among city entities, businesses, and knowledge institutions to extract value from discarded items
	  ○ Instruments: urban/zone planning, direct financial support (form a cluster of businesses, knowledge institutions etc.), economic incentives/frameworks, awareness/advice/engagement campaigns, collaboration platforms and associated infrastructure
	• Help people appreciate the value of their goods, through efforts by the business community (e.g., upcycling)
	  ○ Instruments: regulations, direct financial support (infrastructure investments), economic incentives/frameworks, awareness/advice/engagement campaigns, collaboration platforms and associated infrastructure
	• Treat discarded useful goods with respect in city operations, e.g., by providing collection and second life for usable furniture
	  ○ Instruments: regulations, direct financial support (waste logistics infrastructure investments), awareness/advice/engagement campaigns, collaboration platforms and associated infrastructure

Strengths	Mapping of all actions in relation to specific social needs (e.g., education), environmental constraints (e.g., of the nitrogen cycle), and the phases in the life cycle (production etc., with each stage being addressed), where instruments and the division of roles among stakeholders are specified for each action
Climate justice	Application of the doughnut model[30] to incorporate equity concerns such as water, education, gender, and housing into the circular-economy strategy

[30] This model, developed by economist Kate Raworth, represents the target conditions for prosperity as lying between two concentric rings, where the outer boundary is planet's ecological limits, which impose a ceiling on prosperity. On the 'inside', the lower limit to prosperity arises from the need to offer any given city or country's inhabitants the opportunity for a socially equitable existence (i.e., people need a livelihood, so some economic activity is essential). To prosper equitably and sustainably, humanity should stay between these two boundaries. See the material on Doughnut Economics (2017) linked to via https://www.kateraworth.com/doughnut/.

Replication considera-tions	Implementation of the doughnut model as a concrete tool for individual cities' use is still under development. It entails monitoring multiple indica-tors, which is highly dependent on local context, complex, and potentially data- and labour-intensive. For instance, details of waste materials' com-position may be difficult to obtain in the absence of industry efforts/regu-lation, and replication ability is contingent on many specifics of the city and other context. Future efforts, by e.g., C40 Thriving cities initiative[31], aims to tackle these concerns.
URL for details	https://www.amsterdam.nl/en/policy/sustainability/circular-economy/

[31] See C40 Thriving cities initiative, available at: https://www.c40.org/what-we-do/raising-climate-ambition/inclu-sive-thriving-cities/thriving-cities/.

3.1.2 The Milan Urban Food Policy Pact

Name	Milan Urban Food Policy Pact
Brief description	An international agreement of mayors that provides a practical tool for cities' tackling of urban food-related issues, covering 37 actions and offering suggested indicators in six categories
Objectives	Establish a more sustainable food system in the participating cities
Users	City governments
Content	For the entire food value chain: • Set up governance mechanisms to guarantee an environment that enables effective action through collaboration within/across city agencies, stakeholder participation, local initiative-mapping, and development of a disaster-risk-assessment and preparedness strategy • Ensure residents' sustainable diet and nutrition through promotion of sustainable food choices, development of sustainability-oriented dietary guidance, and investments in universal access to safe drinking water and adequate sanitation • Provide for social and economic equity by promoting relevant networks and grassroots initiatives, reorienting school food programmes (for healthful, sustainable foodstuffs with local origins), and directing cash and food toward these endeavours • Promote urban and semi-urban food production, for increased sustainability, alongside an ecosystem approach, for holistic, mutually integrated land-use planning and management • Ensure sustainable food supply and distribution by analysing the flows of food to and through cities, with infrastructure improvements made accordingly • Reduce food waste through collaboration with researchers, the private sector, and civil society, and cultivate awareness of food loss and waste
Strengths	A holistic approach to the entire food cycle; articulation of multiple indicator suggestions for each action, which city bodies can implement directly; and an annual-awards scheme that highlights success stories of cities' policies
Climate justice	Comprehensive incorporation of equity considerations into most actions and a focus on social and economic equity

Replication considera-tions	Once an overarching objective of “sustainable food systems that are in-clusive, resilient, safe and diverse” has been identified, efforts should fo-cus on identifying concrete references to assist cities in establishing a roadmap for reaching the objective via action-specific targets.
URL for details	https://www.milanurbanfoodpolicypact.org/the-milan-pact/

3.1.3 The WWF's survey of behaviour-change methods and strategies for reduced consumption of animal-based protein

Name	A Systematic Review Investigating Successful Behavior Change Methods and Strategies To Reduce Consumption of Animal-based Protein
Brief description	Output from the WWF's Eat for Change project (funded by EU Development Cooperation), reporting on a systematic literature review focused on behaviour-change interventions that have proved effective in influencing food consumption and encouraging the adoption of a more sustainable diet
Objectives	Produce a literature review that facilitates behaviour-change interventions by increasing knowledge of proven methods
Users	All practitioners and members of society
Content	Assessment of the interventions, which are divided into three classes **What works:** • Self-monitoring and goal-setting • Implementation intention – deliberating about a goal and making a concrete plan for how to reach it (an 'if X…then Y' plan) • Focus on the implications of eating meat for animal welfare • Behaviour nudges, such as making meat-free meals the default (the WWF found these to be the best way of promoting healthful eating) • Lectures and seminars about the climate effects of meat production (e.g., at universities) • Lifestyle-counselling interventions, mostly with individuals affected by, or at increased risk of, chronic diseases **What might work:** • Emphasis on the health consequences of eating meat e.g., presenting a Web page on negative health effects of eating meat) • Provision of printed matter on the environmental impact of eating meat • Information on how others' behaviour is changing over time • Cognitive nudges, such as repositioning meat e.g., to the bottom of the menu in the canteen • Social-media campaigns that utilise 'influencers' **Interventions with unknown effects:**

	• Price changes or tax/other incentives related to meat or vegetarian alternatives – a promising avenue but not yet tested on a large scale • Provision of vegetarian recipes for inspiration • Psychological and/or material rewards for behaviour change • Successful interventions with possible rebound effects – e.g., higher emissions from pursuit of pleasure via other consumption, such as aviation
Strengths	Identification of multiple behaviour-change interventions that cities can incorporate into the measures implemented under their policies
Climate justice	Inclusion of mostly white and well-educated adult populations in the interventions studied, which limits the recommendations' applicability for society as a whole and to priority communities in particular
Replication considerations	While the study usefully identifies behaviour-change interventions that cities can integrate into their measures, it provides a starting point only: since prior work does not present a full picture of society, the extent to which cities can alter the behaviour of specific residents accordingly is speculative. For some sub-populations, the suggestions may even be counterproductive. Further discussion should consider the types of behaviour-change policies that cities can safely implement and their extent.
URL for details	https://wwf.fi/app/uploads/a/3/i/q8xkqw500skmmpove5i4y/eat4change-report.pdf

3.1.4 The World Resources Institute's Science-Based Targets roadmap for clothes and textiles net zero

Name	Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector
Brief description	A World Resources Institute (WRI) roadmap to aid the apparel (fashion and textiles) sector in meeting the ambitiously set Science-Based Targets (SBTs[32]) for climate action in the private sector, with attention to the current state of emissions, scenarios for 2030, and influential actions to decrease emissions
Objectives	Support reaching the SBTs set for the apparel sector
Users	Apparel companies and other value chain organisations
Content	Actions for operations extending throughout the value chain: • Maximise material-efficiency to reduce waste by optimising the design techniques, material selection, and manufacturing methods • Invest in and scale for sustainable materials and processes: replacing emission-heavy materials with more sustainable or recycled ones (e.g., recycled polyester or organic cotton[33]), considering all costs of materials, which may entail higher costs that will eventually be passed on to the consumer • Accelerate the development of next-generation preferred materials (currently in their early stages of development) • Maximise the energy-efficiency of all aspects of apparel manufacture and move over to 100% renewable energy sources for electricity, eliminating coal from the mix, while attending to what these investments might require of the fashion brands (in terms of training and financing) and of authorities (planning for the space and other needs of renewable energy sources) Actions related to circular economy: • Adopt circular business models (e.g., refurbish, repair, rent, resell) Attention to barriers to the transition to circular economy:

[32] See Science-Based Targets initiative, available at: https://sciencebasedtargets.org/.
[33] Note that increasing the use of organic cotton may lead to negative side effects such as increased water and land-use due to lower yields as per 'Roadmap to Net Zero: Delivering Science-Based Targets in the Apparel Sector', available at: https://files.wri.org/d8/s3fs-public/2021-11/roadmap-net-zero-delivering-science-based-targets-apparel-sector.pdf?VersionId=LxrwUSv9dHytM7zybuQgoJ8LUHBZVgM1.

	• Factor in the low financial cost of fast fashion for industry players that might disincentivise the transition to a circular economy • Examine consumer preferences and behaviour – most notably in relation to new items, specific styles, and price points; brands' marketing; and predisposition to purchasing apparel via familiar channels they have used in prior purchases. • Tackle the lack of infrastructure for repairs, etc. • Grapple with today's limited recycling technology • Address geographically dispersed and complex value chains • Rationalise regulations that impede reuse-facilitating flows of waste between countries
Benefits	Spotlighting of the specific emission-heavy links in the value chain and attending to practical actions to decrease the emissions
Climate justice	A strategy with solid holistic grounding (though climate justice is not addressed *per se*); since developing countries, where most of the manufacturing occurs, constitute the setting for the majority of the actions, feasible respectful mechanisms need to be articulated
Replication considerations	The action necessary in textile-manufacturing countries, mainly in the Global South, and to tackle scope-1 and scope-2 emissions is largely known, but, as the report notes, the elephant in the room remains: suitable consumption-decreasing measures on authorities' and the industry's part are less clear. The report thus highlights that future work should focus on how to add value for producers and consumers such that higher sales volumes and shorter-lived products no longer get rewarded. This is a prerequisite to achieving net zero emissions in the apparel sector.
URL for details	https://files.wri.org/d8/s3fs-public/2021-11/roadmap-net-zero-delivering-science-based-targets-apparel-sector.pdf?VersionId=Lxr-wUSv9dHytM7zybuQgoJ8LUHBZVgM1

3.1.5 The UNDP global analysis of sustainability and circularity in the value chain for textiles

Name	UNDP Sustainability and Circularity in the Textile Value Chain: Global Stocktaking
Brief description	Analysis of the environmental and socio-economic hotspots in the textile value chain and a report that identifies both general areas for action and specific recommended actions for climate and other environmental benefits while also addressing key social challenges
Objectives	Examine the entire value chain behind textiles, to identify critical areas and the actions necessary for steering the value chain toward greater sustainability and circularity of flows
Users	Governments, public administration, and other public organisations
Content	A map of the value chain and its hotpots, followed by measures for advancing sustainability and circularity accordingly: The suggested actions are presented on the basis of the stage in the textiles' life cycle. Most consumption-based-related actions recommended in the report consist of awareness-raising activities and efforts to extend the reach of existing campaigns focused on sustainable textiles and clothing. In addition, the report pinpoints actions that deserve special priority: Policy measures • Act to encourage applying business models that increase/extend utilisation of the textiles already produced and decrease consumption, with public-procurement policies and subsidies being among the means of propelling such models' development and the use of sustainable textiles Collaboration and financing actions • Establish public–private partnerships that provide information, skills, and support for scaling sustainable solutions along the value chain Actions to stimulate behaviour change • Change consumption habits by building consumer acceptance of new business models and implementing discounts/refunds to reward sustainable purchasing – where communication plays a vital role by

	• 1) improving industry dissemination and advertising of the new business models, • 2) establishing and improving the reach of awareness campaigns via such tools as social media and emerging digital platforms, and • 3) using product labels that accessibly supply relevant information about environmental and social impacts
Benefits	Attention to the entire textile value chain, with both identification of environmental issues, alongside the associated social challenges, and pinpointing of real-world actions
Climate justice	Consideration of the social challenges connected with the textile value chain though there is no explicit attention to climate justice with regard to the suggested actions (this is not the report's focus)
Replication considerations	Cities could home in on the suggested priority actions to improve public measures for addressing consumption-based emissions from textiles. They could flesh out ways of implementing and measuring the outcomes from the action points dealt with in the report, in light of local circumstances. Also, future work could direct attention to the related GHG impact and its monitoring.
URL for details	https://wedocs.unep.org/handle/20.500.11822/34184

3.1.6 UK charity WRAP's Textiles 2030 Roadmap

Name	WRAP – Textiles 2030 Roadmap
Brief description	Description of the UK's national measures for rapid science-based progress on climate action and circularity in the textile value chain
Objectives	Transform the UK's practices in the supply, use, and disposal of clothing and textiles, with 2030 targets of halving the aggregate GHG footprint of new textile products and reducing the aggregate water footprint of new products sold by 30%, supporting these actions via a roadmap that enables robust measurement and helps focus effort, establish collaborative learning, and inform new policies
Users	Governments, public administration, other public organisations, and businesses along the value chain
Content	The roadmap states absolute or equivalent science-based reduction targets for the signatory businesses, relative to 2019 baselines. The roadmap provides a framework and tools for measuring the businesses' reaching of or contribution to reaching the targets, and it supplies a platform for developing innovative practices in the industry. It also articulates measurement actions required of all signatories, among which are the following: • Collaborating to develop a footprint-measurement tool and provide evidence of the relevant interventions' impacts • Using scenario modelling to identify how to achieve carbon and water-use reductions • Setting targets for the business • Adopting and evaluating the most relevant improvement actions/interventions • Measuring and reporting business-level outcomes by using the tool • Sharing learning that clarifies which interventions deliver the best commercial and environmental results • Implementing actions at large scale The roadmap offers recommendations for industry-specific actions and guides the agreement's signatories toward a circularity pathway that comprises 1) designing for circularity, 2) implementing circular business models, and 3) closing the material loops.

Benefits	Concrete suggested baseline and target values, coupled with a framework for action that strongly involves businesses and utilises measurements from businesses' data
Climate justice	No explicit mention of climate justice
Replication considerations	While the roadmap recognises the importance of government for industry transformation, the project focused on informing and engaging businesses. City-level strategy proceeding from it could bring in various public actors that are able to contribute to citizens' engagement, via concrete means of informing residents and conducting related awareness-raising.
URL for details	https://wrap.org.uk/sites/default/files/2022-04/WRAP-textiles-2030-circularity-roadmap-20220331.pdf

3.1.7 The EU Strategy for Sustainable and Circular Textiles

Name	EU Strategy for Sustainable and Circular Textiles
Brief description	An EU-wide strategy for the textile sector's shift toward circularity and reduced harmful emissions, with specification of six European actions that are vital for sustainable and circular textiles, along with suggested actions for creating the conditions for managing the sector's supply chains and industry operations correspondingly
Objectives	Create incentives for sector-wide transformation of textile and clothing operations by addressing the numerous operations along the supply chain
Users	States and public authorities
Content	The six key actions articulated in the strategy are the following: • Introducing mandatory Ecodesign requirements – binding product-specific requirements for increased durability, reusability, repairability, fibre-to-fibre recyclability, and quantity of recycled fibre • Stopping the destruction of unsold or returned textiles, by such mechanisms as bans on destruction of unsold clothes • Tackling microplastics pollution, which encompasses a European Commission initiative to address unintentional release to the environment • Introducing mandatory disclosure of sustainability and circularity information, with a Commission-proposed Digital Product Passport mechanism making those details and other key environmental factors uniformly available • Reducing 'greenwashing' by restricting claims such as 'green' and 'eco-friendly' to truly sustainable textiles, with such claims being permissible only if environmental performance of this general nature is verified (e.g., via an EU Ecolabel / Type I eco-labels or under specific EU legislation relevant to the claim) (the Commission will review EU Ecolabel criteria for textiles and footwear) • Extension of producer responsibility and boosting of reuse and recycling of textile waste so as to create an ecosystem for collection, sorting, preparation for reuse, reuse, and recycling through revision of the Waste Framework Directive in 2023 The strategy packages the actions listed with industry-wide initiatives and general legislative reform (e.g., the launch of the Transition Pathway for Textiles ecosystem).

