Climate City Contract

2030 Climate Neutrality Action Plan

2030 Climate Neutrality Action Plan of the City of Gothenburg

City of Gothenburg

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2030 Climate Neutrality Action Plan

Summary

The abstract **summarizes the content** of the 2030 Climate Neutrality Action Plan (CCC Action Plan) which is developed jointly by local authorities, local businesses, and other stakeholders.

Textual element
In this text the geographical area of Gothenburg is referred to as 'Gothenburg' and the City of Gothenburg as 'the City.' Gothenburg, Sweden's second-largest city, is strategically positioned at the heart of Scandinavia, nestled between Oslo and Copenhagen. With its current population of 631,000 residents, Gothenburg acts as a crucial hub for the Västra Götaland Region, known for its robust industrial base and Scandinavia's largest port. The city is on a growth trajectory, aiming to accommodate 700,000 residents by 2035. Gothenburg's economy is bolstered by a diverse industrial base, including major corporations and a variety of small businesses across several sectors, further enriched by significant educational and cultural institutions. Gothenburg possesses a long-standing culture of innovation and collaboration, nurtured through close partnerships between industry, academia, and municipal entities, providing a solid foundation for undertaking the mission of becoming one of the 100 European cities to achieve climate neutrality by 2030. This Action Plan outlines the City's endeavour to become a climate-neutral city by 2030, an ambitious and multifaceted task that encompasses a wide range of strategies, actions, and collaborations across various sectors. The Action Plan outlines the City's current state of climate action (part A), pathways towards achieving climate neutrality (part B), and the enabling factors required to realize this vision (part C). The City's climate goal for 2030, "a carbon footprint close to zero," has robust support from a broad political majority, and is particularly highlighted by The Environment and Climate Programme for the City of Gothenburg 2021-2030. This program, applicable to all departments and city-owned companies, represents the overarching document guiding sustainable development efforts within the City. It is implemented through a City-wide Environment Management System in which

committees and boards shall identify and prioritize their environmental and climate measures, and in the program's seven cross-cutting strategies, where committees and boards join forces in areas that require a high degree of collaboration and new cross-cutting solutions.

The City has, during the preparation of this commitment, developed portfolios of action around strategic priorities. Each portfolio addresses various levers: technical, financial, organizational, governance, policy, culture, behavioural, and social. The strategic priorities are:

- The intertwined energy and industrial system portfolio
- The Port as a lever for reduced heavy transport emissions
- Sustainable and efficient mobility
- Improvements in the treatment of waste materials
- Climate-neutral construction
- Capacity for circular economy
- Urban farming, green infrastructure, and nature-based solutions

To become climate-neutral by 2030, the City recognizes the need to continue to develop strategies and processes that support joint action plans and broader community engagement. The Climate City Contract has been instrumental in laying the groundwork for these efforts, providing a blueprint for future progress.

This Climate Action Plan is divided into three parts (A-C). Part A involves a detailed assessment of current greenhouse gas emissions, existing policies and strategies, and the identification of systemic barriers and opportunities. The assessment of current greenhouse gas emissions shows that the largest territorial emissions originate from the city-located industry, heating (CHP), and transportation. These areas are in focus in the City's strategic priorities, and the targets are shaped to address them.

The assessment of existing policies and strategies influencing the transition towards climate neutrality shows a complex landscape of international, national, and local agreements, policies, plans, and guidelines. It reveals strengths in the well-anchored and widespread Environment and Climate Program, and how it establishes the Environmental Management System and the strategies

as strong tools for its implementation. At the same time, areas to develop include the faster implementation of planned measures, the scaling-up of fruitful solutions, the need to develop co-created climate mitigation action plans, and the need for deeper integration of social sustainability considerations to ensure a just transition.

For addressing emissions and managing residual emissions, the City utilized NetZeroCities' Economic Tool. The tool projected a 77% reduction in territorial emissions by 2030 resulting in a 3% emissions gap to be addressed, and a need for handling of residual emissions of 20%. However, it's noteworthy that Gothenburg will be affecting emission reductions from an already relatively low starting point compared to other European cities. This is primarily due to the comparatively low emissions from the energy system, particularly electricity production. To illustrate, the average EU-27 territorial per capita emissions were 8.4 metric tons of CO_2 equivalents in 2018 (EUROSTAT), compared to Gothenburg's 4.3 metric tons. An 80% reduction in emissions would therefore leave 1.68 metric tons per capita for an average European city, whereas Gothenburg's pathway towards a 77% reduction suggests 0.98 metric tons by 2030, predicted population change included. An important part of future iterations of the Climate City Contract will thus be to explore further reduction potential as well as compensation possibilities.

Part A concludes with the identification of systemic barriers and solutions. The City has to foster transition in a range of socio-technical systems, each with its range of stakeholders. Opportunities for systems change identified revolve around innovative collaborations and the utilization of digitalization and visualization tools to support decision-making and stakeholder engagement. The City aims to leverage its strong knowledge base, innovative culture, and the co-benefits of climate measures to drive forward the transition towards climate neutrality, as well as to further engage citizens in the transition process, recognizing the importance of societal norms and behaviour in achieving sustainability goals. The action plan also identifies several systemic barriers that could hinder progress, including knowledge gaps, system inertia, fragmented innovation, and financial constraints.

Part B of the action plan describes decided and planned actions in terms of systemic levers and action portfolios for the following fields of action:
- Energy system (including industry)

- Mobility & transport
- Waste & circular economy
- Built environment
- Green infrastructure and nature-based solutions

Part B also lists indicators for monitoring, evaluation and learning.

Part C delves into governance and social innovation interventions in Gothenburg, aimed at overcoming systemic barriers and exploiting opportunities for climate neutrality. It details the City's efforts in developing governance innovations and provides examples of collaborations across multiple levels and actors, citizen inclusion, and social innovations. The development of a Climate Transition Function is emphasized as a means to enhance strategic intelligence and collaboration across sectors and actors. Coupled with the introduction of a Climate Budget and continued development of existing cross-cutting strategies, further improvement is expected in collaborative decision-making, mobilisation of actors and alignment of actions. Part C also showcases examples of social innovation aimed at addressing climate change, including citizen inclusion interventions to further democratise the climate action process, encouraging public involvement and leveraging community-driven initiatives for a more sustainable Gothenburg. These interventions collectively strive to create a just, inclusive, and sustainable transition for Gothenburg, reinforcing the City's leadership in climate action and social innovation.

Looking ahead, the City is committed to continuously evaluating and updating its Climate Neutrality Action Plan, integrating new insights and adapting strategies as necessary. This iterative process is crucial for staying on track toward the 2030 goal and responding effectively to the evolving landscape of climate action.

List of figures

The list of figures **identifies the titles and locations** (page numbers) of **all visual elements:** figures, drawings, photos, maps, etc. used in the CCC Action Plan.

List of tables

The list of tables **identifies the titles and locations** (page numbers) of **all tables** used in the CCC Action Plan.

Abbreviations and acronyms

The list of abbreviations and acronyms **identifies the abbreviations** (a shortened form of a word used in place of the full word) **and acronyms** (a word formed from the first letters of each of the words in a phrase or name) used in the CCC Action Plan.

Abbreviations and acronyms	Definition
CCS	Carbon Capture and Storage
GHG	Greenhouse gases
GPC	Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories
CDP	Formerly known as the Carbon Disclosure Project
ICLEI	Local Governments for Sustainability
CO2e	Carbon dioxide equivalent
CHP	Combined Heat and Power
SMHI	Swedish Meteorological and Hydrological Institute
CCUS	Carbon Capture, Utilisation and Storage
FF55-package	Fit for 55-package
UNEP	United Nations Environment Programme
GFA	Gross Floor Area
BmSS	Accommodation with special service (Boende med särskild service)
AFULO	Agriculture, Forestry and Other Land Use
IPPU	Industrial Processes and Product Use

1   Introduction

The introduction outlines the local geographic and policy context in which the City's 2030 Climate Neutrality Action Plan is being developed and describes the gap it addresses in broad terms.

Introduction

In this text the geographical area of Gothenburg is referred to as 'Gothenburg' and the City of Gothenburg (organisation) as 'the City'.

A city in transformation – navigating growth with high climate ambitions

Gothenburg, Sweden's second-largest city, holds a strategic position at the heart of Scandinavia, nestled between Oslo and Copenhagen. With a current population of 631,000 residents, Gothenburg serves as a pivotal hub for the Västra Götaland Region, renowned for its robust industrial base and Scandinavia's largest port. As the City embarks on a trajectory of growth, with plans to accommodate 700,000 residents by 2035, the imperative of sustainable development takes centre stage.

The City's industrial landscape is diverse, hosting multinational corporations such as Volvo and SKF, alongside small businesses and specialized clusters across 50 sectors. This economic variety is matched by a rich cultural and educational scene, with two universities and a significant student population fuelling innovation and creativity. Gothenburg's commitment to sustainability is evident in its efforts to transform into a green urban area, redeveloping former industrial zones into new districts and improving infrastructure to encourage public transport and cycling.

With a long-standing tradition of innovation, Gothenburg fosters collaboration within the community and supports robust innovation systems in the region. Since 2013, the City has been host to one of Sweden's six designated Innovation Platforms, and it is also home to several test beds for innovation in technology as well as innovations in services and social collaboration, in both simulated and real environments. The Gothenburg region is gaining an extensive part of national R&I funding and in 2018, the City was a finalist for the European Capital of Innovation (ICapital) award.

Gothenburg's proactive stance on climate and environmental issues is deeply ingrained. The adoption of its first climate program in 2014 outlined a comprehensive strategy spanning education, community planning, energy, transport, and consumption. Large-scale infrastructure projects like 'The West Link' underscore the City's commitment to sustainable mobility. By reporting its greenhouse gas inventory to the Covenant of Mayors and aligning with the EU's climate goals, Gothenburg demonstrates its dedication to reducing emissions and contributing to the vision of a climate-neutral continent by 2050.

In 2022, Gothenburg was honoured as one of 100 European cities stated to achieve climate neutrality by 2030 and serve as a frontrunner for all European cities by 2050. Armed with a clear vision, ambition, and preparedness, the City is poised to take on the EU mission and collaborate with cities across Europe to realize this vision. Today, Gothenburg is navigating its growth phase with a focus on sustainable urban development, aiming to balance its industrial heritage with environmental responsibility. The City's long-standing commitment to climate and environmental issues, along with its culture of collaboration and innovation, places it on a path toward becoming an international leader in sustainability.

Figure I1 – City of Gothenburg geographical layout.

Climate target adopted in broad political agreement

Climate neutrality, as defined by the Mission, entails achieving net-zero GHG emissions by minimizing emissions within the territory as much as possible and compensating for any remaining residual emissions (ideally no more than 20 per cent). This strategy encompasses Scope 1 and Scope 2 emissions from operations within the territory, whereas Scope 3 emissions are not currently mandated. Large-scale energy production or industrial facilities registered under the EU Emissions Trading Scheme (EU ETS) may be exempted.

In the City of Gothenburg, the climate target for 2030 is formulated as "Gothenburg's climate footprint is close to zero". The goal is detailed in the Environment and Climate Program for the City of Gothenburg 2021-2030, which was adopted by a large political majority in the City Council in 2021. The goal applies to all the City's administrations and City-owned companies. Despite shifts in the political leadership, the goal remains unchanged. The current administration has directed increased actions in the 2024 budget to ensure this objective is met. According to the budget, Gothenburg shall be a forerunner in environmental and climate work, while also leading a just transition where it is easy for everyone to be part of the solution, residents as well as businesses and academia.

The climate goal of the City of Gothenburg has a broader scope than required in the Mission. The goal targets emissions from both a territorial and a consumption-based perspective, see below.

Indicators of the Climate goal: Gothenburg's climate footprint is close to zero.

Indicator	Goal	Base value (CO2e per habitant and year)	Target 2030 (CO2e per habitant and year)	Scope
Territorial emissions	Yearly reduction of at least 10.3%	4.3 ton (2018)	1.2 ton	All Scope 1 emissions in the geographical area of Gothenburg municipality
Consumption-based emissions	Yearly reduction of at least 7.6%	9.25 ton (2017)	3.3 ton	Scope 1, 2 and 3 emissions allocated to goods and services consumed by the people of Gothenburg, no matter where they

				are produced, (including public consumption).

The territorial, or geographic, perspective includes all GHG emissions within the geographic area of Gothenburg no matter where in the world the goods and services are consumed. The consumption-based perspective includes all emissions caused by goods and services consumed by the people of Gothenburg (including public procurement), no matter where in the world they are produced. The perspectives are overlapping and provide different ways of looking at partly the same emissions, see figure A1.
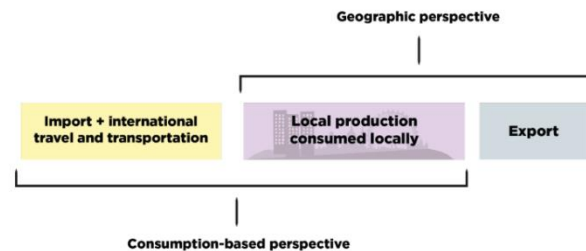
Figure A1 - The image illustrates different perspectives on Gothenburg's climate footprint

The territorial emissions adhere to the same geographical boundary as the city administrative boundary, and can be described as all climate emissions emitted in the "greater city" of Gothenburg municipality. The target includes emissions from both traded and non-traded sectors and involves scope 1 emissions from all sectors, including stationary energy, transport, waste/wastewater, IPPU and AFOLU. The consumption-based emissions include scope 1, 2 and 3 emissions from goods and services consumed by the people of Gothenburg, including public consumption. Scope 1-3 emissions of goods and services procured by the City are thus included in this indicator.

The geographical and the consumption-based emissions are partly overlapping. They shall be seen as two different perspectives on the goal of "close to zero" and are not additive between the logic of different scopes. Following the above, the close-to-zero-goal of Gothenburg has a different scope and target value than the Mission's "climate neutrality". The system boundary of the Gothenburg goal is broader. It includes Scope 1 emissions of all industries in the territory, also traded emissions.

It also includes scope 1-3 emissions of all goods and services consumed in the consumption-based perspective. This is summarized in table I-1.1.

Table I-1.1: Climate Neutrality Target by 2030			
Sectors	**Scope 1**	**Scope 2**	**Scope 3**
Stationary energy	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
Transport	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
Waste/wastewater	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
IPPU	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
AFOLU	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
Other	Included in territorial target	Included in consumption-based target for products and services consumed within Gothenburg	Included in consumption-based target for products and services consumed within Gothenburg
Geographical boundary	**Same as city administrative boundary**	**Smaller than city administrative boundary**	**Larger than city administrative boundary**
(Tick correct option)	YES		

As seen from the Climate Action and Investment Plans, Gothenburg is anticipated to achieve a 77% reduction in territorial emissions. This is slightly less than the 80 per cent recommended for climate neutrality in the Mission, and the City will continue to develop measures to address the remaining 3%. It is also important to note that Gothenburg will manage emission reductions from a relatively low starting point in comparison with other European cities. This is due to relatively low emissions from the energy system, primarily electricity production. To illustrate this, the general EU-27 territorial per capita emissions were 8.4 tonnes of CO2 equivalents in 2018 (EUROSTAT), compared to Gothenburg's 4.3 tonnes. An 80 % reduction of emissions will thus result in 1.68 tonnes remaining for an average European city, whereas Gothenburg's corresponding pathway of 77 % reduction means 0.98 tonnes in 2030, predicted population change included.

Plans for addressing the residual emissions of Gothenburg in 2030 will constitute an important part of upcoming iterations of the Climate City Contract. Further measures will be explored to increase the reduction rate until 2030. The City and its stakeholders are also exploring different ways of neutralizing emissions through carbon sinks and carbon credits. Pilot studies on how to define and calculate such sinks and credits, as well as ensure their additionality, are currently being made by the City together with stakeholders in the building and construction sector.

City structure with transformative potential

The City is organized into public administrations and municipal companies, each led by a political committee or board (see figure A2 below). On behalf of the City Executive Board, the City Management Office is responsible for the overall management, governance and follow-up of the administrations and the companies. Göteborgs Stadshus AB is the parent company of the City of Gothenburg's corporate group. The City Council sets goals and assignments for the City's administrations and companies. The City Executive Board manages and coordinates municipal operations and is responsible for municipal finances.
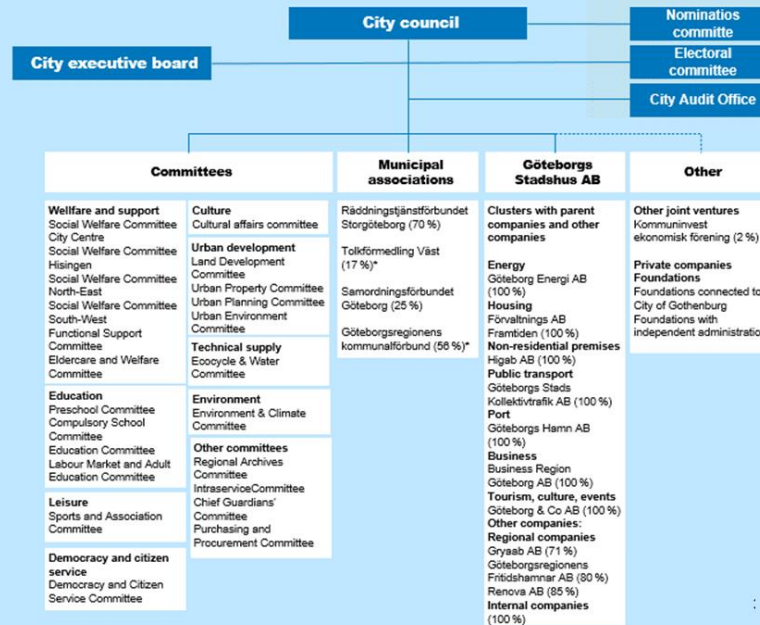
Figure A2 – the City's structure 2024.

The City's administrations are responsible for the daily operations of the various activities that apply to the entire city, such as education, care, urban building, traffic and more. In addition, the City has several municipal-owned companies which are largely owned by the municipality and governed by corporate boards. The companies work on behalf of the politicians and are organized under Stadshus AB. The operations range from private apartments and cultural experiences to the delivery of energy and running the largest port in the Nordic region.

The companies, as well as the administrations, execute their operations in line with political directives, including the goals of the Environment and Climate Program. The wide scope of

operations and sectors handled within the municipality makes the City uniquely positioned to have a large impact on several key areas critical for the green transition, such as:

1. Planning urban development and traffic infrastructure to support sustainability.
2. Leveraging procurement processes to enforce environmental standards.
3. Managing energy production and infrastructure to enhance efficiency and reduce emissions.
4. Implementing construction practices that minimize climate impact.
5. Optimizing water and wastewater treatment processes for reduced environmental footprint.
6. Influencing sustainable energy use and reducing climate impact through policy, supervision, and community engagement.
7. Promoting sustainable lifestyles and consumption through education and guidance.
8. Collaborating with local businesses to foster their role in the ecological transition.

Environmental management for systemic improvements and cross-sector innovation

The Environment and Climate Programme stipulates two main tools for its execution: The environmental management system and the City "strategies". All companies and administrations are obliged to implement an environmental management system and implement climate measures according to their main environmental impact as well as the goals of the Environment and Climate Program. In this way, all City administrations and companies, systematically contribute to the climate goal from the point of view of their own operations.

The second tool is the seven cross-cutting strategies, that aim to bring about change-driven development in areas where a city-wide perspective and collaboration between administrations and companies are necessary. The strategies are:

1. We act as forerunners.
2. We create conditions for sustainable living.
3. We drive the development of a circular economy.
4. We work strategically on financing to accelerate the transition.
5. We drive the development of sustainable construction.
6. We plan for a green and resilient city.

7. We drive the development of sustainable transportation.

In addition to the two tools of the Environmental and Climate program, the City has also established a "Climate Transition Function", intending to form the basis and conditions for effective decision-making toward climate transition in Gothenburg. The Climate Transition Function was initiated in 2020, as part of the City's commitment to a National Climate Contract developed within the framework of Viable Cities. Today the function consists of a Climate Transition Team headed by the Environmental Administration and is tasked with maintaining and developing collaboration with internal and external stakeholders, to promote systemic learning with a focus on change management.

To further support the City's climate transition, 'The Gothenburg Climate Council' was set up in 2022. The council consists of seven independent researchers tasked with analysing Gothenburg's climate work as well as to advise and propose measures to reduce climate impact thus helping the City of Gothenburg achieve its climate goals.

Closing the GAP

The climate goal is followed up biannually by the Environmental Administration. The latest review from 2023 shows that substantial efforts to reduce climate impact are being made, but progress is too slow. Figure A3 shows geographical emissions per inhabitant and year, and what is needed to reach the target (red line). The trend (dotted line) shows decreasing emissions over time, but at a too slow pace to meet the target. System changes are needed with new ways of prioritizing and co-creating solutions together with the public sector, businesses and households. Innovation and collaboration are also needed across sectors to enable systemic transition.

Geographic-based GHG emissions in Gothenburg

Figure caption legend:
- Emissions all categories
- Emissions households' and premises own heating
- Emissions from industry
- Emissions electricity and district heating
- Emissions waste (including sewage)
- Emissions agriculture
- Emissions heavy equipment
- Emissions transports
- Emissions product use (including solvents)
- Target

Figure A3 - Emissions per year 2010–2020 and what is required to reach the target. Data from the national emissions database.

As seen in Figure A3, the lion's share of Gothenburg's territorial emissions come from energy, industry and transport. These sectors are also closely intertwined, not least by a well-developed district heating network that utilizes the industry's waste heat. Half of the emissions in Gothenburg come from two refineries, not owned by the City. Other major emitters are waste incineration and traffic.

Several transformations are needed for climate transition, summarized in portfolios of action around seven strategic priorities:

- The intertwined energy and industrial system portfolio
- The Port as a lever for reduced heavy transport emissions
- Sustainable and efficient mobility
- Improvements in waste treatment
- Climate-neutral construction
- Capacity for circular economy
- Urban farming, green infrastructure and nature-based solutions

The technical transformations needed are associated with large investments. The Climate Council states in its first report (in 2023) that to meet the City's targets, the refineries must either switch to renewable raw materials or capture and store carbon dioxide. Both measures require very large investments, where actors in Gothenburg, the City as well as industries, need to find and agree on ways to finance the long-term investments.

In addition, many of the technical shifts needed are also dependent on national and international development, such as the development of green technologies and products, national policies (e.g. for GHG reduction quotas in petrol and diesel), development of electricity supply and electric grid, etc.

To successfully transform into a climate-neutral city, the City recognizes that while many of the required changes are technological, achieving this goal also demands innovation in organization, governance, culture, behaviour and collaboration. The City acknowledges the need for continued development in governance structures, division of responsibilities, and cooperation models to drive the necessary systemic change.

Gothenburg's control over a broad array of policy instruments—regulatory, economic, and voluntary— is a crucial asset. However, for Gothenburg to become an environmentally and climate-sustainable city, it must make a concerted effort and accelerate the implementation pace.

Key to this endeavour is strengthened coordination between the City, trade and industry, inhabitants, academia, other cities, and actors. This collaboration is vital for Gothenburg to emerge as a leader in addressing environmental and climate issues. Many collaborations are also already

set, for example, Strategic partnership with Chalmers University of Technology and the University of Gothenburg around a fossil-free Gothenburg, multi-actor commitments on circular construction with 50 actors in the construction industry chain, and joint strategy development for urban transition in the Gothenburg region to name a few initiatives (see section C.1 for a more comprehensive list).

The City has long-standing experience with the quadruple-helix model, which involves cooperation with industry, academia, research institutes, science parks, and citizens. The City has already established testbeds encouraging stakeholders to collaborate and learn together, fostering climate transition through new technologies, services, ideas, or operational methods. Nevertheless, there is a need for improved methods to scale up projects, initiatives, and innovations for full implementation.

National and international collaboration

Gothenburg demonstrates a steadfast commitment to sustainable development and proactive collaboration with other cities, both nationally and internationally.
By joining forces with other municipalities and national authorities, Gothenburg underscores its dedication to driving systemic change at the national level. In 2020, the City signed the first national climate contract, a collaborative effort among 23 municipalities and six national authorities. This initiative, led by the Viable Cities national innovation program, aims to accelerate the climate transition in alignment with the Paris Agreement and Agenda 2030. At the regional level, Gothenburg has embraced the 'Municipalities' Climate Pledges' of the county, comprising 30 concrete measures aimed at reducing emissions by approximately 75,000 tonnes of carbon dioxide equivalents. These collectively agreed-upon pledges reflect the City's commitment to collaborative, region-wide efforts towards emission reduction and sustainability.

Internationally, Gothenburg's proactive approach to sustainability has garnered recognition and engagement. The City's consistent recognition as a recipient of the Leadership award in the Global Destination Sustainability Index, from 2016 to 2023, is one example. In 2022 Gothenburg was selected as one of 100 European cities to be climate neutral in 2030 and to be a forerunner for all European cities by 2050. Gothenburg also has a role as one of ten mentor cities within the European Commission's Intelligent Cities Challenge. By sharing its expertise and insights with 65 other

European cities, Gothenburg actively contributes to advancing sustainable urban development across borders.

The City has been involved in the EU Adaptation Mission since September 2022, to learn from other European regions in linking climate adaptation measures to emergency services. Gothenburg is developing a Climate Adaptation Plan (according to the RAST framework as developed by the European Commission) which will be politically approved in the middle of 2024 and implemented between 2024 – 2026. Priority areas and key measures have been identified. Many of the measures identified will have the potential to tackle both climate adaptation and mitigation and therefore can be used to generate synergies with the 100 Cities Mission.

Advancing the transition – The City's evolving approach to climate action
As outlined above, the City has a robust management structure with climate goals well integrated into ordinary governance structures. Yet, the climate challenge remains significant, and rapid societal transformation is imperative. Consequently, Gothenburg continually refines its working processes. In this process, the forming of the first Climate City Contract has contributed to further governance development.

1. Building a strong Mandate

The City's climate goals are deeply embedded in its ordinary governance structures, notably outlined in the Environmental and Climate Program, backed by a broad political consensus. Central to this program is the aim for near-zero emissions, driving action across all municipal administrations and companies. The two main tools for the program execution, the environmental management system and the seven joint strategies, are broadly recognized and gradually show results. Together they help actors in the City navigate action in-house as well as promote cross-functional innovation. Collaboration with academia and industry is robust, reflecting a shared commitment to achieve common climate goals. The award of Gothenburg as one of 100 selected cities in Europe to lead climate transition has further encouraged this joint ambition of Gothenburg as forerunner of climate mitigation.

To address conflicts and synergies between development and a just climate transition, the City also needs to build a strong mandate in the climate work together with citizens and civil society. As part of

this, the City is currently pilot testing a Citizens' Lab, with the aim of identifying tools, methods and processes for increased and improved citizens' interaction and engagement in climate transition. Together with the development of platforms for dialogue, infrastructure for democratic participation, social innovation interventions and other capacity-building interventions, the City will strengthen the buy-in and accelerate the transition.

2. Understanding the system

The City has many ways to assess its impact and understand its needs. To identify systemic barriers and opportunities for transition is, for example, at the core of the seven strategies. Every two years, a comprehensive evaluation is carried out of all the goals and sub-goals within the environment and climate program. The evaluation is carried out by the Environmental Administration in close collaboration with City administrations and companies. In addition to these joint analyses and evaluations, each administration and company also have their analyses, for individual operations or cross-cutting areas.

Gothenburg is committed to enhancing its data collection mechanisms to facilitate informed decision-making. By leveraging tools like the Stratsys reporting system used in other city governance tasks, the City aims to quantify the impact of various measures and track progress toward its climate goals more systematically.

With support from the work on the European Climate City Contract and the National Climate Contract, the work has begun to develop a first Climate Transition Strategy. The strategy aims to provide a shared understanding of the status of the City's climate change work, including the effect of already proposed measures, as well as what further needs to be done to reach the climate goal. The strategy will be based on trend analysis and risk analysis, and include scenarios showing possible pathways for Reaching climate neutrality.

3. Co-Creating an Action Portfolio

City action for climate change includes measures of all of the 57 administrations and companies of the City. To further mobilize resources and drive alignment of actions for systemic change, the City is currently exploring the introduction of a 'Climate Budget'. The budget will offer a strategic framework

for estimating the impact of planned measures on emissions across organizations, fostering increased accountability and alignment of actions. Climate budget has been implemented in other cities, for example in Sweden in Uppsala and Kalmar, with good results. Gothenburg is following the work closely.

A cornerstone of Gothenburg's climate strategy will also be the formulation of a comprehensive Climate Neutrality Action Plan, identifying the actions needed to reduce greenhouse gas emissions and what additional efforts and measures are required. The Climate City Contract process has been a very valuable foundation for this work, leading to the first version of the plan. The plan will be continuously updated and revised to form the basis of a common action portfolio of the City. This 2030 Climate Neutral Action Plan, and its corresponding Climate Neutral Investment Plan, will be an integral and integrated aspect of the City's climate work and will be followed up, revised and evaluated in conjunction with other governing documents.

The Climate City Contract– a catalyst for enhanced innovation and alignment

Through the ongoing process of the Climate City Contract, administrations and city companies have joined forces to identify and harmonize strategies and priorities, initiating and fostering a shared vision for a green transition.

