

Helsinki

Carbon Neutral Helsinki

Action Plan



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Content

Emissions reduction target and development	4
Emissions reduction target	4
Key sources of emissions	5
Development and monitoring of emissions	8
Principles of the emissions reduction plan	10
Definitions of the actions	10
Target monitoring and updates to the actions	11
Management	13
Other climate-related work	13
Sources	14
APPENDIX 1:	
Actions in the emissions reduction plan	16
Previous policies and their progress	16
New actions proposed in 2022	18
APPENDIX 2:	
Actions in the Carbon Neutral Helsinki 2035 Action Plan	28
APPENDIX 3:	
Cost effects of emissions reductions	36



Emissions reduction target and development

Emissions reduction target

Helsinki has set a target of becoming carbon neutral by 2030, attaining carbon zero status by 2040 and aiming to become carbon negative afterwards (City of Helsinki 2021).

The target of this emissions reduction plan is carbon neutrality, i.e. reducing the direct emissions level of the year of comparison, 1990, by at least 80% by 2030 and compensating for the remaining emissions (up to 20%). In the later target of attaining carbon zero status, the option of external compensation will no longer be available: the emissions must be reduced down to a level where the City's own carbon sinks can compensate for the remaining emissions. The actions determined for achieving the target are presented in Appendix 1.

In 2021, the total direct emissions of Helsinki were 2,345 kt CO₂e, which means that the emissions were reduced by 33% from the year of comparison, 1990 (Figure 1). The numerical target for the total emissions reduction is 80% by 2030. The target applies specifically to direct emissions, i.e. emissions generated within the City's geographical borders. Even so, some actions are also aimed at indirect ('Scope 3') emissions.

- Emissions in 1990: 3,514 kt CO₂e.
- To achieve the carbon neutrality target, the City must reduce emissions from the 1990 level by 80%, or 2,812 kt CO₂e, at the minimum.
- Only up to 20%, 702 kt CO₂e, can be compensated for.

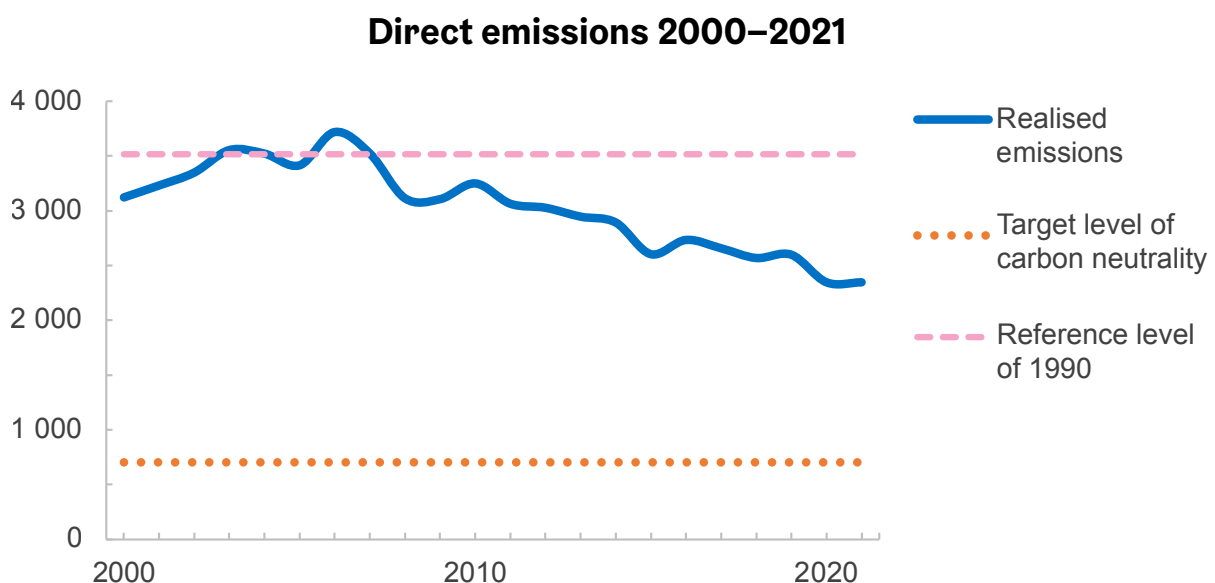


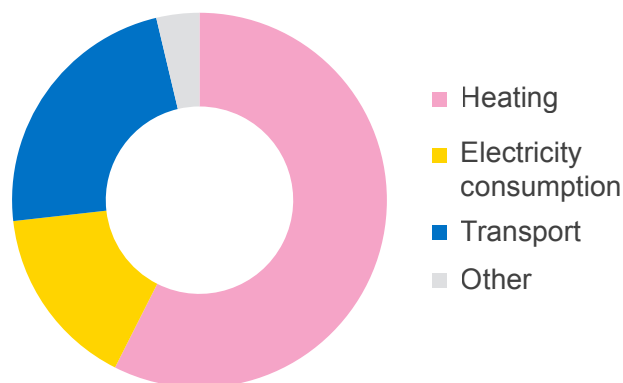
Figure 1. Development of total direct emissions (kt CO₂e) in Helsinki in 2000–2021 (HSY 2022A).

Key sources of emissions

In Helsinki, the most significant sources of direct emissions are heating, transport and electricity (Figure 2). The action plan focuses especially on emissions reductions in these sectors.

Figure 2. Distribution of direct sources of emissions in Helsinki in 2021

Distribution of direct emissions in 2021



Heating

Of the direct emissions in Helsinki, a significant majority (58%) come from heating. The emissions from heating are influenced by the amount of heating consumed and the emission factor for heating production. The amount of heating required can primarily be influenced by improving energy efficiency, while the emission factor of heating production can

be influenced with zero-emission production methods.

A significant proportion of the emissions from heating in Helsinki (91%) comes from district heating consumption. As such, the specific emission factor for district heating production (an indicator in Helen’s development programme) heavily dominates the emissions development (Figure 3).