Benefits	Support for Europe-wide legislation, which enables the measures' effective, broad-based implementation in the Member States, with a coherent EU strategy also providing a platform for developing industry practices that hold potential to reduce consumption-based emissions at scale
Climate justice	No explicit mention of climate justice
Replication considerations	Work grounded in this strategy could address the actions' implementation and application at regional and local levels, with further development and study.
URL for details	https://eur-lex.europa.eu/resource.html?uri=cellar:9d2e47d1-b0f3-11ec-83e1-01aa75ed71a1.0001.02/DOC_1&format=PDF

3.1.8 McKinsey's report on how the fashion industry can reduce greenhouse-gas emissions

Name	Fashion on Climate – How the Fashion Industry Can Urgently Act To Reduce Its Greenhouse Gas Emissions
Brief description	A report presenting the current status and trajectory of the textile industry's GHG emissions and measures by which the stakeholders identified as relevant for emission reductions in the industry (e.g., brand companies, retailers, manufacturers, citizens, investors, and policymakers) can reduce them
Objectives	Pinpoint fitting targets for GHG emission-reduction efforts in the textile value chain and identify relevant stakeholders and actions for those reductions
Users	Brand-owners, retailers, manufacturers, citizens, investors, and policymakers
Content	The report specifies an accelerated-abatement scenario wherein the industry is put on a pathway 1.5 degrees different from the industry *status quo*, which it presents. This scenario entails the industry cutting its emissions from 2.7 billion tonnes CO_2-equiv. to 1.1 billion. The accelerated-abatement scenario is portrayed as achievable via actions concentrated in three areas: • Reducing emissions from upstream operations • Reducing emissions from brands' own operations • Encouraging sustainable consumer behaviour Industry players can tackle the first of these by decarbonising their material production, processing, and clothing manufacture and by minimising production and manufacturing waste. Among the mechanisms for brand-level efforts are an improved material mix, sustainable transport, and better packaging. Actions in both areas depend greatly on strong calls for sustainable textiles and on policies that encourage and enforce sustainable industry practices. Finally, the researchers concluded that circular business models, less washing and drying, and stronger recycling and collection all can influence consumer behaviour and attitudes.

	As for stakeholder-specific efforts, the report cites transparency to consumers, innovative business models for circularity, and a push for sustainable product design and innovation as key actions for brands and retailers. Policymakers are asked to, for example, engage with industry players and make decarbonisation levers attractive. Finally, the authors call attention to consumers' important role in driving new industry practices by making environmental-information-based choices.
Benefits	Identification of specific actors and actions along the entire supply chain, keen awareness of consumer behaviour's vital role for changing industry practices, and corresponding recommendations for actions that industry actors can take to encourage sustainable consumption
Climate justice	No explicit mention of climate justice
Replication considerations	City authorities can carry through the report's recognition that regional and local public organisations/entities enable industry change, into action. One area worthy of more extensive consideration in that process is the actions' potential impacts on priority communities, which may be especially relevant on account of the high percentage of marginalised low-income workers in the fashion industry.
URL for details	https://www.mckinsey.com/~/media/mckinsey/industries/retail/our%20insights/fashion%20on%20climate/fashion-on-climate-full-report.pdf

3.1.9 ETC/WMGE report on electronics and obsolescence in relation to circular economy

Name	ETC/WMGE Report 3/2020: Electronics and Obsolescence in a Circular Economy
Brief description	A European perspective on the production and consumption trends, product lifetimes, and obsolescence factors that affect environmental and climate pressures related to smartphones, washing machines, vacuum-cleaners, and television sets
Objectives	Via case studies, analyse how the environmental impacts of the relevant product categories manifest themselves and what policies and business models can function to decrease their burden
Users	European consumers and policymakers
Content	Electronic products often have a shorter lifetime than designed/desired and exhibit problematic obsolescence, arising from • rapid technological development, whereby models soon fall by the wayside because of consumer mindset or incompatibilities between their hardware and newer software; • marketing-based inducement to purchase new models that may demonstrate only minor (if any) improvements on earlier ones; • declining quality over time in use; • consumer demand for the latest design or technology; • increased energy efficiency of newer products; and • the limited range of repair options for many electronics, stemming from either the design not allowing easy repair or the repair costs being high in comparison to buying a new product. The report lists measures to increase electronic products' service life and decrease their environmental impact, among them • stronger eco-design requirements, to encourage longer life; • improved end-of-life disposal and reprocessing potential; • continued development and use of the EU Energy Label, to aid consumers in their decision-making; • further development of green public procurement (GPP), to create additional demand for environmentally friendly products; • the extension of producer responsibility to end of life as a key incentive for 'production for circularity'; • embracing the forthcoming EU Ecolabel criteria for electronic displays; and

	• implementing electronic product passports to provide information on the origin, composition, and repair possibilities of each product, along with the end-of-life handling that may be involved.
Benefits	Highlighting of the most emission-heavy parts of the value chain for the four categories in question; inclusion of often-simple approaches (such as stricter rules) that tackle multiple links in the value chain; and a ready-made set of actions that cities can turn to directly (in legislative fora) or advocate
Climate justice	No explicit mention of climate justice
Replication considera-tions	While the report focuses on EU-level policies, which cities cannot directly influence, it has much to offer them as-is. Policy development does still need to address variations in the distribution of impacts over the life cycle, across and within product classes (for instance, washing machines, tumble-dryers, and hoovers produce most of their emissions in the use phase, while mobile phones' and televisions' emissions arise mainly from the resource extraction and production).
URL for details	https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-wmge-reports/electronics-and-obsolescence-in-a-circular-economy

3.1.10 Ellen MacArthur Foundation's report on circularity for consumer electronics

Name	Circular Consumer Electronics: An Initial Exploration
Brief description	A report presenting what circular economy for consumer electronics could look like, with focus on smartphones, laptop and tablet computers, and 'smart home' devices
Objectives	Advance the discussion of electronics' position within a circular economy and outline actions by which industry could accelerate the transition
Users	Industry players
Content	The report offers industry actors a five-step plan to accelerate the circularity transition in a manner maximising economic, social, and environmental benefits: 1. Design for circularity. This may encompass designing for durability and designing for adaptability and repairability. The disassembly/fixing may be performed by the user (as in the Fairphone case) or by a technician (as in the Iphone case). 2. Add impetus for migrating to 'the cloud'. Profit remains possible when connectivity eclipses hardware capabilities and ownership in importance. 3. Respond to changing needs. Products can circulate under a non-ownership model aligned with users' differing and changing needs, and the products themselves can announce options and guide the user to swap components or devices as necessary. 4. Increase reuse-market efficiency. Details of the products, their condition, and price estimates can build trust in second-hand products. 5. Enhance automated disassembly and refurbishment. This could increase the number of products processed and reduce turnaround times. As an example, the Dutch company Bundle already offers apparel on a pay-per-use basis. They utilise high-quality machines, monitor the products' condition, manage maintenance and refurbishment that prolong the products' useful life.

Benefits	Clearly articulated and well-justified innovative ideas for decreasing obsolescence, which, by maintaining the industry's economic and social relevance while benefiting the environment, encourage corporations to accept the business models
Climate justice	No explicit mention of climate justice
Replication considerations	Cities can via their own operations affect the implementation of the report's strategies, e.g., via procurement and engagement. Many of the presented strategies require public-private partnership to boost investments into circular electronics.
URLs for details	https://ellenmacarthurfoundation.org/circular-consumer-electronics-an-initial-exploration https://bundles.nl/en/

3.1.11 Portland's report and work plan for sustainable consumption and production

Name	Sustainable Consumption and Production report and two-year work plan
Brief description	A report outlining how the Portland, Oregon, Bureau of Planning and Sustainability will prioritise its efforts to reduce global carbon emissions that result from the consumption of goods and services locally
Objectives	Initiate a long-term project to restructure Portland's systems driving un-sustainable consumption and production, with the work to be expanded in the coming years
Users	The City of Portland, the local community and businesses
Content	The report focuses on actions in the most influential categories revealed via Portland's CBEI – food, goods and services, construction, and land use. Here, we focus on food and goods and services. Actions focused on food: • Reduce the consumption of carbon-intensive foods, particularly red meat and dairy products, via behaviour-change initiatives and procurement policy • Prevent the wasting of food, via partnerships and projects • Collaborate with priority communities to increase food access, food security, and ownership of farming and production by providing direct financial support Actions focused on goods and services (clothing, hardware, furniture, and electronics): • Increase participation in 'reuse, repair, and share' services by scaling up community and business initiatives and advocating right-to-repair legislation • Increase the adoption of low-carbon business practices both within government and in the private sector (e.g., by creating a shadow price for carbon) • Reduce the sale and use of high-emission products by such means as taxes on luxury products • Reduce community exposure to toxins (e.g., air pollution and chemicals), with special attention to the outcomes for priority communities • Expand digital inclusion, and extend genuine Internet access via training and subsidies for broadband connections

	• Improve the end-of-life requirements connected with high-impact goods by supporting state-wide legislation Actions focused on economic progress: • Adjust how economic progress is defined, to better reflect the value of community resilience, well-being, and awareness of environmental limitations, by means of a working group established to develop suggestions
Benefits	Output works together with the CBEI to address the most influential emission sources, with priority communities taken into special account and with the improvement of their status explicitly addressed in the work plan's goals
Climate justice	Application of a racial-equity framework at city level to support equity in the distribution of resources, opportunities, and burdens, with full recognition and articulation of the need for a just transition amid some consuming more and some less (on the basis of living conditions etc.), and implementation of the doughnut model under the C40 thriving-cities initiative (cf. Amsterdam) in strivings to become an equitable and sustainable city. Note that, by nearly all social measures (health, income, housing, public safety, and education), black, Indigenous, and other communities of colour face the greatest disparities in this environment, a fact that hints toward rising consumption needs while wealthier communities should decrease their consumption.
Replication considerations	Future work on the doughnut model focuses on measurements. According to the Doughnut framework measuring prosperity is at its best when employed with considerably higher-order multi-variable success metrics, encompassing various measurements of social, economic, and environmental factors[34].
URL for details	https://www.portland.gov/sites/default/files/2021/sustainable-consumption-and-production-report-and-two-year-workplan.pdf

[34] See Amsterdam Circular Monitor, available at: https://assets.amsterdam.nl/publish/pages/867635/amsterdam_circular_monitor.pdf.

3.1.12 San Francisco Climate Action Plan

Name	San Francisco Climate Action Plan (2021)
Brief description	A 'net-zero San Francisco by 2040' action plan co-ordinated by the city's Environment Department encompassing a commitment to racial equity, social justice, health, resilience, and a just economy (we consider the section on responsible production and consumption, with reference to the first two of the report's four categories: embodied carbon in goods and services, diet and food waste, materials, and air travel)
Objectives	Ensure a 40% reduction in the relevant household consumption-based emissions by 2030 and 80% by 2050, with the following responsible-production and consumption targets: 1) reduce generation of solid waste to 15% below 2015 levels and 2) reduce disposal to landfill by 50% below 2015 levels.
Users	City entities, civil society, and all people and businesses of San Francisco
Content	Measures addressing goods' and services' impact: • Promote reduction, reuse, repair, and recovery of goods and materials. Among the instruments are requiring take-back and resale of used clothing, encouraging and facilitating neighbourhood facilities such as lending libraries, and advancing programmes and policies to maximise material recovery. Actions related to diet and food waste: • Shrink the carbon footprint of the food system by reducing waste, promoting climate-friendly diets, and getting excess food to communities in need. Some means to this end are responsible public procurement, zero-waste projects, policies that create incentives to prevent food waste, and partnerships (with municipal agencies, businesses, and civil society).
Benefits	Anchors in a CBEI that the city conducted to identify the most vital consumption categories to address in the climate action plan (CAP). Includes cost, emission-reduction potential, and equity metrics for each CAP strategy

Climate justice	A community-benefits table covers each strategy's impacts on racial and social equity, just-transition, health, and resilience factors, which may be used alongside the city's 'environmental justice communities map', which identifies the predominantly low-income areas of San Francisco that have higher pollution levels. Hence, policies can be directed to making sure identified justice considerations and inequalities get addressed (e.g., in terms of food aid). To incorporate community insights into the CAP, the city established a Community Climate Council (CCC) which consisted of 11 recruited leaders from San Francisco community-based organizations representing a range of target demographics and stakeholders. The city utilizes an extended producer responsibility (EPR) strategy which seeks to place a shared responsibility for end-of-life product management on producers, and other entities involved in the product chain, instead of only the general public and/or local government.
Replication considerations	The CAP is a good example of a comprehensive strategy which places emphasis on climate justice in each strategy as well as provides example tools and resources for other cities to utilise. Establishing equity metrics is currently challenging due to data constraints and will be a focus for future efforts.
URLs for details	https://sfenvironment.org/sites/default/files/cap_fulldocument_wappendix_web_220124.pdf https://sfplanning.org/project/environmental-justice-framework-and-general-plan-policies

3.1.13 C40's report on the Future of Urban Consumption in a 1.5°C World

Name	The Future of Urban Consumption in a 1.5°C World
Brief description	A report addressing the impact of urban consumption on climate change and outlining the changes required for ensuring that the C40 cities respect the internationally agreed limits for climate-safe emissions
Objectives	Present how cities can honour the climate-safe limits for emissions
Users	C40 cities but with applicability by other cities as well
Content	The report identifies and examines six consumption categories in which the cities can reduce consumption-based emissions (food, clothing and textiles, private transport, aviation, buildings and infrastructure, and electronics and appliances). Here we focus on food, clothing and textiles, and electronics and appliances. The actions per category are listed according to their emission-mitigation impact. Actions in the food domain: • Reduce meat consumption (43% reduction to reach the climate-safe limit) • Reduce dairy consumption (17% reduction to reach climate-safe limits) • Consume no more than 2,500 kcal per day • Reduce household food waste • Avoid supply-chain food waste **Clothing-related actions:** • Reduce the number of new clothing and textile items people purchase (approx. 42% reduction to reach the climate-safe limit) • Reduce textile waste in the supply chain **Actions pertaining to electronics and household appliances:** • Keep electronics and appliances in use for a longer period of time (33% reduction to reach climate-safe limits) o For example, the optimum lifetime of laptops and similar electronic devices is 7 years while currently the average in C40 cities is 5 years.