The City's commitment to initiatives such as the EU Covenant of Mayors (EUCoM) and the national climate contract of Viable Cities remains. The CCC Action Plan concretize and further develops the measures planned within these contexts, positioning them within a systemic perspective on transition towards climate neutrality. Thus, the CCC Action Plan does not replace existing commitments and plans. Rather, it serves as a focal point for integrating planned actions and lays the groundwork for further co-creation of strategies and investment plans, in collaboration with actors in the Gothenburg community.

The work conducted under the Climate City Contract has proved invaluable for aligning the City's climate actions. With fifty-seven public administrations and municipal-owned companies, the overview created through the mission label process is deemed essential. It aids in aligning actions with the City's numerous strategies, programs, plans, and action plans.

The establishment of the Local Transition Team, comprising civil servants from various City administrations and companies, has played a pivotal role in leading this effort. The team has been instrumental in coordinating strategic endeavours across diverse administrations and agencies. This collaborative endeavour has not only laid the foundation for further cooperation but has also led to the permanent formation of the team as part of the Climate Transition Function.

Facilitating common priorities across all stakeholders in Gothenburg is crucial to ensuring a unified approach to a green transition. The Climate City Contract process has underscored the need for intensified collaborative efforts with stakeholders to identify shared priorities and timelines, facilitating collective action towards a sustainable future. A priority in the next version of the Climate Neutrality Action Plan is a larger share of co-creation with different stakeholder groups in Gothenburg.

The main components of the Climate City Contract, including commitments, action plan, and investment plan, are already being integrated into the working processes of the Climate Transition Function for regular iterations and updates. Future iterations will address current gaps in data and calculations through improved data management, such as through a climate budget process. Future iterations will also involve a greater engagement of external stakeholders to identify common priorities and timelines, facilitating collective action and systemic change towards a climate neutral Gothenburg.

2 Part A – Current State of Climate Action

Part A "Current State of Climate Action" describes the point of departure of the City towards climate neutrality, including commitments and strategies of key local businesses, and informs the subsequent modules and the outlined pathways to accelerated climate action.

2.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

Module A-1 "Greenhouse Gas Emissions Baseline Inventory" details and describes the latest GHG inventory, where available from 2018 or more recent, referring to a clearly stated geographic boundary. The aim of this section is to establish the emission baseline and to establish the emissions gap to 2030 climate neutrality

according to the inventory specifications defined in the Cities Mission's Info Kit for Cities[1] and the process outlined in the CCC Action Plan Guidance and Explanations.

GhG Emissions Baseline inventory

The City of Gothenburg is a 'Greater City' with an administrative boundary of 718 sq km and it is this administrative boundary that corresponds to the City's climate neutrality target. The City will address all Greenhouse Gases (GHGs) and sectors/sources of emissions to reach climate neutrality by 2030 as defined by the Cities Mission (Scope 1 & 2). Regarding scope 3, the City has a high ambition to work with this scope.

Since 2005, the City of Gothenburg has undertaken an inventory of GHG emissions, and the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories (GPC) has been applied. Every year, the City reports to CDP/ICLEI, the latest year was 2023 and included data from 2020**. The latest inventory is uploaded with the CCC.**

The inventory, which is also reported to the Covenant of Mayors covers data required to follow the climate-neutrality target. All Greenhouse Gas Emissions are included in the inventory, however only CO_2e is presented in this document. Scope 3 is not included. There are climate footprints for the entire municipality of Gothenburg with no geographical areas excluded. The assessment shows that available data is sufficient to track the City's progress toward its targets.

The result from the inventory shows that the largest emissions originate from the city-located energy industry, the heating (CHP), and the transportation. These areas are in focus in the City's strategic priorities and the targets are shaped to address them.

The City has access to information on emissions of greenhouse gases in Gothenburg from several different national sources such as the Swedish Environmental Protection Agency, SMHI (Swedish Meteorological and Hydrological Institute) and Statistics Sweden. The Stockholm Environmental Institute, in collaboration with Viable Cities, has developed a model to estimate citizens' consumption-based emissions and a tool, the 'Konsumtionskompassen', with a resolution at postcode level and this information is available in the City's map tool GoKart.

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[1] European Commission, 2021, *Info Kit for Cities*, European Commission. Further guidance is available also in:
NZC, 2023, *Guidance on target setting and emissions inventories for the Climate-neutral and Smart Cities Mission*, NetZeroCities https://netzerocities.app/resource-3814

It is challenging for the City to interpret climate data and calculations at different levels and for different purposes. However, there are several initiatives in the City where climate calculations are made at different levels and with different purposes. Within the City's food supply/meals organisation for example, climate calculations have been made with the aim of increasing knowledge of how different raw materials affect the climate footprint of meals and, through conscious choice of raw materials with less climate impact, contribute to reducing the climate footprint of the City's meals.

There are examples from administrations and companies that perform climate calculations in connection with investment projects. Through climate calculations at an early stage, possible choices can be identified that can help to reduce climate impact. For example, the Port of Gothenburg has carried out climate calculations for several projects and has thus obtained a picture of the future climate footprint of planned measures and whether these are sufficient or whether further efforts are required to achieve set targets. Through an environmental pendulum analysis, the Purchasing and Procurement Administration has mapped the climate impact of the City of Gothenburg's purchases in 2020.

From 1 January 2022, the Swedish National Board of Housing, Building and Planning requires a climate declaration for the construction of new buildings. This means that developers must report the climate impact of a new building. Within the City and the strategy for sustainable construction, a method is being developed for calculating the climate footprint when renovating buildings and for calculating the climate footprint when constructing facilities.
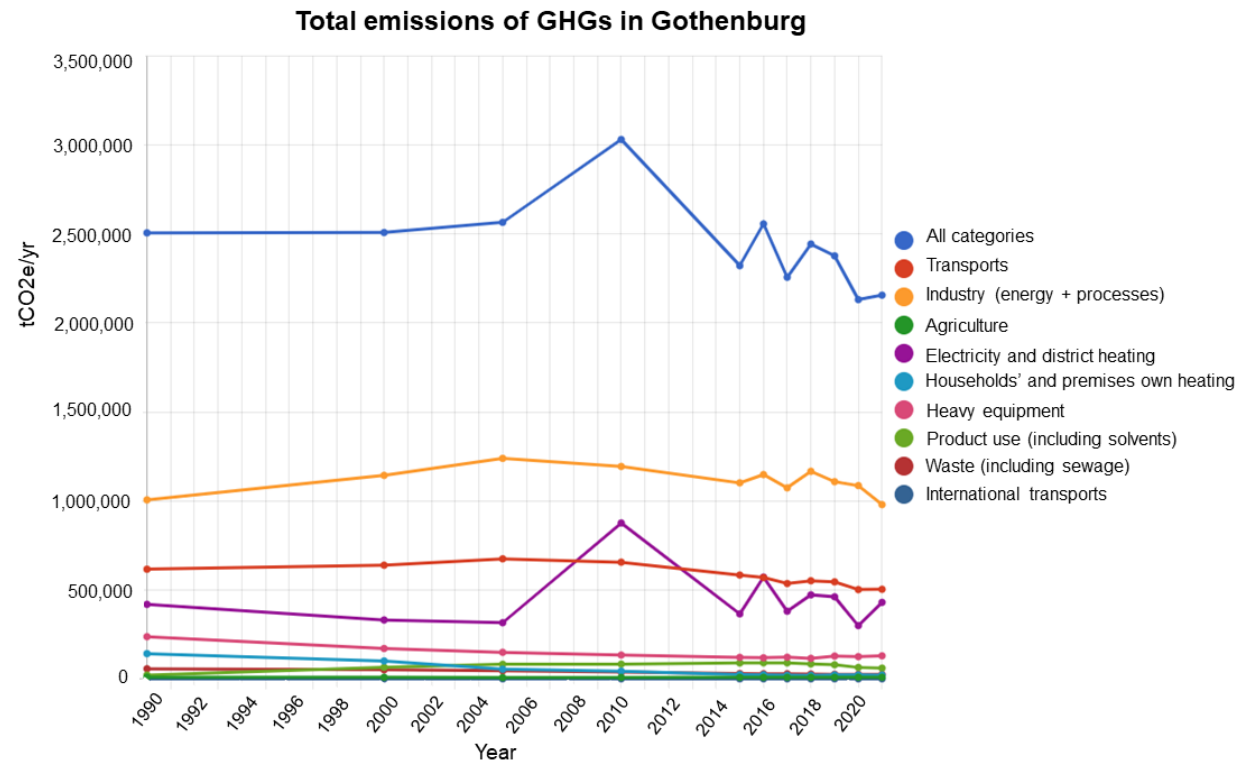
Figure A4 – Inventory of the City's GHG emissions (scope 1 and 2).

Gothenburg's energy system

The figure below displays Gothenburg's energy use over time. Despite Gothenburg having a growing population, energy use has been fairly constant over recent years due to decreasing per-capita energy use. Gothenburg's transportation is relatively car-dependent compared to other European cities of a similar size, mainly due to its infrastructure and physical structure. Energy use in the industrial sector is dominated by refineries. The City has a relatively large district heating system, which to a large extent relies on waste heat from the refineries and combined heat and power garbage incineration. There are limited opportunities for land-based wind power within the municipality, but solar power is increasingly being deployed.
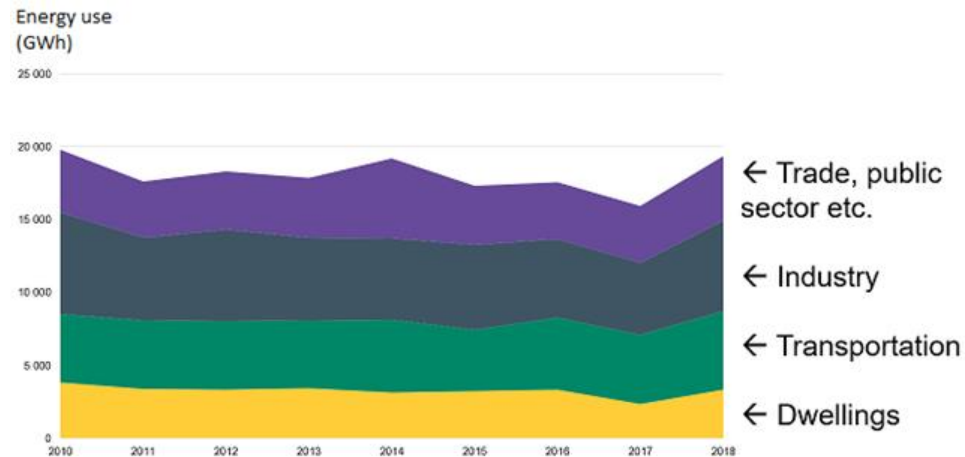
Figure A5 – Total energy use in Gothenburg 2010-2018 per sector.

The Energy plan defines several measures that should be carried out before a certain point in time. Each measure has at least one actor (committee or board) that is responsible for its implementation. The measures are divided into eight topics and will be continually reviewed, assessed and, if necessary, updated several times until 2030. This will increase the possibilities for the plan to stay adequate in relation to changing conditions (e.g. technological development):

- Flexible and robust energy system
- Energy efficiency in the municipal sector
- Energy efficiency in the private sector
- Renewable electricity
- Renewable and recovered heat
- Renewable and recovered cold
- Energy-efficient and fossil-free transport and machinery
- Carbon capture and storage

The measures are quite different by nature. Types of measures represented in the plan include:

- Investigations (e.g. investigate whether a low-emission zone is appropriate within parts of the City)

- Investments (e.g. investing in new infrastructure)
- Processes (e.g. implementing processes for how to include solar energy technologies in construction/renovation)
- Requirements (e.g. demanding that certain committees or boards upgrade their lighting or machinery to more sustainable options)
- Incentives (e.g. adjusting district heating charges)

Waste

Every municipality in the Greater Gothenburg Region has a waste management plan. Since the residents of these municipalities travel across the municipal borders on a daily basis, 13 municipalities (Ale, Alingsås, Gothenburg, Härryda, Kungsbacka, Kungälv, Lerum, Lilla Edet, Mölndal, Partille, Stenungsund, Tjörn and Öckerö) have drawn up common goals for sustainable waste management.

The EU's overall waste strategy, known as the 'waste hierarchy', permeates the waste plan. The 'waste hierarchy' is about working preventively to avoid waste arising, reducing the danger of waste, detoxifying cycles, using waste as the resource it actually is and taking care of the waste that cannot be reused or recycled safely.

The purpose of the waste plan is to prevent waste and develop management of the waste that nevertheless occurs. When planning the new waste plan's target areas, requirements in legislation and evaluation of previous work with the waste plan have been taken into account. Under each target area in the new waste plan, both targets and action areas have been developed. The plan also describes the tools that are planned to be used and how the goals are measured and followed up.

The six target areas in the City's waste plan 2021-2030 are:

- *Prevention*: Waste must be reduced from households and the City's operations – only then will the environmental impact and costs be reduced.
- *Reuse*: Everything that can be reused should be reused.
- *Collection & recycling*: Should be done in the best possible way.
- *Urban planning*: Waste management must have an obvious role in all stages of urban planning.
- *User focus*: Users must be satisfied and find it easy to contribute to sustainable waste management.
- *Litter*: Beaches, natural areas and built-up areas must be attractive environments without litter.

Waste (including sewage) - Total emissions of GHG in Gothenburg

Legend:
- In total
- Waste landfill
- Sewage treatment
- Biological waste treatment
- Crematoria and incineration of hazardous waste
- Unintentional fires
- Other waste management
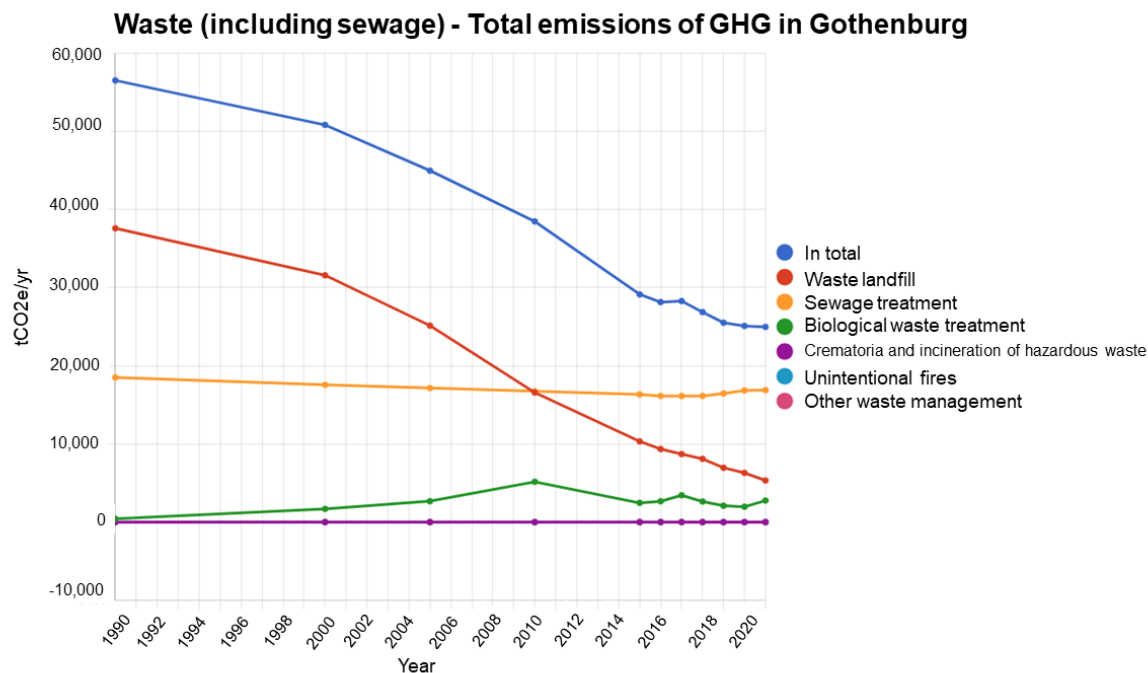
Figure A6 – GHG emissions from waste (including sewage) in Gothenburg 1990-2021.

Transport

Road traffic is the second largest source of geographical greenhouse gas emissions in Gothenburg, just below about 20 % of total emissions. As a large city, Gothenburg has a greater potential to increase walking, cycling and public transport, as well as shifting to more efficient freight transport, compared to other parts of Sweden where the population density is lower. The ambitions regarding the decrease in transport emissions are therefore higher compared to the corresponding national goal. The City's ambition is that the climate impact from transportation will be reduced by at least 90 % by 2030 and that the volume of motorized traffic will be reduced by 25 %. Reaching the targets will require a shift from car travel to walking, cycling and public transportation, and freight transport from road to rail and waterborne transport. Furthermore, the use of fossil fuels needs to stop and be replaced by different renewable fuels, electric or hydrogen-driven vehicles. Renewable fuels will not be sufficient

for the same volume of road traffic as today, nor will they be sufficient for shipping, aviation, work machinery and other sectors. That is why the volume of traffic needs to be reduced as well.

The Port of Gothenburg is Scandinavia's largest port and a central node in Sweden's transport system. This provides the opportunity for the City of Gothenburg to act as a forerunner and become a hub for the climate transition of the transport system for Northern Europe.

Transports - Total emissions of GHGs in Gothenburg

Legend:
- Total
- Private cars
- Heavy trycks
- Light trucks
- Buses
- Mopeds and motorcycles
- Wear of tires and brakes
- Wear of road
- Evaporation from road vehicles
- Domestic maritime transport
- Domestic air traffic
- Railways
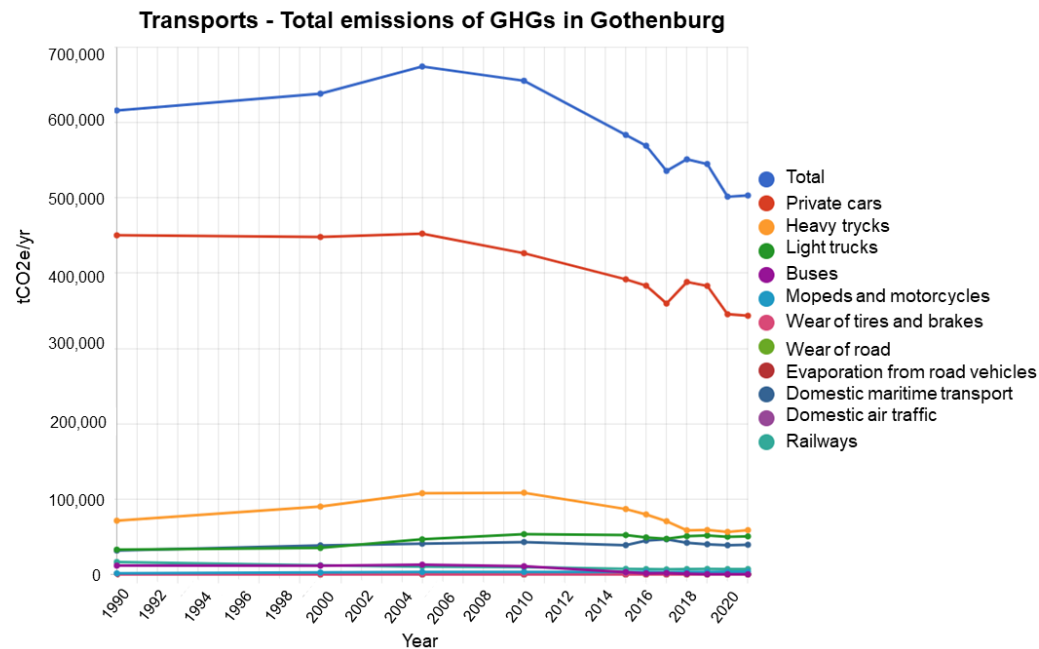
Figure A7 - GHG emissions from the transport sector in Gothenburg 1990-2021.

Activity data is presented according to the GPC structure, with all subcategories included in Stationary. This includes residential buildings, commercial and institutional buildings, manufacturing industries and construction, energy industries, agriculture, forestry and fishing. The distribution for each category is presented in Table A-1.5

A-1.1: Final energy use by source sectors Source 1-6: Statistical database, regional and municipal energy use			
Base year	2020		
Unit	MWh		
	Scope 1	Scope 2	Scope 3
Stationary, total [1]	7,789,878		
Wood [2]	41,983		
Oil [3]	698,323		
Electricity[4]		4,155,506	
District heating[5]		2,893,493	
Biodiesel[6]	573		
Transport	No activity data, only emission data		
Waste	No activity data, only emission data		
Industrial Process and	No activity data, only emission data		

ProductUse (IPPU)			
Agricultural, Forestry and Land Use (AFOLU)	No activity data, only emission data		

A-1.2: Emission factors applied

Sources:
1-4: National emissions factor database, Naturvårdsverket
5: Nordic electricity mix IVL, Emissionsfaktor för nordisk elmix
6: Environmental values for delivered district heating 2020 Göteborg Energi
(Please specify for primary energy type and GHG emission factor according to the methodology used).

Emission factor for electricity
For electricity, an emission factor for the Nordic electricity mix is used. The GHG Protocol provides guidance on how to choose emission factors and offers calculation tools with integrated emission factors for electricity. The GHG Protocol recommends primarily using market-based electricity figures. Market-based means that the emission factor is based on what is purchased, for example, an electricity mix from a specific supplier. Sweden is connected to the European Energy Certificate System AIB, and it is possible to use the market-based method and thereby account for, for example, wind or solar power.

IVL (Swedish Environmental Institute) has, on behalf of the Swedish Environmental Protection Agency, developed emission factors for the Nordic electricity mix, taking into account import and export, where a breakdown of direct and indirect emissions is also presented to facilitate reporting according to the GHG Protocol's scope. See link: Emissionsfaktorer för nordisk elmix med hänsyn till import och export (ivl.se)

Method used: GPC, CRF

Primary energy/ energy source	Carbon Dioxide (CO_2)	Methane (CH_4)	Nitrous Oxide (N_2O)	Unit		
Diesel[1]	259.92	0.0032	0.0022	kg/MWh		
Diesel, small-scale residential[2]	267.336	0.0072	0.022 kg/MWh	kg/MWh		
Wood, CHP (3)	0	0.0396	0.0108	kg/MWh		
Wood, residential[4]	0	0.054	0.0144	kg/MWh		
Electricity[5]	90.4 CO2e			g/kWh		
Heating[6]	48 CO2e			g/kWh		

A-1.3: GHG emissions by source sectors

Data is presented for all categories included in Stationary: residential buildings, commercial and institutional buildings, manufacturing industries and construction, energy industries, agriculture, forestry and fishing.

Sources:

1: Statistical database, regional and municipal energy use Scb.se

2-5: SMHI National Emissions database Nationellaemissionsdatabasen.smhi.se

6: Environmental Protection Agency – Emission in numbers, Naturvardsverket.se; Göteborg Energy, Goteborgenergi.se and Renovas Hållbarhetsredovisning 2020 Renova.se

Base year		2020			
Unit		CO2e			
		Scope 1	Scope 2	Scope 3	Total
Residential buildings [1]		938	201,338	-	202,276
Commercial buildings [1]		180,581	248,790	-	429,371
Manufacturing industries and construction [1]		79,237	238,058	-	317,296
Energy industries [6]		1,479,244	-	-	1,479,244
Agriculture, forestry and fishing[1]		1,069	556	-	1,624
Transport[2]		510,801	-	-	510,801
Waste[3]		25,144	-	-	25,144
Industrial Process and Product Use (IPPU)[4]		23,358	-	-	23,358
Agricultural, Forestry and Land Use (AFOLU)[5]	Sources (positive emissions)	3,627	-	-	3,627
	Sinks (negative emissions)	-	-	-	-
Total		2,304,000	514,545		2,818,545

A-1.4: Activity by source sectors (Table produced by the NZC economic tool)			
Base year: 2019			
	Scope 1	Scope 2	Scope 3
Buildings & Heating Heating demand (space heating + domestic hot water)(GWh/year)	8,218	N/A	N/A

Transport			
Transport need - passenger cars + motorcycles (M km/year)	2,950	N/A	N/A
Transport need - buses (M km/year)	53	N/A	N/A
Transport need - trains/metro (M km/year)	100	N/A	N/A
Transport need - light duty trucks (<3.5 t) (M km/year)	57	N/A	N/A
Transport need - heavy-duty trucks (>3.5 t) (M km/year)	914	N/A	N/A
Electricity Electricity demand within city boundaries (GWh/year)	N/A	4,156	N/A
Waste Collected waste within city boundaries (tonnes)	N/A	N/A	443,573
Other (incl. IPPU & AFOLU)	?	?	?

A-1.5: Activity data - Stationary						
Fuel	Residential	Commercial and institutional	Manufacturing industries and construction	Energy industries	Agriculture, forestry and fishing	TOTAL
Wood	41,983		no activity data	no activity data		41,983
Oil	2,665	691,558	no activity data	no activity data	4,100	698,323
Electricity	1,145,706	2,369,914	633,739	no activity data	6,147	4,155,506
District heating	2,036,790	719,778	136,925	no activity data		2,893,493
Biomass						

Biodiesel					573	573
TOTAL						**7,789,878**

2.2 Module A-2 Current Policies and Strategies Assessment

Module A-2 "Current Policies and Strategies" lists and assesses existing policies, strategies, initiatives, or regulations from local, regional, and national level, relevant to the City's climate neutrality transition. This assessment contributes to identifying the gap (if any) between the emissions reduction due to existing initiatives and the City's 2030 climate neutrality target. Filling this gap by identifying additional actions and levers to achieve the City's emission reduction target is the focus of this Action Plan. The assessment of current policies and strategies offers hence a starting point for exploring the impact pathways (See Part C).

A-2.1: Description & assessment of policies

The starting points for the governance of the City of Gothenburg are laws and constitutions, the political will and the City's inhabitants, users and customers. The governance structure of Sweden is an important aspect as the responsibilities of local, regional and national governments are clearly defined (for example, the region is responsible for transport and health care). The City's politicians describe through governing documents how they want to realize the political will. The City of Gothenburg is governed by the governing documents adopted by the City Council and the City Executive Board. In addition, the boards and corporate boards determine their own governing documents for their own activities. The municipality's budget is the overriding and superior governing document for the City Councils and corporate boards.

There are international agreements in the environmental field such as the Paris Agreement, Agenda 2030 and legislation such as EU directives. There is also national legislation such as the Environmental Code and related environmental quality standards. The goal of the Environmental Code is to promote sustainable development for the current and coming generations to live in a good and healthy environment. Environmental quality standards reflect the minimum acceptable environmental quality or the desired environmental state. In addition to the legislation, there is the national system of environmental goals which contains the goals for the environment on a national level. The purpose of the environmental goals is to provide a long-term objective for environmental policy and to serve as a guide for society's environmental work as a whole. These are also a realization of the environmental dimension of the Sustainable Development Goals, Agenda 2030.

Figure A8 – The governance system in the City of Gothenburg.

The Environment and Climate Programme for the City of Gothenburg 2021-2030, which applies to all committees and boards of the City of Gothenburg is the guide and the shared platform for the City's strategic long-term work for the climate and the environment. It is the comprehensive governing document for work within the environmental dimension of sustainable development in the City of Gothenburg. The programme helps drive the City of Gothenburg to transition into an environmentally sustainable society meaning that Gothenburg will become one of the world's most progressive cities when it comes to preventing and addressing environmental and climate problems. The coordination between the City of Gothenburg and trade and industry, inhabitants, academia, other cities and other actors is a prerequisite to succeed with this.

The starting point of the Environment and Climate Programme is the UN's Sustainable Development Goals Agenda 2030, Sweden's national environmental goals system, the Paris Agreement, and the challenges that Gothenburg as a community and the City of Gothenburg as an organization face in order to make the transition to an environmentally sustainable society.
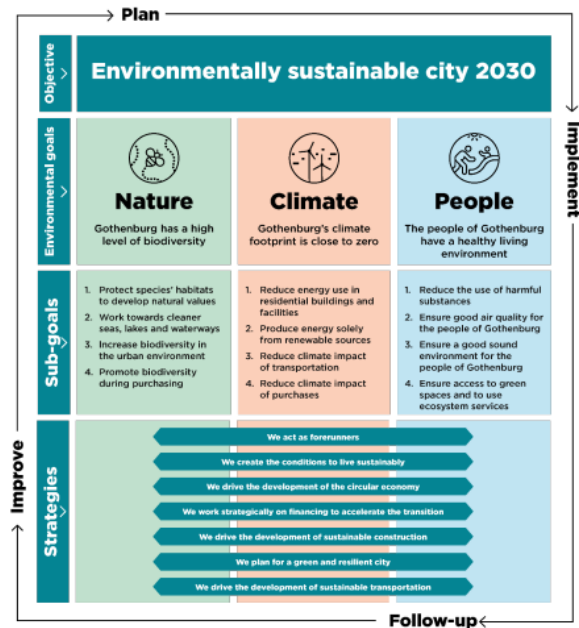
Figure A9 - Summary of the objective, the environmental goals, sub-goals and strategies of the Environment and Climate Programme. The picture is framed by the environmental management system's classification, which is an important part of the implementation of the programme.