The specific emissions of district heating 2000–2021 and forecast for 2030

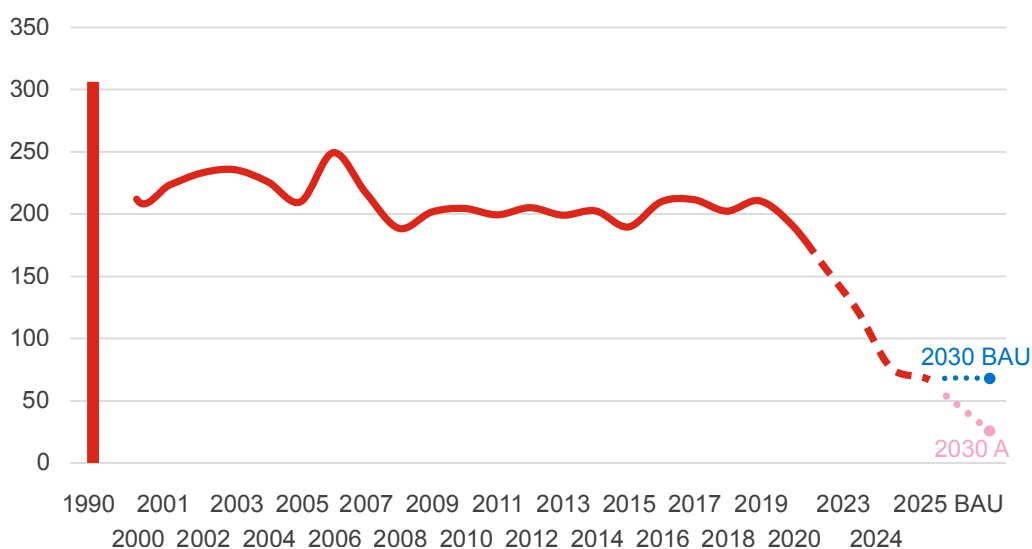


Figure 3. Specific emissions from district heating g CO₂e per kWh.

The total amount of heating energy in Helsinki has not changed very much over the years (Figure 4). In this context, ‘heating energy’ includes district heating and oil heating, whereas electricity used for heating is included in electricity consumption. Even as the City has grown rapidly, it has been able to take energy efficiency measures to cut down the need for additional energy caused by the growth. The systematic improvements to energy efficiency made since 2020 cannot yet be seen in the development due to the long urban development cycle.

However, the City presumes that the need for heating energy will decrease over time thanks to these measures. In the estimate for total emissions from heating, the City has presumed that the consumption of district heating will not decrease (~6,300 GWh/year). However, if the total consumption of district heating decreases by 10% from the current level, it would reduce the total BAU emissions of 2030 by 7%. Compared to the emissions level of 1990, the emissions would decrease from -69% to -71% thanks to the above.

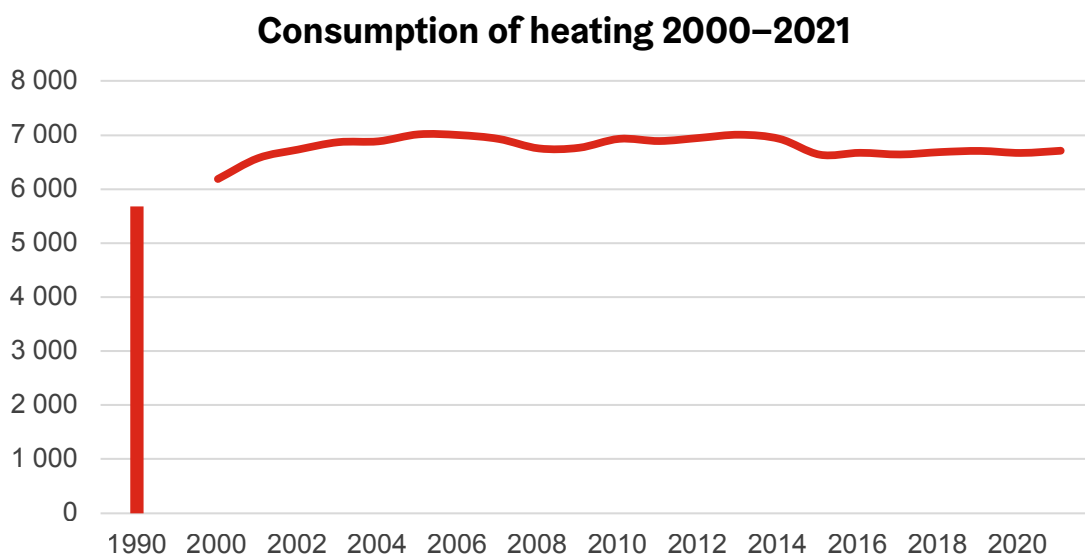


Figure 4. Heating consumption in Helsinki (GWh).

Transport

The second-largest emissions sector in Helsinki is transport (24%). Emissions from transport are influenced not only by mileage, but also the specific emissions of the modes of transport used. Most transport emissions (58% in 2021) come from passenger car traffic, with heavy traffic accounting for 18%, buses for 6% and ship traffic for 16% (HSY 2022). As for mileage, the most impactful

measure is reducing the volume of passenger car transport. The specific emissions of modes of transport can best be influenced by moving on to low-emission motive power. The total emissions from transport are already on the decrease, but development without additional measures will lead to a significantly lower emissions reduction than desired for transport by 2030 (Figure 5).

Emissions development of transport in 2005–2021 and forecast for 2030 and 2040

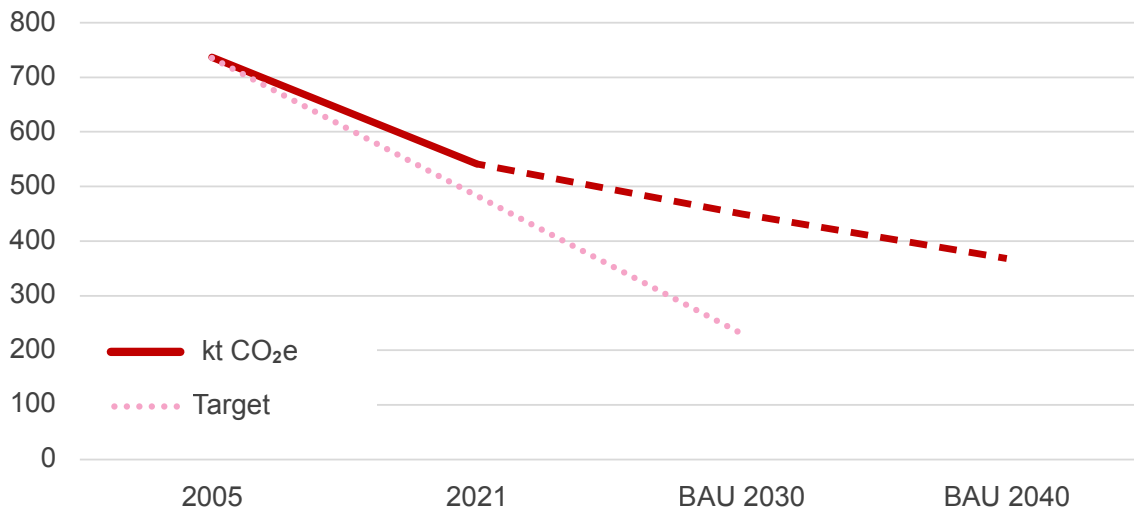


Figure 5. Using the current measures, the emissions reduction in 2030 will be -37% from the 2005 level, while the target is set at -69% (WSP Finland Oy 2022).