	Among the suggested actions that a city can take to reach these reductions are suitable vision development and strategy-setting, legislation and regulation, financial investments, procurement of products, production of services, transparency efforts, and awareness- and capacity-building. Collaboration, partnering, and joint target-setting too possess potential, with partnerships with businesses, civil society, national government entities, and individuals being of utmost importance.
Benefits	Emphasis on the urgency of climate action also in consumption, provision of hard numerical data on the effectiveness of interventions, and presentation of scenarios and actions for reaching the climate-safe limits (though for a limited range of city interventions)
Climate justice	Attention to the fact that, while reducing consumption-based emissions is important, any inequitable consequences of the economic transition have to be addressed (these may be geographically and socially connected).
Replication considerations	The report highlights that on their own, the measures identified are insufficient for reaching the climate-safe limits. Hence, accelerated transition to clean production in electricity generation, shipping, land freight and rail transport, industrial processes, etc. is required, probably in conjunction with other measures too, such as carbon capture and storage technology. At a more radical level, the report raises the question of an alternate to economic growth as a gauge of development and Gross Domestic Product (GDP) as a key metric. Cities and other stakeholders could engage in the dialogue to address this question.
URL for details	https://www.c40.org/wp-content/uploads/2021/08/2270_C40_CBE_MainReport_250719.original.pdf

3.1.14 The WRI's project challenging the paradigm of unfettered consumption

Name	The Elephant in the Boardroom: Why Unchecked Consumption Is Not an Option in Tomorrow's Markets
Brief description	A report explaining how current corporate strategies in three sectors (food, vehicles/transport, and textiles) ignore the pressing need to decrease consumption, improve material- and process-related efficiency, and/or embrace a new market paradigm
Objectives	Highlight the issue and encourage corporations' profound change for decreased consumption
Users	Corporations
Content	The report divides the strategies recommended (for vehicles, food, and clothing) into those for greater efficiency and ways of embracing a shift to lower consumption. For food: • Improve efficiency • address food waste • procure more sustainable food (e.g., via the Global Roundtable for Sustainable Beef) • Embrace the change • Encourage evolution of social norms for what is acceptable/unacceptable, via information and by cultivating engagement • Use visibility to maximise awareness (make the information memorable, and constrain some displays while enhancing others) • Sell a compelling benefit – enhance affordability, stress the food's health or financial advantages, and deliver meeting of current key needs • Minimise possibly uncomfortable change – disguise the change, replicate the familiar experience, and form habits in new markets For clothing: • Improve efficiency by • revisiting manufacturing methods • exploiting tools as the Higg Index to measure goods'/services' environmental, social, and labour impact • Embrace the change by

	• Designing for longevity • Feeding in used items to second-hand markets, and provide repair services • Applying business models such as rental, sharing, or 'slow fashion' (with domestic manufacture from sustainable materials) • Moving jobs from overseas production to local repair
Benefits	A challenge to the narrative of endless pursuit of consumption and strongly distinguishing among the 'ignore' approach, 'improve' strategies, and 'embrace' strategies underpinned by a sound business case
Climate justice	Raises into discussion the need to stimulate a shift from cheaper products such as 'fast fashion" goods to possibly pricier longer-life items (e.g., quality jeans that are ultimately more affordable), with a narrative that stresses long-term rather than short-term thinking. Especially focusing on the priority communities' (which may have limited funds etc.) ability to fulfil their needs.
Replication considerations	Presents important themes on which to focus on. Further work and other reports complement these findings by providing examples and best practice that enhance the strategies' concreteness to further encourage implementation and clarify the actions' real-world impacts.
URL for details	https://files.wri.org/d8/s3fs-public/elephant-in-the-boardroom.pdf

3.1.15 The SBTi's report on best practice for transforming value chains for better scope-3 GHG management

Name	Value Change in the Value Chain: Best Practices in Scope 3 Greenhouse Gas Management
Brief description	A synthesis of good practices by which companies can employ various emission-reduction levers (projects, programmes, business decisions, and other actions) to reduce their scope-3 GHG emissions
Objectives	Provide a summary for companies' reference to decrease their scope-3 emissions
Users	Companies worldwide, with cities being especially relevant for their ability to utilise many similar levers and since the companies operate in their jurisdiction
Content	The report splits the actions into the following categories (it lists several concrete actions under each; these are cited here in brackets): • Set emission-reduction targets, and encourage suppliers to reduce their emissions in line with climate science (1.5 degrees); cities can do the same for companies and other stakeholders within their area • Develop suitable new business models (put a price on carbon, increase products' life span, consider shifting toward product–service systems, and increase the efficiency of logistics) • Promote supplier engagement (work alongside suppliers to reduce their emissions, ideally in line with climate science; identify key suppliers for solid engagement and strong communication channels; assess progress regularly; and create incentives for action) • Design procurement policy and choices well (purchase the same products but from suppliers with a smaller carbon footprint, move over to low-carbon alternatives, etc.) • Consider product and service design (design products that are more efficient, and integrate circular-economy principles into the design) • Nurture customer engagement (either directly through awareness efforts, collaboration, compensation, etc. or indirectly by regulating company operations or motivating customers via the marketing and choice architecture)

	• Establish responsible operation policies (develop suitable protocols, launch incentive programmes for choices such as riding one's bicycle to work or donating products that might otherwise sit unused) • Adopt an appropriate investment strategy (invest more in low-carbon projects/companies + resilient development and less in fossil fuels, thereby accelerating the transition to a low-carbon economy)
Benefits	A wide variety of levers for tackling scope-3 emissions, presented in conjunction with concrete actions and good examples
Climate justice	No explicit mention of climate justice
Replication considerations	While the strategy, designed for companies, is not directly applicable for cities, the report is a strong foundation for inspiration on many fronts. For instance, cities can incentivize firms (positively or negatively) and can help them act commensurately with the best practice described in this report. Furthermore, many of the mechanisms can be used directly: cities can adopt the operations policies, procurement guidelines, and measures for supplier and customer engagement. The levers, which function together to reduce scope-3 emissions, constitute seeds for vast collaboration and innovation opportunities, just as one company's actions may benefit many others in its ecosystem.
URL for details	https://sciencebasedtargets.org/resources/files/SBT_Value_Chain_Report-1.pdf

3.1.16 Selected examples of different industry initiatives for data sharing

Name	- (For initiative names, see the "URL for details" -section)
Brief description	This selection of examples was gathered by Gaia Consulting for this report. Here we showcase several actions applying industry-level partnerships centred on data-sharing to gather knowledge and, thereby, reduce consumption-based emissions. *The following analysis summarizes the characteristics of the selected examples.*
Objectives	Gather and utilise consumer data as a foundation for more straightforward calculation of cities' consumption-based emissions and to inform more robust industry actions in pursuit of emission targets
Users	Cities and businesses
Content	One effort involves Finland's two major supermarket chains, which together enjoy an 83% market share. Both retailers already let consumers see the carbon footprint of their purchases but combining the data from the two separate customer-loyalty programmes, which provide data on what their customers buy, would allow cities to estimate their food-related emissions quite accurately and with minimal effort. Already, the Kulma project has used data from one of the chains to approximate 14 cities' emissions associated with food consumption[35]. The financial industry is developing similar strategies. Amex, C40, the City of New York, and London recently announced a joint endeavour to put knowledge power behind cities' emission-reduction work via pioneering tools for inventories of consumption-based emissions. Among other efforts in this domain is the Åland Index, developed by Ålandsbanken, and Doconomy AB provides banks (e.g., Nordea and BNP Paribas) with calculations of the climate impact of their customers' purchases, available since 2015.

[35] Presented (in the Finnish language) at https://www.sitowise.com/fi/uutiset/kuntien-kulutuksen-hiilijalanjalki-selvitettiin-ensimmaista-kertaa.

	Another group of projects involves ‘city coins’ that municipal and business leaders develop for city-internal use only. Among the cities that boost their economy and encourage shorter logistics chains by such means are Sysmä, Finland; Bristol, England; and, in the USA, Philadelphia. This local currency also improves tracing of consumption-based emissions. City-wide emission-trading schemes, such as the Finnish city of Lahti’s experimental system to decrease transport emissions, constitute a variation on this instrument.
Benefits	Fuelling the identification of hotspots, targeting of actions, and development of indicators via data’s crucial part in co-ordinating and propagating transition
Climate justice	No explicit mention of climate justice.
Replication considerations	Larger-scale projects in particular must wrestle with privacy concerns: how can suitably extensive collaboration between cities and the private sector filter data while maintaining the tools’ power (e.g., in identification of priority communities)? Also, projects may need to address corporate partners’ willingness to share their data in light of the competitive landscape. In regard to the city coins, an option could be investigated where the currency would be provided to priority communities at a lower price, or the coins’ focal target could be businesses owned by priority communities.
URLs for details	https://julkaisu.hsy.fi/consumption-based-emissions-for-municipal-planning.pdf https://www.c40.org/news/amex-map-consumption-emissions-london-new-york-city/ https://doconomy.com/aland-index-solutions-changing-the-game/ https://bristolpound.org/ https://www.lahti.fi/en/news/personal-carbon-trading-scheme-made-lahti-people-question-their-mobility-choices-and-reduce-their-emissions%E2%80%AF/

3.2 How cities can influence consumption-based emissions

The 16 analysed strategies to address consumption-based emissions act as an inspiration catalogue for cities. This section highlights what aspects cities should consider when designing consumption-based emission mitigating actions.

Though the volume of consumption-based emissions often is more than twice that of a city's production-based emissions[36], cities' climate work typically gives more emphasis to the latter, which lie in the city's geographical jurisdiction and thus in which cities have more direct control over, while consumption work remains less systematic. The strategies analysed for development of our policy framework point to a way forward: cities with effective consumption-based emissions policies share a focus on life-cycle emissions, context, role distribution, and methods of influence. Below, we address each of these.

3.2.1 Life-cycle emissions

To consider the full life cycle, one must address emissions generated in the material acquisition, production, distribution and storage, use, and end of life of goods and services, as Figure 1 illustrates.[37] This process can be circular and thus occur multiple times.

Figure 1. An outline of the life cycle of a product.

When cities understand which life cycle stages contribute the most to emissions in each consumption category, they can precisely target their actions. For example, they can 'zoom in on' the electricity consumed in the use of appliances, which accounts for the majority of

[36] See the Carbon Neutral Helsinki Action Plan 2035 (available at http://carbonneutralcities.org/wp-content/uploads/2019/06/Carbon_neutral_Helsinki_Action_Plan_1503019_EN.pdf and the Climate Action Plan prepared for the Portland, Oregon, area in 2015 (https://www.portland.gov/sites/default/files/2019-07/cap-2015_june30-2015_web_0.pdf). Production-based emissions are created within the city borders, while consumption-based emissions are generated as a result of actors consuming goods and services within and outside city borders, as described by Maria Balouktsi in the 2020 paper 'Carbon Metrics for Cities: Production and Consumption Implications for Policies' (*Buildings and Cities*, Vol. 1, Issue 1, pp. 233–259; see http://doi.org/10.5334/bc.33).

[37] The image summarises the framing under the Product Life Cycle Accounting and Reporting Standard (see https://ghgprotocol.org/sites/default/files/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf).

the products' emissions[38], while production generates the bulk of emissions in the cases of food, textiles, and electronics[39]. The level of cities jurisdictional control varies within the different life cycle stages. Thus, cities tools to affect emissions in different life cycle stages vary as well.

3.2.2 Context

Local context determines the most effective emission-reduction actions in any given city, since different groups of people consume differently. Early on, cities should consider demographics (income, household size, education level, etc.), home characteristics (ownership arrangements, size and structure type, and solutions for heating and other utilities), travel factors (vehicle ownership, travel distances, commuting patterns, and modes of transport), geography-linked variables (such as population density and weather), and economic factors (energy prices etc.)[40]. Households' emissions and their sources vary with the locale[41] and with income[42] especially. Once particularities have been highlighted, cities can tune the policy mix for maximal impact. For example, the food-consumption-related emissions of an average person in Finland are substantially higher than their Japanese equivalent, so shifting to a vegetarian diet would have a larger effect in Finland than in Japan[43].

3.2.3 Distribution of roles

Many of the strategies analysed manifest a multi-stakeholder approach, including collaboration throughout/across governments, industries, and groups of people. As an example, the city of Glasgow is working with external and internal stakeholder partners in the city to accelerate the transition of Glasgow's economy from linear to circular. Collaborative actions are executed to support strong leadership, communicate the vision and concept set out in the city's Circular Economy Route map. Results are monitored by measuring the number of eco-innovation activities following the principles of a circular economy (sharing, repair and repurpose.)[44]

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[38] According to findings presented in the Portland area's report and two-year work plan 'Sustainable Consumption and Production'.
[39] Textile-related findings according to the findings presented by Prabod Munasinghe, Angela Druckman, D.G.K. Dissanayake in the 2021 paper 'A systematic review of the life cycle inventory of clothing' (*Journal of Cleaner Production*, Volume 320, 128852, ISSN 0959-6526; see https://doi.org/10.1016/j.jclepro). Same results for textiles, food and electronics can be found on Portland's 'Sustainable consumption and Production', and the publication 'Consumption Based Greenhouse Gas Inventory of San Francisco from 1990 to 2015', produced in association with the Berkeley Energy and Climate Institute (linked to via https://escholarship.org/uc/item/4k19r6z7).
[40] Associated factors are dealt with in the publication 'Consumption Based Greenhouse Gas Inventory of San Francisco from 1990 to 2015' (ibid.)
[41] Ibid.
[42] Per 'Sustainable Consumption and Production'.
[43] See Finnish Innovation Fund Sitra's report-distillation document '1.5 Degree Lifestyle', available at https://www.sitra.fi/app/uploads/2019/06/1-5-degree-lifestyles.pdf.
[44] Information provided in an email discussion with Glasgow city representative January 25, 2023.

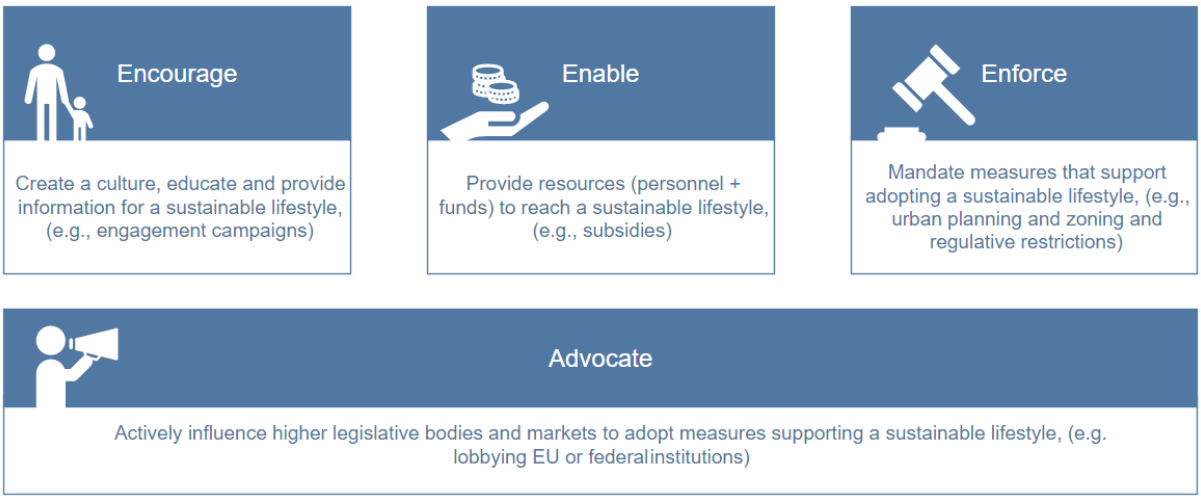
Since participation of major emitters across all categories of stakeholder increases proliferation of more impactful actions, appropriate co-ordination of actions should be guaranteed. This not only yields mutual benefits but also creates synergistic momentum for rapid progress at scale. Mapping relevant stakeholders for the strategies' consumption-based emission mitigating offers an excellent starting point. All parties identified – NGOs, priority communities, and research institutes among them – should then, together, assign each actor a role in reaching the intended outcome. The City of Amsterdam's circularity strategy for food is exemplary in this regard[45]; involving the full range of stakeholders from early on and keeping them invested is crucial.

Important stakeholders can be identified by examining the life cycle of products and services (Figure 1), this is the case also for the consumption categories focused on in this report. Often only use and end-of-life phases are located within the city's boundaries and thereby within the sphere of influence of cities. However, cities have various methods of influencing stakeholders both within and outside its boundaries.

3.2.4 Methods of influence

The desk study identified four means by which cities can exert influence on consumption-based emissions. These action categories are outlined in Figure 2, which cities can apply as a ready-reference tool in their policy-development work alongside Table 2, which elaborates upon them via illustrations from Amsterdam's circularity strategy for 2020–2025. The strongest policy mixes reviewed draw together actions from multiple categories.