The programme is implemented by the following two **toolboxes**:

1. A City-wide Environment Management System - all committees and boards shall in their regular operational planning, identify and prioritize the environmental and climate measures required to be carried out in their respective areas of responsibility for the City to reach its climate goals. This is reported and followed up every year. (Rapport 2023:13 Uppföljning av Göteborgs Stads systematiska miljöarbete 2023 (goteborg.se)

2. Through the programme's seven cross-cutting strategies (explained more in sections B and C), committees and boards join forces in areas that require a high degree of collaboration and new cross-cutting solutions. The strategies aim to bring about change-driven development to accelerate the transition to a sustainable city. (Strategierna sammanfattar arbetet hittills - Miljö och klimat Göteborg 2030 - Göteborgs Stad (goteborg.se)

Gothenburg has several policy documents, projects and processes that wholly or partly concern the climate area and that affect or are affected by the climate programme. Below, those most relevant are described:

Budget: Decided annually, the City of Gothenburg's budget is the comprehensive and overarching governing document for all boards and committees. The role of the budget is to indicate the City Council's prioritized goals and directions within the financial framework and current legislation, including prioritised goals for the climate. Plans, programs, guidelines and policies that the City Council has adopted must be followed and implemented but are subordinate to the budget.

Within each sector, there are also several collaboration platforms where collaboration and cooperation with actors from business, academia and civil society take place. Many of the City's programmes and plans affect the City's ability to achieve the climate goals:

Energy: *The City of Gothenburg's energy plan 2022-2030* identifies several measures to ensure a sustainable, flexible and capacity-secure energy system. The City is also investigating the possibility of creating conditions for carbon dioxide capture and storage (CCS) together with industry players.

Housing and construction: *Programme for environmentally friendly construction, the City of Gothenburg's programme for housing supply 2021-2026, the City of Gothenburg's programme for local supply 2020-2026 and associated plans.*

Mobility: A large part of the city's climate impact comes from transport. The development of the City's transport infrastructure is governed, among other things, by the *Gothenburg 2035: Traffic*

strategy for a close-knit city, *the City of Gothenburg's freight plan 2024 - 2035, the Cycling Programme for a close-knit city 2015-2025, the City of Gothenburg's electrification plan 2022-2030* and the *Målbild koll 2035*.

Circular economy and water and wastewater: The City's work on water and wastewater management, waste minimisation and increased circularity is governed by *the City of Gothenburg's waste plan 2021-2030 and the Region's water supply plan*. The purpose of the waste plan is to prevent waste and develop the management of the waste that nevertheless arises. Several of the plan's target areas have a major direct or indirect impact on the City's climate footprint.

Business cooperation: *The City of Gothenburg's business strategy programme for 2023-2035* has the objective "Gothenburg is an international model for the ability to cooperate - in an environment where people develop and thrive. The business community has full support from the City and can feel proud to operate in one of the world's most innovative metropolitan regions".

Land use and planning: The City can contribute to reducing the climate impact of transport in particular through *the City of Gothenburg's Comprehensive Plan, the City of Gothenburg's Forestry Plan* and climate-smart planning that contributes to a structure that makes it possible to be close to workplaces, public services, leisure facilities and shops, so that many people choose to walk, cycle and use public transport rather than take the car.

Tourism, culture and leisure: *The City of Gothenburg's programme for destination development 2023-2030* aims to ensure that the tourism industry grows and at the same time contributes to the development of people and living environments, and the ambition is to be an environmentally and climate-smart destination with a climate footprint close to zero, with industry players and visitors contributing to an ecologically sustainable destination.

Care and school: A sector with the opportunity to reduce its own and others' consumption-based emissions through indirect impact, see "*Guideline for learning about sustainable development and systematic environmental work in primary and secondary schools*".

Equality and inclusion: How the City works for equality and inclusion related to climate mitigation is important to enable a just climate transition. *Gothenburg City's programme for an equal city* has goals and strategies that aim for the City to become an equal city, concerning people's living conditions.

Other: This includes, for example, the Green Bond Framework, the Knowledge Centre for Digitalisation and the City of Gothenburg's guidelines for purchasing and procurement.

Strengths and gaps of current policies

Current policies for environmental sustainability in Gothenburg exhibit notable strengths for climate transition. Firstly, the Environment and Climate program is specifically designed to address the City's significant challenges towards achieving sustainability and integrate objectives on biodiversity, climate, and a healthy living environment. The program undergoes biennial reviews, including recommendations that draw political interest and influence tasks assigned to administrations and companies, ensuring ongoing improvement and relevance. Moreover, the introduction of the City-wide Environment Management System (MLS) provides a systematic approach to aligning local objectives with the City's overarching goals.

However, the policy documents also reveal areas requiring improvement to fully realize its potential. Several plans and programs need stronger support for implementation. There is today an absence of concrete climate mitigation action plans that complement the existing Environment and Climate Programme and encourage cross-sectoral cooperation, highlighting a need for a more integrated and actionable strategy. Furthermore, there is a recognized necessity for a deeper integration of social sustainability considerations to ensure a just transition, suggesting that programs aimed at promoting equal city and public health should be more closely aligned with environmental and climate initiatives. The management of data and estimation of impacts also demands enhancement, including the implementation of e.g. Climate budget and socioeconomic analyses into the City's management system and decision support.

List of existing & relevant policies, strategies & regulations

Name	Type	Level	Description/scope/relevance	Impact	Limitations/gaps/need for action
Budget 2024 Gothenburg City (Budget 2024 Göteborgs Stad)	Highest governing document	Local	Describes the City's political ambitions.	Outlines the goals and objectives the City has for climate neutrality.	Aims to give an overarching description of the political ambitions and therefore does not include concrete action plans on how to realize them.
Environment and Climate Programme for the City of Gothenburg 2021-2030 (Göteborgs stads miljö- och klimatprogram 2021-2030)	Programme	Local	The programme is the steering document and the shared platform for the City's strategic long-term work for the environment. Contains the City's goals related to climate mitigation and lays the foundation for the transition to an environmentally sustainable city by 2030 and it is the City's comprehensive governing document for work within the environmental dimension of sustainable development	Contains concrete targets for the reduction of GHG emissions. Evaluated every two years. Follow up on the indicators. Results in recommendations Goals will be reported to the City Council every two years Collects information for the programme's indicators continuously	Does not contain goals for areas that are already covered by other governing documents in the City, such as waste prevention, reuse and recycling as addressed by the regional waste plan. Requirements contained in legislation or other regulations that motivate change are not repeated

			The Programme describes seven cross-cutting strategies for working towards the goals. Refers to the City's Environment Management System as a way of working towards the goals.	evaluated and revised during its period of validity Identifies gaps that need to be addressed.	as goals or target values for indicators in the programme.
City-wide Environment Management System (Anvisning för systematiskt miljöarbete)	Instruction	Local	Supports the City's committees and boards' systematic work with the ecological dimension of sustainability. Cyclic work of planning, implementing, follow-up and improving the environmental work.	Identifies gaps in the City's environmental work that need to be addressed.	A tool for continuous improvement rather than transformative measures.
Energy Plan 2022-2030 (Göteborgs Stads energiplan 2022-2030)	Plan	Local	Outlines the City's energy system and defines various measures that the City will take to transform its energy system towards sustainability by 2030. The plan describes how the City is to achieve the energy goals described in the environmental and climate program and at the same time maintain a continued stable energy system with good access to electricity and sustainable fuels, without interruptions and disruptions.	Contains concrete targets for the reduction of GHG emissions. Push for measures that lead to the City of Gothenburg reaching the goals. Maintain and develop the City of Gothenburg's work to have a safe and secure energy supply. Be a common starting point that shows the direction for	Implementation Parallel action plans exist within each organization and the role of the plan as a document driving change varies. Improvements are needed when it comes to systems perspective and the ability to foster collaboration.

				the City of Gothenburg's work with energy issues Fulfill the requirements of the act on municipal energy planning Evaluation in 2023 with the results being implemented in 2024	
Contributes to the City reaching its goals related to climate and energy, and that the City's energy supply should be secured. This is a successor to the Sustainable Energy Action Plan – the energy-efficient City which was produced as a part of the Covenant of Mayors.					
Transport Strategy for a close-knit city 2035 (Trafikstrategi för en nära storstad) Sustainable Urban Mobility Plan/SUMP	Strategy	Local	The Transport Strategy is the governing document for how the transport system and streetscape in Gothenburg are to be developed in order to achieve set objectives and meet the challenges facing the City. The strategy is the guiding document for how the city's transport system is to be developed in order to achieve set objectives and meet the challenges that the City faces over the next 20 or more years. Focuses on three areas and highlights three main objectives: travel, urban space and transport of goods. An easily accessible regional centre, attractive urban	Contains concrete targets for the reduction of GHG emissions. Contains a number of effect targets by 2035 for journeys/travel, urban space and the transportation of goods. By 2035 at least 35 per cent of journeys in Gothenburg will be taken on foot or by bicycle. By 2035 at least 55 per cent of motorised journeys in Gothenburg will be by public transport.	Lacks concrete action plans. Currently under revision 2023-2024 and it is unclear when a revised strategy will be available.

					By 2035 the travel time between two random cores or key destinations is a maximum of 30 minutes by car and public transport.	
Waste and Refuse Plan 2021-2030 (Göteborgs Stads avfallsplan 2021–2030: Göteborgsregionen minskar avfallet och lokal bilaga för Göteborgs stad)	Plan	Local Regional	Governs waste management and is the guide in the entire waste chain. Consists partly of the regional waste plan that applies to the entire Gothenburg region, and partly of the local annexe for the City of Gothenburg.	Contains concrete targets for the reduction of GHG emissions. Set a target of reducing the amount of waste from municipal operations by 40 per cent by 2030. Six target areas are: Prevention, Reuse, Collection & recycling, Included in all stages of Urban planning, User focus, Litter	Implementation. The prioritization of preventive measures and reuse in the plan led to the exclusion of some areas that are associated with negative climate impact, such as landfills.
Electrification Plan 2022-2030 + bi-annual Action Plan (Göteborgs Stads elektrifieringsplan 2022–2030)	Strategy/plan	Local	Plan to support the electrification of the City's transport system.	Described as a measure to reach climate neutrality. Electrification of the transport system can support phase-out use of fossil fuel-driven vehicles.	Implementation. The plan does not contain other measures than electrification to abate climate impact, such as reduced traffic or substitution to fossil-free fuels.

| City of Gothenburg's Strategic Business Programme 2018-2035

(Göteborgs Stads näringslivsstrategiska program 2018-2035)

NÄSP Action Plan 2021-2023 | Programme

Plan | Local | The programme provides direction for the City's work for strengthening business establishment and development.

To enable the City to reach the programme's objectives, there are six mission-oriented strategies. | The strategies are connected to certain global sustainable development goals. Three of the strategies target the challenge of decoupling increased economic growth and climate impact.

Ambition to increase decoupling and decrease CO2 emissions in absolute values per capita, using indicators that are followed-up. | Lacks concrete action plans. The strategies do not describe the operative work needed to realize the objectives. |
|---|---|---|---|---|---|
| Bicycle programme for a close-knit city 2015-2025

(Cykelprogram för en nära storstad 2015–2025) | Programme | Local | Provides a direction for the City to act to increase cycling | Increasing the number of bicycle rides implies that other modes of transportation are used less, which leads to less climate impact since bicycles generally contribute to less climate impact than e.g. cars. | Implementation |
| City of Gothenburg's programme for an equal city 2018–2026.

(Göteborgs Stads program för en jämlik stad 2018–2026) | Programme | Local | Provides direction for the City's work to enhance equality, by describing areas that need to be addressed by stakeholders through joint efforts.

To further specify the overarching goal that Gothenburg should be | Can be viewed as addressing aspects of justice - distributional, recognitional and procedural - which are prerequisites for realizing a just climate transition. | Lacks concrete action plans. The strategies are rather formulated as subgoals.

The programme is planned to be replaced in 2024 by a program |

			an equal city, the programme has four objectives: Create a good start in life and good conditions for growing up, Create conditions for work, Create sustainable and equitable living environments and Create the conditions for participation, influence and trust. Each objective has five to seven strategies.	Certain strategies are connected to strategies in the Environment and Climate Programme.	focusing on equality and public health.
Gothenburg City Comprehensive Plan (Översiktplan för Göteborg)	Strategy/Plan	Local	Provides guidance related to urban development in the city. Introduces goals of reducing climate impact.	The plan guides the City's work in several areas which can result in positive and/or negative climate impact. How the city is built with its infrastructure for e.g. public transport affects both possibilities for climate mitigation and adaptation.	Implementation. Focuses on climate adaptation.
Digitalization Plan for a cohesive, digital and innovative Gothenburg 2023-2026 (Göteborgs Stads plan för digitalisering 2023 – 2026. För ett sammanhållet, digitalt	Strategy/Plan	Local	Provides direction in the work for digitalization of the City's services.	Improved availability to the City may support increased participation, which is an important aspect in a just transition. Possibilities for more efficient use of the City's resources.	Does not outline specific measures for reducing climate impact through digitalization.

och innovativt Göteborg)					
Public Transport Strategy (Målbild Koll2035)	Programme	Local, Regional	Guides how public transport in Gothenburg and its nearest cities should be developed in the long-term to achieve the objectives of the transport strategy.	Plan for the development of a sustainable transport system, where transport by car decreases in favour of public transport, cycling and walking, which in general contribute to less climate impact.	Implementation. Certain aspects of the transport system which could have effect on the possibilities for implementation as well as the total climate impact of the proposed system.
Urban greening plan – for a close, cohesive and robust city 2022-2030 (Grönplan för en nära, sammanhållen och robust stad 2022-2030)	Plan	Local	Describes measures to develop Gothenburg in several areas through strengthening green infrastructure and ecosystem services.	There is often a positive correlation between green infrastructure and climate mitigation, hence measures to implement such measures also have a positive effect on climate mitigation	Implementation.
Programme for Destination Development 2023-2030		Local	Promotes the development of Gothenburg as a sustainable destination.	Strategies for achieving an environmentally and climate-smart destination with a climate footprint close to zero, where destination stakeholders and visitors contribute to an ecologically sustainable destination.	Recently adopted, yet no analysis on gaps.
Parking policy for Gothenburg City	Policy	Local	Aims to increase the availability of Gothenburg city and encourage	Measures facilitating public transport and/or cycling instead of using cars which	Implementation.

(Riktlinjer för mobilitet och parkering i Göteborg Stad 2018)			choosing public transport or cycling instead of car.	correlates with a positive impact on climate mitigation.	Policy focusing on central parts of Gothenburg.
Environment Policy for the City of Gothenburg

(Göteborgs Stads policy för den ekologiska dimensionen av hållbar utveckling) | Policy | Local | Declares common responsibilities for and governing principles for the City. | Clarifies the City's approach to work with sustainable development, where connection to the other sustainability dimensions is highlighted. | Lacks concrete measures for coordinating the work for sustainable development. |
| City of Gothenburg's Policy for Forest Management

(Göteborgs Stads skogspolicy) | Policy | Local | Policy for forest management in Gothenburg. | Forests provide ecosystem services that can help reduce negative climate impact, e.g. by acting as carbon sink or support biodiversity which is crucial to further maintain ecosystems. | The policy is valid for the forest areas managed by a certain committee (Urban Property Administration). There are larger forest areas managed by another committee (Urban Environment Administration).

The policy does not cover management of forests that are part of ongoing plans for exploitation. |
| Guideline for compensatory measures and ecosystem services in | Guidelines | Local | A tool that aims to prevent natural and recreational values from being negatively affected by planning and exploration. | There often is a positive correlation between ecosystem services and climate mitigation, hence | Implementation. |

				measures to implement ecosystem services also have a positive effect on climate mitigation.	
planning- and development projects (Kompensationsåtgärder för ekosystemtjänster i plan- och exploateringsprojekt)					
Green area factors (Grönytefaktorer och kompensationsåtgärder) - Göteborgs Stad (goteborg.se)	Guideline	Local	A tool that implies that the planning process should use nature-based solutions to address various environmental challenges.	There often is a positive correlation between nature-based solutions and climate mitigation, hence measures to implement nature-based solutions also have a positive effect on climate mitigation.	The implementation of the tool is limited, due to overlap with legislation.
Congestion Tax (Trängselskatt)	Policy instrument	Regional	Economic policy instrument aiming to regulate road traffic to reduce congestion.	Reduced congestion may lead to less usage of vehicles, thereby decreasing emissions of GHGs. The tax revenues are used for infrastructure investments for development of public transport.	Does not differentiate between types of vehicles, e.g. fuels used. The tax revenues are partly invested in infrastructure facilitating car use.
Regional Development Strategy for Västra Götaland 2021-2030 (Regional utvecklingsstrategi	Strategy	Regional	Outlines the direction for the development of the Västra Götaland region to become more sustainable and competitive.	Has objective of becoming fossil-free and circular. Focus areas for 2021-2024 are circular business models and electrification of industry and the transport sector,	Implementation, support by concrete action plan. Coordination of actor responsibility for the priorities and focus areas in the strategy.

				aiming to decrease negative climate impact.	
The National Waste Plan and the Waste Prevention Program (Nationell avfallsplan och avfallsförebyggande program 2018-2024)	Plan and program	National	Describes the work in Sweden to decrease waste and decoupling of economic growth and environmental impact from waste. Compilation of existing targets and legislation regarding waste.	Targets to use existing products and materials instead rather than newly produced ones decreases the emissions associated with the production phase.	Implementation.
National Energy and Climate Plan (Regeringens klimathandlingsplan – hela vägen till nettonoll)	Plan	National	Long-term objectives for energy and climate measures.	Objectives of decreased GHG emissions and energy efficiency have a positive effect on climate mitigation. The long-term target is that Sweden will reach net-zero emissions in 2045.	The Swedish Climate Policy Council, a research council set to review the plan, states that the current plan is not sufficient for achieving the 2030 climate targets.
Climate Act (Klimatlagen)	Regulations	National	Regulations for climate policy work by the Swedish government.	Outlines the direction for national climate mitigation.	Implementation, legal interpretation.
Environmental Code (Miljöbalken)	Regulations	National	Regulations aimed to support sustainable development to ensure a healthy environment.	Provides regulations regarding environmental assessments of activities to mitigate climate impact. Includes regulations regarding geological storage of CO2.	Implementation, legal interpretation. Restrictions in regulating GHG emissions from certain activities, to avoid overlap with regulations of emissions trading.

Table A-2.1: Emissions Gap (kt CO2e)

This table is the output from the NetZeroCities Economic Tool, which is aligned with the Climate Neutrality Action Plan (CNAP) and Climate Neutrality Investment Plan (CNIP) templates in the V2.1 Resource Pack. Please see here for reference documents that support the economic model used for Gothenburg's analysis (https://netzerocities.app/group-capabilitybuildingprogrammebuildingastrongeconomiccase). The documents are posted on the NZC Portal in the group called: Capability Building Programme: Building a strong economic case.

The City of Gothenburg has Scandinavia's largest port (which is City-owned) and is home to two refineries and an incineration plant. For the City to reach its climate goals (near zero-emissions 2030) much needs to be done to reduce the emissions from these sectors. Since 2020, the City has been engaged in structured high-level dialogues with the CEOs and Directors from these sectors to identify the necessary measures needed and identify the actions to take place. There is still work to be done to fully characterise and address all (industrial) emissions sources, however, the gap is now well-defined and understood and engagement will continue to advance the development of plans for addressing the gap.

Concrete actions are provided in Part B.

Plans for addressing the emissions gap and the gap and residual emissions of Gothenburg in 2030 are a key part of upcoming iterations of the Climate City Contract, with a focus on exploring further measures to increase the reduction rate by 2030. The City and its stakeholders are investigating ways to neutralize emissions through carbon sinks and carbon credits, conducting pilot studies to define and calculate these mechanisms effectively. A significant portion of residual emissions is anticipated to originate from the City's industries, given Gothenburg's industrial base. These industries set their own climate targets and explore different methods for managing residuals, driven by their own sustainability objectives. Hence, industries are likely to complement the City's efforts in eliminating and compensating residual emissions. Plans for addressing the residual emissions of Gothenburg in 2030, in the City and among actors operating here, will constitute an important part of upcoming iterations of the Climate City Contract.

	(1) Baseline emissions	(2) Emissions Reduction Target 2030		(3) Emission reduction through other Action Plans		(4) Emissions Gap		(5) Emissions reduction through the CCC Action Plan to address the Gap		(6) Residual emissions(1)	
	(absolute) (ton CO2e)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)	(absolute)	(%)
Transport	476	115	24	-	-	0	0	361	76	115	24
Building	287	181	63	-	-	55	19	106	37	126	44
Electricity	441	-	0	-	-	0	0	441	100	-	0
Waste	67	56	85	-	-	43	65	10	15	13	20
Other (including IPPU & AFOLU) (2)	1,606	321	20	-	-	0	0	1,285	85	321	20
Total	2,875	673	23	-	-	98	3	2,203	77	575	20

[1] Residual emissions consist of those emissions that can't be reduced through climate action and are being offset. Residual emissions may amount to a maximum of 20% as stated by the Mission Info Kit.
[2] "Other" which encompasses all emissions that do not fit into the other major sectors (it includes IPPU, AFOLU, etc.)

2.3 Module A-3 Systemic Barriers and Opportunities to 2030 Climate Neutrality

This module aims to document the conclusions of a systems and stakeholder mapping aimed at identifying systemic barriers and opportunities. In conjunction with the GHG inventory and the policy baseline analysis in the previous two modules of Part A, the analysis reported here serves as a basis for designing actions that address these barriers or exploit the underutilised opportunities in Part C.

A-3.1: Description of urban systems, systemic barriers, and opportunities

Main sociotechnical and institutional systems influencing GHG emissions

Gothenburg's GHG emissions are deeply entwined with various sociotechnical systems. The urban systems around *Energy and industry*, *Mobility and transport*, and *Building and construction*, are of particular importance for Gothenburg's geographical climate emissions. *Waste and circular economy*, and the *Food sector*, are also significant contributors, in particular to consumption-based emissions. All these systems are composed of both technical and social elements that influence both their impact and their evolution.

Governance and policy landscape, along with *Social and behavioural systems*, are integral to understanding and transforming these urban systems. They not only contribute to each of the urban systems' internal dynamics but also form crucial systems in their own right, with distinct dynamics and stakeholder interests on their own.

Table A-3.2 offers a stakeholder mapping across these sociotechnical and institutional systems. This mapping highlights key stakeholders within each system and examines their principal influence on Gothenburg's ambition for climate neutrality.

While recognizing the importance of actors in the transition of systems, it's essential to also consider other leverage points. The subsequent sections list major systemic barriers and opportunities for climate neutrality in Gothenburg.

Systemic barriers

Major systemic barriers identified are:

Knowledge, skills and leadership - Systemic transformation demands deep, interdisciplinary *knowledge*. Without a comprehensive understanding of the system and its components, appropriate measures are unlikely to be implemented. Moreover, addressing complex challenges requires *skills and leadership* that can navigate complex issues of sustainability, innovation, and systems change. While multiple transition pathways to climate neutrality are theoretically possible, the dynamics and complexity of systemic transformations introduce *uncertainty* about how these transitions will occur. Developing knowledge and strategies to manage this uncertainty is crucial.

Gothenburg is a city rich in knowledge, with numerous universities, research institutes, and advanced businesses. This wealth of knowledge must be integrated across sectors and disciplines to facilitate transformation. There's a critical need for transformative leadership capable of synthesizing and expanding this knowledge, even in the face of uncertainties. This involves both developing such

leaders and ensuring that system actors prioritize hiring and supporting individuals with these competencies.

Fragmented innovation - Innovation projects are often fragmented, isolated and do not scale to the desired extent. This is interlinked with other challenges of systemic transformation, innovation policy as well as internal organisational factors.

System inertia and path dependence - System inertia derives from the co-evolution that needs to take place between different interdependent parts of the system. If this evolution is not synchronized, the system is likely to resist change. Past events and decisions may also create path dependencies that limit innovation. In Gothenburg, current industry and infrastructure involve substantial investments over extended periods, leading to lock-ins for potential technological choices and urban layouts. The energy and transport systems are examples of systems where this can constitute a barrier to rapid change.

Multi-actor impact and the City's degree of control - Numerous actors influence the systems requiring transformation with power structures and mandates being decentralized. These actors also have varied knowledge and skills pertinent to system and climate transition, as well as varying goals and rationales for their actions.

Despite having significant influence, Gothenburg does not control major greenhouse gas emission sources, such as refineries, highlighting the varying degree of city control and underscoring the importance of multi-actor impact.

Multi-level governance - Influence over the systemic transformation is not only a local issue but also largely affected by regional, national and international institutional levels.

Implications of the political system - The democratic governance system is an important enabler and a prerequisite for systemic transformation. However, in terms of barriers, there are several built-in challenges. Time frames with one-year budgets and four-year terms of office, as well as shifting political landscapes, risk creating counterproductive incentives and high complexity for climate transition.

Silo organization - The City of Gothenburg is, like most other municipalities, organised in silos for adequate management according to each administration's specific task, but is not organised to meet major challenges that require a cross-sectoral approach.

Financing and Business Models - Present financing and business models, including issues like "split wallets" where actors taking the costs do not necessarily get the benefits, can pose barriers and discourage actions towards climate neutrality due to too narrow scope in cost-benefit calculations and competitiveness across actors.

Geographical spread - Reductions of territorial emissions as well as consumption-based emissions are dependent on actions in other geographical areas, since value chains, markets and different local-regional-global developments are interconnected in various ways.

Societal Norms and Behaviour - Norms and behaviour of today tend to enhance extrinsic values (such as self-interest and individual focus) rather than intrinsic values (such as benevolence and togetherness). This promotes higher resource consumption and carbon emissions and is a barrier to climate change.

Systemic opportunities

Although facing considerable barriers, Gothenburg also has several systemic opportunities that potentially can help to enable the climate transition:

Cross-sector and multi-actor collaboration - Sweden boasts a collaborative culture characterized by a high degree of openness and trust among various stakeholders. This collaborative spirit, coupled with shared visions of climate neutrality, offers significant potential to break down internal silos and overcome barriers between organizations through effective collaboration. By doing so, challenges posed by fragmented innovation, knowledge gaps, uncertainty, and system inertia can be addressed, thereby facilitating a smoother transition toward systemic change. The City's seven strategies are examples of forums that initiate and materialize this kind of collaboration, e.g. in research projects and actor platforms. The research institutes and science parks of Gothenburg are also home to many such initiatives.

Digitalisation and visualisation - Digitalization holds the potential to reduce emissions by enabling new solutions, higher efficiency, and increased dissemination of knowledge. Moreover, digitalization and visualization serve as essential tools for supporting decision-making and involving stakeholders. Gothenburg exhibits a high level of maturity in digital solutions, both within the City and among its citizens and businesses, which could serve as a strong lever for change.

Co-benefits - Climate mitigation measures in Gothenburg offer numerous co-benefits that, if considered and implemented, could lay the groundwork for a more sustainable society from a broader perspective. Planned climate measures present many possible synergies, including improved health, increased biodiversity, social inclusion and equity, as well as economic competitiveness. The desire and potential to create such synergies could spur further action for climate mitigation

Just transition - Linked to co-benefits, but important to address separately, is the matter of creating conditions for a just transition. Striving for a just transition offers opportunities to enhance social sustainability and prevent societal dysfunctions. Additionally, a more equal and inclusive society may facilitate the implementation of climate mitigation measures. The City collaborates with academia in exploring pathways for just transitions.

Societal norms and behavioural change - Whilst norms and behaviours may constitute a systemic barrier, they may also constitute important and powerful opportunities for systemic transformation in support of climate transition.

Degree of City Control - The City of Gothenburg wields a high degree of control and influence over local society, compared to many other cities. Given its responsibilities in areas such as urban planning, construction, energy provision, and property management, actions taken by the City can have a multiplier effect. As the second-largest city in Sweden, Gothenburg also has considerable influence on the national society, for instance through the influence on the national market that the procurement of the City implies.

Innovative culture and portfolio thinking - Gothenburg fosters a culture of innovation through initiatives like test beds and portfolios of innovation projects spanning different sectors. These approaches could contribute to systemic transformation if further developed, creating favourable conditions for larger-scale endeavours needed for climate action.

Green bonds and financial mechanisms - Gothenburg is a pioneer in adopting and developing the use of green bonds, laying the groundwork for further development to reach the full potential of this tool.

Green electricity - Sweden's renewable energy system presents a favourable context for Gothenburg's transition. A substantial share of electricity derived from renewable sources facilitates the shift towards intensified electrification with minimal carbon footprint. Moreover, this green energy infrastructure attracts industrial investment. The ongoing establishment of the Northvolt and Volvo battery plant in Gothenburg illustrates this trend.

Citizen inclusion - Citizen inclusion remains an underutilized opportunity with the potential to accelerate the pace of climate transition, foster new and improved solutions, increase acceptance, and facilitate upscaling and behavioural change.

Social innovation - Closely linked to an innovative culture and citizen inclusion, social innovation addresses societal challenges in reaching climate neutrality through a bottom-up, collaborative, holistic, and human-centred approach to innovation.

Mission orientation - Working towards a common mission is an opportunity to bridge gaps between organizations, spur innovations, and direct efforts across various actors, including citizens, in an effective manner.

Empowering Gothenburg's systemic transformation through collaboration and learning
The seven strategies of the City were specifically designed to enhance the City's capacity to address systemic challenges. These strategies are tasked with identifying, addressing, and overcoming systemic barriers through testing and learning, while also exploring and enhancing systemic opportunities. The strategies do so in collaboration with stakeholders across the Gothenburg community. This explorative and collaborative approach has yielded promising results thus far and is likely to be pivotal in driving the transition forward. To this end, it is imperative to mobilize widespread engagement and capacity for active participation in these strategies and their explorations of solutions. The Climate City Contract could enforce this endeavour, by uniting stakeholders around the shared vision of being a leader in Europe in carbon neutrality.