Electricity

Of the direct emissions in Helsinki, 13% come from the consumption of electricity. The emissions from electricity consumption are influenced by the amount of electricity and also the emission factor for electricity production. The emission factor for electricity production is currently decreasing rapidly (Figure 6); even now, as much as

67% of electricity produced in Finland is CO₂-free. However, electricity consumption will likely increase over time as vehicles and heating are being increasingly powered by electricity, but this increase in consumption will be compensated by the rapidly increasing share of CO₂-free electricity production.

Emissions development of electricity consumption in 2000–2021 and forecast for 2030

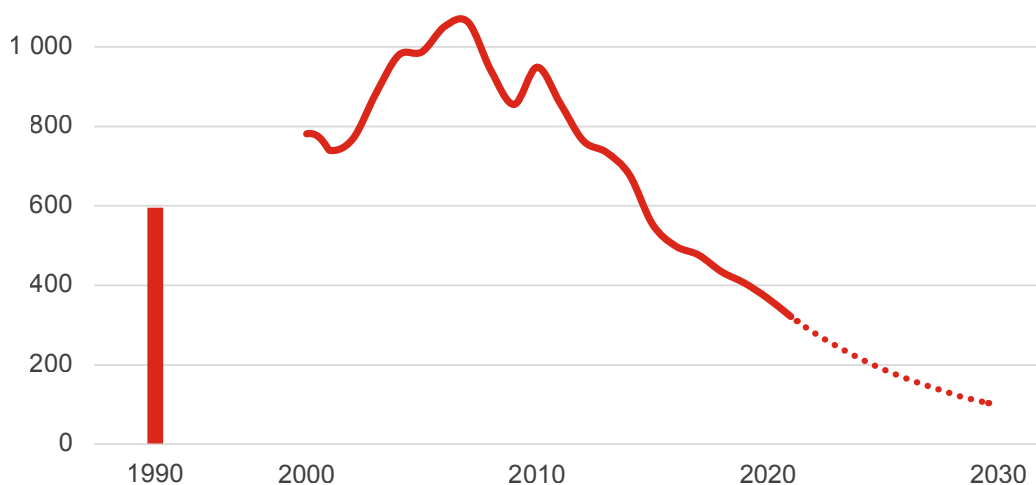


Figure 6. The emissions from electricity consumption are on the decrease (HSY 2022).

Development and monitoring of emissions

An essential indicator to follow is the development of total direct emissions in Helsinki (Figure 7). Emissions are being monitored by using a verifiable calculation model. To ensure the availability of up-to-date information, the aim is to accelerate the assessment cycle. At the moment, the realisation of direct emissions (Scopes 1 and 2) is being monitored through the shared GHG emission calculation system of the Metropolitan Area, produced by the Helsinki Region Environmental Services Authority (HSY). The monitoring is based on the Global Protocol

for Community-Scale Greenhouse Gas Emission Inventories (GPC) and built on the framework of the IPCC's calculation methods and parameters for national emission inventories and emission factors for fuel classifications as defined by Statistics Finland (more information on the method: HSY 2022A).

With the currently existing actions, the emissions will be 1,098 kt CO₂e in 2030, whereas carbon neutrality requires that the emissions are cut down to the level of 702 kt CO₂e. The reduction from the 1990 level is 69%.

Emissions development in 2000–2021 and forecast for 2030

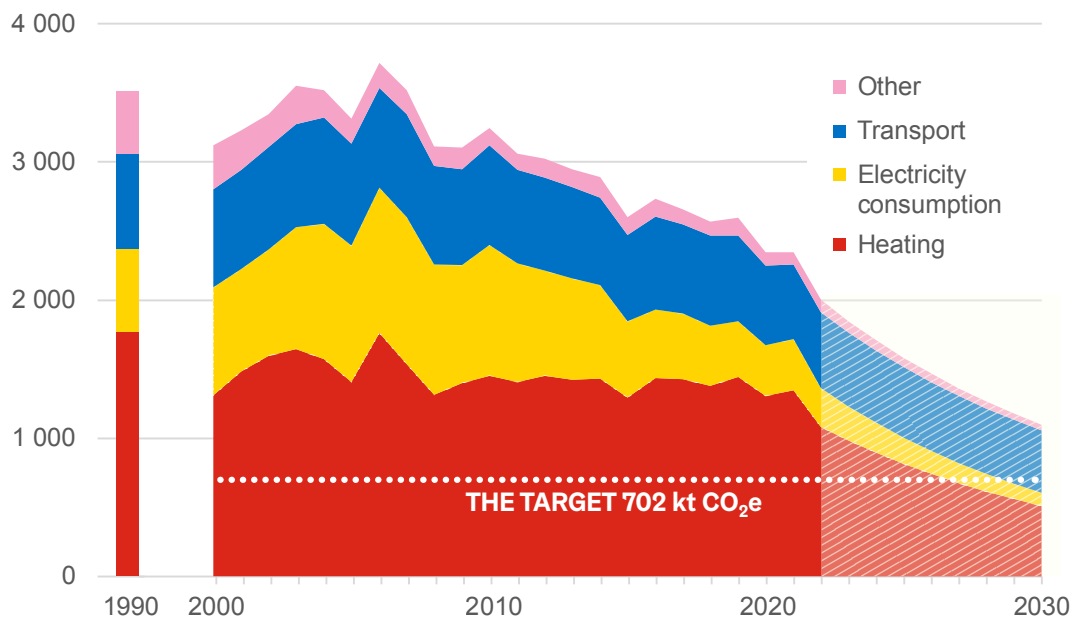


Figure 7. Development of total direct emissions in Helsinki by sector (Realised emissions: HSY 2022A).

The plan's sector-specific estimates for emissions development will be carried out so that they are compatible with HSY's emissions monitoring. The development of the specific emission factor for district heating was assessed by HSY based on the production scenarios delivered by the energy company Helen (HSY 2022B). The development of specific emissions from electricity consumption is based on Fingrid's (2022, p. 65) growth forecast for electricity consumption in Finland and on Finnish Energy's (2020) forecast for the development of specific

emissions from electricity consumption. The emissions development for transport is based on an estimate by WSP (WSP Finland Oy 2022).

The achievement of the emissions reduction target can primarily be influenced through actions that directly reduce emissions (Category 1). As for previous and currently proposed actions, 50% of the actions will reduce emissions directly, 33% will facilitate emissions reductions, and 17% involve surveys to determine new emissions reduction actions (Figure 8).