While these categories are context-agnostic in most cases, the specific actions under each require tailoring to the various contextual facets of each consumption category in question.



[45] 'Amsterdam Circular Strategy 2020–2025'.

Figure 2. The four action categories for cities to influence their consumption-based emissions.

Table 2: Examples of policy measures in each category, from Amsterdam's 2020–2025 Circularity Strategy

Action category	**Types of policy instruments**
Encourage	**Knowledge, advice, and information**: Research activities, awareness and engagement-stimulation programmes, information campaigns, and capacity-building **Collaboration platforms and infrastructure**: Data- and information-exchange platforms, living labs, matchmaking platforms, and participation platforms **Governance tools**: Institution design, public–private partnerships, voluntary agreements, and lobbying
Enable	**Fiscal frameworks**: Both positive (reward based on chosen actions, e.g., tax-breaks, fee-less permits) and negative (penalties based on chosen action. e.g., fine, increased permit requirements) financial incentives **Direct financial support**: Subsidies, circular procurement and circularity-oriented infrastructure, and debt financing **Economic frameworks**: Tradable permits, public–private partnerships, and strong producer-responsibility mechanisms
Enforce	**Regulation**: Strategy and objective-setting, urban/zone planning, environmental-impact assessments and associated permits, and monitoring and enforcement **Legislation**: Prohibitions, performance standards, technical standards, labels, and other legislative provisions
Advocate	Lobbying towards measures of all the types listed above

Table 3. Examples from cities, pertaining to food, textiles, and electronics and appliances.

	Food	Textiles	Electronics and appliances
Encourage	**The Milan Urban Food Policy Pact** includes actions for cities to develop a sustainable dietary guideline to raise public awareness[46]	**The City of Austin's** website includes a Reuse Directory that identifies places within the city where people can donate, resell, rent and repair items[47]	**San Francisco** is organizing inclusive and networked neighbourhood-scale efforts such as lending libraries, repair clinics, and reuse exchanges for tools, equipment, electronics, furniture and other goods that reduce emissions resulting from the production and consumption of goods[48]
Enable	**Helsinki** will increase the proportion of vegetarian meals in schools and day care centres based on the national nutritional guidelines[49]	**Oslo** contributes to projects to increase reuse and circulation of textiles through hiring, swapping and lending[50]	The city of **Boulder** is looking into dropping local taxes on second-hand goods to incentivize reuse[51]
Enforce	**Glasgow** City Charter seeks commitments to circular economic and	**NY State's** proposed Fashion Sustainability and Social Accountability Act (Senate Bill S7428) would require fashion retailers	**Amsterdam** is utilising e.g., regulative and pricing tools to work with the business community to help the people of Amsterdam to

[46] See Milan Urban Food Policy Pact, available at: https://www.milanurbanfoodpolicypact.org/wp-content/uploads/2020/12/Milan-Urban-Food-Policy-Pact-EN.pdf.
[47] See C40 Knowledge Hub, available at: https://www.c40knowledgehub.org/s/article/How-to-grow-your-city-s-reuse-and-repair-economy?language=en_US.
[48] See 'San Francisco's Climate Action Plan 2021', available at https://sfenvironment.org/sites/default/files/cap_fulldocument_wappendix_web_220124.pdf.
[49] 'The Carbon-neutral Helsinki 2035 Action Plan'.
[50] Oslo's 'Future Consumption - Strategy for Sustainable and Reduced Consumption 2019-2030', available (in Norwegian language) in: https://urldefense.com/v3/__https://www.klimaoslo.no/wp-content/uploads/sites/88/2019/11/Framtidens-forbruk.pdf__;!!HBVxBjZwpQ!3JJieCH0egu723rQ13cfjSX-ONnpTzR1mkUUFph2XUxLQ7EQZwTMryyYWZPaNgYG4AXmPNoMr6hs-MtTUibrIyK7WupSJ4H5zL8bt$.
[51] See Circular Boulder, 2020, available at: https://bouldercolorado.gov/media/2553/download?inline.

	sustainable practices from its stakeholders[52]	and manufacturers to map their supply chain and disclose the environmental and social impacts of their activities and set binding targets for decrease those impacts[53]	appreciate the value of their goods[54]
Advocate	**Paris** collaborates with other cities, in Europe and around the world, to promote sustainable food and agriculture for all (e.g., via EU-level lobbying in support of local food production)[55]	**London** calls on the government to provide additional funding and better regulatory framework to cut waste and increase recycling performance[56]	**Portland** advocates for Oregon State Right to Repair Legislation[57]

Most consumption-based actions thus far have focused on encouragement via community engagement and awareness-raising due to their simplicity, though these actions do not necessarily have the largest impact. Enable strategies can be simple to introduce but require financial investments. Enforcement strategies, on the other hand, could be more impactful, but political challenges related to the goal of altering people's behaviour and also entail cost issues (expensive monitoring etc.) and practical challenges stemming from the mandates' state or national/federal nature. Advocate strategies consume human resources, their actualisation is not guaranteed, but the potentially obtained impact is extensive. When the measures blend actions in multiple categories, they support larger changes and smooth transition to sustainable consumption[58]. For example, if an enforcing action is implemented, it could be supported by subsidies for sustainable operations / withdrawal of support for unsustainable ones (enabling) and information campaigns (encouraging).

[52] See 'Circular economy route map for Glasgow 2020 – 2030', available at: https://www.glasgow.gov.uk/councillorsandcommittees/viewSelectedDocument.asp?c=P62AFQDNDX2UT1NTNT.
[53] See New York State Senate Bill S7428A, available at: https://www.nysenate.gov/legislation/bills/2021/s7428/amendment/a.
[54] 'Amsterdam Circular Strategy 2020–2025'.
[55] The text of the Paris Climate Action Plan is available at https://cdn.paris.fr/paris/2020/11/23/257b26474ba3ba08ee02baa096f9c5dd.pdf.
[56] See 'London Environment Strategy', available at: https://www.london.gov.uk/sites/default/files/london_environment_strategy_0.pdf.
[57] See Portland's 'Sustainable Consumption and Production'.
[58] This was among the findings articulated via Workshop 1 (of June 13 2022), with its 'CNCA Consumption-based GHG Emissions Policy Framework for Cities' output.

3.2.5 Business strategies through city conduits

A wide array of actors produced the strategies probed in the desk study. Because many of them involve not just status-quo solutions but also more 'outside the box' thinking, cities need guidance in their practical application.

Private companies produce many of the goods and services that generate emissions, so working with the private sector is vital for combating these emissions. The four-action-category typology can assist with cities' efforts to deploy techniques for working alongside or influencing companies. Within this framework, cities can disseminate information to *encourage* businesses' adoption of sustainable practices, *enable* change through public procurement of sustainable products, *enforce* through procurement restrictions, and *advocate* by exerting influence at higher legislative levels that policies such as EPR get implemented. Likewise, work at higher levels (e.g., behind strategy-underpinned actions for regional government entities, supranational entities, or multinational corporations) can inspire cities and inform their decisions about where to place practical focus – for instance, on repair shops or a deposit-refund system. Additionally, cities can directly implement some actions originally envisioned for companies, whether establishing sustainable operation and procurement policies themselves or encouraging/enforcing business entities' application of supplier- and customer-engagement measures.

3.2.6 Systematic emission mitigation through an action plan

One of the most powerful tools in cities' arsenal is aligning their ambitions with the 1.5°C target of the Paris Agreement and then ensuring rigorous actions and monitoring thereof[59]. An important step along the way is to set intermediate goals. Concrete targets with shorter timeframes emphasise urgency. This should help the alleviate the currently observed disparity between the targets and action timelines, so that the sets of actions actually reach the intended goals.

To fulfil cities ambitions of achieving a 1.5°C target a consistent and comprehensive approach is advised. In this *deeper approach*[60] cities create a consumption-based climate action plan, which includes targets, a list of actions, and a monitoring system via indicators. Rather than expend resources to develop a separate strategy for each consumption category (food, textiles, and electronics and household appliances), cities can craft a comprehensive climate action plan for consumption-based emissions[61]. Mapping all relevant categories and

[59] This is specified in the Workshop 1 output (ibid.).
[60] Throughout the policy framework we discuss the deeper and lighter approaches to highlight the different granularities of cities' approaches to calculate, mitigate and monitor consumption-based emissions. The more resource-intensive deeper approach is the advised approach due to its systematic and comprehensive nature. However, the lighter approach is also possible for cities starting their journey and aiming to address their consumption-based emissions with less resource-intensive techniques.
[61] Workshop 1

the respective actions to a single plan often proves more efficient when category-specific strategies are not needed. It may be necessary, though, to supplement the common framework with sub-strategies addressing the nuances and unique contexts of each category. Cities should seek balance between the specificity that frequently characterises existing actions (related to, for example, food consumption) and more broadly applicable actions to counter consumption-based emissions in general.

Developing an action plan is not mandatory in the design of consumption-based emission mitigating actions. Research has identified emission-intense consumption-categories (e.g., food) and products (e.g., meat). Based on this knowledge, cities can choose specific consumption-categories and products to focus their actions on. This *lighter approach* can many times prove to be the most manageable technique, especially for cities who are only starting their journey. Whether the city's choice is a deeper or a lighter approach, nevertheless, the work on consumption-based emissions needs a co-ordinating body to align processes and remove overlapping actions within the city organisation.

3.2.7 Systems change considerations

Cities are coming to recognise that awareness-raising strategies alone are insufficient to decrease consumption-based emissions at scale[62]. Acknowledging a need for additional policy interventions, cities are embracing the ethos of making sustainable choices affordable, convenient, and desirable. Since consumers already rely on governments to safeguard their health and safety via regulatory and other mechanisms for products, this remit can be extended to environmental impact, via systems guaranteeing the sustainability of the options available to consumers. Profound system-wide change requires ultimately addressing the root of the problem: the current model of economic growth, which relies on ever-increasing consumption and resource extraction. Not only is that prevailing paradigm untenable environmentally, but economic growth does not lead to improved quality of life for society beyond a certain threshold[63]. Likewise, research attests that increased consumption does not bring individual-level well-being or happiness[64].

Therefore, conditions are ripe for other methods of creating value. While business models have already begun shifting from product creation to services, metrics for cities' prosperity tend to adhere to quite traditional indicators centred on business growth and new jobs rather than social sustainability, various liveability factors, and the city's environmental wellbeing and climate impacts.

[62] The examples come from Workshop 1 (ibid.).
[63] According to '[Sustainable Consumption and Production]'.
[64] Ibid.

Cities that integrate environmental, social, and economic sustainability into their strategy offer a valuable example, informed by approaches such as doughnut economics[65]. However, a complex issue such as climate change requires more than blueprints from others. To tackle the numerous dependencies and inter-relations specific to their context, cities need data too. Knowledge is essential for establishing baseline and target values, then measuring and managing the ensuing transition. Additionally, data can support cities' discussion of how far to go in their actions and can help them answer and engage with other entities in society's tapestry. Accordingly, the next section of the report examines data and associated issues, related to the required resources and possible approaches.

[65] Further details at https://www.kateraworth.com/doughnut/.

4 Baselines and targets

This section presents the key considerations in calculating consumption-based emissions and setting targets for their reduction. The discussion describes the creation of a city policy for reducing consumption-based emissions as a two-pronged effort with these interdependent processes[66]:

1. GHG accounting, or inventorying, which equips the city to set the emission baseline and monitor progress in relation to it

2. Target-setting that articulates the ambition level, performance expectations, and timeframe for actions

These processes develop in parallel, with the inventory process and its outcomes informing the policy process and *vice versa*. Figure 3, below, captures the iterative cycle of the two processes (where 'GHG calculations' encompasses the methodological aspect of emission-reduction policies and 'Policy' covers the political process). Together, the GHG calculations and the policy process inform the third component examined below: an efficient framework for monitoring and development. This element, addressed in Subsection 4.3, encompasses, alongside tracking the emissions, tuning such process components as the input data and calculation models to the knowledge or data gaps detected.

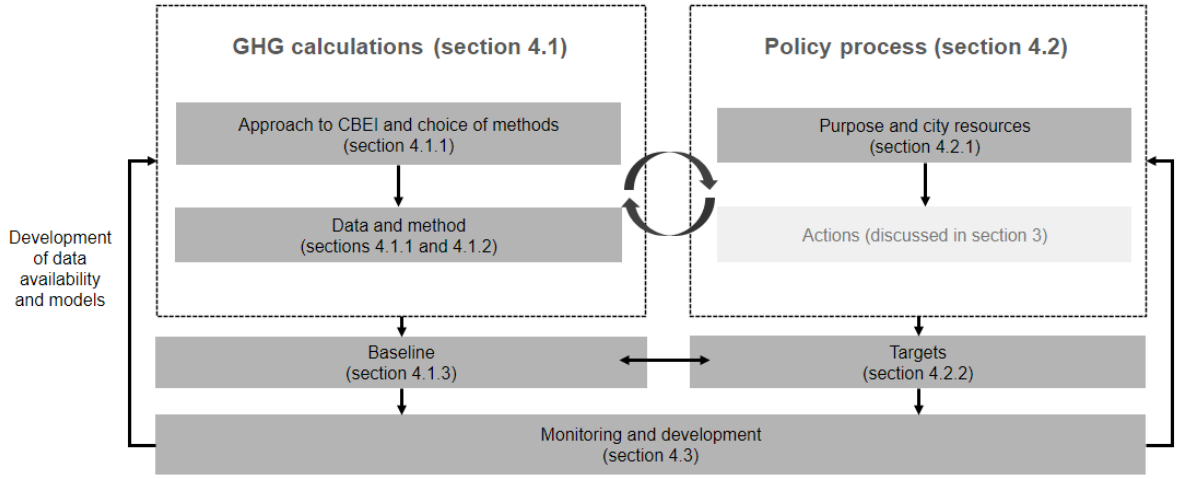


Figure 3. GHG calculations and policy depicted as parallel processes (see section 3.2's discussion of the actions embodied by the policy process). Flow chart where processes and outcomes of GHG calculations and policy processes are described in

[66] 'Carbon Metrics for Cities: Production and Consumption Implications for Policies'.

4.1 GHG calculations

Approaches to GHG inventories fall into two main categories:

1. The production-based approach (PBA), or territorial approach, which sets the city's borders as the boundary for the emissions covered

2. The consumption-based approach (CBA), which covers those GHG emissions generated through consumption of goods and services both within and outside city borders[67]

While the CBA approach is aligned well with our project and we examine how to conduct a city consumption-based-emissions inventory, or a CBEI as earlier referenced, accordingly, other methods exist and are still emerging. One of them is the community-wide infrastructure footprint approach (CIFA), a hybrid strategy that covers both territorial and trans-boundary GHG emissions. This practical approach covers supply-chain emissions from essential infrastructure: energy and water supply, transport, wastewater treatment, building/shelter materials, green/public spaces, and food provisioning.[68] While a comprehensive picture is important, no inventory can address everything, and complexity may grow unmanageable. Keen awareness of what lies outside the boundaries is vital.