Enabling interventions
The systems and stakeholders in the table below do not make an extensive list of all relevant stakeholders, and it is partly aggregated for better readability and overview. Nevertheless, the point here is made clear that there are multiple stakeholders which influence the pathways towards the climate neutrality ambition, and which all have different roles and interests in the transition. Many of the enablers described in part C are about summoning these stakeholders around fields of common interests. Here, minimum common denominators are a key factor for finding fruitful collaborations, but where different interests in detail will be, and must be, present around the same table. It's within these collaboration interventions that different interests become visible, addressed and to some extent also managed.

The barriers, opportunities and stakeholders described in this section are guiding the City on which type of enabling interventions the City needs to develop. The interventions described in part C visualize in which fields the City is already working, where the City is strong or weak, and which areas the City plans to develop. The remaining gaps are identified and must be handled by the City, its partners and/or stakeholders on various levels.

A-3.2: Systems & stakeholder mapping			
System	**Stakeholders**	**Influence on the City's climate neutrality ambition**	**Interest in the City's climate neutrality ambition**
Governance & policy landscape (local, regional, national and international)	EU Commission	High	High. Compliance with, and contribution to, EU legislation and targets.
	National government & parliament	High	High. Compliance with, and contribution to, national legislation and targets.
	Government agencies	High	High. Applies laws and carries through activities decided by the government and parliament.
	City politicians (City Council/City Executive Board)	High	High. "Owners" of the climate goal.
	The City's administrations & companies	High	High. The City's Environment and Climate Programme applies to all administrations and companies in the City, hence the whole City has an interest in the ambition. Conflicts of interests and/or synergies with other strategic priorities and policies.
	Region Västra Götaland	Medium	High. Has regional goals regarding climate mitigation. Gothenburg is the largest city in the region.
	County Administrative Board of Västra Götaland	Medium	High. Monitors regional environmental status. Responsible for carrying out activities that comply with national legislation and targets.
	Gothenburg Region	Medium	High. Has a strategy for sustainable urban development. Gothenburg is the largest city in the region.
	EU cities	Low	Low. Interested in learning and exchange
	Gothenburg European Office (GEO)	Low	Medium. GEO continuously monitors new EU initiatives targeting

			cities, to assist alignment in Gothenburg.
Social and behavioural systems	Citizens, visitors, employees	High	High. Affected by measures for climate neutrality. Personal interest/alignment of values. Possible synergies with well-being.
	Traditional and social media actors	High	Medium. Local media may have interest in the Gothenburg ambitions, addressing both synergies and conflicts.
	Local, national and global industry and business	High	Medium. Potential resistance, aiming for high consumption and extrinsic values. Also beneficial to social entrepreneurship, (circular) business model innovation, sharing services, etc.
	Knowledge arenas (schools, universities, research institutes & platforms)	Medium	Medium. Constitutes a field of research and demonstration. Synergies with the well-being of, and possibilities to attract, students and employees.
	Civil society organisations, NGOs	Medium	Medium. Depending on the organization's agenda; the ambition and implemented measures might align with the values of the organization, or there might arise goal conflicts.
Energy, Industry & Commerce	Refineries	High	High. Interest in green positioning and legitimacy for operation. And a city that attracts qualified workforce.
	Port of Gothenburg	High	High. The Port aims to have 70% lower CO2 emissions by 2030.
	Göteborg Energi	High	High. Provides Gothenburg with electricity, gas, broadband fibre, district heating and cooling, hence the company's activities are

			affected by the climate neutrality ambition.
	Business Region Gothenburg	Medium	High. Responsible for the City's strategic business program as well as the linked action plans.
	Local companies (non-manufacturing/processing)	Medium	Medium. Measures for climate neutrality may affect the ability to pursue or maintain certain businesses, as well as new opportunities for existing and new businesses. Customers of Göteborg Energi.
	Local industries	High	High. Interest in green positioning and legitimacy for operation. Possible actors for utilising CCSU.
	Citizens	Medium	High. Green and affordable energy. (Customers of Göteborg Energi.) Recipients of encouragement (from e.g. the City) to behavioural change regarding energy use.
Mobility and Transport	Public transport operators (local, regional and national)	High	Medium. The climate neutrality ambition implies a dependency on the public transport system as well as development of the current system.
	Research institutes and Science parks	High	High. Partner for case studies, test beds, and demonstrations.
	Port of Gothenburg	High	High. The Port aims to have 70% lower CO2 emissions by 2030. Constitutes an important role in transforming the transport system for northern Europe.
	Companies in the automotive industry and mobility sector	High	Medium. Gothenburg as important niche market, (first)

			customer and demonstration site
	Landvetter Airport	Low	Medium. Affected by transformation of the transport system.
	ElectriCity	Medium	High. A platform to test electrification of buses, an initiative which aligns with the climate neutrality ambition.
	Gothenburg Green City Zone	Medium	High. The initiative Gothenburg Green City Zone shall, by driving change in all parts of the transport system and the entire Gothenburg region, be a tool to accelerate the transition.
	Citizens	High	High. Sustainable and competitive mobility. Quality of life. May be affected by measures implemented to comply with the climate neutrality ambition (e.g. changed modes of travelling, improved bicycle paths, increased parking fees). Possible resistance to change.
Building & construction	Property owners, property managers Construction contractors Developers	High	High. The sectors in question are associated with emission-generating activities, such as substantial amount of material use, development of public spaces and land use. Thus, the actors' activities are affected by the climate neutrality ambition.
	Construction companies, product and material suppliers	High	Medium. Interest in Gothenburg as a market, and frontrunner in climate claims.
	Sector governments, trade associations and standardization bodies	High	Low. Interest in the development and testing of new tools and regulations.

	Private landowners	Low	High. Affected by regulations regarding land use.
Waste and circular economy	Local, national and global industry and business	High	Medium. Potential resistance, aiming for high consumption and extrinsic values. Potential for circular business model innovation and test markets. Sharing services etc.
	Waste and wastewater administrations and companies	Medium	High. Responsible for recycling and waste management. Connected to the district heating system. Rationales for behavioural change
	Business Region Göteborg	Medium	High. Encourage local businesses to green transition
	Citizens	High	High. Interest in ways of living and consuming more sustainably. Interest in cheap products and fast fashion. Recipients of encouragement (from e.g. the City) to behavioural change regarding waste prevention and -management.
Food sector	Producers, grocery stores, restaurants & cafés	Medium	Medium. Affected by regulations and goals regarding procurement. Possibilities for market positioning and industrial symbiosis.
	Welfare sector (schools, elderly care)	Medium	High. Ambition to reach the target. Goal conflicts with economy, nutrition density, secure delivery, etc.
	Citizens	High	High. Willingness to live a healthy and sustainable life.

			Habits, lack of time, economic priorities.

3 Part B – Pathways towards Climate Neutrality by 2030

In this text the geographical area of Gothenburg is referred to as 'Gothenburg' and the City of Gothenburg as 'the City'.

This part of the City of Gothenburg's action plan describes decided and planned actions in terms of systemic levers, see Table B-1.1, Table B-1.2 and the text below. The systemic levers are presented for each field of action:
- Energy system (including industry)
- Mobility & transport
- Waste & circular economy
- Built environment
- Green infrastructure and nature-based solutions

The fields of actions and systemic levers are linked to the emission sectors (presented in Part A of the action plan) and target emissions in scopes 1, 2 and 3. The linkages both between the fields of actions and the emission sectors as well as between the various fields of actions are in some regards complex and interconnected. Notably, the energy system is closely connected to the industry sector, the transport sector, waste management and the built environment. The reason for this is the district heating system that uses waste heat from the industry and the waste incineration plant as well as heat produced from the energy firm's own plants. Additionally, electrification is featured as an important means to reduce climate impact from both the industry and transport sector, which increases demand for electricity within the geographical area of Gothenburg. Finally, the building sector also affects the energy sector in terms of its energy demand (heating, electricity and cooling). Circular economy is key for reducing material and energy use and indirectly emissions. Hence, circular economy is linked to particularly the energy system, the built environment and the business sector.

There are four areas of systemic levers in the fields of actions energy system (including industry) and mobility & transport, that are key for reducing scope 1 emissions in Gothenburg (see Table B-1.1[2]):
- Reduce the emissions from the two refineries by switching to renewable energy or implementing carbon capture and storage (CCS).
- Replace the natural gas used as fuel at the combined heat and power plant (Rya) owned by Göteborg Energi (the municipal energy utility).
- Stop the incineration of waste including plastics at Renova (the local waste-to-energy plant) or implement CCS.

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[2] For an analysis of these sources of emissions the report from the City of Gothenburg's Climate Council from 2023 [Göteborgs klimatråds rapport 2023 (goteborg.se)](#).

- Reduce climate impact from transportation through electrification, switching to biofuels and taking measures to improve efficiency.

To expand the perspective, in terms of emission domains, scopes, mandate and possible levers to influence emission reductions in Gothenburg in a systemic way, the City has developed seven strategic priorities. The strategic priorities are portfolios of action embracing several levers ; technical, financial, organisational, governance, policy, culture, behavioural and social.

The seven strategic priorities are:
- The intertwined energy and industrial system portfolio
- The Port as a lever for reduced heavy transport emissions
- Sustainable and efficient mobility
- Improvements on waste treatment
- Climate-neutral construction
- Capacity for circular economy
- Urban farming, green infrastructure and nature-based solutions

To succeed with the above-listed atrategic priorities, cooperation and co-creation are essential. This is achieved in many forms and constellations (see Part A and Part C of the action plan). An important example is the Environment and Climate Programme of the City of Gothenburg which works with seven strategies that cut across administrations and companies.
The strategies provide a platform to drive and coordinate work on the actions that require a high degree of collaboration across the City's administrations and companies (sustainability work within each administration and company is performed according to the City's environmental management system). The work of the strategies contributes to continuous learning in the City and to increase the pace of implementation of actions.[3]

In addition, the City has several processes for developing the climate mitigation work further (see part C of the action plan for an overview). An example is that the City is developing a method for calculation of CO2 emissions (including scope 1-3) that can be applied to all actions planned and decided by the administrations and companies (see "Climate Budget" described in part C of the action plan). Currently calculations are only available for some systemic levers and different methods and system boundaries are applied. Therefore, most of the systemic levers within this field of action (see Table B-1.1) do not have measures of direct impact.

For the purpose of the Climate City Contract, the City has used NetZeroCites' economic tool/model and will continue to use the model to explore various scenarios leading the path to climate neutrality 2030 (More information is available here: https://netzerocities.app/group-capabilitybuildingprogrammebuildingastrongeconomiccase. The documents are posted on the NZC Portal in the group called: Capability Building Programme: Building a strong economic case).

In the following section, the systemic levers within each field of action are described. First, systemic levers that have the potential to dramatically reduce emissions in Table B-1.1 are listed. Second, each field of action, including both context and systemic levers is described. Third, in Table B-1.2 a more detailed list of systemic levers is presented, and in Table B-2.2 a comprehensive example for each field of action is presented. Finally, indicators for monitoring, evaluation and learning are presented.

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[3] For more information see Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se).

3.1 Module B-1 Climate Neutrality Scenarios and Impact Pathways

Table B-1.1: Impact Pathways

Fields of action	Systemic levers		Early changes (1-2 years)	Late outcomes (3-4 years)	Long-term outcomes (2030 and later)	Direct impacts (Emission reductions)	Indirect impacts (co-benefits)
Energy system (including industry)	The City has decided to invest in a new CHP production plant for biobased district heating.	Technology and infrastructure, Finance and funding	Investment in a new bio CHP in combination with switching from fossil fuels to fossil-free fuels used in the district heating system will result in a fossil-free production of district heating from the local energy plants.	Fossil-free production of district heating from the local energy plants and reduced emissions.	Fossil-free production of district heating from the local energy plants and reduced emissions.	100,000 ton CO2e from 2026–2030.	Enhancement of the electrical system. Cleaner energy for business and the citizens. Increased resilience in the energy system.
Energy system (including industry)	The City investigates possibilities for infrastructure for CCUS in the port of Gothenburg.	Technology and infrastructure, Finance and funding, Governance and policy, Learning and capabilities	No early changes	Investments in CCUS infrastructure in the port will allow for off-loading and short-term storage of carbon. This will be an enabler for other actors to remove carbon from their processes and reduce emissions.	Investments in CCUS infrastructure in the port will allow for off-loading and short-term storage of carbon. This will be an enabler for other actors to remove carbon from their processes and reduce emissions.	The infrastructure in the port aims at handling up to 4,000,000 tons of CO2 by 2030.	Building CCUS infrastructure will provide lessons learnt to share with others, both regarding technical aspects as well as models for finance and funding and new governance and policy.
Energy system (including industry)	The refinery Preem investigates CCS.	Technology and infrastructure	No early changes	CCS at Preem would substantially reduce CO2 emissions.	CCS at Preem would substantially reduce CO2 emissions.	260,000 tons of CO2e until 2030.	Applying CCS will provide lessons learnt to share with others, both regarding technical aspects as well as models for finance and funding and new governance and policy.
Energy system (including industry)	Renova (the local waste to power-plant) investigates CCS.	Technology and infrastructure	No early changes	Potential to reduced and negative emissions due to a mix of waste, roughly 40% fossil and 60% biobased.	Potential to reduced and negative emissions due to a mix of waste, roughly 40% fossil and 60% biobased.	100,000 tons CO2e per year (40,000 tons fossil carbon and 60,000 tons biocarbon)	Applying CCS will provide lessons learnt to share with others, both regarding technical aspects as well as models for finance and funding and new governance and policy.

Mobility & transport	The City expands and improves infrastructure for walking and cycling.	Technology and infrastructure, Governance and policy	Enables more journeys to be made by walking and cycling instead of by car.	Enables more journeys to be made by walking and cycling instead of by car.	Enables more journeys to be made by walking and cycling instead of by car.	Ongoing examinations.	Less noise and air pollution. A more attractive city to live and stay in. Stimulates active travel that improves public health. Enables children to move around the city on their own
Mobility & transport	The City expands and improves the infrastructure for trains.	Technology and infrastructure, Governance and policy	Negative impact due to emissions from construction, during the construction of new train tunnel.	Negative impact due to emissions from construction, during the construction of new train tunnel.	Enables increased commuting and other travel to and from the city by train instead of by car	Ongoing examinations.	Less noise and air pollution. Improved travel time ratio for public transport compared to car. A more attractive city to live and stay in.
Mobility & transport	The City in cooperation with many actors works for improved infrastructure for fossil-free freight transport by sea, port and land.	Technology and infrastructure, Governance and policy	More energy-efficient and emission-free transportation to the port.	More energy-efficient and emission-free transportation to the port.	More energy-efficient and emission-free transportation to the port.	180,000 tons of CO2e by 2030.	A more attractive port and city for industry actors.
Waste & circular economy	Renova works to phase out plastic in waste incineration.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation	Less fossil carbon dioxide emissions from waste incineration and less plastic in the waste. However, the amount of waste is estimated to increase due to increased population, which evens out the emission reduction.	Avoiding increased emissions from waste incineration.	Avoiding increased emissions from waste incineration.	18,000 tons CO2e per year, but this is expected to be offset by increases in waste volumes.	Less incineration of plastics enables a better use of plastic resources (recycling, reuse and avoidance). Complementary upstream measures can also affect the spread of hazardous chemicals.
Waste & circular economy	The City develops a facility for treatment of food waste to increase the amount going to biogas production.	Technology and infrastructure	No early changes	Reduce food waste to incineration. Increased production of biogas and biofertilizer. Increased production of more biogas and biofertilizers will replace the use of fossil fuels and fertilizers, which reduces emissions.	Reduce food waste to incineration. Increased production of biogas and biofertilizer. Increased production of more biogas and biofertilizers will replace the use of fossil fuels and fertilizers, which reduces emissions.	Ongoing examinations	More sustainable fertilizers provide better soil health in a long-term perspective. Contributes to higher food system resilience and the local economy.

Waste & circular economy	The City builds capacity for action on circular economy and mobilizing key actors within the City.	Learning and capabilities	Administrations and companies are learning and changing their approach to purchasing and disposal.	All administrations and companies have changed their approach to purchasing and disposal, leading to a significant decrease in the purchase of new virgin materials and products, and at the same time increase in reuse, longer life spans and utilisation rates.	Significantly decreased purchase of new virgin materials and products, and at the same time increase in reuse, longer life spans and utilisation rates.	Reduced need for virgin resources and emissions reduction to decrease by 90% by 2030 implies that the yearly emissions have been reduced with 338,400 tons of CO2e in 2030.	Shift in norms among employees and in society in favour of circular economy. Less impact on biodiversity. Less toxicity.
Built environment	The City improves energy efficiency in public and private residential buildings and premises.	Technology and infrastructure, Finance and funding	More efficient energy use.	Less energy used.	500 GWh less energy used by 2030	Emission reduction depends on the development of the energy system and how the electricity "made available" is used e.g. for electrification of transportation or industry.	Reduces costs and the need to expand for more production. More effective use of resources.
Built environment	The City uses public construction projects as an engine in the transformation to a climate-neutral construction sector in Gothenburg. This involves: 1) working with requirements in public procurements of buildings and constructions and 2) using living labs for long-term co-creation and innovation processes.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation	Increased demand and use of materials, transport, vehicles and machinery that reduce carbon dioxide emissions	New and altered construction systems, products, materials processes, with special focus on biobased and reused products, as well as electrification of machinery and transportation.	New and altered construction systems, products, materials processes, with special focus on biobased and reused products, as well as electrification of machinery and transportation.	Ongoing examinations	New business opportunities via new business models and circular products and services.

Built environment	The City works with mobility in public housing (25% of the citizens in Gothenburg). Increases use of and infrastructure for EVs. Improves prerequisites for cycling, including sharing services. Co-working spaces close to housing. Prerequisites for home-based sharing and repair services. Neighbourhood parking instead of individual parking.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation	Reduced need for travelling and transport. Enables more journeys to be made by cycling instead of by car and increased amount of sharing of bicycles and cars.	Reduced need for travelling and transport. Enables more journeys to be made by cycling instead of by car and increased amount of sharing of bicycles and cars.	Reduced need for travelling and transport. Enables more journeys to be made by cycling instead of by car and increased amount of sharing of bicycles and cars.	Not applicable since emission reduction depends on reduced travel by car.	Less noise and air pollution. Improved travel time ratio for public transport compared to car. A more attractive city to live and stay in.
Built environment	The City works with densification by building on already hardened surfaces (especially car parks freed up by mobility measures).	Technology and infrastructure, Governance and policy	Reduced climate impact due to land use change. Better conditions for the 15-minute city.	Reduced climate impact due to land use change. Better conditions for the 15-minute city.	Reduced climate impact due to land use change. Better conditions for the 15-minute city.	Ongoing examinations	Increased greenery and resiliency in the City.
Green infrastructure and nature-based solutions	The City works, in collaboration with many actors, to increase urban farming and security of food supply.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation, Democracy and participation	Increased knowledge about farming and an increasing number of local farmers. More connection between food consumers and the food they eat, eg. pupils in local schools. Shortening of food supply chains and as a result better margins for producers and less food waste. This is in line with the EU food and fork strategy.	Increased knowledge about farming and an increasing number of local farmers. More connection between food consumers and the food they eat, eg. pupils in local schools. Shortening of food supply chains and as a result better margins for producers and less food waste. This is in line with the EU food and fork strategy.	Increased knowledge about farming and an increasing number of local farmers. More connection between food consumers and the food they eat, eg. pupils in local schools. Shortening of food supply chains and as a result better margins for producers and less food waste. This is in line with the EU food and fork strategy.	75,000 ton CO2 (if 40% of the food is produced locally)	More local jobs. Biodiversity, Ecosystem services. Greenery in the city

| Green infrastructure and nature-based solutions | The City implements a focus on ecosystem services and nature-based solutions in city steering urban planning documents and guidelines. | Governance and policy | Focus on ecosystem services and nature-based solutions in the urban planning process. Solutions are chosen from ecological, social as well as economic perspectives. | Focus on ecosystem services and nature-based solutions in the urban planning process. Solutions are chosen from ecological, social as well as economic perspectives. | The City's ecosystem services remain or have been compensated for within or in close proximity to the plan area. The municipality knows how to work with ecosystem services in urban planning and the expertise is spread across several administrations, both among specialists and planning administrations. | | More greenery, more multifunctional solutions for biodiversity, climate adaptation and climate mitigation. Better air quality, more recreational space, less noise, increased well-being, better protection against heat stress and flooding. |

B-1.2: Description of impact pathways
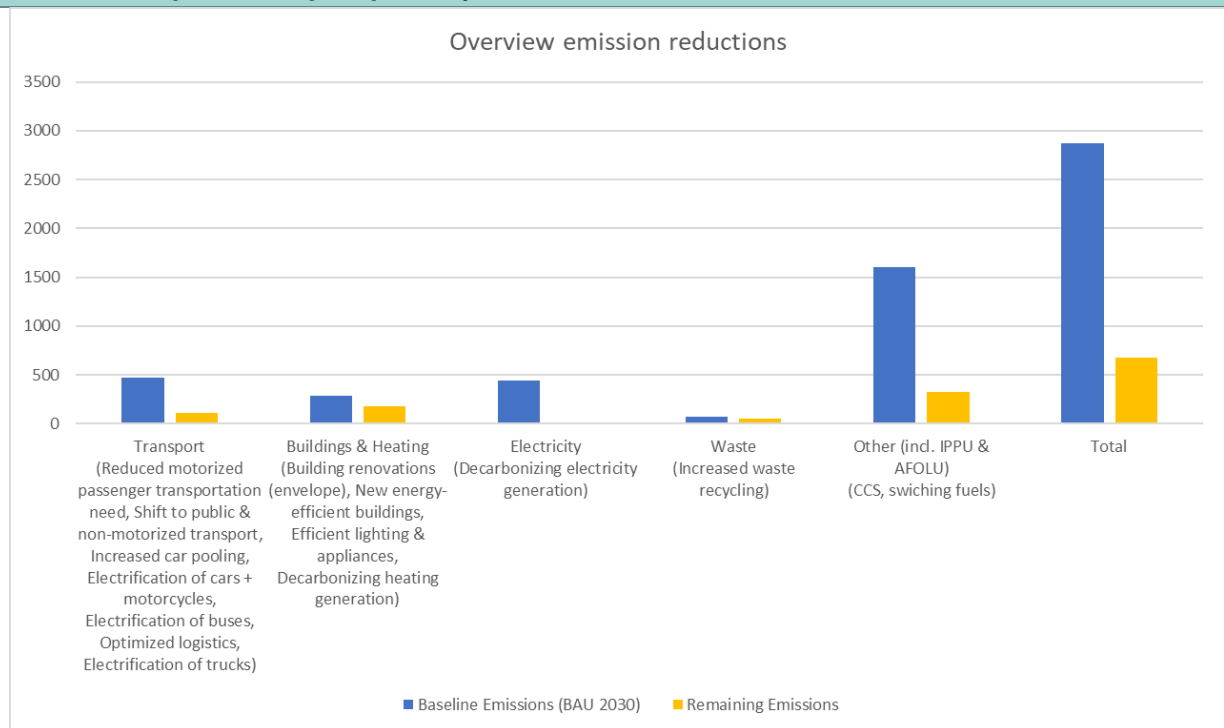
Figure B1 – Overview of emission reductions.

Figure B1 presents an overview of the emission reductions included in the scenarios until 2030 and the main areas where these emission reductions will be done. In the following, the systemic levers and impact pathways for each field of action that contribute to these scenarios are described.

Energy system
The energy system in Gothenburg includes several energy carriers such as heat, electricity, and gas that operate in parallel, but also interconnected systems. Below the impact pathways for the various energy carriers are described.

Two private refineries contribute to half of the emissions in Gothenburg
The two refineries in the city, Preem and ST1, collectively contribute to approximately 50% of the CO_2 emissions in Gothenburg. Preem has committed to achieving climate neutrality by 2035, outlining a comprehensive strategy. This includes implementing CCS, utilizing renewable hydrogen and biogas in their production processes, and transitioning to advanced bio- and electro-fuels to reduce emissions from the transport sector. As part of this transition, Preem aims to maintain the waste heat output, ensuring its availability for Göteborg Energi's district heating system.

ST1 does not currently have a similarly explicit plan for climate neutrality. However, in terms of biofuel production, ST1 is already producing advanced ethanol and biogas from waste. Moreover, a new bio-refinery is currently under construction in Gothenburg, specifically designed to optimize the production of 200,000 m3 of renewable diesel and sustainable aviation fuel. This initiative demonstrates ST1's

commitment to expanding its sustainable energy portfolio and contributing to the overall reduction of environmental impact in the region.

Heat

Most of Gothenburg's buildings are heated by the city-wide district heating system. More than 90% of residential and commercial buildings and some 20% of single-family houses are connected to the district heating system. The majority of the remaining family houses use electricity, either directly or with heat pumps.

The district heating system has been developed since the 1950s and is based on waste heat from activities in the surrounding society, most notably two refineries and the local waste incineration plant. Around 75% of the yearly heat supply is waste heat. The carbon emissions from the refineries and incineration plant were about 1.2 million tons in 2022, roughly 60% of the City's carbon emission. Hence, the district heating system in Gothenburg has high indirect emissions. As the refineries transition towards climate-neutral production of fuels, the City's indirect emissions from district heating will decrease. Depending on which path the refineries will choose to decarbonise (biofuels, hydrogen, Carbon Capture, Utilization, and Storage (CCUS) or a mix), the amount of accessible waste heat can change. The same goes for the incineration plants and their transition towards decreased incineration of waste, not least of fossil plastics and possibly implementation of CCUS/BECCUS. The City has identified the need to plan for alternative scenarios including aspects such as supply, demand and price development for biomass, reduced energy use and energy efficiency potential, technology development and global and external events. The City must then have the capacity to act on the strategy developed from such scenarios. The digital twin (see Part C of the action plan) that is being developed can be a tool for developing scenarios.

The remaining 25% of the yearly heat supply comes from various qualities of biomass, electricity (through large and small heat pumps) and a small part of fossil gas and oil for peak load. The City of Gothenburg, which owns the energy utility Göteborg Energi, has set a target in the Environment and Climate Programme for the City of Gothenburg that district heating and electricity production by the energy utility shall be free from fossil fuels after 2025. To meet that challenge, Göteborg Energi will build a biomass combined heat and power (CHP) plant that will enable a fossil-free district heating production. Hence, from 2026 the heating and electricity produced by Göteborg Energi will be free from fossil CO_2 emissions.

Lately, the district heating system has become an important tool for balancing the power grid, by being able to both produce electricity in CHP plants when there's a shortage of electricity or consume it in heat pumps when it is abundant, see figure below. In the near future, it will be crucial to offload the power grid by supplying heat without putting strain on the power system, as other sectors are set to increase their electricity consumption as a means to reduce emissions of greenhouse gases.
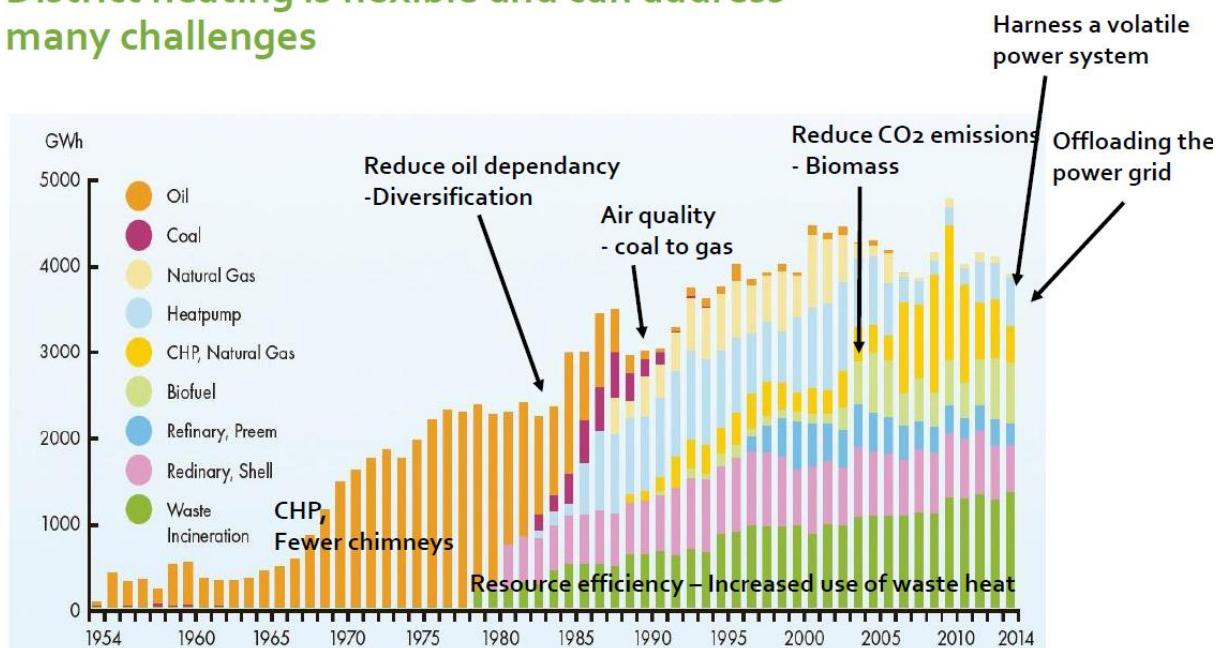
Figure B2 - Potential benefits of utilising district heating.