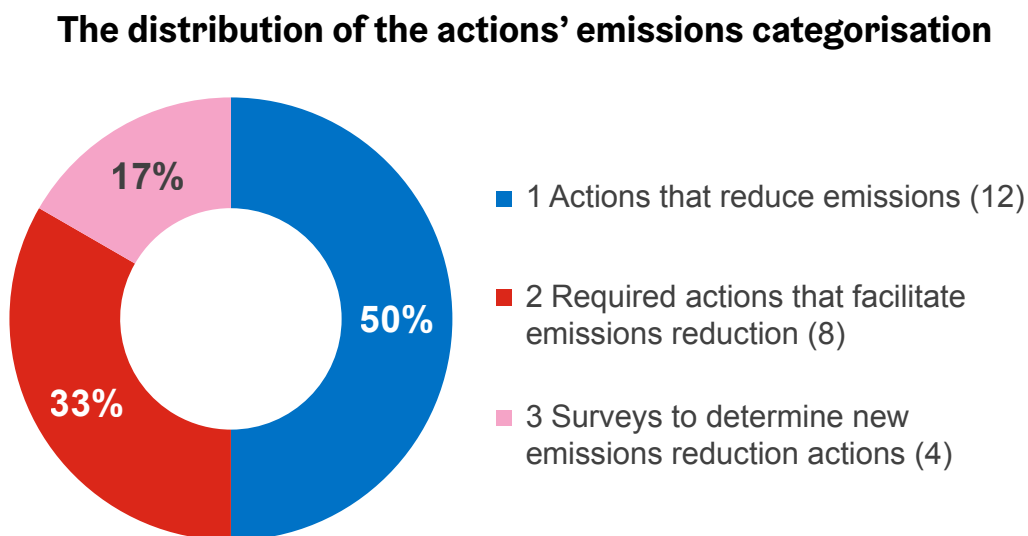


Figure 8. The distribution of the actions' emissions categorisation for both the previous actions and the new actions proposed.

Principles of the emissions reduction plan

Definitions of the actions

The purpose of the actions is to realise the target in question. When operating on a tight schedule and with limited resources, the effectiveness of the actions to be selected into the plan is emphasised. To ensure sufficient effectiveness, most actions will be directed so that, instead of short-term pilots, the operations' continuous change towards the target will be ensured. For example, cooperation on projects and networks will only occur when they significantly support the achievement of the strategic objectives. In the action preparation phase, the City will ensure that the actions' additionality, effectiveness of emissions reductions, indicators, cost effects and parties responsible will be defined clearly and that the actions are justified.

The additionality ensures that resources in the plan are allocated primarily to actions that are not already a part of official work or actions that have been defined elsewhere. This plan will only include such actions that would not be realised without the support from the plan and that are essential for the achievement of the emissions reduction target. The definition of the actions is tied to sector-specific scenarios for direct emissions. With them, the City can ensure that the gap between the BAU development and emissions reduction target is bridged. The effectiveness of emissions reductions will be defined for category 1 actions that promote direct emissions reductions. For category 2 and 3 actions, the effectiveness is not calculated, as they have an indirect impact on the emissions reductions, they

are difficult to verify, and they are strongly dependent on the premise selected.

The actions are divided into three categories based on the effectiveness of the emissions reductions. The distribution of the categories will be monitored annually:

- 1.** Actions that reduce emissions: the action has a direct impact on the sectors selected as focal areas; moving forward, most new actions will be in this category.
- 2.** Required actions that facilitate emissions reduction: the action is a prerequisite for implementing the category 1 actions, even though the action itself does not involve a direct impact on the emissions reductions.
- 3.** Surveys to determine new emissions reduction actions: the actions require additional preparation or studies with the aim of preparing category 1 and 2 actions.

An indicator determines what is the essential aspect to monitor in terms of the action and the level at which the action can be considered to be completed. The indicators will be monitored at the same cycle as the total emissions, and they will include a target schedule whenever possible. Reviewing the cost effects is a way to ensure that an action is realisable with the resources being used or allocated separately. The party responsible is an unambiguous definition of who is responsible for implementing an action and/or the coordination of any cooperation required by it. In principle, only these operators are involved in the work on the plan.

Target monitoring and updates to the actions

There are about two council terms left to achieve the carbon neutrality target. In order to rapidly react to factors that influence technological development, political and other types of guidance and other emissions, the actions will be updated annually, moving forward. Sets of actions that extend over a council term are no longer suitable. With carefully targeted monitoring, the City can ensure that the City is making progress towards the emissions reduction target. Monitoring will be carried out annually to define the sufficient additional actions. Based on the monitoring, necessary actions based on the latest information may be added to the plan regularly. The Ambitious Climate Responsibility programme group and the operative Carbon Neutral Helsinki group will report on the target monitoring to the City Board every autumn, about 6 months before the closing of the accounts. The reporting will pay special attention to the definition of the emissions reduction actions, the progress of the actions, and additional actions when they are needed.

Moving forward, the actions in the emissions reduction plan will be updated annually and approved as a part of the budget proposal. In connection with this, reports will also be submitted for the realised emissions development by sector and the estimated impact of new actions proposed on future emissions development. In connection with the update, the City will ensure that the new additional actions will support the achievement of the emissions reduction target even when the City has fallen behind from the tar-

get in the previous periods. This approach corresponds, for the relevant parts, to the programming method of the City of Oslo called the climate budget.

The key indicator for monitoring is the development of the City's total emissions. The progress on the target will also be monitored through the following sector-specific indicators:

- specific emission factor for district heating (an indicator in Helen's development programme);
- total heating consumption;
- total emissions of transport; and
- emissions of electricity consumption (including the volume of electricity consumed and the emission factor for electricity production).

In addition to this, the distribution of the actions' emission categorisation and the progress on individual actions will be monitored when this is necessary for seeing the strategic overview, maintaining situational awareness and allocating resources appropriately. The indicators for individual actions are defined when the action is established. Indirect emissions, i.e. consumption-based Scope 3 emissions, will be taken into consideration in a more target-oriented manner. To prioritize effective actions through which the City itself can make a difference, the focus of indirect emissions will be on construction - in accordance with the City strategy.



A platform based on the plan's structure will be established for monitoring the emissions reduction plan.

In the future, the suitability of the existing monitoring and networking practices will be assessed in terms of their actual contribution to achieving the targets. Additional monitoring practices and networks will be abandoned if they do not add significant

value for the work on emissions reductions. Based on this assessment, it has already been decided that CDP reporting will cease.

For its part, the Carbon Neutral Helsinki Action plan supports several of the UN's sustainable development goals (SDGs), and progress is also reported in the City's Voluntary Local Reviews (VLR) report.

Management

The Climate Unit within the City's Urban Environment Division will be in charge of the coordination, updates, monitoring and continuous development related to the Carbon Neutral Helsinki Action plan.