4.1.1 Approaches to consumption-based emission inventories and the choice of methods

A CBEI assesses all greenhouse-gas emissions associated with production, transportation, use, and disposal of the goods and services consumed by the community or other entity within the given period[69]. There is no single calculation standard, model, or tool for conducting CBEIs, and various methods exist; however, some guidelines have been offered to this end[70]. For instance, updating the inventory every 2–5 years is recommended best practice per the

[67] Emissions can be allocated on the geographic location of the final purchase, e.g., purchases from a grocery store (i.e., destination-based allocation) or based on the home-residence of the consumer regardless of the geographic location (residence-based). In the former, city X's emissions may be distorted for example by a high level of tourism or commuting into city X. While on the latter, all city X residents' consumption-based emissions are allocated to the city, including goods purchased in another city or abroad on holidays. For further reference see the 2020 paper *Spatial consumption-based carbon footprint assessments - A review of recent developments in the field* by Jukka Heinonen, Juudit Ottelin, Sanna Ala-Mantila, Thomas Wiedmann, Jack Clarke & Seppo Junnila (Journal of Cleaner Production Vol. 256. Available: https://doi.org/10.1016/j.jclepro.2020.120335)
[68] 'Carbon Metrics for Cities: Production and Consumption Implications for Policies'.
[69] See the February 2019 Stockholm Environment Institute report 'Estimating Consumption-Based Greenhouse Gas Emissions at the City Scale: A Guide for Local Governments', prepared by Derik Broekhoff, Peter Erickson, and Georgia Piggot, available at https://www.sei.org/wp-content/uploads/2019/03/estimating-consumption-based-greenhouse-gas-emissions.pdf.
[70] The SEI report (Ibid.) is one such effort.

examples of Adelaide and San Francisco[71], but updates should be considered based on city-specific factors. Among the key factors in the choices behind a CBEI are the quality and types of data available and the most suitable method for calculation over the relevant time span. In general, the input data available dictate the calculation method, and the emission baseline for target-setting and monitoring usually comes from the first year subject to calculations. For example,

- econometric input–output models are most suitable with spending data (e.g., details of the money spent on goods and services) while
- process-based life-cycle assessments (LCAs) utilise 'physical data' (actual quantities of goods as revealed by billing data, waste-audit data, surveys of consumers, etc.).

Proceeding from established best practice for developing CBEI guidelines[72], we discuss three distinct methods for conducting a CBEI, below: use of 1) a top-down model, with spending data + econometric modelling; 2) a bottom-up model, relying on physical data + process-based LCAs; and 3) a hybrid model combining the two aforementioned models. Each of the three requires certain types of data, data-collection methods, and calculation frameworks.

4.1.1.1 The top-down approach

To apply the top-down approach, the city uses spending data with an econometrically based input–output model to form an overview of local consumption. The practitioners proceed from general (national or regional) data, which they subject to various means of 'downscaling' to describe general consumption patterns in city context[73]. Downscaled data does not accurately describe city´s unique consumption patterns or economic structure but gives general information on consumption trends based on national or regional data. Once brought down to city level, the numbers can be drawn even lower, to represent an average individual resident's consumption-based emissions or, alternatively, illustrate the average household. National estimates of consumption at this level[74] can serve either in lieu of econometric modelling or to complement it, and the data often permit comparing city and national household averages. Input-output models may include restrictions in their scope (e.g., exclusion of emissions coming from capital investments such as buildings) that should be considered when deciding on scope and using such model.

Econometric modelling traditionally applies models that map the types and relative quantities of goods and services (the inputs) that go into producing the products ultimately consumed (the outputs). Also, input–output models can capture the various inputs' and outputs' interdependencies, and knowing each input's GHG emission factor lets one estimate the total

[71] Per Workshop 2 (of September 8 2022): CNCA Consumption-based GHG Emissions Policy Framework for Cities.
[72] As presented in the 2019 SEI report 'Estimating Consumption-Based Greenhouse Gas Emissions at the City Scale: A Guide for Local Governments'
[73] More about downscaling data in the 2019 SEI report (Ibid).
[74] Ibid.

GHG emissions of the final goods or services per currency unit spent. Econometric models put to environmental purposes, sometimes called environmentally extended input–output (EEIO) models[75], equip cities for production- and consumption-based inventories both. These can aid in identifying the most emission-intensive goods and services, judging consumption levels in relative terms by category, and pinpointing the most emission-heavy parts of the life cycle.[76] Among the globally available input–output models commonly behind CBEIs are EXIOBASE tools, the GTAP GMRIO, and EORA models.

Since the spending statistics available cover a wide array of consumer goods and services, they afford 'seeing the big picture' of consumption-based emissions. In most cases, regional or local analysis based on spending requires starting with national data. There are several benefits to relying on spending figures, such as widespread data availability in many countries and frequent surveys by national/regional statistics institutes or other entities. However, the data's granularity varies, as tracing the data from national to local scale often proves impossible.

4.1.1.2 The bottom-up approach

When the foundation is, in contrast, data from the locale itself (e.g., collected directly from the city's residents and companies), one can form a detail-rich picture of its consumption-based emissions and perform a genuinely community-specific analysis for the relevant goods and services. Rather than apply econometric modelling for an overview, the city works with local figures at the level of units (per ton of waste, kilogram of foodstuffs, etc.) or total quantities (e.g., masses of material from waste-audit data) and conducts an LCA accordingly. This requires suitable data sources. Some data, such as utility-billing details that reveal the quantities of electricity, water, etc. used, may already be in the city's possession, with businesses' data and surveys of consumers completing the picture. For instance, consumer-level data may potentially be available from retailers that furnish their customers with consumption details.

While a bottom-up method offers a window to fine-grained measurements and estimates of actual consumption levels within the city, the data sources bring their own issues. For instance, waste-audit data cover only a narrow range of products (items differ in how they are disposed of). Such gaps are inevitable, so the bottom-up approach cannot capture the full flow of goods at city level. A genuinely comprehensive CBEI requires supplemental material. This is prudent in any case, since the in-depth analysis demanded by LCA often renders LCA for a wide array of consumer goods infeasible.

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[75] Further information on gathering data for EEIOs has been compiled in the report 'Environmentally Extended Input–Output Tables and Models for Europe' report (details available at https://op.europa.eu/en/publication-detail/-/publication/1edb6271-5b07-40fa-ae6b-55bce1c1c220).
[76] See the SEI's 2019 report 'Estimating Consumption-Based Greenhouse Gas Emissions at the City Scale: A Guide for Local Governments'.

LCA still constitutes a valuable lens: by covering all stages in the product life cycle, it can inform policy development with insight to alternative production, transportation, use, and end-of-life processes. However, the city must bear possible gaps in mind. It may have to find additional data sources, process the data for comparability, and tune the LCA calculation methods where the assumptions behind the framework do not mesh with the city's reality (e.g., atypical production patterns).

4.1.1.3 Hybrid models

Combining the two methods discussed above offers a third approach. Models that apply econometric modelling and LCA as complementary methods can offset some shortcomings of each. The hybrid approach utilises both large-scale spending data (in line with the top-down approach) and local physical data (applied bottom-up), to eliminate blind spots and flesh out the picture of the local consumption-based emissions.

The implementation may take physical data as its foundation, complementing these details with national-scale spending data or other higher-level measurements (e.g., odometer readings), or it may proceed from the other direction, complementing high-level consumption-related data and econometric modelling with local-scale LCAs for selected goods and services.

4.1.1.4 The choice of method

The city's conditions, the needs motivating the CBEI, and other case-specific factors determine which method is best. Generally, high-level data serve primarily informational purposes, orienting overall efforts, while local policy development and related monitoring demand more in-depth bottom-up work. Balance is paramount: detecting and monitoring the impact of a policy change may remain impossible without a local survey, yet the data acquisition and complex calculation entailed by bottom-up processes may entail immense effort.

In light of such considerations, generally recognised best practice for cities conducting a CBEI is a hybrid approach that starts with national data and adds more local details for the consumption categories found most relevant.[77] Providing illustrations, Table 4 presents several methods of conducting a CBEI that appear to have yielded solid results.

[77] This emerged as one of the key findings from Workshop 2.

Table 4. Examples of CBEI approaches from selected cities.

City	Data type	Inventory process
Helsinki	Spending data (top-down approach)	Use of the Kulma model[78], developed by Natural Resources Institute Finland and Sitowise, to estimate consumption-based emissions (among its sources are national estimates and retailers' data on kilograms of goods purchased)
Stockholm	Spending data (top-down approach)	A SEI-developed Consumption Compass[79] tool is available for Swedish municipalities, but Stockholm is not yet using the method. The tool measures consumption-based emissions via economic figures from national data
New York	Spending data (top-down approach)	A spending-data-based CBEI developed in partnership with the C40 network, Amex, and London[80]
Vancouver	Physical data (bottom-up approach)	Application of the ecoCity Footprint Tool[81] (developed by Dr Jennie Moore), which follows a bottom-up 'component method' relying on community- and regional-scale data
San Francisco	Spending and physical data (hybrid model)	Econometric analysis of national household-survey data to reveal the main drivers behind consumption-based emissions across various product categories (e.g., meat); figures are then adjusted for San Francisco based on local conditions (e.g., emission factor for electricity, average home size, etc.).[82]

Developing a CBEI is advised as part of a *deeper approach*[83] as it provides a sound basis for tracking consumption-based emissions and target setting (see. Section 4.2.2). However, if CBEI is not possible due to e.g., lack of data, actions towards reducing consumption-based

[78] Presented (in the Finnish language) at https://www.sitowise.com/fi/uutiset/kuntien-kulutuksen-hiilijalanjalki-selvitettiin-ensimmaista-kertaa.
[79] The tool is presented, in Swedish, as 'Konsumtionskompassen' at https://www.sei.org/projects-and-tools/tools/konsumtionskompassen/.
[80] See the collaborative effort's press release at https://www.c40.org/news/amex-map-consumption-emissions-london-new-york-city/.
[81] This is available in app form via https://www.ecocityfootprint.org/#home (JavaScript required).
[82] The method and progress are detailed in 'Consumption-Based Greenhouse Gas Inventory of San Francisco from 1990 to 2015'.
[83] For more information on the lighter approach, see section 3.2.6.

emissions can be done also based on tracking and monitoring of emission-intense key indicators (*lighter approach*[84]). Using key indicators as a substitute for a CBEI may act as a steppingstone for more large-scale approach in the future but does not replace CBEI.

4.1.2 Obtaining the data

The first and most serious challenges facing a city CBEI frequently emerge in relation to the data's availability and suitability[85]. Since the choice of CBEI method and modelling technique hinges on the nature of the data available, the process should start with mapping the types, quality (including temporal and other granularity), and sources of the data available. The types of data that cities most often use are population/demographic details, economic figures, and local sector-specific data (e.g., car purchases/registration and construction permit applications)[86].

This characterisation leaves cities vast leeway, which might well be intimidating. However, ready-to-use tools and models to simplify emission calculations for cities are under development in many countries. One of them is the CoolClimate calculator (from www.coolclimate.org), which lets cities in the United States derive consumption emissions directly from spending. Similar tools for calculations from spending data have been developed in the Nordic countries (Konsumptionskompassen in Sweden and the Kulma model in Finland). These tools aid in deriving more detailed information about the specific consumption characteristics of a city (e.g., carbon footprint of city´s food consumption, energy use or building and construction) but currently their use requires specific expertise and are commonly used in collaboration with researchers and other experts.

Emissions may be, for example, represented as absolute figures either *per capita* or at household level, depending on the city's aims (such as the targets of an awareness campaign) and the data available[87].

The table below outlines the types of data sources commonly associated with inventories applying the above-mentioned methodological approaches and tools.

[84] For more information on the lighter approach, see section 3.2.6.
[85] Per the Workshop 2 output 'CNCA Consumption-based GHG Emissions Policy Framework for Cities'.
[86] Ibid.
[87] For details, consult the 'Consumption-Based Greenhouse Gas Inventory of San Francisco from 1990 to 2015'.

Table 5: Outline of methodology for approaches to calculating consumption-based emissions

	Spending data (national, regional, and local)	**Physical data (units of goods and services consumed)**
Data sources	• Spending statistics from national agencies' and other organisations' records • Existing estimates of national-level emissions from household consumption (see. Tools below)	• Locally collected data from questionnaires surveying residents' behaviour and technology choices • Goods- and services-import data from businesses (e.g., grocery, electronics and appliance, and clothing retailers)
Tools	• The CoolClimate calculator (for the US context) • Konsumtionskompassen (Sweden) • The Kulma model (Finland)	• The ecoCity Footprint tool (based on local activity as represented by utility bills, transportation surveys, data on waste composition, etc.)

Cities' increasing attention to engagement with the local community for data collection with an engagement orientation could dovetail with the calculation efforts discussed above. A project in Boulder, Colorado, invited 200 residents to carry heat sensors with them so that the local government could better understand temperature variations within the city[88]. Cities could well integrate novel techniques of this nature into their consumption-based emissions projects. The benefits are twofold: from the data collection and people's involvement in it. Fine-grained data can augment the city's interpretation of the higher-level economic and other figures without extensive effort, and society can reap vast engagement and advocacy benefits.[89]

4.1.3 Forming a baseline

Baseline or base year is a historical datum (e.g., year) against which a city's emissions are tracked over time. Thus, baseline refers to the reference emission level. The baseline can be complemented with business as usual (BAU) scenarios that are the result of the *status*

[88] For more information see City of Boulder, Mapping Heat islands, available at: https://bouldercolorado.gov/projects/mapping-heat-islands
[89] Per the Workshop 2 conclusions.

quo policies, estimating probable future emissions levels without emission reduction actions (baseline scenario).[90]

The baseline figures come from the CBEI calculations. That is, the first year assessed in the inventory is the base year, producing the city's reference emission level. The selection of the baseline year is largely determined by data availability – usually, it is the most recent year for which sufficient data are available. To be credible, the baseline figures ought to provide the widest possible coverage of relevant emission categories. It also should be a recent year with representative emission levels, reflecting typical consumption. In one timely example, 2020–2021 might not serve as valid base years for many cities, on account of the SARS-CoV-2 pandemic. Example baseline years include San Francisco's[91] and Portland's[92] 1990 that mirrors the base year of the Kyoto protocol[93], or London's 2001[94].

4.2 Policy process

4.2.1 Purpose and city resources

Cities must balance limited resources between creating/applying strategies for consumption-based emission inventories and implementing policies accordingly. When setting targets, cities must consider the purpose behind the work and the range of actions that are possible and practical.

For example, an off-the-shelf tool (e.g., the CoolClimate one) may suffice for informing citizens of their household's environmental footprint, while local policy development and impact-monitoring often require a more in-depth inventory and wider approach. In isolation, top-down estimates of spending do not enable tracking consumer behaviour and consumption patterns, because of the scale involved and the data's rough resolution. On the other hand, bottom-up approaches facilitate city-specific tracking of these but still may leave information gaps.[95]

Practical resource constraints and the various complexities of data collection, calculations, impact assessment, and target-setting have prompted cities to consider a phased approach to consumption-based inventories and new ways of setting targets[96]. After all, climate actions

[90] 'Global Protocol for Community-Scale Greenhouse Gas Inventories'.
[91] 'Consumption-Based Greenhouse Gas Inventory of San Francisco from 1990 to 2015'.
[92] Climate Action Plan for Portland, Oregon area.
[93] Kyoto Protocol is an agreement adopted in 1997 to mitigate climate change and report on progress. The protocol is available at: https://unfccc.int/resource/docs/convkp/kpeng.pdf
[94] See 'London's consumption based greenhouse gas emissions 2001-2018', available at: https://data.london.gov.uk/dataset/london-s-consumption-based-greenhouse-gas-emissions-2001-2018
[95] This counts among the findings presented in the 2019 SEI report 'Estimating Consumption-Based Greenhouse Gas Emissions at the City Scale: A Guide for Local Governments'.
[96] According to the Workshop 2 outputs.

are urgently needed, so commencing even with an incomplete body of data is better than waiting. Also, the process can evolve: it may begin with relatively qualitative targets that express an awareness-related goal related to getting the community involved and establishing motion. Such actions before the CBEI set the direction and gather momentum. Then, as the baseline is formed, data become available, and the policy direction is established, the city can adjust its targets to become more action-based and focus on the consumption categories that the CBEI has revealed to have the highest emissions. The city can tune policies for specific products or stages in their life cycle as it completes more detailed analysis and develops insight related to the major emission sources identified. With this groundwork completed, the city is equipped to monitor progress via a selection of a few key indicators for consumption patterns.