Electricity

The electricity import is on a yearly basis about 90% in Gothenburg. As more industries and the transport sector are electrified, the electricity demand increases and the import demand as well if not met by increased production within the city. By 2035, the scenario shows an increase of 70% in electricity demand compared to 2022. This is a major challenge for the City, see summary in the figure below.

A major challenge for Gothenburg is the necessary reinforcement of the grid capacity from outside of Gothenburg to meet this demand in time. Therefore, several measures need to be taken, many of which are listed as actions above in B-1.1 and B-1.2 below.

Figure B3 - Forecast of electricity demand in Gothenburg.

Another challenge is the low potential for renewable electricity production within the city border. The City is investigating the potential for solar and wind power. Previous investigations have shown low potential regarding large-scale wind power parks, both on- and offshore within the city border. The solar power potential has earlier (2016) been estimated to meet about 5-10% of the electricity demand, corresponding to 350 GWh/year. The potential needs to be updated to consider technology development and policy changes among other things. That being said, Gothenburg is the city in Sweden that by far has the most installed solar power. Nevertheless, public housing and other entities in the city have ambitious investment plans in solar power. Nonetheless, the City also needs a strategy to contribute to electricity production in other municipalities close by to meet its own demand. This is one way to take responsibility for the City's climate transition through more clean energy as well as increasing energy security.

Gas
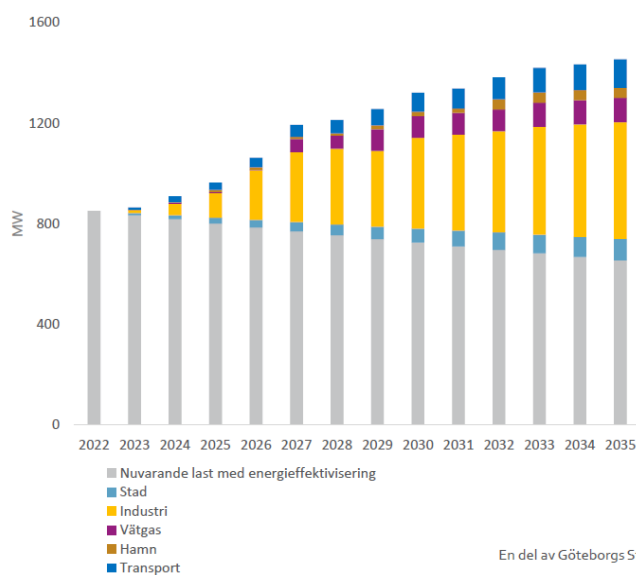The gas grid capacity is not as constrained as the electricity grid. Moreover, the physical content of biomethane in the grid has grown over the last decade and now exceeds 30%. Purchasing biogas, instead of natural gas, has been a convenient way for industries and transport to become carbon neutral. However, the market conditions for biogas production and use have been subject to abrupt changes, and lack of reliable support from politics both nationally and the EU. To a large extent, Sweden has failed – so far – to realise the domestic potential for increased biogas production and use. The production potential is enough to make Sweden a net exporter of biomethane made from waste streams, but actual production levels are only a fraction of the potential. In Gothenburg, the production is about 70 GWh of biogas from the cities and nearby municipalities' sewage sludge and another 50 GWh from slurry. The City sees potential to increase biogas production from both sewage sludge and food waste.

Reducing emissions with energy efficiency and reduced energy use
The City has identified a potential to decrease energy consumption with 500 GWh in residential buildings by 2030, compared to 2010. This can be achieved through a combination of renovation and investments in energy efficiency measures, efficient price models and by increased focus on knowledge sharing to bring about behavioural change.

Reducing emissions with Carbon Capture, Utilization, and Storage
The City owns the port in Gothenburg, notably the largest port in Scandinavia. This distinctive municipal privilege affords the opportunity to allocate land specifically for Carbon Capture, Utilization, and Storage (CCUS) infrastructure. Collaborative endeavours, spearheaded by the port authority in conjunction with diverse entities encompassing both public and private energy enterprises, as well as local refineries, have been investigating the potential of CCUS within the region. In the event of successful implementation, the envisaged infrastructure is poised to manage a capacity of 4 million metric tons of CO_2 over the imminent years. CCUS could be used to substantially reduce emissions from large point sources both at the public waste incineration (Renova - owned by the City of Gothenburg and 9 other municipalities) and private refineries.

A prestudy shows that CCS on one of Renova's (the local waste incineration plant) four combustion lines would provide an emission reduction until 2030 of about 100,000 tonnes of carbon dioxide, of which about 40,000 is fossil, at an investment cost of about SEK 500 million. This would have a minor impact on district heating production, but lead to a 20% reduction in electricity production at Renova. The cost of carbon dioxide capture and intermediate storage on the site would be SEK 1,150 per tonne of carbon dioxide captured, with additional costs for transport and storage. Overall, knowledge of CCS technology has increased, but there are still some major barriers to overcome before a potential investment decision can be taken.

Preem, owner of one of two refineries in Gothenburg, has CCS plans to decrease emissions with 300,000 tons of CO2 until 2030, corresponding to roughly 60% of their scope 1 emissions. Both refineries have plans to produce Renewable Fuels of nonbiologic origin (RFNBO) to decrease emissions from the transport sector, where CCU is one possible solution. Both refineries put extra focus on RFNBO for aviation, due to requirements from EU:s FF55-package.

CCUS is a new and complex value chain. There is a large lack of legislation in this field at present, which creates a great risk for actors who want to invest in CCUS which makes it difficult to create business cases. Infrastructure for CCUS in the port could solve parts of the chicken-and-egg situation, but in order to realize this, risk sharing from the public sector and bilateral agreement is required. Information is needed from actors who are interested in interim storage of CO2, when the need occurs and what volumes are relevant. Ongoing dialogues persist between the port authority and a spectrum of public and private stakeholders, with the overarching aim of creating solutions and business cases for CCUS.

Mobility & transport

Gothenburg is a hub for passenger and freight transport in Western Sweden. 120,000 people commute into Gothenburg every day, and roughly 50,000 people commute out. Gothenburg has many companies with large volumes of goods and is the largest port in the Nordic region, through which a large part of Sweden's exports and imports pass. Road traffic is the biggest source of both air pollution and noise in the city, and the second biggest source of greenhouse gas emissions. At the same time, the city is in the midst of the largest and most extensive urban development in modern times. This means that there have become about 70,000 more citizens of Gothenburg in 15 years, and the City is expected to have approximately the same number more in the next 15 years. In addition, the surrounding municipalities are also growing.

The traffic system of today is characterized by traffic to large-scale industries and the port, tram traffic in radial lines and the functionally separated planning ideal of the automobile society. Together, they have made fast transportation possible, which has resulted in a sparse urban structure where many people live far from the centre and their workplace. The City's climate targets regarding sustainable transportation in the Environment and Climate Program are to reduce the climate impact from transportation by 90% by 2030 compared to 2010 and to reduce road traffic work by 25% by 2030 compared to 2020.

Planning and building a denser city, where the inhabitants have close access to what they need in everyday life, is important to create a sustainable city in the long term. To reach the City's environmental and climate goals linked to 2030, powerful measures are also needed that have the potential to reduce environmental and climate impacts in the short term. For traffic, this means a rapid electrification of the vehicle fleet and a transition to biofuels, while the amount of travel and transport by car and other vehicles also needs to be reduced.

The City of/actors in Gothenburg does not have full control of the entire adjustment that needs to be made to reduce the environmental and climate impact of transport in the city. International and national conditions affect both technology development and the demand for different fuels and modes of transport, and thus the opportunities the City has to achieve its goals. In the same way, collaboration with the national traffic authority, the region, the public transport authority and nearby municipalities is also necessary to influence cross-municipal travel and transport.

Urban planning for sustainable transport

Gothenburg's Comprehensive plan states that Gothenburg is to be developed into a close, cohesive and robust city. It should provide proximity to what you need in everyday life so that more people can get

through everyday life by walking and cycling. Development must mainly take place in connection with good public transport. A city that is connected in the street network and with public spaces that are for everyone means that people meet and get better conditions for equal life opportunities. A resilient city has resilience and adaptability to face challenges and crises, while residents have trust in each other and in the functions of society.

In order for Gothenburg and the region to be able to grow in accordance with set goals, it is necessary to restructure the traffic system and change travel patterns. The transition in traffic systems and travel patterns means that more journeys need to be made by foot, bicycle and public transport, but above all it means that the proportion of car journeys needs to decrease. A change in the transport system also means streamlining business transport and that some of the freight transport that currently takes place by road is moved to rail or waterways.

Public transport

A substantial expansion of public transport is a prerequisite for reaching the City's goals of expansion and sustainability. Gothenburg is working together with the regional municipalities and the local public transport authority according to a common target image, Målbild Koll 2035, which describes how the public transport core network should be developed in the contiguous urban area until 2035. In this scenario/vision, various existing and new traffic concepts such as Metrobus, City Railway, tram and Citybus, together with a new network structure with fast journeys between important destination points, will lead to an increase in capacity by 70% and that journey times can be shortened by 20-25%.

To strengthen public transport in Gothenburg, but above all in the region, the construction of the Västlänken is underway, which is an approximately eight kilometer long double-track railway for commuter and regional trains that will run in a tunnel under central Gothenburg. Västlänken will get three new underground stations in the central city, creating the conditions for more and longer trains, and making it possible to connect train traffic in Western Sweden in a better way. By strengthening train capacity in Gothenburg with a tunnel, instead of building above ground, land can be freed up for more green areas, workplaces and homes. The areas around the stations are to be developed into more attractive environments to stay in and into strengthened hubs for public transport.

Walking and cycling

Increased walking and cycling is good for the individual, the city and for city life. Pedestrians and cyclists create life and movement in urban spaces and contribute to an attractive urban environment, reduced environmental impact and improved health and well-being. New forms of cycling such as e-scooters and e-bicycles create new conditions for traveling by bicycle for part of the journey or longer distances. Travel by foot and bicycle is increasing in Gothenburg, but not at the rate needed to reach the City's goals. The cycling program for a nearby big city 2015-2025 directs the work on expanding, operating and maintaining the cycling infrastructure in the city and the development of support, services and communication to increase cycling.

Car traffic

Reduced car traffic is a key area to reduce noise and air pollution in the city as well as carbon emissions. Reduced car traffic is also a prerequisite for creating room for increased sustainable travel. The City has several control instruments at its disposal that have the ability to have an effect on travel relatively quickly, such as accessibility for different modes of transport, reduced speed, supply and price for parking. Gothenburg also has congestion tax, but it is not controlled by the municipality but by national authorities. Another way is to reduce the relative advantage of traveling by car by redistributing areas and transforming existing street environments in favor of leisure, pedestrians, cyclists and public transport or using areas for new buildings and greenery where suitable.

In order to reach the environmental and climate goals by 2030, the City needs to develop and increase the use of both proven and new control measures to reduce car traffic. The change required will affect people's everyday lives and therefore needs to be anchored and implemented in a way that can be accepted by the residents.

Transport of goods and business transport
Gothenburg has many companies with large volumes of goods and the Nordic region's largest port, through which a large part of Sweden's exports and imports pass. More residents, visitors and businesses means more freight transport, distribution of goods and other utility traffic. In order to reduce environmental and climate impact, freight transport needs to be electrified or powered by other sustainable fossil-free fuels. They also need to be made more efficient, for example through reloading and consolidation for increased filling rate or transfer from road to rail and river. The largest volume of freight transport in the city comes from or goes to the Port of Gothenburg. The Port of Gothenburg strives to be the world's most sustainable port, The Green Connection, and to reduce its climate emissions by 70% by 2030. By, for example, giving electric trucks priority passage and handling in the container terminal, offering access to electricity, HVO, biogas and hydrogen gas in the port area, and expand the railway for the transport of containers to and from the port, The port is driving development towards sustainable freight transport.

Electrification and Sustainable Biofuels
Gothenburg has a strong position as an international role model in electrified transport and energy solutions and, in addition, a strong vehicle cluster. The transition to a fossil-free transport system requires the City's actors and the business community to work together. Openness to cooperation, combined with a complete ecosystem for vehicle manufacturing, has given Gothenburg a unique position when it comes to making the transition to an electrified and connected transport system.

For many years now, the City has had a successful collaboration with the region, the business community and academia, which aims to develop, test and implement solutions that can contribute to accelerating the electrification of the transport sector and thereby create new opportunities for urban development. The ElectriCity collaboration started with testing and development of electric buses, which has resulted in Western Sweden today having the most electric buses in the Nordic region. Projects around sharing charging infrastructure between different modes of transport, Bus-as-a-service and electrified construction sites are now underway. Within the Gothenburg Green City Zone collaboration wireless charging of taxis, passenger cars as energy storage, regional goods hubs and climate-smart events are tested.

The City's Electrification Plan 2022-2030 aims to drive the transition to an electrified transport system and contains measures to realign the City's own and procured vehicles and transport as well as measures to stimulate a rapid transition to electrified transport in the rest of society.

The strategy We drive the development of sustainable transportation
The strategy We drive the development of sustainable transport is one of seven strategies within the City's Environment and Climate Program. The strategy aims to clarify and strengthen the work to reduce environmental and climate impacts from transport in Gothenburg. In concrete terms, this means reducing and making transport more efficient and driving the transition towards electrification and sustainable biofuels. The strategy is an impetus to increase efforts to reduce car traffic in the city, while at the same time strengthening the conditions and attractiveness for walking, cycling and traveling by public transport. In order to reach environmental and climate targets by 2030, measures that have the potential to have an effect in the short term need to be prioritized, while the longer-term development of the city needs to be steered towards a more transport-efficient society. The strategy also aims to support the City's work with electrifying transport and the conversion to sustainable fuels. Development of working methods for

collaboration and communication are important tools to gain acceptance for the measures that will be needed to succeed in a rapid transition to a sustainable transport system.

Waste & circular economy

The UN's International Resource Panel has found that the extraction and processing of natural resources has increased dramatically over the past two decades, which is now responsible for more than 90% of biodiversity loss and water scarcity, as well as about 50% of the climate impact globally. It is therefore essential to shift resource use to protect ecosystems. According to the Circularity Gap Report, Sweden is 3.4% circular, which means a circularity gap of more than 96%. This means that the majority of the resources used in Sweden come from virgin sources. To reduce unsustainable resource use, greenhouse gas emissions and the spread of toxic substances, the patterns of how and what is produced and consumed need to change. Circular economy has a great potential to contribute to sustainable consumption and production, as well as reducing the City's costs. Toxic-free cycles are a prerequisite for a circular economy in order to stop both the release of harmful substances and to detoxify the cycle.

Circular economy can also provide socio-economic benefits. A study from the Swedish Recycling Industries Association (2018) of five significant product areas (steel, plastic, aluminium, paper and cement) showed that as much as ¾ of the material value is lost after just one use, which from a socio-economic perspective means a cost of SEK 42 billion per year in Sweden.

Since 2016 circular economy has been seen as an important tool to reach the City of Gothenburg's goals. Today, these goals can be found in the City's Environment and Climate programme 2021-2030, the City's waste plan, business strategy program and plan for an equal Gothenburg. Some examples of goals are:
- Reduce climate impact from the City's purchase by 90% until 2030
- Reduce the amount of waste from municipal operations by 40% until 2030
- There should be good conditions for the City's administrations to reuse products
- Gothenburg's climate footprint is close to zero until 2030

In 2016, the circular work in Gothenburg started with a tax funded initiative 'Circular Gothenburg'. Since then, the focus has been on resource efficiency (focusing on the top two steps of the EU waste hierarchy), climate impact and on SDG 12 of Agenda 2030. The mission of this work has been to develop and create practical conditions for circular transition and therefore the approach has been practical, and action based from the start. Target groups have been both the City administrations and citizens, consequently the work has been carried out in broad collaboration with business, academy and civil society.

The strategy We drive the development of circular economy

Since 2021 the work with circular economy is organised and driven by the strategy 'We drive the development of circular economy', which has representatives from nine different key administrations in the City. The strategy is a means for working across the various administrations and companies within the City aiming at making them able (and willing) to make circular purchases, circular disposal, reuse, repair and share. The strategy focuses on the reduction of material flows, i.e. how resource extraction can be reduced and the value of products and materials retained over time. In practice, this means how the City will significantly reduce new purchases through increased utilisation rate and increased lifespan for products and materials. The strategy also drives the development of conditions that support working in a circular way, e.g. new roles, working methods, norms and governance within the City of Gothenburg (as an organisation), to collaboration and innovation together with market players, academia, other public organisations and civil society. An example of how the strategy works is that it aims to become a Circular Customer by 2030, which includes circular purchase and procurement, circulation and sharing between administrations, circular divestment and adaptation of the organization.

The work within the strategy includes several systemic levers that aim to increase the circular economy, these are described below:

Implementing circular economy principals in city steering documents and guidelines
The City's own consumption of goods and materials needs to be reduced, made more efficient and based on circular principles instead of the current linear ones. This applies to all flows including food, inventory, electronics, construction materials and demolition waste. Therefore, the strategy is implementing circular economy principals in city steering documents and guidelines, such as the guidelines on acquisition and disposal 2022-2024, Environment and Climate Programme for the City of Gothenburg 2021-2030, Waste Plan 2021-2030, Business strategy program 2018-2035 and Gothenburg's Comprehensive Plan.

Building capacity for action and mobilizing key actors
The strategy is building the City's capacity for action and mobilizing key actors within the City in order to be able to act on the circular economy principles in the strategy and documents. A lot of effort will be put into anchoring, implementation and mobilization of key players at all the administrations and companies. The organizations will be included and need to act in accordance with circular economy principles. This will make it clearer what needs to be done differently and why, who needs to act and what support each administrations and companies can get. Any gaps in responsibilities and roles will also be identified and communicated to those concerned. To be able to act there is also a need to align the governance at different levels within the City so that administrations and companies are able to act on the circular economy principles. Platform building and mobilization are part of the work and is important for learning from and inspiring each other. The focus is also on practical action - testing and developing, and then deploying and integrating into regular processes. It is also about using available tools to make it difficult to make mistakes from a circular perspective.

New ways for circular procurement and market dialogues
The strategy is changing the City's procurement to include and support circular economy principles as well as developing new ways for market dialogues. This involves for example early and continuous transition dialogue with the market, requesting other or new products and services (not currently available in framework agreements). This is already done in several product areas, but a systematic approach is needed as well as cooperation with other municipalities. By doing this the City of Gothenburg can find new ways of dividing and sharing the responsibility of developing new business models for both products and services. In addition, in broad collaboration, the City of Gothenburg will look further at the development area of Industrial Urban Symbiosis (IUS). The plan is to carry out two feasibility studies in 2024, in which the City's role, development areas and proposed approaches are described, and the potential from a business perspective.

Collaboration for circular economy
The City of Gothenburg participates in several national and international networks focusing on the circular economy in order to exchange experiences and jointly pursue issues with politicians and market players. These include municipal networks, expert networks and networks focusing on different themes, such as circular procurement and circular construction. This is to inspire others, drive development, raise issues at national and EU level, and to initiate the collaborations needed to achieve better results and scaling up. An example of this is the *EU's Circular Cities and Regions Initiative (CCRI),* where the City of Gothenburg has been selected as one of 12 circular pilots, thanks to the City's circular strategy work and ambitious environmental and climate objectives. Procurement and market dialogues is an important area for development within this pilot.

By working in this way, the work within the City affects the wider society in Gothenburg via the need of new business models, circular products and services, which are needed to reach the goals set in the city as an organization and as the society.

Reducing emissions from management of waste and water

The Administration for Sustainable Waste and Water manages the water supply, handles waste and sewage in the City of Gothenburg. They work with waste prevention which includes several different fractions: plastic, food waste, textiles, bulky waste and electronics. This includes for example, feasibility studies and testing of measures that can give households feedback of waste quantities that will be carried out in collaboration with academia. Activities to prevent and collect textile waste for reuse are also done in cooperation with several non-profit organizations. By preventing waste, carbon dioxide emissions from waste incineration are reduced. Reaching the goals of the *City of Gothenburg's waste plan 2021 - 2030* imply significant emission reductions. For example, the City of Gothenburg is working on increasing the collection of food waste and EU requirements for sorting and separate collection of biowaste are implemented in Swedish legislation in January 2024, which is pushing this work further.

The production of drinking water causes significant carbon dioxide emissions through, for example, the use of energy and chemicals in production. By reducing water use or, where possible, using water of a different quality, less drinking water needs to be produced and energy and chemical consumption can be reduced. Examples of how this can be done is by watering with rainwater or cooling and cleaning with treated wastewater. For the Northvolt battery factory under construction in Gothenburg pipes are now being built to cool the factory with treated wastewater. In addition, expansion and maintenance of the network of waterpipes is a large source of greenhouse gas emissions.

Reducing the amount of fossil-based plastics in waste streams

Several waste streams end up at the Renova waste-to-energy plant, which is owned by the City of Gothenburg and 9 other municipalities. Over 99% of Renova's climate impact consists of the fossil content of the waste that goes to energy recovery. The fossil material consists almost exclusively of plastic, including small amounts of synthetic textiles, foam rubber and rubber. Unfortunately, the consumption of synthetic materials tends to increase over time.

Renova has investigated how to limit the plastic content of the waste. For example, a) by providing feedback to customers about the climate impact of their waste, offered source separation solutions for plastic and help to find outlets for plastics on a recycling market; b) by offering differentiated gate fees that depend on the plastic content of the customer's waste - a lower plastic content results in a lower fee; c) by using sorting plants, that sorts out larger plastic items from the waste, which then are become recycled material for other products and d) by investigating post-treatment in an automated facility for residual waste from apartment blocks. Such a facility was estimated to reduce fossil emissions from the waste-to-energy plant by 10,000 to 20,000 tonnes of CO2e per year and would cost around SEK 4,000 per tonne of fossil carbon dioxide avoided by the plant at Renova.

The use of plastic continues to increase in society. UNEP and the Swedish Government's Action Plan for Plastics estimate that the amount of plastic will double by 2040. Therefore, Renova's efforts above do not result in a drastic change in fossil emissions at the waste-to-energy plant. Since the fossil share of carbon dioxide began to be monitored in the stack at Renova in 2013, the emissions have remained at about the same level, while many of Sweden's other waste incineration plants have given rise to increasing emissions during the same period. The tightened targets in legislation and policy documents from the EU, Sweden and the regional waste plan on the use of plastics are expected to counteract the increase of plastics in waste for incineration. However, Renova does not expect emissions to decrease because of them.

Built environment

Gothenburg is in an expansive phase as it is growing in terms of population, companies and workplaces, and is consequently facing an extensive investment in construction works (premises, residentials and

infrastructure). The City has a relatively large amount of control, partly because more than half of all new production is via municipal land allocation agreements, and partly because the public utility group Framtiden is responsible for a majority of new construction of housing (both construction for own ownership, but also construction for sale). Furthermore, the City owns 76,000 flats via the group, which means that 25% of Gothenburg residents live in a municipally owned property. The rate of expansion is also high in municipal services, particularly schools, preschools, retirement homes and specialised housing. The construction works (renovation, infrastructure, and new buildings) accounts for 65% of the City's purchases.

Climate impact from the construction sector and the built environment

The climate impact of the construction sector in Sweden (estimated to have the equivalent distribution in Gothenburg) accounts for 21% (about 11.7 million tonnes CO_{2e}) of domestic emissions. In addition, there are emissions of about 7.7 million tonnes CO_{2e} due to import of construction materials. Of these emissions, heating accounts for 25%, new construction almost 50% and renovation and retrofitting for the remaining 25%. The relatively low share of heating by international comparison is partly due to longstanding systematic efforts to improve energy efficiency in the sector and to the conversion of the energy mix to more sustainable alternatives. The high share of district heating in Gothenburg is a major contributor with e.g. waste heat being used. As countries in EU convert their heat production to renewable sources and reduce the energy demand in buildings, they will have similar figures, with building and construction measures accounting for an increasing share of the climate impact from the construction sector.

There are no detailed data of the climate impact from all construction works in Gothenburg, but the climate works from the City's own activities is calculated to 170,000 tonnes CO2 yearly. Construction of buildings accounts for about ¾ of this climate impact, and infrastructure accounts for about ¼. Concerning infrastructure, the climate impact of characteristic projects has been analysed and the distribution of the climate impact is assessed to be the following: 84% of the climate impact is related to investment and exploitation, 16% to operation and maintenance. The study shows that fuel use in transports and machineries accounts for about 40% of the climate impact, asphalt for 22% (where of bitumen 6.5%), steel 9% and concrete 7%. In new building projects, the fuel use accounts for <10%, instead the building frame, envelope and foundation account for >60% of the climate impact. By focusing on these elements, the climate impact of new construction can be significantly reduced. The conditions are very different in renovation, where the foundation and building frame (two of the heaviest climate-impacting elements) are rarely included. Therefore few individual reduction measurements seldom result in a significant reduction of climate impact in renovation projects, but all the constituent parts must be addressed.

By 2025 the City aims to reduce the climate impact of construction works by 50% and by 90% by 2030. There is a roadmap and framework for reducing the climate impact by -90% by 2030 from the LCA stages A1-A5 for new properties including the effects of altered land use (works procured by the City and by land allocation agreements). These are based on academical estimate of potential (BAT and BATNEEC solutions until 2030, including new innovative solutions identified needed to be stimulated by the City), also indicating technical and systemic effects of the reduction pace. In the exploratory and knowledge-building pilot Hoppet ('hope' in English), which involve the construction of a preschool, the climate impact of the construction project has been reduced by 60% (70% if the scope is limited to the regulations of the Swedish National Board of Housing and Planning, where installation products are not included).

All new construction projects started after 2020 are included in ongoing action plans for halving the climate impact by 2025, including projects with high requirements of at least 50% reused materials with a special focus on heavy and loadbearing parts. Besides a reduction of the construction work's climate impact by 50%, the focus is also on a radical reduction of climate impact in the operational phase, which

besides energy and water use includes the lifestyle of tenants, such as the impact of sharing services, sustainable mobility services etc.

Energy efficiency in the City's properties

Energy consumption in properties owned by the City has systematically been reduced over the years and is well on track to be reduced by 30% by 2030 compared to baseline year 2010. Between 2010-2017 the reduction of primary energy consumption per m2 was 12%, and ongoing reduction keeps the same pace. The energy use in the City's buildings constitutes to approximately 80% of district heating and 20% of electricity (mainly for lighting, ventilation, laundry facilities). Being well on track, considerable measures still need to be taken. The climate impact from energy accounts for 20% of the CO_2 emission from the building sector within the City.

The strategy We drive the development of sustainable construction

The strategy *We drive the development of sustainable construction* is one of seven strategies on which the City's Environment and Climate Programme is based. The strategy includes new construction, reconstruction and renovation of buildings and facilities, adaptation of existing premises, infrastructure and development of public spaces such as squares, parks, sports facilities and playgrounds. The work in the strategy has the perspective of the whole life cycle, from the construction phase, through the use phase to the final phase. The work requires close collaboration with academia and industry throughout the value chain. The fact that the City is a clear and long-term owner of needs creates favourable conditions for the market to make the transition in a resource-efficient way.

The public utility group Framtiden is designated coordinator for the Strategy and mandated to lead this work. The concerned administrations and companies have a designated responsibility to come together and collaborate whenever needed, especially in areas with great need for transition and new innovative methods.

The Strategy includes new construction, reconstruction and renovation of buildings, facilities and infrastructure and adaptation of existing premises. The City is expected to set higher standards with less environmental impact. The Strategy involves e.g. improving the City's governance of sustainable construction in LCA perspective, in terms of resource management and environmental and health impacts, cooperating with industry to test and develop new methods and materials, using innovative procurements to drive the development of a circular, non-toxic and resource-efficient construction.

Green infrastructure and nature-based solutions

There is often a positive correlation between improvements in green infrastructure and nature-based solutions and climate mitigation. Overall improving of improvements in green infrastructure and nature-based has many co-benefits such as more greenery, more multifunctional solutions for biodiversity, climate adaptation and climate mitigation, better air quality, more recreational space, less noise, increased well-being, better protection against heat stress and flooding.

There are currently only a few calculations of direct climate impact (emission reduction) on individual projects. An example is the project SPARC in which direct climate effects of the forestry management in the City of Gothenburg is calculated by researchers at SLU (Swedish University of Agricultural Sciences). The City is developing methods for calculation of CO_2 emissions to be applied to all actions (see description in the introduction to this text element), but it is not available nor applied yet. Therefore, most of the systemic levers within this field of action (see Table B 1.1) do not have measures on direct impact.

Sustainable food system

There is a strong connection between green infrastructure, nature-based solutions and the City's food system. The City is not characterized by agricultural activities but one of the unique features is the

ownership of around 3,000 ha of agricultural land and the many ongoing activities to promote and support urban farming on public property. A study performed by the municipality has provided estimates for self-sufficiency of food, if this land were to be utilized, and concluded a potential of nearly 40% of the annual consumption. An increased share of local production is one of the City's related goals and it will not only support local businesses, enable control and transparency throughout the food chain and shorten the food chains (which also lessen food waste) but also make possible a decreased footprint in regard to biodiversity and climate change.

In addition to this the City's procurement for public meals is one of the largest in Sweden, which makes it possible to send a signal on sustainable consumption patterns as well as making a real difference to individual suppliers of food. To support that public meal makers uses a local food concept ('miljömåltider', 'environmentally friendly meals' in english) to weigh up different sustainability aspects and promote a sustainable food culture.