Ambitious climate responsibility, and the Carbon Neutral Helsinki Action Plan as a part of this, is one of the City's four cross-administrative strategic programmes. The work will be directed by a programme group chaired by the Mayor.

To ensure the implementation and impact of the actions agreed on and to prevent delays, a Carbon Neutral Helsinki coordination group will be formed of the managers in the City organisation who hold decision-making power in the plan's focus areas. The group will be chaired by the City Manager. The group in question will streamline the steering of the implementing organisation and monitor the progress on the actions.

The steering of companies owned by the Helsinki City Group is ensured through Helsinki City Group steering, as defined in the administrative regulations.

Other climate-related work

Actions that influence direct emissions and that are carried out as a part of official work have not been included in the Carbon Neutral Helsinki Action Plan. Also actions related to indirect emissions have mainly been excluded. They will be supported and monitored through the Environment and Climate Network coordinated by the Environmental Management Team and the Climate Unit of the City's Urban Environment Division. The network includes experts that are responsible for environmental and climate-related work in public divisions and enterprises. HSY will be the primary operator to carry out consumption-related influencing and communication directed at residents, based on the City's strategic steering.

The first Carbon Neutral Helsinki Action Plan (City of Helsinki 2018) included many actions that focused on indirect emissions (actions #90–#128, in particular). Some actions were completed during the first period of the plan. Some actions were integrated into other operations, and their implementation will continue as a part of ordinary offi-

cial work. The actions that require separate resourcing and where the implementation is still underway have been transferred to the City's other action plans where relevant (Appendix 2).

In accordance with the existing ownership strategies, most of the City's subsidiary communities have prepared or are about to prepare carbon neutrality plans, through which they can contribute to the City's carbon neutrality objectives. In the new City Strategy, A Place for Growth (City of Helsinki 2021), it is stated that the energy company Helen must update its own development programme. In addition to this, the Port of Helsinki Ltd (2022), Helsinki City Housing Company Ltd Heka (2022) and Metropolitan Area Transport Ltd (2022) all have their own emissions reduction plans. The City's subsidiary communities carry out their climate work independently, and they are directed through ownership steering. The steering of subsidiary communities' climate work will be developed as needed and supported by the Climate Unit and the Environmental Man-

agement Team of the Urban Environment Division.

In the work on the Carbon Neutral Helsinki Action Plan, the indicators of key subsidiary communities will be monitored insofar

as they significantly impact the City's total emissions development. An essential indicator is the specific emission factor for district heating as defined by the energy company Helen, which has a direct and significant impact on the City's heating emissions.

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APPENDIX 1:

Actions in the emissions reduction plan

Previous policies and their progress



Theme	Action	Progress
CATEGORY 1: Actions that reduce emissions		
Heating	Planning and implementing City facilities and service buildings so that the E value will be -30% of the national threshold value for the use class.	Well underway
Heating	Renovation projects of City facilities and service buildings will be implemented so that the E value will decrease by 34% of the buildings' original E value.	Well underway
Heating	Requiring energy class A of residential blocks of flats (use class 2) in the property conveyance conditions.	Well underway
Heating	Requiring energy class A of residential blocks of flats (use class 2) in detailed planning.	Well underway
Heating	In detailed planning, buildings other than residential ones will be required to be of a class that is -20% of the national norm set for that type of building.	Well underway
Heating	The main heating system selected for the City's facilities and service buildings will be a heat pump system if its repayment period is under 15 years and its implementation is technically feasible.	Progressing moderately well
Transport	Exchanging City-owned passenger cars for electric cars in 2021–2025.	Not on schedule: Delays in the construction of charging stations; cars have not been replaced as planned.
CATEGORY 2: Required actions that facilitate emissions reduction		
Heating	Launching Energy Renaissance guidance services.	Well underway
Heating	Allowing the construction of geothermal heating systems in public areas.	Well underway: the principle has been approved (Urban Environment Committee 1 February 2022); first advance enquiries have been answered
Transport	The plot conveyance conditions will require that new sites' parking spaces be implemented so that they are electrified and one third of the spaces are equipped with a charging station.	Well underway
Transport	Implementing the Bicycle Action Plan.	Not on schedule. Indicators to be monitored: Construction of the inner city target network : 50.0 km (target of 130 km); construction of the Baana cycling network: 20.1 km (target of 130 km); modal share of cycling: 9 % (City of Helsinki 2022).

New actions proposed in 2022

Theme	Action	Party responsible
CATEGORY 1: Actions that reduce emissions		
Heating	Adjusting the ventilation in City facilities to an appropriate level.	Urban Environment Division
Heating	Lowering temperatures in City-controlled facilities.	Urban Environment Division
Construction (Scope 3)	Low-emission concrete in infrastructure projects.	Urban Environment Division
Construction (Scope 3)	Reducing the emissions from the preconstruction at the former Malmi Airport area by 50%.	Urban Environment Division
Electricity	Replacing outdoor lights with LED lights.	Urban Environment Division
CATEGORY 2: Required actions that facilitate emissions reduction		
Heating	Principles for low-temperature regional heating entities.	Urban Environment Division
Transport	Reprogramming the implementation plan of the Baana cycling network and the target network up to 2030.	Urban Environment Division
Transport	Constructing charging stations for electric cars in line with the forecast on the number of electric cars.	City Executive Office/Urban Environment Division
Heating, electricity	Establishing tendering processes for the energy solutions for City-owned facilities.	Urban Environment Division
CATEGORY 3: Surveys to determine new emissions reduction actions		
Heating, construction (Scope 3)	Review on steering construction through carbon footprint.	Urban Environment Division/City Executive Office
Heating, electricity	Accelerating the energy efficiency improvements on City-owned properties outside renovation projects (Definition of the implementation process for energy surveys).	Urban Environment Division
Transport	Review of emissions reduction methods for transport.	Urban Environment Division
Transport	Promoting the definition of effective regional emissions reduction measures on mobility.	Urban Environment Division/City Executive Office

Category 1: Actions that reduce emissions

ACTION: Adjusting the ventilation in bookable City facilities to an appropriate level.

Controlling ventilation according to demand is an essential action to be taken between renovation projects to improve the energy efficiency of buildings. Appropriate use of the system refers to the ventilation system not being used at night when there is no one in the building, and as such, there are no sources of humidity. It also refers to controlling the air flow based on the number of people in the room. Ventilation requires heating energy to increase the air supply temperature to the desired level. When the ventilation machines are not running while there are no activities or people in the building, a significant amount of heating energy can be saved, and good indoor air quality can still be ensured when the buildings are occupied. The potential of adjusting the operating hours of ventilation systems has been studied together with the City's divisions. Based on the study, the most cost-effective way is to equip facilities that operate outside regular hours with carbon dioxide meters based on which the ventilation is controlled.