Since inventories of consumption-based emissions can be labour-intensive and demand some expertise, most cities that do not already have estimates or calculation models available outsource the calculation portion of the work. Also, pooling resources with neighbouring cities or municipalities is recommended, for better coverage, consistency, and comparability of local inventories[97].

4.2.2 Target-setting

Although cities' targets for consumption-based emissions vary with local circumstances, goals, stage of climate action, and resources, the project identified a few popular strategies for target-setting. One of these is to establish annual reduction targets (such as a certain percentage every year until 2030). Another is to set an overall reduction target for a given time span (reduction by a certain percentage before 2030). For example, Gothenburg has stated that consumption-based emissions must be reduced by at least 7.6% per year by 2030[98], while both San Francisco[99] and Paris[100] have specified a 40% reduction in them by 2030.

More specific targets are possible too, such as targets and actions specific to 'indicator products'. In our consumption categories of focus, some of these might be, for example, meat and dairy products (in the food category), cotton and polyester (for textiles) or specific electronics or appliances. Emission-reduction targets can be set per household also, on the basis of, for example, the average consumption level. Indicator specific targets can be monitored by using indicator products as proxies that guide actions. These targets may complement

[97] Per the SEI report 'Estimating Consumption-Based Greenhouse Gas Emissions at the City Scale: A Guide for Local Governments'.
[98] See 'Environment and Climate Programme for the City of Gothenburg 2021–2030' available at: https://goteborg.se/wps/wcm/connect/be800f8b-8c25-498e-80e8-b982d56ddc08/Environment+and+Climate+Programme+for+the+City+of+Gothenburg+2021%E2%80%932030.pdf?MOD=AJPERES
[99] 'San Francisco's Climate Action Plan 2021'.
[100] 'Paris Climate Action Plan'.

general goals for consumption-based emission or act as an easy steppingstone towards more large-scale targets (e.g., when city utilizes the *lighter approach*).

Setting targets may be challenging, for example, because of the novelty of the subject and lack of benchmarks from similar cities. In addition, the constantly developing CBEI methodologies and improvements in the applicable data may set challenges to target setting as well as for monitoring the targets. However, targets can be modified and specified (e.g., in terms of specific indicators) later based developments in methodologies or e.g., data coverage.

4.3 Monitoring and development

While factors such as the data's coverage and resolution can render monitoring of consumption-based emissions tricky, monitoring is crucial. Cities cannot assess the chosen policy measures' impact or the progress toward their targets without it. Tackling the issue of monitoring requires a shared understanding of the specific aim behind it, discussion of the challenges that the data and calculations may present, and possibly also setting of objectives for the monitoring and its future development.

While it is important to reduce consumption-based emissions in aggregate, their sum total alone may reveal little about the actions' impact. Consumption-side monitoring differs markedly from its production-based counterpart, in which effectiveness can be gauged largely from current emission levels. In the context of consumption-based emissions, evaluating the relationship between action and outcome involves large uncertainty factors, and it varies between consumption categories. That said, one can refine the process somewhat by means of indicator products: the selection of products to track should be based on their share in total emissions and the emission-abatement potential.

When taking the *deeper approach* to develop systematic monitoring process the cities should decide, how often they perform CBEI. The inventory and monitoring cycle depends largely on the data used, timeframe of actions and the city resources (box 3). Here an inventory cycle of 2-5 years is suggested to develop a frequent monitoring schedule.

Box 3: Who should do the monitoring, and how often should checks be performed? The answers depend greatly on the data updates and developments, but we identified the following key considerations for the tracking schedule:

1. What data are used, and how often do city or external bodies (e.g., statistics agencies) update the databases?

2. With what timeframe are the actions to be implemented? What evaluation interval best fits the local politicians', city officials' and residents' needs – every other year, once every five years, …?

3. Who collects city-specific data and who analyses it (e.g., research cooperation, outsourcing to consultancies, etc.)?

A hybrid of top-down and bottom-up methods enables examining consumption-based emissions from multiple perspectives. For each consumption category, cities can use key indicators in their monitoring – for instance, the city of Stockholm has utilised meat kg per food kg procured by the city as an indicator on the city's food-related emissions[101]. The city has an annual target that decreases yearly, ensuring continuously declining emissions. Similar indicators could be utilised to track meat consumption within residents and thereby gain insights on the city's food-related consumption-based emissions. Mobile phones and refrigerators could serve as the key indicators in the electronic devices and household appliances category. In addition, category-specific waste-audit data and survey results can inform estimates for particular categories such that one can track and measure policy actions' effects on consumption.

Those cities taking the *lighter approach* on reducing consumption-based emissions could consider choosing only some specific indicator targets rather than undertaking complete emission inventories at the outset, then track them with key indicators as discussed above. This entails the assumption that the indicator targets will reveal whether the city is headed in the right direction, even if the impact on emissions cannot be accurately quantified. Hence, the city should take care to identify the targets and indicators well.

Transparent tracking of progress and communication is essential, for both informational and policy-development purposes. Transparency requires a solidly defined emission inventory that employs well-explained methods, non-opaque data, and regular publication of results. A potential solution could be a system where measurement, evaluation, and reporting are performed in one publicly available site similar to the Helsinki Climate Actions portal[102] or the Monitoring Evaluation and Reporting (MER) system San Francisco is developing[103]. To

[101] According to the Workshop 2 outputs.
[102] See Helsinki's Climate Actions, available at: https://helsinginilmastoteot.fi/en/.
[103] 'San Francisco Climate Action Plan 2021'.

develop the CBEI methodology and its accuracy the city should apply updated methodologies and data sources when available, understanding that this may compromise comparability with previous CBEIs. The CBEIs' results may be distorted by developments in data or enhanced methods. For instance, data that capture a larger percentage of disposal may lead to the erroneous conclusion that emissions are rising. If such improvements in coverage bring previous underestimates to light, transparent communication about the reasons can rectify matters.

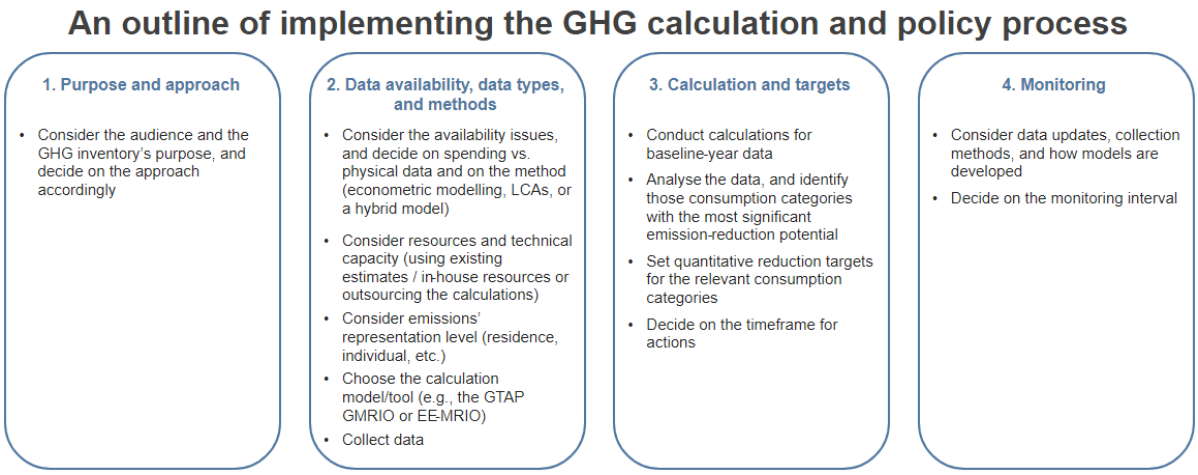

Figure 4. An outline of implementing the GHG calculation and policy process.

4.4 Recommended policy for baselines and targets

The desk study and dialogue with cities led to several recommendations for GHG calculations, policy development, and monitoring. On this basis, the team identified the following steps as central for cities deciding how to address consumption-based emissions:

- Consider the purpose of developing a consumption-based emission inventory and what might be possible limitations for doing CBEI. Commit to decrease consumption-based emissions within the city. This commitment early on aids in gathering momentum at community level and educates the citizens and other local actors in the effects of consumption-based emissions and the impact of possible mitigating actions.

- Start working to decrease consumption-based emissions in the consumption categories identified as significant, even if there are insufficient data to verify the actions' impact at this stage. Trust in the expertise at the city's disposal – it can reveal what is most important and that the direction is appropriate.

- Conduct, if possible, a top-down CBEI based on national averages to set a baseline and identify the consumption categories causing the largest emission burden from the city. The process can be repeated every five years to reveal how high-level data trends have changed. When possible, include bottom-up data from the first update onward, at least

for the most significant emission sources. Developing a CBEI is recommended as it provides a sound basis for consumption-based emission mitigation and establishes a systematic updatable approach (*deeper approach*). However, if CBEI is not possible due to e.g., lack of data, the city can take a *lighter approach* and develop actions based on tracking and monitoring of emission-intense key indicators (e.g., meat). Using key indicators as a substitute for a CBEI may act as a steppingstone for more large-scale approach in the future but does not replace CBEI.

- Set specific qualitative and/or quantitative targets such as a qualitative target expressing the level of reductions the city aims to reach by a specific year (e.g., 40% reduction in consumption-based emissions) or qualitative targets based on emission-intensive key indicators. You can modify targets on the basis of later CBEI results, developments in data coverage, and enhancements to methods.

- Focus your policy development on the major consumption categories and select appropriate key indicators for monitoring. The set of tightly focused indicators (such as meat consumption or use of cotton as revealed by surveys) can be adjusted if, for example, the relative significance of the various consumption categories changes.

Throughout the process, communicate progress transparently, publish results openly, and invite city-wide community dialogue incorporating best practice for collaboration in pursuit of climate justice (identified in section 2).

5 The policy framework for strategy implementation

The policy framework (illustrated in Figure 5 below) was developed based on an extensive desk study, interviews, workshops, and discussions with the steering-group cities. In its full form, it synthesises 18 recommendations, addressing the following themes:

- General recommendations – six recommendations focused on understanding consumption-based emissions, cultivating preparedness, and mitigating the emissions in a holistic manner
- Climate justice recommendations – six recommendations aimed at ensuring that multifaceted awareness of climate justice is a cornerstone in the process of preparing policy, developing the city's actions, and evaluating the results
- Calculation recommendations – a step-by-step guide comprising six recommendations for comprehensive efforts to identify impacts, calculate and monitor the consumption-based emission

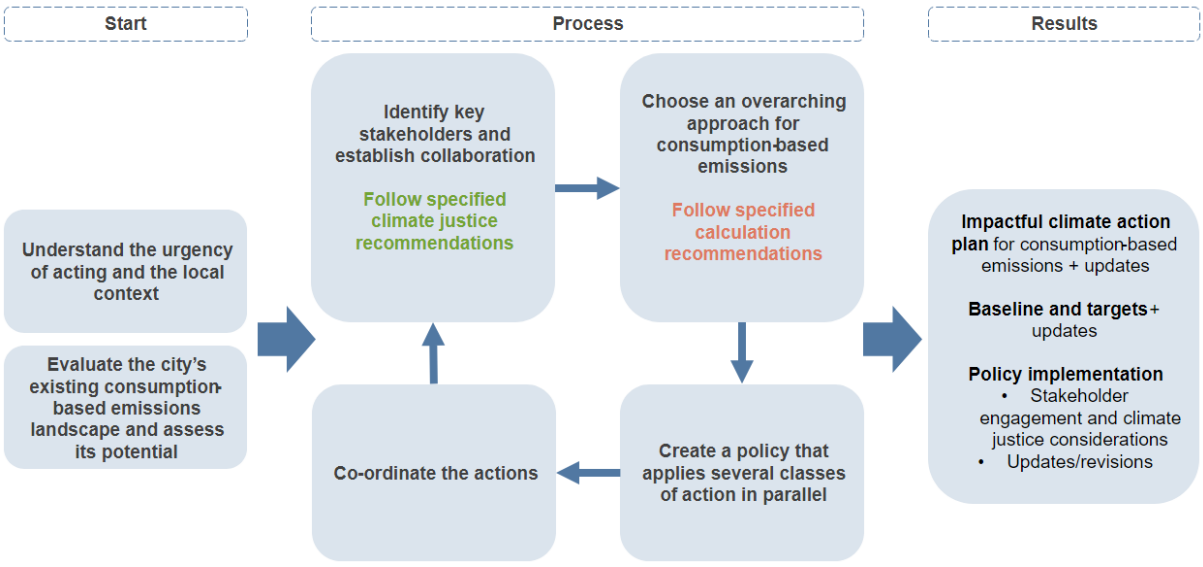

Figure 5. The process connected with the consumption-based emissions policy framework.

Cities' journey to reducing consumption-based emissions is not a linear path but a continuous iterative process of doing, learning, and adjusting in light of the information amassed, the tools and technology available, and stakeholders' evolution and input. Hence, the individual recommendations are far from independent, and we conceptualise their links to each other in terms of looping processes. In general terms, cities should commence their journey by identifying the key stakeholders, choosing a suitable approach, creating the policy mix and establishing solid mechanisms for co-ordinating the actions to follow. Some cities may arrive at their destination through a single loop, while others might benefit hugely from

several rounds of stakeholder identification, approach choices, policy-mix formulations, and co-ordination revisions. In all cases, the do–learn–adjust approach entails regular updates: periodically returning to the process loop ensures just and impactful consumption-based emission-mitigating policies.

At this juncture, it bears reiterating that, while our study focused primarily on food, textiles, and appliances and electronics, the end result may be utilised for a broader spectrum of consumption categories. The aim is to assist cities – whatever their local context might be – in the larger journey of reducing consumption-based emissions. The recommendation-specific tables below synthesise and condense content discussed in greater depth earlier in the report. Analysis of each recommendation is presented alongside good example cases from actual city practice, which offer inspiration and reference value.

5.1 General recommendations

5.1.1 Understand the urgency of acting and the local context

Ascertain what general measures the city can take to lower consumption-based emissions, and articulate an overall purpose for initiating action. Form a good understanding of the benefits and burdens that each potential action could create, not merely its emission impact. Disseminate this understanding widely to build support within the city and among stakeholders.

There is strong consensus among numerous cities that the measures currently in place, focusing especially on awareness-raising, cannot decrease consumption-based emissions on their own. Therefore, cities now acknowledge the need for deeper, system-level change, for genuine transition to more sustainable lifestyles.

Possible considerations	**Examples from cities**
• The magnitude of consumption-based emissions (double the size of production-based emissions) has prompted cities' increasing exploration of opportunities to address these alongside production-based emissions actions in their climate work. • Cities already address consumption-based emissions e.g., via their procurement practices. For more impact, many cities could expand the actions in line with a more systemic approach. • Each city is unique in its starting point and the expected impact of consumption-based actions.	• Cities and other entities, around the world, offer many examples of strategies and practices that can offer inspiration and a model. The strategy-specific tables in section 3.1 following our template provide links to further references. • In ground-breaking efforts, Portland has established a working group to investigate a paradigm shift for defining economic progress in a manner that better reflects community resilience, well-being, and environmental limitations. See section 0.

5.1.2 Evaluate the city's existing consumption-based emissions landscape and assess the potential

Map what the city government is doing now to address consumption-based emissions, which departments' activities tie in with emission policies, what kinds of knowledge and data are already amassed and handled by the city officials, and what kinds of stakeholder involvement exist. The goal is to obtain an overview and facilitate wise use of resources, so it is key not to get stuck in this phase and sink excessive time into this orientation stage. Assess opportunities for further action in light of locally relevant factors, to unlock the city's emission-reduction potential.