To make good use of these local features City is currently reviewing the comprehensive plan to ensure responsible land and water use in relation to substantial public interest and to future-proof the expansion of Gothenburg. For this purpose, the City also develops a visualization within the City's digital twin to exhibit a future food system with minimized climate impact as well as taking other ecological and societal aspects into account at the same time as it will display a wide range of urban food production methods.

A more sustainable food culture to support societal development brings another additional benefit, aside from contributing to a sustainable food system, since it improves resilience of the society in the new reality of external, antagonistic agendas in the geopolitical situation.

An ecological perspective in the urban planning process
The City has several steering documents, guidelines and methods to ensure a structured and systematic approach for handling various environmental challenges in the urban planning process. The direction of development of the Gothenburg comprehensive plan shows ways to achieve the City's overall goal of sustainable development. This involves that the City as far as possible will preserve and develop existing ecosystem services and biodiversity in planning and construction. When new areas are planned, more ecosystem services should also be created. A coherent blue-green structure, from the large natural areas and watercourses in the suburbs to a more fine-meshed network in the dense city, promotes outdoor recreation as well as plant and animal life. The City strives to protect agricultural land for food supply.

The Green Plan shows how the City works with green qualities from an ecological, social and economic perspective. Three overall perspectives define Gothenburg as a close, cohesive and robust city where a) a variety of nature types and green connections create conditions for a high level of biodiversity, b) parks, natural areas and urban spaces contribute to varied, equal and healthy living environments and c) the ecosystem services of the green structure create value and form the basis for a sustainable economy.

Another example is the Guideline for ecosystem services. Working with this tool imply that if natural and/or recreational values risk being negatively affected by planning and exploration, the City of Gothenburg uses the checklist to see which functions exist and how the development risks affecting them. By doing so impacts can be avoided and minimized. However sometimes the ecological functions of the site need to be replaced in such cases this is done with compensatory measures. The measures can be to create new or improve existing functions that sites have for various ecosystem services. Another tool is 'green area factors' which imply that the planning process should use nature-based solutions to address various environmental challenges, such as local climate, biodiversity and large amounts of water.

GIS, geographic information system, is necessary for both environmental monitoring and for strategic urban planning. The City of Gothenburg is working to develop the information that is needed to analyse the conditions of the nature resources in the municipality. For example, a new layer in GIS is produced for ecosystem services.

Additionally, the City is building knowledge and capacities to be able to work according to the documents and guidelines at the city scale.

Nature preservation and restoration
The City works with many activities for nature preservation and restoration. For example, the City is since 15 years ago applying close to nature forestry management and work with restoration of peat bogs and biotope protection for eelgrass.

The strategy We plan for a green and resilient city
The strategy *We plan for a green and resilient city* is one of seven strategies on which the City's Environment and Climate Programme is based. The strategy aims to clarify and strengthen work on biodiversity and ecosystem services across administrations and companies. This means speeding up the work of utilizing, developing, integrating and increasing the proportion of urban greenery, blue structures and ecosystem services. It also means emphasizing blue-green infrastructure as a structuring and natural part of urban planning. The strategy also targets changing the perception of biodiversity, green-blue structures and ecosystem services. The effect that the work with the strategy target is that biodiversity, blue-green structures and ecosystem services are valued in the same way as other infrastructure, making the issues a natural and integrated part of all urban development and the City's economic assessments.

3.2 Module B-2 Climate Neutrality Portfolio Design

The actions/systemic levers presented in Table B-2.1 below complements the systemic levers in table B-1.1 above.

B-2.1: Description of action portfolios for each field of action

Fields of action	Systemic levers		Systemic impact and change
Energy system (including industry)	The City optimizes the district heating system.	Technology and infrastructure, Finance and funding	More investments in district heating to reduce the need for heating solutions from electricity. This helps decrease "power peaks" and marginal production in a situation where Gothenburg needs a lot of electricity in a short amount of time.
Energy system (including industry)	The City expands production and infrastructure as well as optimizes measures for the district cooling system.	Technology and infrastructure, Finance and funding	The need for cooling system will increase as temperature rises. Scaling up and optimize existing district cooling system will lead to decreased use of electricity for cooling. For Gothenburg, this is a matter of householding with resources as well as maintaining lower power peak in the electricity system, compared to more investment in single household solutions. This also allows waste heat to be used, which during the summer months exceeds the demand.
Energy system (including industry)	The City investigates possibilities for seasonal heating storage, taking care of waste heat and also investigates combination of district heating/waste heat and heating pumps.	Technology and infrastructure, Finance and funding	Resource and energy efficient heating system in the city. This is due to a decreased need for single solution-investments for heating where district heating is possible from an economic and environmental perspective.
Energy system (including industry)	The City implements local policies for the local electricity system such as efficiency rates, flexibility markets and conditional agreements. This affects many groups of actors and contributes to increase connectivity between different sectors such as buildings, transport and electricity system.	Governance and policy	By implementing new local policies and scaling up already implemented local policies, the companies and citizens use energy more efficient due to economic incentives. The use of electricity will also be spread out during the day, which will even out power peaks and thereby decrease the need of investment in production. By increasing the link between the electricity sector with other sectors, such as transport and building, the flexibility in the electricity system will increase, leading to decreased need of investment in more production.
Energy system (including industry)	The City works to increase cooperation between cities, regions, authorities, companies, organisations and citizens for expanding renewable production of electricity.	Governance and policy, Democracy and participation	Enhanced cooperation at all levels, from local to national and between different actors in the society is a necessity to meet the increased demand of renewable electricity. The need is mainly drivers from the industries and transport sector in Gothenburg, on the path to become fossil free. This demands a large amount of cooperation between national and local authorities as well as private actors to produce large amounts of renewable electricity in a relatively short period of time.
Energy system (including industry)	The City invests in new clean electricity (solar, wind and bio power).	Finance and funding	Increased supply of renewable electricity from solar PV's on public and private buildings, large scale wind and solar farms at land and sea as well as electricity from CHP.
Energy system (including industry)	The City develops storage of electricity in large and small batteries.	Technology and infrastructure, Finance and funding	Investments in small and large batteries will decrease power peaks and the need of investments in production of electricity.

Energy system (including industry)	The West coast Hydrogene valley application: The Port of Gothenburg and Göteborg Energi (the local energy firm) have decided, together with several other actors in academia and the industry, to send in an application to the EU with the ambition to become a hydrogen valley.	Finance and funding, Learning and capabilities	If approved, this will create opportunities for partly funding hydrogen investments in Gothenburg. Renewable hydrogen is an enabler for climate transition of primary the industry but for the transport sector as well.
Energy system (including industry)	The City increases biogas production from sewage sludge etc. at the City of Gothenburg's own production site (Gryaab).	Technology and infrastructure	Increasing the biogas production will help transition in heat production and the transport sector. More waste heat from the production of biogas can be used in the district heating system.
Energy system (including industry)	Göteborg Energi (the local energy firm) investigates the possibility for BECCS.	Technology and infrastructure	Negative emissions at the new bio CHP after 2025 is a possibility. The same goes for the local biogas production plant at Rya (Gryaab), where 7,000 ton CO2 is released to the atmosphere today in the anaerobic digestion process.
Energy system (including industry)	The refineries replaces fossil fuels with biofuels.	Technology and infrastructure	By using more biofuels in the production of renewable fuels, the fossil emissions from industry will decrease. This can contribute to decarbonisation of the transport sector.
Mobility & transport	The City works for densification of the city and expansion in areas with good public transport.	Technology and infrastructure, Governance and policy	A dense City provides short distances between people and the functions needed for everyday life and reduces the need to travel. More people can cope with everyday life by walking and cycling.
Mobility & transport	The City expands and improves infrastructure for public transport.	Technology and infrastructure, Governance and policy	Enables more journeys to be made with public transport instead of by car.
Mobility & transport	The City in collaboration with regional actors works for electrification of public transport.	Technology and infrastructure, Governance and policy	Reduced use of fossil fuels in public transport.
Mobility & transport	The City in collaboration with many actors works for expanded charging infrastructure for EVs.	Technology and infrastructure, Governance and policy	Enabling emission-free car and freight transport.
Mobility & transport	The City in collaboration with many actors implements measures to reduce car traffic in the city.	Technology and infrastructure, Governance and policy	Reduced speed, parking measures, redistribution of space from cars to sustainable modes of transport.
Mobility & transport	The City in collaboration with many actors works for increased shared micromobility and micrologistics.	Technology and infrastructure, Governance and policy, Social innovation	Increased use of micromobility can reduce car traffic and enable more people to travel by public transport as the first and last part of the journey can be done with micromobility
Mobility & transport	The City investigates the possibility to introduce a zero emission zone in Gothenburg.	Governance and policy	Possible introduction of a fossil-free zone will increase uptake of EVs
Mobility & transport	The City investigates the possibility of a car-free city center.	Governance and policy	Investigation of how the city center can be made car-free. This measure would reduce the car traffic and emissions.

Mobility & transport	The City works with requirements in public procurements.	Governance and policy	Increased demand and use of electric and fossil-free transport, vehicles and machinery in the City's own operations and in procured transports and contracts.
Mobility & transport	Co-creation between different stakeholder-groups such as businesses, the City, citizens, civil society organizations and the academy enables greater benefit and acceptance of innovative solutions and new technologies to increase sustainable travel and transport.	Social innovation, Governance and policy, Democracy and participation	Development, testing and implementation of innovative solutions and new technologies to increase sustainable travel and transport, reduce car traffic and accelerate the electrification of the transport sector. Increased confidence in the City. Increased commitment and acceptance of the changes required in the climate transition.
Waste & circular economy	The City implements circular economy principals in city steering documents and guidelines on acquisition and disposal.	Governance and policy	All administrations and companies have changed their approach to purchasing and disposal, leading to a significant decreased purchase of new, virgin materials and products, and at the same time increase in reuse, longer life spans and utilization rates.
Waste & circular economy	The City engages in circular procurement and market dialogues in new ways.	Learning and capabilities	All administrations and companies have changed their approach to purchasing and disposal, leading to a significant decreased purchase of new, virgin materials and products, and at the same time increase in reuse, longer life spans and utilization rates.
Waste & circular economy	The City develops waste prevention methods via communication and R&D.	Social innovation, Democracy and participation	Contribute to changes in behaviour and norms that leads to less consumption and less waste.
Waste & circular economy	The City establishes a municipal team to coordinate and streamline excavated mass management within the city.	Technology and infrastructure	Increased knowledge and better routines (via guidelines and regional mass management plan) for how to reuse of excavated masses. Create areas in the city to enable reuse of excavated masses. This leads to more reuse of excavated masses and less transport of excavated masses.
Waste & circular economy	The City investigates possibilities to increase usage of recycled water.	Learning and capabilites	Development and implementation of new solutions and services that leads to less usage of drinking water and indirectly less use of energy and chemicals.
Waste & circular economy	The City implements actions to decrease the usage of drinking water through communication with citizens and large water customers.	Technology and infrastructure, Governance and policy, Learning and capabilities	Changes in norms and behaviour that leads to less usage of drinking water and indirectly less use of energy and chemicals.
Waste & circular economy	The City implements activities in the action plan for good water status.	Technology and infrastructure, Governance and policy, Learning and capabilities	Better water status.
Built environment	The City provides free advice to private individuals, housing associations and SMEs for energy efficiency measures. The City is also an energy educator in the public sector.	Learning and capabilites	Decreased energy use.

Built environment	The City, academia and many other actors establishes an interactive circular digital twin model and tool; showing and matching construction reuse resources within the built environment in the Gothenburg region.	Technology and infrastructure, Governance and policy, Learning and capabilities	Resource efficiency; decreased need for new materials and products. Less waste from renovation and deconstruction. Decreased climate impact from the production chain. Decreased transport distances due to a increased local circularity.
Built environment	The City implements climate neutral and circular requirements* in land allocation agreements. (*Climate neutral building process including the material production chain, reused materials, energy-efficiency and design for disassembly)	Technology and infrastructure, Governance and policy	Resource efficiency; decreased need for new materials and products. Less waste from renovation and deconstruction. Decreased climate impact from the production chain. Decreased transport distances due to a increased local circularity.
Built environment	The Gothenburg platform for climate neutral construction is an ecosystem for the transition to a climate neutral construction sector enabling ongoing co-creation between the City, private developers, the industry and academia.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation, Democracy and participation	New and altered construction systems, products, materials processes due to co-creation of climate neutral ecosystem for construction. Decreased energy demand and reduced emissions.
Built environment	The City in collaboration with others works with a roadmap to new built constructions for -90% CO2 emission.	Governance and policy	Directions and incentives for development of climate neutral ecosystem for construction. Decreased energy demand and reduced emissions.
Built environment	The City implements a methodology and tool for climate neutral renovation.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation	Decreased climate impact from renovation measures. Increased level of reuse and maintaining. Easily accessed climate-data for all renovation measures taken in public buildings (housing and premises) in Gothenburg. As a result of collaboration and up-scaling the tool has been implemented in many cities in Sweden.
Built environment	The City revises the municipal planning processes to enable climate-neutral and circular buildings and constructions (from comprehensive plans to building and deconstruction permits).	Governance and policy, Learning and capabilities	Decreased climate impact from construction. Increased level of reuse and maintaining. Resource efficiency; decreased need for new materials and products. Less waste from renovation and deconstruction. Decreased climate impact from the production chain. Decreased transport distances due to an increased local circularity.
Green infrastructure and nature-based solutions	The City collaborates with many other actors to integrate sustainable food production on a strategic level in Gothenburg comprehensive plan.	Governance and policy, Learning and capabilities	This creates possibilities to prioritize the use of farmland for food production over other exploration interests. Easier to handle goal conflicts. Increased knowledge about land use. In total this will help the City to increase local food production, which will lead to reductions of CO2 emissions.
Green infrastructure and nature-based solutions	The City works with cluster management and categorization of food in the City's purchasing system.	Governance and policy, Learning and capabilities	This will optimize the amount and types of food that is purchased via procurement in the City and contribute to more sustainable food supply. Reduces the amount of food waste and increase requirements in procurement. This will lead to reductions in CO2 emissions.

Green infrastructure and nature-based solutions	The City builds knowledge and capacity to work with nature-based solutions.	Learning and capabilities	The City's civil servants have knowledge and capacity to work with ecosystem services and nature-based solutions in the urban planning process.
Green infrastructure and nature-based solutions	The City works with nature preservation activities on the City's land.	Technology and infrastructure, Governance and policy, Learning and capabilities, Social Innovation	More nature preservation and restoration.
Green infrastructure and nature-based solutions	The City implements a pilot area for city green areas. The pilot area for greenery provides tools and ways of working to increase biodiversity and ecosystem services.	Governance and policy, Learning and capabilities	This leads to more greenery and the creation of a city-wide blue-green infrastructure. Methods and lessons will be spread to other parts of the city. This will contribute to create an overall blue-green infrastructure in the city, resulting in increased biodiversity and new ecosystem services. As a result, blue-green structures are given the same priority as other infrastructure in the city.
Green infrastructure and nature-based solutions	The City works strategically with green and blue structures and ecosystem service. This includes to define and map the City's green infrastructure to better protect, develop and create conditions for increased biodiversity and ecosystem service.	Governance and policy	More greenery, more multifunctional solutions for biodiversity, climate adaptation and climate mitigation. Better air quality, more recreational space, less noise, increased well-being, better protection against heat stress and flooding.
Green infrastructure and nature-based solutions	The City uses the green plan as a strategic basis for urban development.	Governance and policy	Biodiversity and ecosystems are valued and prioritized, providing more and the right green space in the city, and in the right places. More multifunctional solutions for biodiversity, climate adaptation and climate mitigation. Better air quality, more recreational space, less noise, increased well-being, better protection against heat stress and flooding.

We provide **one example** of individual action outline per fields of action to illustrate in more detail how the City of Gothenburg operates.

B-2.2: Example Energy system Individual action outlines		
Action outline	Action name	Bio CHP
	Action type	Renewable energy production
	Action description	Investment in a new renewable production line at the existing district heating production site in Rya.
Reference to impact pathway	Field of action	**Energy system**
	Systemic lever	Technology and infrastructure
	Outcome (according to module B-1.1)	A fossil free district heating production in Gothenburg by 2025.
Implementation	Responsible bodies/person for implementation	Göteborg Energi (The local energy firm, owned by the City)
	Action scale & addressed entities	The district heating system in Gothenburg
	Involved stakeholders	Private actors which will deliver the bio CHP, fuels and groundworks
	Comments on implementation – consider mentioning resources, timelines, milestones	The new production line will be in place during the winter 2025/2026.
Impact & cost	Generated renewable energy (if applicable)	156 MW heat and 39 MW electricity
	Removed/substituted energy, volume, or fuel type	Fossil gas
	GHG emissions reduction estimate (total) per emission source sector	100,000 ton CO2
	GHG emissions compensated (natural or technological sinks)	There are ongoing discussions and investigations planned to look at the technical and economic possibility to apply CCS at this plant after 2025. If possible, the captured CO2 will result in negative emissions (BECCS).
	Total costs and costs by CO2e unit	2.53 billion SEK (220,000 million Euros) or 25 SEK/ reduced kilo of CO2 (2.5 Euro/ reduced kilo of CO2)

B-2.2: Example Mobility & transport Individual action outlines		
Action outline	Action name	Developing mobility facility concept
	Action type	Technology & infrastructure Social innovation Learning & capabilities
	Action description	Developing mobility facility concept
Reference to impact pathway	Field of action	**Mobility & transport**
	Systemic lever	• Measures to reduce car traffic in the city • Expanded and improved infrastructure for walking and cycling
	Outcome (according to module B-1.1)	• Reduced speed, parking measures, redistribution of space from cars to sustainable modes of transport.

		• Increased use of micro mobility can reduce car traffic and enable more people to travel by public transport as the first and last part of the journey can be done with micro mobility • A dense city provides short distances between people and the functions needed for everyday life and reduces the need to travel. More people can cope with everyday life by walking and cycling. • Increased road safety for pedestrians and cyclists. • Reduced noise and air pollution. • Areas that have been used for cars can instead be used for sustainable travel, greenery, ecosystem services and social spaces.
Implementation	Responsible bodies/person for implementation	The parking company (Göteborgs Stads Parkerings AB) in collaboration with the Urban Planning Administration and the Administration for Land Development.
	Action scale & addressed entities	The geographical area of Gothenburg.
	Involved stakeholders	Administrations and companies from the City and business such as real estate developers, shared micromobility companies.
	Comments on implementation – consider mentioning resources, timelines, milestones	The concept will be further developed in 2024 and implemented gradually, primarily in city development areas, in collaboration with the City's administrations and other stakeholders.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume, or fuel type	A successful development and implementation of this concept can contribute to reduce the amount of car traffic and hence the fuel volumes.
	GHG emissions reduction estimate (total) per emission source sector	Too early to say, since the concept is still under development.
	GHG emissions compensated (natural or technological sinks)	NA
	Total costs and costs by CO2e unit	Too early to say, since the concept is still under development.

B-2.2: Example Waste and circular economy Individual action outlines		
Action outline	Action name	Tage
	Action type	Learning & capabilities Technology and infrastructure
	Action description	Tage is the City of Gothenburg's internal reuse and sharing system for furniture and furnishings. The sharing system was founded in 2013 and since 2019 there is a framework agreement for reused furniture and related architectural and renovation services. Since 2021, the digital reuse site has been supplemented with a physical intermediate intermediate storage and free transport for the City of

		Gothenburg's administrations and companies. Supported by the Circular economy strategy, the responsible company (Göteborgs Stads Leasing) is now looking at what capacity Tage needs to fulfilment of targets for 2030.
Reference to impact pathway	Field of action	**Waste and circular economy**
	Systemic lever	Building capacity for action and mobilizing key actors within the City.
	Outcome (according to module B-1.1)	Reduced climate impact (-90% until 2030) Shift in norms among employees and in society in favour of circular economy Less impact on biodiversity Less toxicity
Implementation	Responsible bodies/person for implementation	Göteborgs Stads Leasing.
	Action scale & addressed entities	City of Gothenburg's all administrations and companies.
	Involved stakeholders	City of Gothenburg's administrations and companies.
	Comments on implementation – consider mentioning resources, timelines, milestones	The system was founded in 2013 and is a key component for how the City will work with its internal reuse and sharing for furniture and furnishings, and by doing so reach its target in terms of reduced climate impact and waste.
Impact & cost	Generated renewable energy (if applicable)	Not applicable (NA).
	Removed/substituted energy, volume, or fuel type	40,000 products have been re-circulated via Tage.
	GHG emissions reduction estimate (total) per emission source sector	About 2,000 ton of carbon dioxide equivalents has been reduced.
	GHG emissions compensated (natural or technological sinks)	NA
	Total costs and costs by CO2e unit	The cost of purchases decreased with 17 MSEK in 2023, the cost of Tage is 4.5 MSEK. Thus, thanks to Tage the City has saved 12.5 MSEK.

B-2.2: Example Green infrastructure & nature-based solutions Individual action outlines		
Action outline	Action name	Pilot area for city green areas.
	Action type	Governance and policy Learning & capabilities
	Action description	The pilot area for whole city greenery provides tools and ways of working to increase biodiversity and ecosystem services.
Reference to impact pathway	Field of action	**Green infrastructure & nature-based solutions**
	Systemic lever	Strategic work with green and blue structures and ecosystem service
	Outcome (according to module B-1.1)	The pilot area for whole city greenery leads to more greenery and the creation of a city-wide blue-green infrastructure. Methods and lessons learnt will be spread to other parts of the City. This will contribute to create an overall blue-green infrastructure in the city, resulting in increased biodiversity and new ecosystem services. As a result, blue-green structures are given

		the same priority as other infrastructure in the city. Increased biodiversity provides more and better opportunities for nature-based solutions that reduce and sequester greenhouse gases and address climate change. In addition, more greenery in the city, more multifunctional solutions for both biodiversity and climate adaptation.
Implementation	Responsible bodies/person for implementation	The cross-cutting strategy: We plan for a green and resilient city.
	Action scale & addressed entities	The geographical area of Gothenburg.
	Involved stakeholders	The City's administrations for urban development, property owners
	Comments on implementation – consider mentioning resources, timelines, milestones	Two-year project, first year mapping and developing tools and communication with stakeholders in the pilot area. Second year – developing strategies and actions, methods and implementation.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume, or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	Too early to say, since the pilot area is still under development.
	GHG emissions compensated (natural or technological sinks)	Too early to say, since the pilot area is still under development.
	Total costs and costs by CO2e unit	Too early to say, since the pilot area is still under development.

B-2.2: Example Built environment Individual action outlines		
Action outline	Action name	Hoppet (eng. Hope/Leap/Jump)
	Action type	Learning & capabilities Technology and infrastructure
	Action description	In 2017, the City Council commissioned Sweden's first fossil free construction project: a pre-school whose entire value chain is fossil-free, including upstream raw materials, transport, production, construction, and the finished building. The pre-school named Hoppet, completed in December 2021, was the first building using a methodology developed by the City which challenges the construction industry to raise their sustainability standards, which is now incorporated in the City's innovation program for fossil-free new construction. Hoppet managed to reduce its CO2 emissions by 60%. Hoppet helps the City achieving its goal of becoming climate neutral by 2030 and challenge cities and stakeholders to make more sustainable choices. By mapping the LCA CO2 emissions, the City knows where to direct innovation efforts to push the forefront of materials research. The fossil-free ideals enshrined in the construction process have been included in the pedagogical mission of Hoppet. At the

		school yard, the children can learn how to reduce their own carbon footprint, e.g. waste reduction, material reuse and energy efficiency. In this way, Hoppet seeks to instil values of sustainability early on in childhood education.
Reference to impact pathway	Field of action	Built environment
	Systemic lever	The City uses public construction projects as an engine in the transformation to a climate-neutral construction sector in Gothenburg.
	Outcome (according to module B-1.1)	New and altered construction systems, product, materials processes, with special focus on biobased and reused products, as well as electrification of machinery and transports.
Implementation	Responsible bodies/person for implementation	The Urban Property Administration
	Action scale & addressed entities	See action description above.
	Involved stakeholders	Förvaltnings AB Framtiden, The Urban Property Administration
	Comments on implementation – consider mentioning resources, timelines, milestones	NA
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume, or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	Hoppet managed to reduce its CO2 emissions by 60%.
	GHG emissions compensated (natural or technological sinks)	NA
	Total costs and costs by CO2e unit	NA

B-2.3: Summary strategy for residual emissions

The work with residual emissions is in an early state in the City of Gothenburg and mainly involves learning and capacity building activities. This involves learning from other cities that have done more in this area and investigating methods and actions that could work in Gothenburg.

An example of actions that are investigated to see how they could work as natural sinks are in the area of nature preservation and restoration. The City is, for example, applying close to nature forestry management and work with restoration of peat bogs and biotope protection for eelgrass.

Additionally, Renova AB (the waste-to-energy facility owned by the City of Gothenburg and nine other municipalities) in collaboration with the Administration for Sustainable Waste and Water and Göteborg Energi AB, has initiated a pilot project aimed at generating biochar from collected waste originating from gardens and parks, with the potential to harness surplus heat (6-10 GWh) as a resource in the district heating system. The biochar produced at the local facility can, for instance, be used as a soil

amendment in urban plantations. Approximately 1,300-2,300 tons of biochar are anticipated to be produced, resulting in a natural carbon sink of approximately 4,500-8,500 tons of carbon dioxide per year.

3.3 Module B-3 Indicators for Monitoring, Evaluation and Learning

The indicators to monitor the climate transition in Gothenburg are set in the Environment and Climate Programme for the City of Gothenburg 2021–2030.[4] The program also includes indicators for nature and people. In this application, focus is on the indicators for climate, in terms of climate change mitigation. Since the program (and indicators) was implemented a review of the program, following up on the indicators, was done in the spring 2023 and presented in a report which is available online.[5] Further development of the indicators is underway.[6]

B-3.1: Impact Pathways					Target values		
Outcomes / impacts addressed	Action/ project	Indicator No. (unique identified)	Indicator name				
					2025	2027	2030
(List early changes/ late outcomes and impacts to be evaluated by indicator)	(List action/ pilot project if applicable)	(Indicate unique identifier)	(Insert indicator name)		(List one value per indicator)	(List one value per indicator)	(List one value per indicator)
See Table B-1.1 and B-1.2 early and late changes.	See Table B-1.1 and B-1.2 for actions.	1.	Emissions of greenhouse gases per inhabitant and year within the geographical area of Gothenburg (includes emissions from both traded and nontraded sectors).		No defined value for 2025, see below for start value.	No defined value for 2027.	Target value 2030 is 1.1 tons of carbon dioxide equivalents per inhabitant and year.
		2.	Consumption-based greenhouse gas emissions per inhabitant in Sweden.		No defined value for 2025, see below for start value.	No defined value for 2027.	Target value is 3.3 tons of carbon dioxide equivalents per inhabitant and year in 2030.
		3.	Primary energy consumption per inhabitant within the municipality.		No defined value for 2025, see below for start value.	No defined value for 2027.	Target value 2030 12 MWh per inhabitant.

[4] Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se)
[5] The report from the review can be found here Uppföljning av mål och delmål i Göteborgs Stads miljö- och klimatprogram 2021–2030 (goteborg.se).
[6] For suggested development of the indicators see Handling 15 Bilaga 1 MKN 20231017.pdf (goteborg.se)

		4.	Average primary energy consumption per square meter in the City of Gothenburg's facilities and residential buildings where the operation can be related to surface area.	No defined value for 2025, see below for start value.	No defined value for 2027.	Target values 2030: Facilities:130 kWh/m2, Residential buildings: 84 kWh/m
		5.	The proportion of electricity and district heating produced by renewable fuels in the production facilities of Göteborg Energi AB.	Target values in 2030: Electricity :100% District heating: 100%.	No defined value for 2027.	Target values in 2030: Electricity:100% District heating: 100%.
		6.	Greenhouse gas emissions from transportation in Gothenburg.	No defined value for 2025, see below for start value.	No defined value for 2027.	Target value for 2030 is at least 90% less compared to 2010.
		7.	Volume of traffic, i.e. the number of kilometers driven by all types of motorized road vehicles per weekday, in Gothenburg.	No defined value for 2025, see below for start value.	No defined value for 2027	Target value for 2030 25% less compared to 2020.
		8.	Proportion of the City of Gothenburg's vehicles that are fossil-free.	No defined value for 2025, see below for start value.	No defined value for 2027.	Target value in 2030 100%.
		9.	Greenhouse gas emissions from purchased inventories, products, materials, and services from a life cycle perspective (Does not apply to purchases covered by other	No defined value for 2025, see below for start value.	No defined value for 2027.	Target value in 2030 at least 90% less compared to 2020.

			indicators of the sub-goal).			
		10.	Greenhouse gas emissions from new and renovated buildings under own management and from new development on land with land allocations.	At least 50% less compared to 2020.	No defined value for 2027.	At least 90% less compared to 2020.
		11.	Greenhouse gas emissions from facilities under own management and from new development on land with land allocations.	At least 50% less compared to 2020.	No defined value for 2027.	At least 90% less compared to 2020.
		12.	Greenhouse gas emissions from purchased foods from a life cycle perspective.	No defined value for 2025, see below for start value.	No defined value for 2027.	Target value in 2030 1.3 kg carbon dioxide equivalents/kg food.