- Indicator: Facilities that can be booked outside regular hours will be prioritised, and carbon dioxide meters will have been installed in all such sites by the end of 2025.
- Impact on emissions reductions: -20,000 tCO₂e/year in comparison to a situation where the ventilation system is running full-time. There is no information available on the current usage rate of the ventilation systems.
- Cost effect: -11 million euros/year in comparison to a situation where the ventilation system is running full-time. There is no information available on the current usage rate of the ventilation systems.
- Party responsible: Urban Environment Division

ACTION: Lowering temperatures in City-controlled facilities.

Helsinki employs guidelines approved in October 2020 and based on the National Supervisory Authority for Welfare and Health's guidelines for applying the Housing Health Act. These guidelines offer instructions on controlling temperature conditions in various facilities and weather conditions. The guidelines also include target temperatures. At the same time, the City will perform energy surveys on dozens of service buildings and implement the necessary energy conservation measures on them. In addition to this, the Urban Environment Division has launched planning on what sort of quick and, if necessary, temporary additional measures can be implemented in the coming autumn and winter to cut down energy consumption and costs so that working conditions will remain at a sufficiently good level. To ensure rapid action, a clear decision will be made on how and in which locations temperatures will be decreased.

- Indicator: Decision to be made by the end of 2022 on how temperatures will be lowered wherever possible.
- Impact on emissions reductions: The consumption of district heating in properties directly owned by Helsinki was 391 GWh in 2021. If the temperature could be decreased by 2°C in half of the properties, the consumption of district heating would drop by 5%, or 20 GWh (with the assumption that a drop of 1°C in indoor temperature corresponds to a drop of 5% in heating energy consumption). With the emissions of 2021, the drop equals an emissions reduction of 3.7 kt CO₂e.
- Cost effect: To be carried out as official work. Lowering the temperature will reduce the consumption of heating energy. When calculated using the assumptions above, the savings achieved would be 5% of the district heating costs of properties directly owned by the City. The action is cost-positive.
- Party responsible: Urban Environment Division

ACTION: All infrastructure projects commissioned by the City will use low-carbon concrete that meets the class GWP.85 requirements as defined by Betoniyhdistys. The class required of low-emission concrete will be reviewed and updated annually, at the minimum.

Most of the carbon footprint of concrete-intensive infrastructure comes from the use of concrete. For example, 92% of emissions from the construction of the Jokeri Light Rail came from the materials' emissions, and in turn, 50% of these came specifically from the emissions of concrete. Since the volume of concrete used is often high, especially in infrastructure that requires subgrade reinforcement or concrete tiles, large reductions in Scope 3 emissions can be achieved by reducing the emissions from

concrete. Often, there are not many alternatives for concrete in infrastructure construction, which is why using low-emission concrete is the simplest and quickest way of reducing the emissions of infrastructure construction. The concrete industry association (Betoniyhdistys) has published classifications for low-emission concrete. By using this classification, it is possible to set comparable and consistent criteria for low-emission concrete. The classification also makes it easier to hold tendering processes for

concrete. As such, it can also influence the procurement costs. Betoniyhdistys studied the availability of GWP.85-class concrete and discovered that all types of concrete used in infrastructure are available from multiple suppliers, so availability will not become a problem (Betoniyhdistys, to be published in spring 2022). Along with the criteria for low-carbon construction, the supply of low-emissions concrete will also grow. The decisions of the City of Helsinki also have a wider impact on the society, since the City's requirements as a major client set incentives and pressure for the construction product industry to develop their products and production processes. The pioneer status of a leading operator has a wider impact on the construction market beyond the operator's own actions.

- **Indicator:** The requirement of using low-carbon concrete is to be added in the procurement criteria. The requirement will enter into force on 1 January 2023. The level of the requirements will be reviewed annually.
- **Impact on emissions reductions:** -15% (GWP.85) compared to conventional concrete.
- **Cost effect:** +10–20% compared to conventional concrete. The estimate is based on the experiences from the Kalasatama–Pasila project. As competition increases, the price difference is expected to diminish. Furthermore, it must be taken into account that the price of concrete is only a fraction of a project's total costs. In the pilot site, the cost effect of low-emission concrete was only parts per thousand in the overall costs of the project. The price of conventional concrete will increase in the future, which will reduce the price difference even further.
- **Party responsible:** Urban Environment Division

ACTION: The emissions of the preconstruction of the former Malmi Airport will be reduced by 50% in 2020–2030, compared to the preliminary preconstruction plan.

The former Malmi Airport is located on clay soil typical of the Metropolitan Area. Before such areas are constructed on, the City of Helsinki will carry out preconstruction following a procedure developed in the 1970s–80s. The emissions estimate for the preconstruction in the former airport area is based on the preliminary preconstruction plan from 2017 (Figure 9). In the preliminary plan, the preconstruction is assessed to be carried out mainly by deep-stabilising the soft clay layer to control dents formed during use. Preconstruction by pillar stabilisation has been widely used in Helsinki

since the 1980s, at which time the use of a burnt lime and cement mix ('compo') as a stabilisation binding agent started. When calculated in this fashion, the emissions of preconstruction were estimated to be 340 kt CO₂e. Based on the calculation, the most significant source of emissions is the production and transport of the binding agent for deep stabilisation, the proportion of which is 95% of the emissions. By replacing the binding agent used for the stabilisation with an available recycled agent, emissions can be reduced by 60–70%. When using binding agents in the commissioning phase,

Simplified scenarios for emissions options in pre-construction 2020–2030

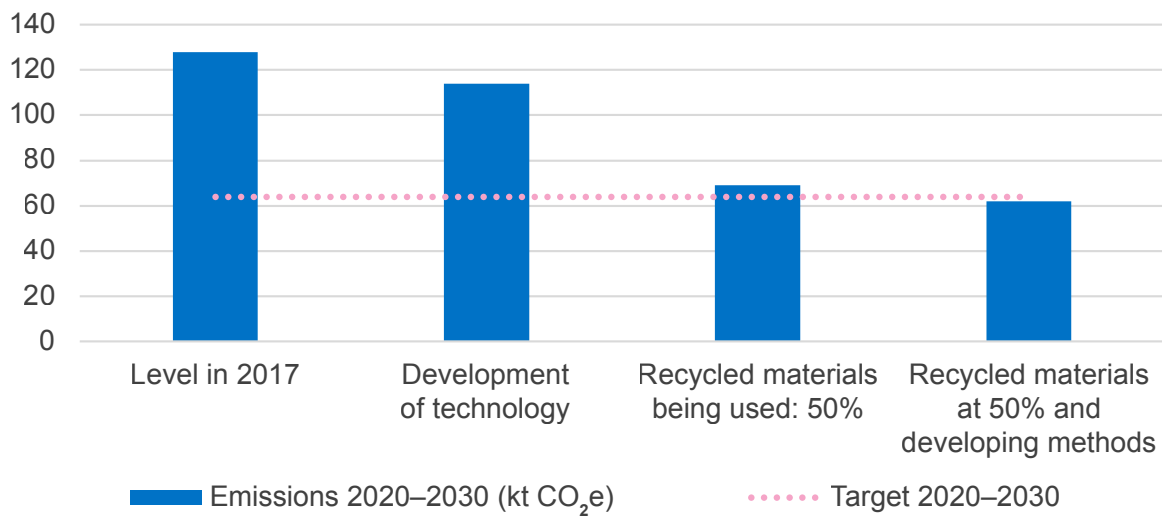


Figure 9. Simplified scenarios for emissions options in preconstruction 2020–2030.