The picture produced should reflect the local context and consider the most likely emission hotspots while also highlighting the key factors in emissions from local consumption (e.g., household size, electricity mix, transport methods). For example, on contextual differences: Finnish diets are generally more emission-intensive than Japanese – therefore adoption of a vegetarian diet is a more impactful action in terms of mitigating consumption-based emissions in Finland than in Japan.

Possible considerations	**Examples from cities**
• A comprehensive picture of the action landscape requires input from people throughout the city organisation, since information on policies related to mitigating consumption-based emissions may be scattered and diffuse. • The status should be reviewed periodically. • Once cities have pinpointed the part of the product's life cycle that generates the most emissions and has the most significant abatement potential, they can target their policies precisely to the corresponding part of the value chain. Also, they should favour actions in the areas of their greatest influence. Looking into both of these aspects enables a more systematic approach to consumption-based emission mitigation. • Since groups of people differ in their consumption patterns, the relevant differences should be identified.	• Portland has calculated that the production stage generates a substantial share of the emission burden in the city's focal consumption categories (apart from electronics, ~90% of whose emissions are use-based. See section 3.2.1). • Some of the factors identified by San Francisco as correlated with consumption-based emissions are demographics (income, household size, race, education level, home characteristics (home size/structure, home ownership, structure type, heating arrangements, behaviour related to vehicles and travel patterns, geography-linked variables (population density, weather), and economic data (energy prices). See section 3.2.2.

• Equity considerations necessitate policy design that considers the needs of priority communities.	

5.1.3 Identify key stakeholders and establish collaboration

Cities' stakeholders' relative importance depends on the local context, but generally the process should consider prominent companies and other industry actors, communities and groups (especially priority communities), NGOs, government entities, and educational/research institutions. In planning of consumption-based strategies, it is important to collaborate with the stakeholders to assign clear roles to the various parties.

Stakeholders' engagement actions ensure inclusion of the major emitters, important changemakers, and priority communities, thereby yielding impactful and equitable mitigation measures. The actions of the city and each of its discrete stakeholders benefit each other and create increasing momentum that propels joint efforts forward.

Possible considerations	**Examples from cities**
• Relevant stakeholders can be identified by examining the value chain of the focus consumption-category or product. • Cultivating and maintaining stakeholder engagement is an ongoing process. • The potential for the city's actions to exert an influence varies between stakeholder types, as do the appropriate tools. For instance, engagement especially with large industrial companies ties in with city procurement practices. • Targeted outreach can raise awareness of sustainable choices among several stakeholder groups.	• Amsterdam's circularity strategy assigns roles to specific stakeholders in pursuing each of the city's subsidiary strategies (e.g., for the food substrategy). See section 3.1.1. • San Francisco's EPR strategy imposes shared responsibility for end-of-life product management on producers and other relevant entities involved in the value chain. See section 3.1.12.

5.1.4 Choose an overarching approach for consumption-based emissions

Decide on the granularity of the approach, considering the purpose and use as well as possible barriers such as resource-scarcity or data availability.

To systematically address CBEs, a *deeper approach* is advised. This implies the creation of a consumption-based emission action plan. Consumption-based emissions can be addressed under one umbrella strategy while it is also possible to develop several strategies for different consumption categories (e.g., food, textiles or electronics and appliances). Action plans assist in securing sufficient resources, facilitate thorough consideration of each consumption theme chosen for attention, and design the strategies for highly visible positive results. If employing a deeper approach, set a target and decide on the ambition level, design actions accordingly, and monitor the city's progress relative to the targets. Remember that short-term goals act as 'mile markers' and support an adaptive approach to understanding progress and adjusting strategies.

Developing an action plan is not mandatory for actions towards reducing consumption-based emissions. In a *lighter approach*, cities can develop actions around research-identified emission-intense consumption-categories (e.g., food) and key emission-intensive products (e.g., meat). For a lighter approach, choosing specific consumption categories and pilot actions may prove to be the most manageable technique.

Possible considerations	**Examples from cities**
• The most important thing is to get started and implement 'do-learn-adjust' principle. • A top-down approach may be inflexible and require considerable tailoring, while a bottom-up one could overlook opportunities for synergy and economies of scale. • The traditional emissions-reduction rubric is facing increasing challenges as cities seek more systematic and efficient planning and progress-monitoring models (doughnut economics, metrics for well-being, etc.). • The participating cities concluded that the best approach is most likely to be a hybrid one that proceeds from the top downward but still integrates bottom-up elements.	• To develop its CAP, San Francisco utilised a conducted CBEI and performed extensive engagement work. The CAP includes a portion devoted to responsible production and consumption. See section 3.1.12 • In light of evidence that a decrease in emissions from food consumption follows, Stockholm is tracking the emission intensity of procured food. The city has an annual target that decreases yearly, ensuring continuously declining emissions. See section 4.3. • Amsterdam's circular strategy has mapped the social needs, environmental constraints, and life cycle stage each of the actions address. See section 3.1.1.

	• In conjunction with C40 Thriving Cities Initiative, Portland and Amsterdam both develop their strategies in accordance with the principles of doughnut economics. See section 3.1.1.

5.1.5 Create a policy that applies several classes of action

While the bulk of cities' activities thus far has been oriented toward awareness, such measures are not necessarily the most effective for reducing consumption-based emissions. The most effective policies cover actions of multiple kinds, so a dynamic mix of actions might well be more effective. After identifying the relevant mix, establish a timeframe for implementing the actions. Finally, choose key performance indicators to track progress on each of them.

The action categories, presented earlier on in the report, can be summarised thus:

- The city can **encourage** by creating an appropriate culture and providing information on sustainable choices via engagement campaigns etc.;
- It can **enable** through resources such as subsidies or staffing of services that advise citizens on a sustainable lifestyle;
- It can **enforce** outcomes by means of mandatory measures and restrictions (e.g., urban/zone planning and emission regulations), and
- It can apply the various means at its disposal to **advocate** actively such that legislators and markets are more likely to support a sustainable lifestyle.

Possible considerations	**Examples from cities**
• The most effective policies are cross-cutting ones to draw together actions from multiple categories that are tailored for specific local contexts. • The policy mix should be revisited periodically. • Enforcing actions are less commonplace in cities' arsenals than at other levels. Applying the stick rather than the carrot is often challenging politically and may entail prohibitive costs; also, the mandate may lie with higher-level jurisdictions.	• **Encourage**: Measures to inform individuals in relation to guidelines for a sustainable diet form the core of Milan Urban Food Policy Pact efforts. See Table 33. • **Enable**: Helsinki will increase the proportion of vegetarian meals in schools and day care centres based on the national nutritional guidelines. See Table 33. • **Enforce**: Glasgow City Charter seeks commitments to circular economic and sustainable practices from its stakeholders. See Table 33. • **Advocate**: Paris collaborates with other cities, in Europe and around the world, to promote sustainable food and agriculture for all (e.g., via EU-level lobbying in support of local food production). See Table 33.

• Key indicators are often a more accessible mechanism than a full-scale CBEI, and they afford relatively simple monitoring. Therefore, they are especially important for acting on identified 'low-hanging fruit' in the earlier stages of consumption-based actions, before an exhaustive calculation process establishes a complete foundation.	• Each key indicator should reflect the emissions of the consumption category in question; for these, the city should choose emission-intensive products. e.g., meat, cotton or a mobile phone, See section 4.3.

5.1.6 Co-ordinate the actions

The actions and management connected with consumption-based emissions may be tucked within various branches of the city organisation. To encourage co-ordination and afford a holistic picture, which can reveal opportunities for collaboration, establish a co-ordinating entity to maintain awareness of the consumption-based actions in the city.

Possible considerations	Examples from cities
• For some cities, it makes sense to unite all consumption-based actions under one umbrella strategy, while others might find it more suitable to develop several consumption-category-specific strategies. Whichever framing they select; the most important element is central co-ordination of all the efforts involved.	• The work under San Francisco's climate action plan is co-ordinated by the Environment Department. See section 3.1.12. • Portland's Bureau of Planning and Sustainability co-ordinates the city's actions for sustainable consumption and production. See section 0.

5.2 Climate-justice recommendations

5.2.1 Build an initial understanding of possible priority communities

Incorporating priority-community engagement into the consumption-based action plans leads to more equitable policies and simultaneously advances work toward the city's climate goals through more universal engagement and acceptance of the policies. Consider climate justice and equity from early in the planning and policy-development process, to minimise resistance to climate action and contribute to mutual trust that builds dialogue and change between the authorities and the many groups who constitute the city's people.

The climate-justice process is interwoven with the identification of stakeholders, so the two often commence simultaneously. Articulating the purpose and benefits of climate equity and justice clearly from the outset should support shared understanding among city staff, businesses, and communities alike as to the aims behind the climate-justice work.

Possible considerations	**Examples from cities**
• Community engagement and corresponding communications may play a vital role in building trust between cities and their constituent communities. • When considering food, textiles, electronics and household appliances a substantial share of the affected priority communities may be located outside the borders of the city in raw material producing countries, e.g., mining minerals or growing cotton.	• Vancouver's work to develop a climate-justice charter convened a working group comprising of representatives of priority communities. The resulting document, developed independently by the working group, guides all of the city's climate-related efforts. See section 2.3.

5.2.2 Incorporate equity into the core of policymaking

Integrate climate equity and justice into climate policy, side by side with emission reductions. This includes equipping the organisation to address climate justice – for example, by educating city employees about diversity, equity, and inclusion, or DEI. Develop strategies and performance indicators specific to equity.

Consider the following questions: How can climate equity be integrated into climate policymaking? What kinds of abilities and resources does the city already possess in the equity and justice domain? How could the city get priority communities involved and encourage their involvement in integrating equity with policymaking? How might tools aid in bringing their voices and lived experiences into it and improve the representation of priority communities in appropriate positions of power?

Possible considerations	**Examples from cities**
• Since integration of an equity component may face resistance when there is no mandate, policymakers can nurture motivation for their climate-justice work by articulating the benefits listed in the previous recommendation. • To incorporate equity into public plans and strategies and to build their internal capacity and skills for implementing these, cities must gain insight from the priority communities' perspective. Their involvement may include a project-specific equity working group in which they are represented.	• San Francisco developed its R-SEAT tool to address climate justice in the climate action plan's multiple strategies. This set of questions is designed to help city officials assess climate justice and consider priority communities in their policymaking. See 2.3. • The New York Mayor's Office for Climate and Environmental Justice furnishes city policymaking with special emphasis on an equity and justice perspective. In systematically identified environmental justice (EJ) areas, analyzing EJ concerns, and evaluating relevant City programs and processes, the city strives to meaningfully engage with priority communities, and embed EJ considerations into City decision-making processes. See sections 2.2.2 and 2.3.

	• Vancouver has adopted an equity framework with the ambitious goal of handing decision-making power to the communities e.g., climate justice will become a section in Council reports. The development work led to awareness that city staff should adopt a new way-of-working and dedicate more resources to climate justice. See section 2.2.2.

5.2.3 Identify priority communities

Identify the priority communities, and develop an understanding of their burdens. A set of equity and justice tools can assist with this, as can establishing dialogue directly with community representatives (e.g., community advocates and community-based organisations).

City-planning tools such as spatial maps may prove suitable for identifying the communities – generally and policy-specifically. So might research-based publications by city entities and others. Such tools render it easier to identify relevant groups or neighbourhoods and assess both their present state and their current representation in the decision-making process. The city's efforts must extend further, however, for assessment of policies' likely impacts on them. This requires understanding their needs, which demands deep engagement.

Possible considerations	**Examples from cities**
• The inventory of priority communities must be updated regularly – to identify emerging inequity, address changes in the communities' geospatial distribution within the city, etc. • A solid overview might require input from members of various departments, since the pertinent information may be dispersed across the city organisation. • Identifying concrete information on the possible burdens is crucial. The city should not overlook data sources behind impact assessments for various policies or policy programmes.	• San Francisco identified its priority communities in conjunction with development of the CAP. The city has created a finer-granularity environmental justice communities map, which identifies at-risk groups and districts based on indicators such as income and pollution. Climate actions are then modified as appropriate to consider/redress these inequalities accordingly. See section 3.1.12. • New York is developing an environmental justice web-portal that will map out EJ areas throughout the city along with data on key environmental justice concerns. See section 2.3. • Among the Copenhagen climate task force's methods for breaking silos in city development is to assign climate officers to specific districts. By working with both local communities and central-office personnel, they form a link for fruitful dialogue between the people and officials. See section 2.2.2.

5.2.4 Empower priority communities to participate in the policymaking process

Provide multiple accessible opportunities for participation, via several channels. The engagement practices, tools, and methods should support and consider the resources of the priority communities. This has to be an ongoing process, so follow up and give feedback. Continuing the shift from consulting toward co-creation of policies, consider how to balance decision power (via citizen councils/assemblies, compensation for participants' time, and other mechanisms).

The aim for policy development with respect to climate justice is to understand the disproportionate and inequitable impacts of climate policies and to prevent/mitigate these through community engagement.

Procedures for stakeholder engagement should reflect the multifaceted approach required, by applying a multitude of tools and methods. Accommodating different means of participation, such as interviews within each relevant district, collaboration with NGOs, and city-hall events, affords a comprehensive picture.

Possible considerations	**Examples from cities**
• Existing guidance such as the Jemez Principles for Democratic Organizing can aid in the engagement design. • Engagement opportunities' accessibility requires suitable resources (e.g., support for multiple languages and offering of day care services). • Active and equitable engagement may require working alongside community leaders, advocates, and community-based organisations in various ways; providing accessible information; and other ways of addressing possible knowledge gap such that the engagement itself yields knowledge and involvement as intended.	• Many cities apply multiple engagement practices/policies in parallel, and equity work considers such factors as language barriers. Vancouver and New York are exemplary in their targeting of priority communities. See section 2.2.2. • Oslo's citizen councils bring a sample of the population into discussion of city development, to support transition from consultation to co-creation of policy. See section 2.2.2. • San Francisco's action-plan process recruited 11 leaders from community–based organisations representing a range of target demographics and stakeholders for a Community Climate Council. See section 3.1.12.

5.2.5 Assess policies' potential effects on the priority communities

Equity questionnaires and other such evaluation tools help the policy-development process assess who is and who is not targeted by the policy in question, how it affects the various groups identified, what unexpected outcomes might arise, are the benefits equally distributed, and how to maximise positive and minimise any negative effects.

The reflection and evaluation should engage the communities deeply. Ensure that the policy-development process accounts for representatives' and others' views, and follow up with the participants and larger communities.

Possible considerations	**Examples from cities**
• Address the diversity of perspectives and tackle all types of barriers to participation by providing different groups of people participation methods which suit their needs.	• Oslo applies guidelines it developed to evaluate all policy measures and budget proposals with regard to both the climate and the costs and benefits' distribution between groups. The distributional-benefits analysis for climate measures considers various people's social, mobility and age groups etc. See section 2.3. • San Francisco's R-SEAT equity questionnaire is an excellent contribution to policy design. See section 2.3.

5.2.6 Iteratively assess impacts, adapt, and create supportive policies

Be prepared to adapt, adjust, and create supplemental policies and programmes to enhance the work. A continuous process keeps the city attuned to newly emerging priority communities and relevant stakeholders.

Maintaining an equitable process requires active awareness and corresponding continuous improvements. While unexpected consequences may be unavoidable, agility prevents gulfs from developing and supports ongoing progress toward full equity and justice.