B-3.2: 1 Indicator Metadata	
Indicator Name	Emissions of greenhouse gases per inhabitant and year within the geographical area of Gothenburg (includes emissions from both traded and nontraded sectors)
Indicator Unit	Tons of carbon dioxide equivalents per inhabitant and year
Definition	Target value 2030 is 1.1 tons of carbon dioxide equivalents per inhabitant and year Status as of 2018 is 4.3 tons of carbon dioxide equivalents per inhabitant and year
Calculation	National data source
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Stationary energy, Transportation, Waste, Industrial processes and product use, Agriculture, forestry, and fishing activities
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	All impact pathways
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Kolada
Is the data source local or regional/national?	National
Expected availability	The national data is updated once a year with data from two years ago
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se) Environmental goal: Gothenburg's climate footprint is close to zero
Other indicator systems using this indicator	-

B-3.2: 2 Indicator Metadata	
Indicator Name	Consumption-based greenhouse gas emissions per inhabitant in Sweden
Indicator Unit	Tons of carbon dioxide equivalents per inhabitant and year
Definition	Target value is 3.3 tons of carbon dioxide equivalents per inhabitant and year in 2030. Status in 2017 is 9.3 tons of carbon dioxide equivalents per inhabitant and year
Calculation	National data source
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Stationary energy, Transportation, Waste, Industrial processes and product use, Agriculture, forestry, and fishing activities
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	All impact pathways, particularly waste and circular economy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Naturvårdsverket/Swedish environmental protection agency
Is the data source local or regional/national?	National
Expected availability	The national data is updated once a year with data from two years ago
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Environmental goal: Gothenburg's climate footprint is close to zero
Other indicator systems using this indicator	-

B-3.2: 3 Indicator Metadata	
Indicator Name	Primary energy consumption per inhabitant within the municipality
Indicator Unit	MWh per inhabitant
Definition	Status 18 MWh per inhabitant (2010) and 16 MWh per inhabitant (2018) and target value 2030 12 MWh per inhabitant
Calculation	National statistics
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Energy consumption
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Energy system (including industry)
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	National statistics (SCB)
Is the data source local or regional/national?	National and local
Expected availability	Every year with one year delay
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 1: The City of Gothenburg reduces energy use in residential buildings and facilities
Other indicator systems using this indicator	-

B-3.2: 4 Indicator Metadata	
Indicator Name	Average primary energy consumption per square meter in the City of Gothenburg's facilities and residential buildings where the operation can be related to surface area
Indicator Unit	Facilities: kWh/m2 Residential buildings: kWh/m2
Definition	Status: Facilities: 186 kWh/m2 (2010), Residential buildings: 120 kWh/m2 (2010) Target value 2030: Facilities: 130 kWh/m2, Residential buildings: 84 kWh/m
Calculation	A local method based on national principles
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Energy efficiency in buildings and facilities
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	From a local calculation method based on national principles
Is the data source local or regional/national?	Local
Expected availability	Every year in February
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 1: The City of Gothenburg reduces energy use in residential buildings and facilities
Other indicator systems using this indicator	-

B-3.2: 5 Indicator Metadata	
Indicator Name	The proportion of electricity and district heating produced by renewable fuels in the production facilities of Göteborg Energi AB
Indicator Unit	%
Definition	Status: Electricity: 1.6% (2010), 20% (2018). District heating: 35% (2010), 69% (2018). Target value in 2030: Electricity: 100% District heating: 100%
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Production of renewable energy
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Energy system (including industry)
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	From the local energy company (Göteborg Energi AB)
Is the data source local or regional/national?	Local
Expected availability	Every year in February
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 2: The City of Gothenburg produces energy solely from renewable sources
Other indicator systems using this indicator	-

B-3.2: 6 Indicator Metadata	
Indicator Name	Greenhouse gas emissions from transportation in Gothenburg
Indicator Unit	Tons of carbon dioxide equivalents per year
Definition	Status 687,246 tons of carbon dioxide equivalents per year (2010). Target value for 2030 is at least 90% less compared to 2010
Calculation	National data source
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Transportation
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Mobility & transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Nationella emissionsdatabasen/SMHI
Is the data source local or regional/national?	Both
Expected availability	Every year in June with two years delay
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 3: The City of Gothenburg reduces the climate impact from transportation
Other indicator systems using this indicator	-

B-3.2: 7 Indicator Metadata	
Indicator Name	Volume of traffic, i.e. the number of kilometres driven by all types of motorized road vehicles per weekday, in Gothenburg
Indicator Unit	Kilometres
Definition	Status 2019 is 7,262,000 kilometres driven by all types of motorized road vehicles per weekday. Target value for 2030 25% less compared to 2020.
Calculation	The volume of traffic is estimated by measuring flow changes in traffic on roads assumed to be representative and the relative changes are then applied to the road network as a whole.
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Less traffic
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Mobility & transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Congestion tax portals and other traffic measurements
Is the data source local or regional/national?	Local
Expected availability	Every year in February with figures from the last year
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 3: The City of Gothenburg reduces the climate impact from transportation
Other indicator systems using this indicator	-

B-3.2: 8 Indicator Metadata	
Indicator Name	Proportion of the City of Gothenburg's vehicles that are fossil-free
Indicator Unit	%
Definition	Status 55% in 2019. Target value in 2030 100%
Calculation	N/A
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	No
If yes, which emission source sectors does it measure?	-
Does the indicator measure indirect impacts (i.e., co- benefits)?	Yes
If yes, which co-benefit does it measure?	Fossil-free vehicles
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Mobility & transport
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	The City's register of leased cars
Is the data source local or regional/national?	Local
Expected availability	Monthly
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 3: The City of Gothenburg reduces the climate impact from transportation
Other indicator systems using this indicator	-

B-3.2: 9 Indicator Metadata	
Indicator Name	Greenhouse gas emissions from purchased inventories, products, materials, and services from a life cycle perspective (Does not apply to purchases covered by other indicators of the sub-goal)
Indicator Unit	Tons carbon dioxide equivalents
Definition	Status 376,000 tons carbon dioxide equivalents in 2020. Target value in 2030 at least 90% less compared to 2020
Calculation	Environmental Spend Analysis (ESA)
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste, this indicator is covering consumption-based emissions
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Waste & circular economy
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	The Administration for Purchase and Procurement
Is the data source local or regional/national?	Local
Expected availability	Economic data is collected once a year for the previous year. Method for updated emissions data is under development
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 4: The City of Gothenburg reduces the climate impact from purchases
Other indicator systems using this indicator	-

B-3.2: 10 Indicator Metadata	
Indicator Name	Greenhouse gas emissions from new and renovated buildings under own management and from new development on land with land allocations
Indicator Unit	Kg carbon dioxide equivalents/m2 GFA
Definition	Statues 2020: Newly constructed buildings (kg carbon dioxide equivalents/m2 GFA), Apartment buildings: 400, Small houses: 170, Office buildings: 390, Pre-schools: 360, Schools: 360, Pre-schools: 360, BmSS: 360, Retirement homes: 390 At least 90% less compared to 2020
Calculation	Method for calculation of emissions from new buildings is based on the method for the act on climate declarations with additions (The Swedish National Board of Housing, Building and Planning). Method for calculation of emissions from renovated buildings is under development
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Stationary energy, Waste, Industrial processes and product use
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Administrations and companies that build new constructions, reconstructions and renovations of buildings and their contractors
Is the data source local or regional/national?	Local
Expected availability	
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 4: The City of Gothenburg reduces the climate impact from purchases
Other indicator systems using this indicator	-

B-3.2: 11 Indicator Metadata	
Indicator Name	Greenhouse gas emissions from facilities under own management and from new development on land with land allocations
Indicator Unit	Method for calculation is under development
Definition	At least 90% less compared to 2020
Calculation	Method for calculation is under development
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Stationary energy, Waste, Industrial processes and product use
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Built environment
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Method for calculation is under development
Is the data source local or regional/national?	Local
Expected availability	Method for calculation is under development
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 4: The City of Gothenburg reduces the climate impact from purchases
Other indicator systems using this indicator	-

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B-3.2: 12 Indicator Metadata	
Indicator Name	Greenhouse gas emissions from purchased foods from a life cycle perspective
Indicator Unit	kg carbon dioxide equivalents/kg food purchased
Definition	Status 1.9 kg carbon dioxide equivalents/kg food in 2019. Target value in 2030 1.3 kg carbon dioxide equivalents/kg food
Calculation	New tool under development to be used in revision in 2025
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Agriculture, forestry and fishing
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	-
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Green infrastructure and nature-based solutions
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	No
Data requirements	
Expected data source	Data to be provided by the Administration for Purchase and Procurement
Is the data source local or regional/national?	Local
Expected availability	New tool to be used in revision 2025
Suggested collection interval	Revision every second year (2023, 2025…)
References	
Deliverables describing the indicator	Environment and Climate Programme for the City of Gothenburg 2021–2030 (goteborg.se), Sub-goal 4: The City of Gothenburg reduces the climate impact from purchases
Other indicator systems using this indicator	-

4 Part C – Enabling Climate Neutrality by 2030

Part C "Enabling Climate Neutrality by 2030" aims to outline any enabling interventions, i.e., regarding organizational setting or collaborative governance models or related to social innovations – designed to support the climate action portfolios (Module B-2) as well as aiming to achieve co-benefits outlined in the impact pathway (Module B-1). These interventions also address the identified opportunities, gaps and barriers identified Module A-2 and A-3.

4.1 Module C-1 Governance Innovation Interventions

C-1.1: Description or visualisation of the participatory governance model for climate neutrality

Introduction to governance innovation interventions

The governance innovation interventions are addressing the systemic barriers and opportunities identified in section A3. The interventions are categorised in four groups of different character:

1) Governance innovation interventions for the City organisation

2) Multi-level innovation interventions primarily addressing the aspects of multi-level governance, and

3) Multi-actor innovation interventions primarily addressing the multi-actor collaboration within different sectors, systems or emission impact domains

4) Citizen inclusion interventions

Governance innovation interventions for the City organisation

The governance challenge

The City of Gothenburg is, like most municipalities, organised in silos according to each department's specific task. This is, in the case of the City of Gothenburg, enhanced by a decentralised organisational structure with strongly independent organisational bodies, each having their own mandate and governance. This means that the City of Gothenburg is organised for effective continual management. This effectiveness is an advantage for climate transition actions that can be handled vertically. But since some overarching climate transition actions require collaboration and decision-making across silos, the vertical management structure needs to be complemented with functions that support joint information sharing, collaboration and decision-making between the different administrations and companies.

Since 2019, the City has addressed this challenge trying to find governance innovations capable to unlock the potential it would bring to the climate transition and mission of climate neutrality. The City's work on this is ongoing and will continue to evolve until the mission is within reach. The main tools developed so far in this development are described below.

The Climate Transition Function

The Climate Transition Function is a complementary governance innovation with the aim to address the challenges described above by complementing the vertical structures to better handle the governance and management required to achieve the necessary climate transition. This may include the development of new development pathways for the City that involve systemic change, which requires management and governance to incorporate a city-wide perspective. Moreover, it requires that certain enabling capabilities and capacities are in place.

The purpose of the City of Gothenburg's Climate Transition Function is thus to create the conditions for effective decision-making within the City's management and governance that are required to achieve the City's climate goals. The work towards this purpose includes showing 1.) what is being done to achieve the City's climate goals, 2.) what more is required to achieve the goal and 3.) how this can be achieved. The Climate Transition Function should not be regarded as an organisational unit in the traditional sense. It is rather a form of organizing that is coordinated by the Environmental Administration but is based on the active participation of a large number of municipal administrations and companies, which together develop and shape the work.

The Climate Transition Function - the "engine" for the Climate City Contract
The Climate City Contract, with its Action Plan and Investment Plan are crucial tools that answer to the need of functions that support joint information, collaboration and decision-making. The first Climate City Contract of Gothenburg is this one, but continuous revision is planned in order to keep it a relevant tool serving its purpose. Besides, the City sees the need to develop a Climate Transition Strategy that complement the Action Plan and Investment Plan by external analysis of trends and risks, exploring different pathways on long-term and short-term basis, and accordingly, constituting a better basis for joint decision-making.

The Climate Budget
In addition to the Climate Transition Function, the Climate Budget is being developed as a tool to address the barriers to systemic transformation in the City, related to knowledge, skills and leadership (described in A-3.1).

The Climate Budget aims to raise awareness and mobilise stakeholders by compiling and visualising results in the form of the current climate footprint and estimated future climate footprint in relation to the City's climate targets.

The City's Climate Budget is proposed to describe how the City can manage and plan the use of the remaining amount of greenhouse gas emissions without exceeding the climate target.

The Climate Budget is:
- a methodology for more clearly linking the City's climate goals to the effects of the climate measures that the City is implementing and planning to implement through a city-wide framework for reporting current and estimating future emission reductions.
- a platform to visualise the City's climate footprint and how the implementation of the City's climate action plan is progressing.
- a tool to effective management of emissions data.

The seven cross-cutting strategies
Another governance innovation intervention aiming at addressing the challenges connected to the silo organisation aspect is the City's new cross-cutting strategies that was launched as part of the Environment and Climate Programme in 2021.

Through the seven cross-cutting strategies, committees and boards will join forces in areas that require a high degree of collaboration and new cross-cutting solutions. The strategies aim to bring about change-driven development to accelerate the transition to a sustainable city. For each strategy, there is a coordinating board or committee responsible for driving and aligning the strategy. The Environmental- and Climate Committee is responsible in coordinating the work within and between the strategies.

Two strategies to deal with underlying enablers

Two of the seven cross-cutting strategies (*We act as forerunners* and *We work strategically on financing to accelerate the transition*) focus on underlying enablers such as cross-sector multi-actor cooperation, skills and leadership, influence and strategic communication, improved financial capacity for the transition as well as addressing the problem of fragmented innovation. Hence, these strategies are governance innovation interventions also due to their focus areas.

The Climate Council (Klimatrådet)
Another governance innovation intervention is the local Climate Council that provides knowledge for the City to implement, contributes to skills and leadership and is an example of cross-sector multi-actor collaboration.

The seven members of the Climate Council are all active researchers in the three sustainability dimensions of social, economic and ecological sustainability. The members are elected for two years. With their independent expertise, they can support both the City of Gothenburg and society's transition. The Climate Council will propose feasible and specific measures to reduce climate impact in the future. The Climate Council shall report its work in writing to the Environment and Climate Committee once per year. The report must state which measures are deemed to provide the greatest climate benefit and the greatest social cost-effectiveness.

Testbed Gothenburg (Testbädd Göteborg)
Testbed Gothenburg is an initiative that includes the entire city: industry, public actors, academia, research institutes science parks and the City. It aims to create inspiration and discussion around test beds: development, business models and collaboration opportunities. Testbed Gothenburg is based on existing testbeds, initiatives and programmes with the aim of raising the level further and opening up to new actors. Testbed Gothenburg is one tool to build on the successful work on testbeds and further address the systemic barriers of fragmented innovation and involve more actors to enable upscaling.

The Knowledge Arena (Din Kunskapsarena)
Another intervention is The Knowledge Arena focusing on internal capabilities of the City to foster innovation and digitalisation.

Virtual Gothenburg
Virtual Gothenburg is a digital twin developed to address the increasing societal challenges of climate change, segregation and the complexity of society at large. Virtual Gothenburg creates new opportunities to better describe, understand, plan and manage the city. It enables better basis for decision-making and understanding of the challenges and solutions related to climate neutrality.

Multi-level governance innovation interventions
The multi-level governance innovation interventions have emerged in collaboration with other actors. They are either initiated and developed by the City of Gothenburg together with other actors or the City has simply joined initiatives developed by other actors.

Viable Cities and NetZeroCities
The multi-level governance innovation interventions are all addressing the systemic barriers of multi-level governance, enabling the City of Gothenburg to interact with regional, national and international levels. Viable Cites and NetZeroCities are both system innovation platforms with multiple aims enabling the City of Gothenburg to work with organisations and institutional bodies on all levels as well as other cities.

West Sweden Regional Mobilisation

To be successful towards the mission of climate neutrality it is important to collaborate regionally as many of the challenges are closely linked with neighbouring municipalities and the region. Gothenburg, together with the Gothenburg region and a handful of other regional cities are planning on how to build a stronger regional mobilisation, here called the West Sweden Regional Mobilisation.

Municipalities' 30 climate pledges
The municipalities' climate pledges are an initiative within the 'Climate 2030 - Västra Götaland is changing', which is run by Region Västra Götaland and County Administrative Board Västra Götaland. In 2021 and 2022, the municipalities in Västra Götaland have together implemented climate pledges that are estimated to reduce emissions by more than 75,000 tonnes of carbon dioxide equivalents. For 2024-2026, most of the municipalities in Västra Götaland have now submitted their climate pledges, with a total of around 800 pledges being adopted. The municipalities have a strategically important role in achieving the climate goals. The municipalities' climate pledges consist of 30 concrete measures over which the municipality has control, which are tried and tested, and which can lead to major emission reductions. The climate pledges are politically adopted and each municipality is responsible for implementing the adopted climate pledges. A platform for collaboration is formed where successes and failures are shared among the municipalities.

Orchestrate climate transition through collaboration and networks

The City is involved in many member organisations, networks and platforms and uses this as a tool to solve problems, gain knowledge and influence other actors. The City plans for further development on how to contribute to and utilise networks and collaborations on local, regional, national and international levels in a more coordinated way aiming to orchestrate a higher transition speed. Developing a more coordinated and intentional way of contribution to the collaborations will enable the City to bridge systemic barriers to a larger extent.

Multi-actor governance innovation interventions
The thematic multi-actor governance innovation interventions are all being developed to overcome systemic barriers and combat system inertia by working together across sectors and organisations. By bridging the gap between organisations the City enhances its influence over the development and creates knowledge, skills and leadership to increase the pace towards climate neutrality. Fragmented innovation and implications of the political system are also barriers that are remedied by these initiatives. Mission orientation is at its core in these types of interventions.

Gothenburg and western Sweden has a solid experience and has cultivated a culture for this type of multi-actor collaborations. They are often joint initiatives by the City or any of its partners.

Housing and buildings emission impact domain

The Gothenburg Platform for Climate-Neutral Construction (Göteborgs plattform för klimatneutralt byggande) summons 130 organisations within the Housing and buildings emission impact domain, also contributing to reduced emissions within the waste and energy systems as well as consumption based emissions.

The Handshake (Handslaget – initiativ för cirkulärt byggande och återbruk) is an initative comprising 50 actors working towards circular construction building a new market to reduce emissions from construction.

Mobility and transport emission impact domain

Gothenburg Green City Zone is a multi-actor initiative creating emission free transportation within three geographical areas developing test beds and scaling up innovation.

Public transport for the future is a portfolio of initiatives in collaboration between actors working on the development of public transportation and the intersection with new solutions within micro-mobility and car sharing.

ElectriCity is a demonstration arena for electrification of transports and work machines developed by a cross-sectoral team from public, private and academic sectors.

The Green Connection is a portfolio of linked initiatives together with numerous actors with the ambitions to become the world's most sustainable harbour. Involving the entire logistics chain this initiative has the potential to reduce emissions both locally and globally.

Industrial processes emission impact domain

Climate-leading Process Industry (Klimatledande Processindustri) organises seminars, working group meetings, meetings with decision-makers and initiates innovation and development projects in the chemical and process industry. There is also collaboration with other sectors and clusters in Sweden and Europe.

Fashion, Facts and Fun is the name of the City's collaboration with fashion companies in the Gothenburg region to support their transition. The ambition is to contribute to more sustainable and competitive business models, understand and see opportunities in increased requirements and stricter regulations. This is part of the regional Textile Movement.

Food, water and green areas emission impact domain

The food system collaboration node aims to enhance collaboration between the City's food system actors to reduce emissions from food production while creating resilience and co-benefits.

Other domains/unspecified

The world's most sustainable destination is an initiative cutting across emission impact domains reducing emissions from transportation and mobility, energy, waste and buildings by working with the tools connected to destination development. Seven times in a row, Gothenburg has ranked as the world's most sustainable destination according to the Global Destination Sustainability Index. And in 2021, Lonely Planet named Gothenburg the world's Best sustainable city stay. To keep this leading position requires even more developed and broad efforts engaging key actors across the City organisation as well as the tourism sector, accommodation, restaurants, events, etc.

Partnerships with academia
The City is also engaged in partnerships with academia. The City, Chalmers University of Technology and Gothenburg University has ongoing collaboration with one focus area for in-depth collaboration on "A fossil-free Gothenburg".

Urban Futures – Centre for Sustainable Urban Development is an important platform for developing knowledge, networks and transdisciplinary methodology to address sustainability challenges, not least concerning governance for a just climate transition. The platform is regional and includes the City of Gothenburg, Chalmers University of Technology, the University of Gothenburg, RISE Research

Institutes of Sweden, IVL – Swedish Environmental Research Institute, GR – the Gothenburg Region, VGR – Region Västra Götaland, and the West Sweden County Administrative Board.

Wexsus (West Sweden Nexus for Sustainable Development) is a new platform under development. It is a collaborative arena run jointly by Chalmers University of Technology, the University of Gothenburg and University West. The platform connects all sectors of society and build relationships to strengthen the ability to implement a sustainable transition based on research-based knowledge.

Citizen inclusion interventions

A society where people's commitment is taken care of is the basis for a strong democracy, as well as for strengthening social innovation. Therefore, it is important that the City of Gothenburg continues to develop its capacity and ability to cooperate and include citizens and civil society organisations to a greater degree. This requires both new ways of working, organization and many times also a cultural change in the City. The City is currently building a stronger infrastructure for democratic action, consisting of tools and methods for citizen dialogue and engagement such as citizens proposals, citizen budget and open arenas for dialogue. In addition to that, the City has initiated a new citizen assembly taking place in spring 2024 where the participants will work on the question of how citizens can become more involved in the climate transition.

There are already many civil society and community driven initiatives in Gothenburg contributing towards the transition to a climate neutral city, but the local government needs to improve its capacity to collaborate and take advantage of the engagement already existing, including enabling for new bottom-up initiatives. Plans are being developed in order to work in a more structured way with civil society. The aim is to explore how dialogue and cooperation can be improved, potentially leading to a new way of co-creating solutions to become a climate neutral city.

Initiatives that will support this development towards 2030 and onwards are constantly being processed.

Initiatives providing different types of platforms to support this development are:

- An **Infrastructure for democratic action and participation** is being developed to strengthen the City organisation and enhance organisational and personal skills for democratic action and participation.
- The test of a **Citizen assembly** as a social innovation and citizen inclusion method.
- A **Civil society platform for climate and environmental transition,** a concept currently under development with the aim of creating more common action towards the mission together with civil society organisations.
- "**The Futureable City**" – an ambulant concept for stakeholder and citizen dialogue about the sustainable future of the City.
- "**The Transition City**" – a concept which is at an early stage and not yet formed, but with ambitions to fill a perceived gap of supporting initiatives towards the mission.
- **Frihamnsdagarna** – an annual democracy festival and an arena for city dialogue around many issues including sustainability and climate transition.
- **Virtual Gothenburg** – a digital twin that provide tools for citizen involvement and shared understanding.

Introduction to table C-1.2

The following table C-1.2 gives an overview of governance innovation interventions. The table lists involved stakeholders, and the underlined stakeholder for each intervention is the main responsible actor. Opportunities and barriers that the interventions are linked to are described in section A3.

C-1.2: Relations between governance innovations, systems, and impact pathways					
Intervention name	Description	Systemic barriers / opportunities addressed	Leadership and stakeholders involved	Enabling impact	Co-benefits
Overarching governance innovation interventions					
Climate Transition Function	To create the conditions for effective decision-making within the City's management and governance that are required to achieve the City's climate targets.	**Barriers:** Silo organisation, multi-actor impact, Knowledge, Skills and leadership, Uncertainty. **Opportunities:** Degree of City control, cross-sector collaboration.	The City. Environmental Administration, all municipal administrations and companies, whereof key organisations listed in C1.1.	Enables city-wide bridging governance required to achieve the climate transition. Processing of new development pathways based on systemic change perspectives.	Intervention of an overarching character. Supports several co-benefits indirectly.
Climate Budget	A methodology underway aiming for a city-wide framework to link climate mitigation measures to the climate targets, effective management of emissions data and visualisation of the progress of the climate action plan.	**Barriers:** Silo organisation, Knowledge, Skills and leadership. **Opportunities:** Digitalisation and visualisation, Degree of City control.	The City. Environmental Administration, all municipal administrations and companies.	Contributes to raising awareness of the City's carbon footprint and required actions for achieving climate targets. Follow-up and planning instrument for implementing the right measures.	Contributes to efficient measures (economic perspective). Intervention of an overarching character. Supports several co-benefits indirectly.
The seven cross-cutting strategies	New working structure for areas within the climate and environmental transition that require a high degree of collaboration and new cross-cutting solutions.	**Barriers:** Silo organisation, Knowledge, Skills and leadership, multi-actor impact. **Opportunities:** Degree of City control, Co-benefits,	The City. Environmental Administration, all municipal administrations and companies. Each strategy has a different responsible	The strategies aim to bring about change-driven development to accelerate the transition to a sustainable city.	Intervention of an overarching character. Supports several co-benefits indirectly.

		Cross-sector multi-actor collaboration.	organisation for coordination.		
Strategy: We act as forerunners	New working structure to address enabling factors for the City to be successful: - governance, leadership and skills, - communication - collaboration - influence	**Barriers:** Silo organisation, Knowledge, Skills and leadership, multi-actor impact, multi-level governance **Opportunities:** Degree of City control, citizen inclusion, innovative culture and portfolio thinking, cross-sector multi-actor collaboration	Environmental Administration, all municipal administrations and companies.	Aiming to level up climate mitigation measures and increase transition pace.	Intervention of an overarching character. Supports several co-benefits indirectly.
Strategy: We work strategically on financing to accelerate the transition	New working structure addressing improved financial knowledge and capacity, innovative approaches and investment priorities.	**Barriers:** Silo organisation, Financing and business models, Fragmented innovation. **Opportunities:** Degree of City control, Green bonds and financial mechanisms.	The City. Environmental Administration, all municipal administrations and companies.	To finance climate mitigation measures and prioritise investments to maximise positive impact.	Sound decisions from socio-economic and municipal economic perspectives.
The Climate Council	A council of seven researchers from different disciplines supporting the City with proposals in further measures on climate mitigation.	**Barriers:** Knowledge, Skills and leadership, Uncertainty. **Opportunities:** Degree of City control, Co-benefits,	Seven researchers from Chalmers University of Technology, Gothenburg University and Halmstad University.	Independent expertise to support the City's transition with proposals of feasible and specific measures.	Intervention of an overarching character. Supports several co-benefits indirectly.

		Cross-sector multi-actor collaboration.	Commissioner: City Council		
Testbed Gothenburg	An inclusive initiative to inspire and discuss test beds: development, business models and collaboration opportunities. Based on existing testbeds with the aim of raising the level further and opening up to new actors.	**Barriers:** Multi-actor impact, Fragmented innovation. **Opportunities:** Innovative culture and portfolio thinking.	Johanneberg Science Park, City of Gothenburg, Business Region Gothenburg, RISE, Chalmers, Gothenburg University	Through collaboration at a completely new level, this initiative aims to accelerate development, build unique, world-leading knowledge and utilise the region's innovative power to meet tomorrow's challenges.	Contributes to job creation and a growing economy, raising knowledge level among involved stakeholders. Intervention of an overarching character. Supports several co-benefits indirectly.
Virtual Gothenburg	A digital twin is being developed to address the increasing societal challenges of climate change, segregation and the complexity of society at large.	**Barriers:** Knowledge, Skills and leadership, Uncertainty **Opportunities:** Digitalisation and visualisation, Citizen inclusion, Social innovation.	Urban Planning Administration, Lindholmen Science Park.	Creates new opportunities to better describe, understand, plan and manage the City. Enables better basis for decision-making and understanding of the challenges and solutions related to climate neutrality.	More efficient decision making and knowledge sharing.
The Knowledge Arena	An innovation and digitalisation initiative to enhance innovation capacity within the City, a digital platform, courses and seminars	**Barriers:** Fragmented innovation, Skills and leadership. **Opportunities:** Digitalisation and visualisation, Innovative culture and portfolio thinking.	City Management Office, all City administrations and Companies		A more efficient organisation (economic dimensions of City governance). Intervention of an overarching character. Supports several co-benefits indirectly.
Multi-level governance innovation interventions					

Viable Cities	A national strategic innovation programme for climate-neutral cities.	**Barriers:** Multi-actor impact, Multi-level governance, Geographical spread, Knowledge, Skills and leadership. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking.	KTH Royal Institute of Technology, 6 national authorities, 23 cities, many more members and partners from across sectors.	Develop common working methods, multi-level governance, collaboration within and between cities and actors.	The aim of the innovation programme is to support climate neutrality of cities by having a holistic approach where synergies and co-benefits are important parts of the theory of change.
Net Zero Cities	Project within Horizon 2020 designed to help cities overcome the current structural, institutional and cultural barriers they face in order to achieve climate neutrality by 2030.	**Barriers:** Multi-actor impact, Multi-level governance, Geographical spread, Knowledge, Skills and leadership. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking.	EIT Climate-KIC, 34 organisations, 112 Mission cities.	Building capabilities, forging a platform with tools, resources and expertise for rapid learning.	The aim of the innovation programme is to support climate neutrality of cities by having a holistic approach where synergies and co-benefits are important parts of the theory of change.
Orchestrate climate transition through collaboration and networks	The City will contribute to and use networks and collaborations on local, regional, national and international levels in a more coordinated way aiming to orchestrate a higher transition speed.	**Barriers:** Multi-actor impact, Multi-level governance, Geographical spread, Knowledge, Skills and leadership. **Opportunities:**	Environmental Administration, Climate-KIC, Intelligent Cities Challenge, Covenant of Mayors, Green City Accord, EuroCities, ICLEI, FossilFree Sweden, RUS,	Using the city's networks and collaborations in a coordinated and intentional way will increase learning, influence, resources and pace of transition.	A more efficient use of resources when aggregated. Use of other organisations resources (economic dimensions of City governance). Intervention of an overarching character.

			Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking.	Klimatkommunerna, Swedish Association of Local Authorities and Regions, Climate Transition Function, and more.		Supports several co-benefits indirectly.
West-Sweden regional mobilisation	An ambition to regionalise efforts and building alliances to cities and organisations striving for net zero.	**Barriers:** Multi-actor impact, Multi-level governance, Geographical spread, Knowledge, Skills and leadership. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking.		City of Gothenburg, The Gothenburg Region (13 municipalities), Region Västra Götaland, City of Borås, Trollhättan Municipality, Mariestad Municipality. County Administrative Board of Västra Götaland.	Stronger influence, more resources, broader learning, collaboration in measures with regional scope for greater implementation.	A more efficient use of resources when aggregated. Use of other organisations resources (economic dimensions of City governance). Intervention of an overarching character. Supports several co-benefits indirectly.
Municipalities' 30 climate pledges	An initiative within the 'Climate 2030 - Västra Götaland is changing' The municipalities have a strategically important role in achieving the climate goals. The municipalities' climate pledges consist of 30 concrete measures over which the municipality has control, which are tried and tested, and			Region Västra Götaland, County Administrative Board Västra Götaland. 50+ municipalities.	In 2021 and 2022, the municipalities in Västra Götaland have together implemented climate pledges that are estimated to reduce emissions by more than 75,000 tonnes of carbon dioxide equivalents. For 2024-2026, most of the municipalities in Västra Götaland have now submitted their climate pledges, with a total of around 800 pledges being adopted.	A more efficient use of resources when aggregated. Use of other organisations resources (economic dimensions of City governance). Intervention of an overarching character. Supports several co-benefits indirectly.

	which can lead to major emission reductions.				
Multi-actor governance innovation interventions					
The Gothenburg Platform for Climate-Neutral Construction	Platform to gather actors throughout the value chain around ten concrete commitments, which are based on the five key factors in the roadmap for a fossil-free building and construction sector.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	130 organisations in the collaboration throughout value chain.	Together and action-oriented, the actors quickly and powerfully reduce climate impact in practice, in a learning and inclusive environment. Plans to scale regionally and to more key stakeholders in the area.	Job creation, new businesses and new branches of industry, economic advantages, less and more sustainable resource use.
The Handshake	Building a new market for reuse of construction materials through a signed declaration of intent in which they promise to scale up their work and efforts in circular construction.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models,	50 private and public organisations from four stakeholder groups; the City's property and facility owners, private and other property owners, the industry organization The Property Owners,	Rapid emission reductions through circular construction requires a systemic shift in business models, pricing, procurement, collaboration between actors and change of norms and regulations.	Job creation, new businesses and new branches of industry, economic advantages, less and more sustainable resource use.

		Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	Business Region Gothenburg.		
Gothenburg Green City Zone	Within three different geographical areas the focus is on testing, evaluating and implementing new solutions, methods and processes, generating knowledge on emission free transportation	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	Business Region Gothenburg, Volvo Cars, RISE, Research Institutes of Sweden Chalmers University of Technology, Gothenburg University, Johanneberg Science Park, Swedish Exhibition & Congress Center, City of Mölndal.	Driving change in all parts of the transport system and in the entire Gothenburg region to accelerate transition.	Job creation, new businesses and new branches of industry, economic advantages, less and more sustainable resource use, decrease of noise and air pollution, less congestion, more efficient use of urban areas, enabling greening of urban areas.

Fashion, Facts and Fun	Platform for collaboration with the fashion industry to contribute to more sustainable and competitive business models.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	Business Region Gothenburg, Region Västra Götaland, Science Park Borås, TEKO – Swedish trade and employers' association for companies working in the textile and fashion industry, Nordic Textile Academy, Swedish Fashion Council, Swedish Commerce, RISE, City of Borås, Tillskärar-akademin in Gothenburg, West Sweden Tourist Board, Wargön Innovation, Borås University, Region Borås.	Transition of an industrial sector, having implications on sustainable clothing consumption and consumption-based emissions in Gothenburg and elsewhere.	Contributes to maintained or increased competitiveness of the local fashion industry, job creation/maintenance.
Public transport for the future	A portfolio of initiatives and projects in collaboration between actors to develop public transport at the intersection with for example micro-mobility, car sharing and new approaches for public transportation.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration	Västtrafik, Keolis, GoMore, Urban planning administrations in Gothenburg and other municipalities in the region.	Enabling collaboration and outside-the-box solutions for a seamless and more attractive public transportation – to gain market shares from unsustainable travel.	Job creation, new businesses and new branches of industry, economic advantages, less and more sustainable resource use, decrease of noise and air pollution, less congestion, more efficient use of urban areas.

		, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.			
Climate-leading Process Industry	Platform for collaboration, working group meetings, meetings with decision-makers. Initiates innovation and development projects in the chemical and process industry.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	Lindholmen Science park, Adesso Bioproducts, Adven, Afry, BASF, Bioshare, Borealis, Business Region Gothenburg, Chalmers, Chalmers Industriteknik, Confidere, Cowi, Designed Chemistry, Essity, Fortum Waste Solutions, Polyfuels, Gladium, Göteborg Energi, Hansson & Friborg, University of Borås, IKP, Inovyn, IVL Swedish Environmental Institute, JWR Engineering, Lantmännen, Linde, Liquid Wind, Lysekil Municipality, Meva Energy, Molekylverkstan, Mölnlycke Health Care, Nordion Energi, Novoplast, Nouryon,	Contributes to a fossil free region through catalysing efforts within the chemical and process industry.	Economic growth and job creation, maintained or increased competitiveness, diverse positive environmental impacts.

			Nynas, Ohla Plast & Färgteknik , Out of Ocean, Perstorp, Preem, Profu, Rejlers, Renova, RISE, Scandinavian Enviro Systems, Siemens, Siemens Energy, Stena Metall, Stenungsund municipality, Södra, Uniper, Vattenfall, Region Västra Götaland and Wendelsbergs beräkningskemi AB.		
ElectriCity	Demonstration arena for collaboration where industry, research and society develop and test solutions for tomorrow's electrified transport. Quiet, emission-free buses, work machines, ferries and even heavy vehicles powered by renewable electricity are included in the demo arena.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-	Lindholmen Science Park, AB Volvo, Region Västra Götaland, Västtrafik, City of Gothenburg, Chalmers Technical University, Göteborg Energi, Keolis, Älvstranden Utveckling, Akademiska Hus, Ericsson, ABB, Transdev, Renova.	ElectriCity develops, tests, demonstrates and evaluates solutions that can contribute to sustainable, electrified travel and transport, thereby creating new opportunities for future urban development.	Job creation, new businesses and new branches of industry, less and more sustainable resource use, decrease of noise and air pollution.

		benefits, Degree of City control.			
The Green Connection	A portfolio of linked initiatives together with numerous actors with the ambition to become the world's most sustainable port and lower carbon emissions by 70% by 2030. Includes the port itself and the entire logistics chain.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.	Port of Gothenburg, Göteborg Energi, AB Volvo, Scania, Swedish Transport Administration, APM Terminals, Stena Line, shipping companies, logistics companies, combi-terminals in Sweden and Norway, other international ports with similar ambitions, and more.	Enables large efficiency measures of the logistics chain, infrastructural and technical shifts as well as new business models and collaboration across the logistics chains.	Economic advantages, higher efficiency, lower resource use, reduced environmental impact on land and sea, maintained or increased competitiveness.
The world's most sustainable destination	To keep this leading position requires even more developed and broad efforts engaging key actors across the City organisation as well as the tourism sector, accommodation, restaurants, events, etc.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours.	Gothenburg & Co, Got Event, Sustainable Waste and Water, Business Region Gothenburg, a broad network of local actors and companies within the destination/tourism/leisure industry.	Enabling emission reduction across emission impact domains. Reducing emissions from transportation and mobility, energy, waste and buildings by working with the tools connected to destination development.	Economic growth of companies within destination and tourism, maintained or increased competitiveness, diverse positive environmental impact, less waste, decreased resource use, less chemical use, more attractive and livable city/neighborhoods, less noise and air pollution.

		Opportunities: Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control.		Behavioural changes of citizens and visitors.	
The food system collaboration node	Implementation of a coordination function for sustainable local food in the city.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Financing and business models, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control, Social innovation.	Environmental Administration, Land Development Administration, Democracy and Citizen Service, Purchasing and Procurement Administration, Meal Service Administration, Business Region Gothenburg, Göteborgs Stads Leasing, County Administrative Board of Västra Götaland, Västra Götaland Region, RISE, Lindholmen Science Park.	Enhances collaboration between the City's food system actors based on the current governance, but add the system perspective to include each unit or part that contributes to the transition. Enables systemic measures to reduce emissions from food.	Job creation, new business branches within the food sector, economic growth of local food chain, greening of urban areas, more efficient resource use, more livable and attractive city/neighbourhoods, increased city resilience, increased public health.

Citizen inclusion interventions

Infrastructure for democratic action and participation	A package of infrastructure, tools, policy, cross-sectoral networks within the City being developed to increase participation of citizens in the City's processes.	**Barriers:** Knowledge, Skills and leadership, Societal norms and behaviours. **Opportunities:** Co-benefits, Just transition, Citizen inclusion, Social innovation.	Democracy and Citizen Service Administration, all City Administrations and Companies.	Enhance skills and capacity among politicians, leaders and employees across the City's organisation in order to ensure an inclusive pathway towards climate neutrality.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.
Citizen assembly	Citizen assembly focused on environmental and climate transition.	**Barriers:** Multi-actor impact, Knowledge, Societal norms and behaviours, Political implications, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.	Environmental Administration, Democracy and Citizen Service Administration	An inclusive method to reflect the entire population in Gothenburg, enabling new ideas and solutions with higher receptiveness	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.
Civil society platform for climate and environmental transition	A platform under development to gather interested CSO:s for collaboration and co-creation of measures for climate neutrality.	**Barriers:** Multi-actor impact, Knowledge, Societal norms and behaviours, Political implications, Degree of City control.	Environmental Administration, Democracy and Citizen Service Administration, all City administrations and City companies, CSO:s of Gothenburg.	Enables action-focused collaboration through participatory governance, building a movement of different actors towards the mission.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character.

		Opportunities: Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.			Supports several co-benefits indirectly.
"The Transition City"	A cohesive initiative from the City under development aiming to communicate, support, inspire to and enable climate neutrality initiatives and social innovation through citizen involvement and City–citizen collaboration.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Political implications, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.	Environmental Administration, Democracy and Citizen Service Administration, all other City administrations and City companies.	Enables action-focused collaboration through participatory governance, building a movement of different actors towards the mission.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.
"The Futureable City"	An ambulant concept for dialogue open to different city stakeholders and citizens to discuss and gain deeper knowledge and understanding about solutions for a futureproofed city.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Political implications, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration,	Democracy and Citizen Service Administration	Enables an arena for action-focused collaboration through participatory governance, building a movement of different actors towards the mission.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.

		Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.			
Frihamnsdagarna (The Frihamn Days)	An annual democracy festival and Sweden's new arena for change, sustainability, and democracy.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Political implications, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.	The economic association Frihamnsdagarna, and different partners each year.	Enables an arena for action-focused collaboration through participatory governance, building a movement of different actors towards the mission.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.
Virtual Gothenburg	A digital twin is being developed to address the increasing societal challenges of climate change, segregation, and the complexity of society at large.	**Barriers:** Knowledge, Skills and leadership, Uncertainty **Opportunities:** Digitalisation and visualisation, Citizen inclusion, Social innovation, Mission orientation.	Urban Planning Administration, Lindholmen Science Park.	In addition to the description in C.1.2, the digital twin will be essential to provide tools for citizen involvement and shared understanding of challenges and solutions related to climate neutrality.	Informed decisions for more efficient governance, acceptance of measures with diverse positive environmental impact. Intervention of an overarching character. Supports several co-benefits indirectly.

4. 2 Module C-2 Social Innovation Interventions

This module lists the actions taken by the City to support and foster social innovation initiatives or non-technological innovation more broadly (e.g., in entrepreneurship, social economy, social awareness & mobilization, social cohesion and solidarity, etc) aimed to address the systemic barriers and leverage the opportunities identified in Module A-3.

C-2.1 Relations between social innovations, systems, and impact pathways					
Intervention name	Description	Systemic barriers / opportunities addressed	Leadership and stakeholders involved	Enabling impact	Co-benefits
Strategy: We create conditions for sustainable living	New working structure canalising the City's efforts to use all its available tools and policy instruments to create conditions for a sustainable lifestyle for its citizens.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Political implications, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Social innovation, Mission orientation.	Democracy and Citizen Service Administration, in collaboration with all other City administrations and City companies.	Enables sustainable lifestyles and reduced emissions from consumption (products and services, leisure, food, housing, travel, etc)	Diverse positive environmental impact, less resource use, improved health, social cohesion.
User-centered innovation initiative	An initiative providing courses, knowledge sharing and a toolbox to	**Barriers:** Knowledge, Skills and leadership, Societal norms	Democracy and Citizen Service Administration, City Management Office.	To maximize outcome of solutions in line with the mission of	Informed decisions and service development for more efficient governance.

	develop organisational and personal skills to better form solutions by and for the users, often citizens.	and behaviours. **Opportunities:** Co-benefits, Just transition, Citizen inclusion, Social innovation.		climate neutrality, a key is to put people in the center of solutions.	Intervention of an overarching character. Supports several co-benefits indirectly.
Just Transitions Graduate School	The positioning of the graduate school at the intersection of a number of different but interconnected fields of research and practices relating to governance, climate change, urban justice, and transdisciplinary and cross-border cooperation, marks an important step in linking together past knowledge and experience in all these fields. In this way, an integrated perspective on management and governance is developed to address the challenges society faces in achieving a just climate transition.	**Barriers:** Knowledge, Skills and leadership. **Opportunities:** Co-benefits, Just transition.	University of Linköping, Urban Futures – Centre for Sustainable Urban Development, Chalmers University of Technology, University of Gothenburg, City of Gothenburg, Region Västra Götaland, City of Linköping, Norrköping Municipality, the County Administrative Board of Östergötland	The aim of the Just Transitions graduate school is to build knowledge and competence about how a just climate transition can be implemented in a local context, including eight PhD students.	Enables more efficient governance, cross-fertilization of issues.

Urban infrastructure for a circular and sharing economy	Encourage and collaborate with actors in urban development who can influence people's local environment and develop sustainable and circular services and offerings in consumption, leisure and entertainment.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation, Mission orientation.	Democracy and Citizen Service Administration, Urban Environment Administration, Culture Administration, Land Administration Administration, Förvaltnings AB Framtiden, CSO:s of the circular and sharing economy.	Enables a stronger infrastructure for citizens to have the utilities at hand to adopt more sustainable lifestyles and reduce emissions from private consumption.	Job creation, new business branches/diversified economy. Diverse positive environmental impact, less resource use, improved health, social cohesion, equal opportunities to meet certain everyday needs.
The Smart Map	A social innovation and digital platform showing the way to sharing and circular initiatives in the city	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Degree of City control. **Opportunities:** Digitalisation and visualisation, Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation,	Kollaborativ Ekonomi Sverige, Democracy and Citizen Service Administration, Business Region Gothenburg, Gothenburg&Co.	Makes the infrastructure visible for citizens to use utilities for sustainable lifestyles and reduce emissions from private consumption.	Diverse positive environmental impact, less resource use, improved health, social cohesion, equal opportunities to meet certain everyday needs.

		Mission orientation.			
Reallocate	Living labs to find interventions that catalyse change in mobility practices, focusing on school children's active travel in peri-urban areas as well as seamless travel, citizen engagement and nudging tools in Korsvägen, a complex mobility hub.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Degree of City control. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation.	Urban Environment Administration	Finding social innovation solutions to challenges connected to mobility and greenhouse gas emissions.	Improved health, more attractive and liveable neighbourhoods, reduced noise and air pollution, less congestion, increased road safety.
Green City Zone - Social innovation	Develop the concept as described in C.1.1-2, adding the citizen inclusion and behavioural change to a larger degree	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Societal norms and behaviours, Degree of City control, Fragmented innovation. **Opportunities:** Cross-sector multi-actor collaboration, Co-benefits, Just transition, Citizen inclusion, Social innovation,	Business Region Gothenburg, Volvo Cars, RISE, Research Institutes of Sweden Chalmers University of Technology, Gothenburg University, Johanneberg Science Park, Swedish Exhibition & Congress Center, City of Mölndal.	Adding citizen inclusion and behavioural change creates better conditions for systemic change.	Improved health, more attractive and liveable neighbourhoods, reduced noise and air pollution, less congestion, increased road safety.

		Mission orientation.			
Sustainable destination and climate smart events	The pathway towards the most sustainable destination described in C.1.1-2 is a catalyser for behavioural change inspiring citizens and visitors towards climate neutrality.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration , Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control, Social innovation, Mission orientation.	Gothenburg&Co, Got Event, Sustainable Waste and Water, Business Region Gothenburg, Greentopia, a broad network of local actors and companies within the destination/tourism/leisure industry.	Understanding that events and tourism pose a window of opportunity for a higher receptiveness to behavioural change, an explorative work in this field can contribute to lasting changes in behaviour for both citizens of Gothenburg and people elsewhere.	Economic growth of companies within destination and tourism, maintained or increased competitiveness, diverse positive environmental impact, less waste, decreased resource use, less chemical use, more attractive and liveable city/neighborhoods, less noise and air pollution.
Single-use free city	An initiative paving the way for the elimination of single -use food and drink packaging by being ahead of regulation, testing and scaling up solutions.	**Barriers:** Multi-actor impact, Knowledge, Degree of City control, Fragmented innovation, Societal norms and behaviours.	Gothenburg&Co, Got Event, Sustainable Waste and Water, Innerstaden Göteborg Association, Avenyföreningen Association, Urban Environment Administration, TINT.	Enables a shift within behavioural change connected to emissions from waste and resource use.	Less resource use, less littering, lower costs for city cleaning, attractive city/neighbourhoods, increased competitiveness and less costs by being ahead of legislation.

		Opportunities: Cross-sector multi-actor collaboration , Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control, Social innovation, Mission orientation.			
The urban and peri-urban food production stimulant	An initiative with a portfolio of activities and projects aiming to stimulate more citizens and entrepreneurs to be part of food production and build the local food system stronger.	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Fragmented innovation, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration , Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree	Land Development Administration.	Enables emission reductions within food, water and green areas emission impact domain as well as transportation.	Job creation, new business branches within the food sector, economic growth of local food chain, greening of urban areas, more efficient resource use, more liveable and attractive city/neighbourhoods, increased city resilience, increased public health.

		of City control, Social innovation, Mission orientation.			
Private consumption & Consumption-based emission tools	Integration of consumption-based emissions in map planning tool and awareness raising	**Barriers:** Multi-actor impact, Knowledge, Skills and leadership, Degree of City control, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration , Societal norms and behavioural change, Co-benefits, Degree of City control, Social innovation, Mission orientation.	Democracy and Citizen Service Administration, other City administrations and companies.	Enables new ways of working with emission reductions, especially relevant from a citizen point of view.	Better informed decisions, more efficient governance/measures, social cohesion.
Way out West	Gothenburg's most famous annual music festival has a focus to inspire visitors and exchange ideas on greener lifestyles. The City has collaborated dedicatedly with the	**Barriers:** Multi-actor impact, Degree of City control, Fragmented innovation, Societal norms and behaviours. **Opportunities:** Cross-sector multi-actor collaboration	Luger, Göteborg&Co, Greentopia.	Enables behavioural change and a meeting point to spur social innovation and interaction between citizens, businesses and public authorities with a	Diverse positive environmental impact, less resource use, improved health, social cohesion.

	festival, with good results, and with the devotion to continue along the same path.	, Innovative culture and portfolio thinking, Societal norms and behavioural change, Co-benefits, Degree of City control, Social innovation, Mission orientation.		bottom-up approach.	

C-2.2: Description of social innovation interventions

Introduction to social innovation interventions

Strongly connected to innovative culture and citizen inclusion, social innovation tackles the societal challenges that is reaching climate-neutrality with a bottom-up, collaborative, holistic and human-centred approach to innovation.

The governance innovation interventions described in C.1 are not isolated from the social innovation interventions. Some interventions described in this section focus on how the governance innovations will be further developed to grasp the social innovation aspect to a larger extent.

What the social innovation interventions have in common is a focus on overcoming the systemic barriers of societal norms and behaviours, political implications, knowledge, skills and leadership described further in section A.3. The social innovation interventions have the potential to enable more rapid change towards the mission of climate neutrality through unleashing the potential of the systemic opportunities. Important opportunities for these interventions are cross-sector multi-actor collaboration, co-benefits, just transition, citizen inclusion and, of course, social innovation.

Capacity building within the City

Within the City organisation there is a need for continuous work on building skills and capacity to better make use of social innovation as a tool for unlocking potential. Initiatives supporting this are:

- The **Strategy: We create conditions for sustainable living** which from a strategic point aims to canalise the City's effort to a sustainable living in Gothenburg.
- **User-centered innovation initiative** – capacity building to put people in the center of solutions, based on a Design Thinking methodology.
- **Just Transitions Graduate School** will build knowledge and train eight PHD students on how a just transition can be implemented in the local context of a city.

Urban infrastructure and culture of a circular and sharing economy

Opportunities to make sustainable choices are often associated with the range and conditions available in and around homes, neighborhoods and in commercial centers. An important focus is therefore to encourage and collaborate with actors in urban development who can influence people's local environment and develop sustainable and circular services and offerings in consumption, leisure and entertainment.

The City of Gothenburg has during many years facilitated the development of the circular and sharing economy in Gothenburg in order to enable a more resource efficient consumption and lifestyle for its citizens. Gothenburg was previously part of the national program Sharing Cities Sweden, where the city became a testbed for developing new concepts and service for sharing products and space, such as Sweden's first toy library, but also exploring how the sharing economy can become integrated in new urban development projects. As part of the "15-minute city concept", that has inspired many cities during recent years, the City of Gothenburg has also just started its journey on developing local squares and neighbourhoods, where the eco-system of sharing and circular economy initiatives must be integrated as well.

The City government is as well cooperating with the civil society organization Kollaborativ Ekonomi Sverige who developed the Smart Map Start - Smarta Kartan | Gothenburg launched in 2016, a social innovation and digital platform showing the way to sharing and circular initiatives in the city. The challenge for many NGOs and community driven sharing initiatives is access to premises to a low rent to run their activities. The City of Gothenburg is currently revising its grant system for civil

society organisations to better meet the needs of those organisations active in the sharing economy.

Private consumption & Consumption-based emission tools
Since private consumption accounts for approximately 60 percent of the consumption-based climate emissions in Gothenburg, it needs to decrease drastically for the City to reach its climate goals. As part of the Environment and Climate Programme, the City has a strategy focusing on creating the conditions for a sustainable consumption and lifestyle for those who live, visit and work in Gothenburg. This requires the City to use all available tools and policy instruments, for example planning Gothenburg in a manner that facilitates a sustainable lifestyle and offering services and events always being environmentally and climate friendly.

The task of reducing consumption-based emissions is complex and depends on a variety of factors and solutions taking place on all political levels. In addition to that, it is important to recognize the fact consumption-based emissions vary a lot between different income groups in society. Recent research from Stockholm Environment Institute calculates consumption emissions down on post code level for every municipality in Sweden. The City of Gothenburg has incorporated this data in its own map planning tool Gokart. The next step is to continue increasing awareness among civil servants and politicians on how consumption-based emissions vary a lot among groups and geographical areas of Gothenburg in order to develop more sharp and efficient measures.

Focus area consumption
The initiatives described above can be seen in the context of social innovation initiatives focused on consumption. An overview of the initiatives shows:

- **Urban infrastructure for a circular and sharing economy** – creating the utilities needed for circular consumption through collaboration within the City and together with CSO:s.
- **The Smart Map** – a social innovation and digital platform enabling circular initiatives.
- **Single-use free city** - An initiative paving the way for the elimination of single-use food and drink packaging by being ahead of regulation, testing and scaling up solutions.
- **Private consumption & consumption-based emission tools** – an innovative analyse tool under development.
- **Sustainable destination and climate smart events** – an initiative comprising consumption broadly but with the departure point of events and Gothenburg as a destination.
- **Way out West** – Gothenburg's most famous annual music festival has a focus to inspire visitors and exchange ideas on greener lifestyles. The City has collaborated dedicatedly with the festival, with good results, and with the devotion to continue along the same path.

Focus transportation
Initiatives within the field of social innovation interventions focused primarily on transport and mobility are:

- **Gothenburg Green City Zone –** emission free transportation zones with the ambition to widen efforts towards scaling-up through social innovation tools.
- **Reallocate** – living labs to find interventions that catalyse change in mobility practices.

Focus food production
The initiative within the field of social innovation interventions focused primarily on food is:

- **The urban and peri-urban food production stimulant** – a portfolio of activities and projects to stimulate more citizens and entrepreneurs to take part in sustainable food production.

4 Outlook and next steps

This section should draw any necessary conclusions on the CCC Action Plan above and highlight the next steps and plans for refining the CCC Action Plan as part of the Climate City Contract in future iterations.

Plans for next CCC and CCC Action Plan iteration

This 2030 Climate Neutrality Action Plan, as part of Gothenburg's Climate City Contract, is the first plan of this kind that the City has generated and will act as the foundation for future versions.

Looking at the different parts of the Climate City Contract together, further development is needed to assist the City along the pathway ahead. The City will continue to base future investment plans on modelling in combination with an inventory of ongoing activities. The City needs to identify effective ways of working based on interaction between top-down and bottom-up processes to produce an investment plan that is as relevant as possible. The Action Plan, with its measures and calculated emission reduction impact, is also a subject for further work on consolidating the top-down and bottom-up perspectives.

The forming of the Action Plan, as well as the Investment Plan and Commitment, has generated new insights that need to influence the content and procedures of the Environment and Climate Programme as well as other relevant governing documents and processes.

The Action Plan needs to be refined and continuously iterated to be a relevant tool for the City and its partners. A prognosis regarding the City's progress will need to be looked at annually and justly revised in conjunction with the operational planning for the City's administrations and companies.

The Environment and Climate Programme, including the City-wide Environment Management System, has well-planned structures of evaluation and revision. The National Climate Contract, conducted in a process together with 22 other Swedish municipalities and six national authorities, has an additional procedure with an annually edited and signed contract. Now, forming a Climate City Contract as part of the climate neutral and smart cities on an EU-level, adds to the complexity. All these three main processes have additional values to the City of Gothenburg, and therefore it is crucial that these processes are aligned to provide maximum output. Put together, they also need to be streamlined to enable the City and other involved stakeholders to focus limited resources on the right things. Exactly how this alignment will look like in detail, is not possible to outline in this early stage and need to be further examined. The Climate City Contract in its complete form will be revised annually or biannually.

Monitoring and accelerating learning

The governance innovation interventions that the City of Gothenburg has developed, and will continue to develop, will contribute to the collective learning and shared knowledge that is necessary for dealing with the uncertainty that comes with climate transition.

The Climate Transition Function is a central tool to orchestrate co-action, but also co-learning. The Climate Transition Function is developing climate transition scenarios, which provide knowledge on how the different City departments and companies need to act, and how the management needs to adapt in relation to the scenarios. Together with the Climate Budget, the City will be better placed to manage emissions data and plan future measures. The interventions to coordinate the work within the City organisation need to be connected to the collaborative work with other actors, other levels and the citizens. From strengthening these connections, the City will have better preconditions to

carry out sensemaking, reflection and synthesis based on a strong knowledge base. This is crucial for being successful when working in a system transforming way.

Conclusions from the accelerated learning is absorbed by the processes of the Environment and Climate Programme, including the City-wide Environment Management System and the seven cross-cutting strategies, where actions of different character, both short-term and long-term, will be incorporated. The Environment and Climate Programme is monitored every second year and is also subject for revision, the next revision taking place 2025. Learnings from the Climate City Contract will be included in the monitoring of the programme. The monitoring process means that there is a constant learning loop within the City, forming preconditions for utilising the accelerated learning.

The Climate City Contract
The Climate City Contract is more than a document. It is a process of assembling all relevant efforts and plans, and for connecting most relevant stakeholders around the City's ambition to reach its climate goal. Continuous revision will ensure that it will be a continuous tool for joint information sharing, collaboration and decision-making. Together with the Climate Transition Strategy and the national climate contract, the Climate City Contract will be much more than a manifestation – it will be one of the City's most important tools for successful climate transition.

5 Annexes

1. The City of Gothenburg's Environment and Climate Programme 2021-2030
2. The City of Gothenburg's Energy Plan 2022-2030
3. Budget for Gothenburg City 2024
4. CDP-ICLEI Track 2023