the emissions reduction potential is even greater. Recycled binding agents are already being piloted at the first preconstruction sites in Malmi. By developing the stabilisation methods, emissions can further be reduced in the 2020s. In terms of the preconstruction that is underway in the area, it has been estimated that a cumulative emissions reduction target of 50% could be possible compared to the conventional solution by 2030. As materials, technologies and subgrade reinforcement methods develop, the level of the emissions reduction target can be reassessed.

- Indicator: Emissions reduction in preconstruction (-50%) compared to the conventional solution.
- Impact on emissions reductions: Direct impact on emissions reduction: a minimum of 64,000 tCO₂e by 2030 (-50% from the reference level of 2020–2030).
- Cost effect: Lower-carbon preconstruction will likely incur lower costs than the conventional option. The costs of the preliminary option for a preconstruction plan are increased due to the costs of burnt lime increasing along with the emissions trading in the EU. The objective will not affect the construction schedule.
- Party responsible: Urban Environment Division

ACTION: Replacing the City's outdoor lights with LEDs by 2030.

The area of Helsinki currently has about 70,000 outdoor light sources that use technology other than LED. Even now, all new lighting fixtures are automatically built to be based on LED technology. In addition to this, existing outdoor lights will be replaced so that the number of LED lights increases by about 4,000 pieces annually. A LED light source consumes about 80% less electricity than the existing lamps based on discharge technology. The service life of LEDs is remarkably long, which also allows us to save in maintenance costs. The repayment period of adopting LEDs is 5–7 years, depending on the type of fixture. This supports the adoption of LEDs also from a financial standpoint with regard to the average service life. The increasingly strict EU legislation will also make it more difficult to access the discharge lamps that are currently in use. To realise the action, the number of lamps being replaced by LEDs should double.

- Indicator: Number of lamps replaced by LEDs per year in relation to the annual target (8,000 pcs/year).
- Impact on emissions reductions: Direct impact on emissions reductions in relation to the City's total target for emissions reductions: less than 1%. The energy saving estimated for a single lamp is 50–75% compared to a discharge-based light source.
- Cost effect: additional cost €2.5 M/year in 2023–2025 and €2 M/year in 2026–2030. Depending on the type of lighting fixture, the repayment period is 5–7 years. The lifecycle costs will be added.
- Party responsible: Urban Environment Division



Category 2: Required actions that facilitate emissions reduction

ACTION: Principles for low-temperature regional heating entities.

In the heating roadmap prepared for the City of Helsinki in 2021, the promotion of low-temperature regional heating solutions was identified as a prerequisite for accelerating the development of a low-carbon heating ecosystem not based on combustion. The City will promote low-temperature grids by establishing processes to facilitate regional heating solutions. The City will create both the processes for the provision of regional commercial low-temperature solutions and the model for the implementation of block-specific solutions, and promote the adoption thereof. The preparation will be carried out through extensive cooperation with companies that offer heating solutions in this highly competitive market.

- Indicator: Principles for regional geothermal solutions to be approved in September 2022.
- Impact on emissions reductions: Facilitation of emissions reduction measures; no direct reduction of emissions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division

ACTION: Reprogramming the implementation plan for the Baana cycling network and target network up to 2030.

Moving the carbon neutrality target from 2035 to 2030 also means that the target for cycling as a mode of transport must be achieved five years earlier. The programming of the Baana cycling network and the target network must be accelerated at the same pace.

- Indicator: Reprogramming to be carried out in 2022.
- Impact on emissions reductions: Facilitation of emissions reduction measures; no direct reduction of emissions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division

ACTION: Ensuring that the number of charging stations for electric cars will grow in the City area, in line with the predicted increase in electric cars.

For the predicted vehicle electrification rate to be realised, there must be a sufficient number of charging stations for electric cars. In the coming years, the number of charging stations will also determine the emissions reduction realisation of plug-in hybrids: if there are no charging stations, combustion engines will be used, and the predicted emissions benefits will not be achieved. Most passenger cars will be charged at the parking areas and carparks of residential buildings, but this is not possible everywhere in the city. Charging stations are also needed for public and commercial properties, public areas and parking areas. The City must also prepare for acquiring an electric fleet of its own. The City applies various methods to promoting the construction of charging stations. For example, there is an existing process for the charging stations to be implemented in public areas, but not all types of charging stations have

such a plan. The City is also lacking an overall view of how many charging stations have been built. The number of different types of charging stations around the city varies, which should be taken into account when implementing the action.

- Indicator: Annual number of charging stations in relation to the forecast on electric cars. The plan for promoting charging stations to be made in 2022.
- Impact on emissions reductions: Facilitation of emissions reduction measures; no direct reduction of emissions.
- Cost effect: The direct costs incurred by the City come from the implementation of the charging stations in the City's own properties.
- Party responsible: City Executive Office/ Urban Environment Division

ACTION: Establishing a tendering process for the energy solutions for City-owned facilities.

During the work on the City's Roadmap for Carbon Neutral Heating, one of the measures identified as being within the City's sphere of influence was that the City would open the implementation of the heating systems in its facility complexes and area construction sites for tendering. At the moment, heating solution providers do not have the opportunity to offer their solutions due to the missing process phase. The current process does not support the business development objectives or ensure the realisation of best heating solutions in the City's own properties. The City will establish and implement a process that allows the provid-

ers of various energy solutions to offer their solutions to the City's facilities and area construction sites.

- Indicator: Process to be established and implemented by 30 June 2023.
- Impact on emissions reductions: Support for emissions reduction measures; no direct impact on emissions reductions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division

Category 3: Surveys to determine new emissions reduction actions

ACTION: Carrying out a survey through which the threshold value for the carbon footprint can be defined in the steering for building construction.