Possible considerations	Examples from cities
• Continuous monitoring and readiness to adapt requires readily accessible, well-publicised feedback mechanisms alongside a mindset and set of practices for adaptive city governance. • When soliciting citizens' feedback, cities should prioritise the priority communities, so as to target support measures to those whose needs require them most.	• In 2018, Vancouver adopted a strategy for reducing waste from single-use items. The strategy included a proposed by-law that would prohibit businesses from using plastic straws. During consultation with stakeholders on the proposed by-law details, City staff learned that a proposed by-law completely prohibiting businesses' use of plastic drinking straws could cause significant harm to people with disabilities, many of whom rely on flexible plastic straws to safely consume beverages and nutrition. Under the final version, adopted in 2019 and entering force in 2021, restaurants and cafés must make flexible plastic straws available on request, but no other types of plastic straws. See section 2.3. • All the component strategies of San Francisco's CAP are subject to an equity metric (still being honed) and a climate metric. See section 3.1.12.

5.3 Calculation recommendations

5.3.1 Initiate a suitable consumption-based emission approach

To choose the right approach (deeper or lighter) for consumption-based emissions, identify city resources and technical capabilities, assign responsibilities for setting baseline and target values for consumption-based emissions[104]. Sometimes, benchmarks from other cities' CBEIs can serve as a guide. Consider the calculations' use and the audience: the necessary granularity etc. differ between awareness-raising (such as informing communities of their consumption footprint) and policy development (developing impactful policies and judging their effects).

To systematically address consumption-based emissions, a deeper approach is advised. This implies the creation of a regularly updated CBEI. However, conducting a CBEI is not mandatory for guiding consumption-based emission mitigation. In a lighter approach, identifying and monitoring only a few key indicators can act as a steppingstone towards more comprehensive regularly updated CBEI.

Possible considerations	**Examples from cities**
• Conducting a CBEI is a resource-intensive process, but leads to long-term consistent consumption-based emission mitigation process • Cities might not possess sufficient expertise or resources for completing a full CBEI internally. An option would be to hire an external consultant. • The target granularity depends on the purpose behind the calculations.	• The SEI's compass helps Swedish cities and municipalities illustrate, analyse, and thereby diminish emissions at postcode granularity. See Table 4. • San Francisco has developed two consumption-based emission inventories with the aid of UC Berkeley's CoolClimate project, whose calculator enables calculating their consumption-based environmental footprint. See Table 4.

[104] *Developing a CBEI is recommended as it provides a sound basis for consumption-based emission mitigation and establishes a systematic updatable approach. Different levels of CBEIs can be conducted depending on the local context (e.g., whether there is national data available) and city resources (see section 5.3.3.) However, research has identified emission-intense key indicator products (e.g., meat) that could be monitored as proxies, guide actions and thus act as a small-scale substitute for a CBEI (see section 5.3.6). This approach does not capture the informational or policy design benefits that a CBEI has.*

• They are likely to serve an informational purpose initially: setting the direction, sparking involvement in the city, and gaining momentum for decreasing consumption-based emissions. • Later, the purpose often shifts to policy development focusing on the most emission-heavy sectors as revealed by the calculations, e.g., food. • Setting the baselines and targets may seem complex and challenging. Do not be discouraged – start the work with a 'learning by doing' attitude.	• The Kulma project assessed the consumption-based emissions of Helsinki and 13 other Finnish municipalities through support from Sitowise and Natural Resources Institute Finland. See Table 4.

5.3.2 Consider the data-collection approach and availability of data

Consider the various data-availability issues, and choose a way of using the data that matches the purpose and use intended for the calculations. Which sources are more suitable – spending or physical data? How often are the data updated? Could the city adjust the collection/update frequency or start collecting the relevant data itself?

Normally, the approach emphases either spending data, such as money spent on goods and services, or physical data: actual quantities of goods. Consumer surveys, billing details, and waste audits are typical sources for the latter.

Often, the first and most serious challenges encountered in city-level CBEI work are connected with finding data sources that are both readily available and applicable for the city's aims.

Possible considerations	**Examples from cities**
• Cities usually turn to population, demographic, and economic data; national and regional level data; and local sector-specific data e.g., car purchase/registration data or construction permit application data. • Emission data can be derived at either *per capita* or household level. Which functions better depends on the city's needs and the data available. • Engaging people in data collection may present advocacy advantages and, through finer-granularity data, could inform the city's interpretation of the higher-level data with richer insight.	• Various tools directly estimate cities' consumption-based emissions on the basis of spending data. Among them are the CoolClimate calculator (www.coolclimate.org), Sweden's Konsumptionskompassen in Sweden, and Finland's Kulma model. See Table 4. • Cities have started to consider how the local community's involvement could serve data-collection + informational aims. The City of Boulder project in which 200 locals carried heat sensors to help the local government understand temperature variations within the city is a case in point. See section 4.1.2.

5.3.3 Choose a calculation approach and collect the data

Choose an overall approach to the calculations (top-down, bottom-up, or a hybrid) and a tool to match it (EXIOBASE, GTAP-GMRIO, EE-MRIO, ecoCity Footprint, and other platforms are available). In a manner aligned with the approach chosen, collect the data, in light of the data-availability assessment conducted earlier.

The data sources and material used reflect the calculation approach, just as the nature, comprehensiveness, and other characteristics of the available data influence the kind of approach chosen. All three approaches have their implications for the best data type, data-collection model, and calculation framework.

- The top-down approach typically entails examining spending data in combination with an econometric input–output model to form an overview of local consumption.
- A bottom-up approach follows methodology of collecting local physical data – for example, directly from city residents – to inform the overview of consumption-based emissions specifically at city level.
- A hybrid model blends the other two approaches. It can support a more comprehensive picture of local consumption-based emissions.

Possible considerations	**Examples from cities**
• Comprehensive CBEIs at city level are rendered challenging by the costs involved and data limitations. Nationally or regionally, on the other hand, data on consumption-linked emissions are more readily available. The latter can give cities a starting point for well-informed decisions without requiring a full bespoke inventory. • The most suitable method varies with the city and with the purpose for the CBEI. Generally, high-level data (under a top-down method) serve primarily informative and engagement purposes well, while local policy development and monitoring of effects require a more in-depth bottom-up method. • A top-down approach may render the impact of a policy change invisible and make monitoring impossible.	• New York is looking into a CBEI creation jointly with C40, Amex, and London by means of a spending-based data model developed for assessing and addressing consumption-based emissions. See Table 4. • The SEI Konsumtionskompassen tool applies a top-down approach, stipulating municipality-specific results from national data. See Table 4. • Vancouver's bottom-up or LCA approach utilised physical data at community and regional scale and the ecoCity Footprint tool. See Table 4.

• Bottom-up techniques that involve bespoke local surveys may entail a heavyweight process, on account of the data-acquisition effort and the complexity of the calculation. Also, the result might not be comparable with, for instance, neighbouring cities' figures. • Generally agreed best practice for city-level CBEIs involves a hybrid technique that takes national data as a starting point, then adds detailed local data from the bottom up.	• San Francisco's hybrid approach has combined spending and physical data, for econometric analysis that uncovers the main drivers of consumption in each product category (e.g., meat) from national household-survey data and then estimates the city's consumption via modelling that factors in local variation in these drivers relative to national averages. See Table 4.

5.3.4 Define baseline year and perform the calculations

With the power of the statistics and more specific data, conduct a CBEI for the baseline year. If the baseline year deemed appropriate is not the most recent one with sufficient data, conduct a CBEI for the latter year too.

A credible baseline represents the widest possible coverage of relevant emission categories by the data. The base year should be a recent one that accurately reflects the usual emission levels. It should capture typical consumption.

Possible considerations	**Examples from cities**
• Choosing 2020–2021 may distort the conclusions because of the pandemic's effect on emissions, both locally and globally. • Among the generally recommended baseline years for calculations are 2018, 2019, and 2022 onward, with the choice depending on the data available.	• San Francisco and Portland use 1990 as the baseline year for their consumption-based-GHG inventory. See section 4.1.3. • London's baseline year is 2001. See section 4.1.3. • Cities' choice of baseline has often been informed by local circumstances. Among the considerations are avoiding years of recession, considering the data sources, and factoring in the methodology.

5.3.5 Choose the most significant consumption categories and set targets

Proceeding from the calculation results, identify the categories of consumption that are most significant by considering both their emissions and the abatement potential. Then, set targets and establish a timeframe for meeting them.

The targets will be specific to local circumstances, the city's aims, its stage in climate actions, and the resource pool. They can be quantitative or qualitative: create the best quantitative targets possible, and complement the set with qualitative targets. Most commonly, quantitative targets take the form of either reduction by a certain percentage each year until the end point or overall reduction by a target date.

Possible considerations	**Examples from cities**
• Target-setting is tightly bound up with the developments in data, data's availability, and updates to the data. • It should consider the full set of action categories (encourage, enable, enforce, advocate) so that the actions form an efficient policy mix. • Because data may have gaps and some consumption categories/factors are not fully captured/understood, the city must maintain awareness of the data's limitations and be ready to adapt to new information. Policymakers should welcome iteration and further honing of the targets.	• Amsterdam chose to focus on food and organic waste streams, consumer goods, and the built environment because of these consumption categories' economic significance to the city, their impact on ecology and climate, and the opportunities for Amsterdam to influence them. See section 3.1.1.1. • Portland has focused its efforts on the categories with the greatest significance as revealed by the city's CBEI: food, goods and services, construction, and land use. See section 0. • Gothenburg has set a target of reducing consumption-based emissions by at least 7.6% per year by 2030. See section 4.2.2. • San Francisco and Paris have set overall targets to reduce their consumption-based emissions by 40% by 2030. See section 4.2.2.

5.3.6 Monitor the actions' progress and changes in the data

When monitoring the progress of the set targets, follow the principle 'do, learn, and adjust'. Decide how and when to collect and update the view of the CBEI data, and examine how the calculation models may need to be developed in light of changes in data quality and availability. To preserve the view of overall consumption trends and the categories' relative impact while still accounting for enhancements, the city could consider reviews or updates to their CBEI every 2–5 years. Key indicators of emission-intensive products can be used instead of a CBEI or as proxies to monitor the city´s progress that may be otherwise difficult to detect.

This work must link the monitoring and the methods' development back to actions. Remember that monitoring consumption-based emissions involves many uncertainty factors: the relationships between policy actions and outcomes are complex, there are variations between consumption categories, etc. For guidance, continue following the identified (either in the CBEI calculation process or via the city's internal work) key performance indicators for the most relevant consumption-categories (e.g., meat, cotton, and mobile phones), and adjust and develop the actions carefully in accordance with changes in the data. Communicate transparently about the process to maintain understanding, support and momentum for consumption-based emission mitigation.

Possible considerations	**Examples from cities**
• The effectiveness of measures to reduce consumption-based emissions can be assessed in light of data on actual emissions, proxies for these, and/or activity data (what has been done in a given period of time). • Monitoring can be integrated with other climate-policy-related or emissions-related checking cycles, such as climate reporting or annual/biannual updates to statistics. • Feed the monitoring into communications with city residents. Communicate consumption trends, and be prepared if changes in data and methods reveal that previous CBEIs led to underestimates. Communicate accordingly, also on policy changes.	• Adelaide reports its scope-3 emissions every two years. See section 4.1.1. • San Francisco updates its CBEI every five years. Also, the city is developing a monitoring, evaluation, and reporting system, to help stakeholders understand progress toward the city's climate targets and to track key metrics. Similar systems are behind the Helsinki Climate Actions portal. See section 4.3. • The steering-group cities employed calculation cycles. While they agreed that it would be very good to perform calculations every year, this has proved overly resource-intensive thus far. See section 4.1.1 and 4.3.

• Cities early in their consumption-based emissions journey could focus on key indicators instead of full-blown inventories. They should identify indicator targets that are likely to reveal whether they are moving in the right direction. It is important to take climate action even if the data are insufficient for accurately quantifying the emission impact.	

5.4 Deployment of the policy framework

The framework developed constitutes a versatile instrument suitable either as a structured guide circumscribing policy processes for cities assessing and acting on their consumption-based emissions' or as a checklist for holistic incorporation of well-grounded consumption-based emissions mitigation into cities' operations. The framework can equally well serve the first steps on cities' consumption-based journey, inform a subset of their actions (such as tackling sector-specific climate-justice concerns), or provide for retrospective validation of steps already taken and development of prospective adjustments. Though we created it for attention to consumption-based emissions, many of the actions and approaches outlined show much broader applicability – for assessments, decisions, and action plans in a host of policy areas. Likewise, parties other than cities may derive benefits from various aspects of it.

The cities participating in the project found the concrete examples especially valuable. Experiences from cities all over the world[105] form a rich inspiration catalogue for those embarking on consumption-based actions, of whatever sort. These references may also ease the hurdles of the most challenging aspects of implementation: identifying the best data sources and setting targets. While choice of an optimal policy mix of consumption-based emission mitigating actions and complexities related to climate justice pose an obvious challenge[106] in some cities, the framework expresses a multifaceted approach that should equip cities to motivate all stakeholders and find a place for them in pursuing responsible actions of the necessary magnitude. As cities and their stakeholders pool their wisdom and resources for further application of the framework, new ways of improving it will emerge, further contributing to the consumption-based emission mitigation journey.

[105] Workshop 4 (December 1, 2022): CNCA Consumption-based GHG Emissions Policy Framework for Cities.
[106] Ibid.

6 Conclusions

This policy framework report summarizes the work implemented by Carbon Neutral Cities Alliance (CNCA) together with Gaia Consulting in 2022-2023.

Gaia's summary of the key findings from research provides a general overview of the status of consumption-based emissions work across a broad spectrum of cities and other organisations. A carefully devised work method with participatory orientation co-created a comprehensive picture of the landscape behind the policy framework.

Against the backdrop of the in-depth desk study, interviews fleshed out the perspective via practical insight, and the four workshops – specifically addressing, in turn, best practice for consumption-based emission-mitigation strategies and other key insight, from cities in various situations (June 13, 2022); methods by which cities can calculate these emissions and set a baseline and targets appropriately (September 8, 2022); honouring principles of climate justice and community engagement when planning, developing, and evaluating consumption-based policies (October 27, 2022); and the functionality of the framework produced, which aspects of the recommendations are most valuable, and where challenges remain to be addressed more fully by future work (December 1, 2022).

The policy framework itself is intended primarily for cities' attention to consumption-based GHG emissions (assessment, action plans, mitigation/reduction measures, and impact-monitoring), it was developed in light of the consumption categories chosen for emphasis in this study: food, textiles, and household appliances and electronics. However, the recommendations produced, and indeed all components of the policy framework, cohere around helping cities – whatever their local context might be – along their consumption-based emission journey, irrespective of the consumption categories stressed.

For ease of use, we divided the practical guidance into general, climate-justice, and inventory-process recommendations. Sequential presentation provides for a user-friendly process overview to simplify implementation, with special focus given to the often-problematic calculation process (defining a baseline and targets etc.). This emphasis was informed by priorities that emerged early on in the project: the steering-group cities desired common approaches and guidance. Similarly, the focus on embedding climate justice in the policy process was an outgrowth from needs expressed by participants. Hence, it informed the key objectives for the research and the final framework's development.

To enhance its practical utility the policy framework includes real-world examples on climate justice, consumption-based emission mitigation and calculation. This constitutes a ready reference that we hope will furnish cities around the world with ready reference for best practice and an inspiration-multiplier. Some of the examples can serve as direct models, while others offer seeds for very different cities' progress.

Cities inherently manifest quite different contexts, in multitudes of respects. Therefore, understanding the local setting is crucial – from political constraints in the relevant part of the

world to the origins of the most pressing issues with consumption-based emissions. Only then can one consider what the appropriate ways to influence these might be. The research process rendered it more and more evident that the consumption-based journey is an iterative one of continuously doing, learning, and adjusting on the basis of a constellation of interwoven technologies, tools, information, and stakeholders. Still, one thing is clear above all else: the most important action is to get started. Learning by doing will follow, improvements and adjustments can be made further along the way, and results will blossom accordingly.

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