The City is currently steering new construction using an E value criterion. Whether the criterion is fulfilled is especially influenced by the structural energy efficiency of the building, its main heating system and the volume of renewable energy produced. Since, in addition to reducing direct emissions, more attention needs to be paid on reducing the indirect emissions generated during construction, steering measures should also be aimed at the latter emissions. Instead of steering individual solutions, it has been recognised as financially beneficial and helpful for market development to set threshold values for the results desired, while letting the project participants choose the means of reaching the results. The carbon footprint, which also includes emissions from the construction process, in addition to emissions from the use, is recognised as a good potential steering method. In the future, even the legislation will require calculation. The Ministry of the Environment

is currently developing a method for this purpose. In the future, an actor engaging in a project must state the building's carbon footprint in the building permit. The survey to be implemented aims to define a sufficiently ambitious carbon footprint through which new construction can be steered through detailed planning, property conveyance conditions and/or the management of construction on the City's own facilities.

- Indicator: The proposal for the threshold value to be used in steering will be finished by 30 June 2023.
- Impact on emissions reductions: Support for emissions reduction measures; no direct impact on emissions reductions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division/City Executive Office

ACTION: Implementing financially feasible energy efficiency improvements in City-owned facilities outside renovation projects.

There is notable energy conservation potential in the City's own facility and service buildings even outside renovation projects. As improvements to energy efficiency are financially feasible, it is also worthwhile from a financial standpoint to focus on implementing them. The aim of this action is to ensure efficient implementation of financially feasible projects identified in the energy surveys.

- Indicator: The implementation process of financially feasible energy efficiency

projects identified in energy surveys is to be defined in 2022.

- Impact on emissions reductions: Support for emissions reduction measures; no direct impact on emissions reductions.
- Cost effect: To be carried out as official work.
- Party responsible: Urban Environment Division

ACTION: Carrying out a review of the most impactful emissions reduction measures for transport available to the City by 2030.

The actions identified previously are not sufficient to achieve the carbon neutrality target for transport. The proportion of electric cars of cars registered for the first time is growing rapidly. However, the vehicles will not be renewed to such an extent by 2030 that the emissions reduction objectives could be achieved through an upgraded vehicle population alone. Furthermore, heavy vehicles are not becoming electric at the same rate, and the blending obligation will not reduce emissions from diesel vehicles to such an extent that the objectives could be achieved for them. New national or EU-level measures will likely enter into force before 2030, which will also reduce the emissions from Helsinki traffic as well. However, the schedule of the actions is not consistent with the City of Helsinki's targets, and binding decisions have not yet been made regarding emissions trading for road

traffic, for example. The City's own actions will be required to realise the remaining emissions reductions on time. Based on the experiences so far, promoting sustainable mobility alone will not yield a sufficient transition from car traffic to sustainable modes of transport. To achieve the targets, the City should also look at new actions that will directly influence the volume of car traffic.

- Indicator: Review to be completed in 2022.
- Impact on emissions reductions: Support for emissions reduction measures; no direct impact on emissions reductions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division

ACTION: Promoting the definition of effective regional emissions reduction measures on mobility.

The regional emissions from transport are also highly influenced by traffic across the city's borders. The City will actively promote the definition of impactful regional emissions reduction actions through the shared land use, housing and transport planning (MAL) for the Helsinki Metropolitan Area. Helsinki will actively promote such measures that are in line with the City's own emissions reduction target for transport.

- Indicator: The most impactful emissions reduction measures for regional transport are to be defined.
- Impact on emissions reductions: Support for emissions reduction measures; no direct impact on emissions reductions.
- Cost effect: No additional cost effect; to be carried out as official work.
- Party responsible: Urban Environment Division/City Executive Office

APPENDIX 2:

Actions in the Carbon Neutral Helsinki 2035 Action Plan

No	Action	After the update
1	Services offered at traffic nodes and improved smoothness of transfers	Action plan for Helsinki Regional Transport Authority's (HSL's) 'Solmu' node project and park-and-ride services in the Helsinki region
2	Target network of cycling routes in the inner city	Bicycle Action Plan 2020–2025
3	Cycling network	Bicycle Action Plan 2020–2025
4	High-quality winter maintenance on the cycling network	Bicycle Action Plan 2020–2025
5	A pleasant and safe environment for pedestrians	Development Programme for Traffic Safety 2022–2026
6	Services for cycling	Bicycle Action Plan 2020–2025
7	Development Programme for tram traffic	Development Programme for tram traffic
8	Sustainable transport and land use planning	Part of the official work of the City, City Transport and Helsinki Regional Transport Authority
9	Bicycle Action Plan and Bicycle Parking Development Programme	Bicycle Action Plan 2020–2025 and General Plan and Implementation Programme for Bicycle Parking 2021–2025
10	A pricing system for vehicle traffic	Part of the regional cooperation related to the MAL agreements (Helsinki Regional Transport Authority, the City, the national government)
11	Parking policy and pricing	Helsinki Parking Policy 2022
12	Scaled parking fees	Helsinki Parking Policy 2022
13	Parking fee zones	Helsinki Parking Policy 2022
14	Urban structure and sustainable modes of transport	Part of the City's official work
15	Updating the parking norms	Helsinki Parking Policy 2022
16	Land use planning and sustainable modes of transport	Part of the City's official work

No	Action	After the update
17	Developing an environmental zone	Part of the City's official work; City of Helsinki Air Protection Plan 2017-2024
18	Construction of public charging infrastructure for electric cars	Part of the City's official work
19	Procurement criteria for freight transportation and machinery projects	Part of the City's official work
20	Procurement criteria for the freight transportation fleet and driving powers	Part of the City's official work
21	City logistics and delivery traffic	City Logistics Action Plan
22	Promoting a zero-emission bus fleet	Part of the sustainability work of Helsinki Regional Transport Authority
23	Charging infrastructure for buses	Part of the official work of the City and Helsinki Regional Transport Authority
24	Carbon Neutral Port 2035 Action Plan	Carbon Neutral Port 2035 Action Plan
25	Smoothing traffic in the West Harbour	Master plan and Environmental Impact Assessment (EIA) for the harbour tunnel (a project of the Port of Helsinki)
26	Smart mobility services	Situational awareness and statistical system for traffic data (LIDO-TIKU); partially, the Jätkäsaari Mobility Lab project
27	New mobility services	Situational awareness and statistical system for traffic data (LIDO-TIKU); partially, the Jätkäsaari Mobility Lab project
28	Helsinki Intelligent Transport System Development Programme	Helsinki Intelligent Transport System Development Programme 2030 and Action Plan 2020–2024
29	Promoting sustainable modes of transport through communication	Part of the official work of the City, City Transport, Helsinki Regional Transport Authority and Helsinki Region Environmental Services; also included in many action plans
30	Mobility plans	Part of the official work of Helsinki Regional Transport Authority and the City
31	Energy surveys	Part of the official work of the City and Helsinki City Housing Company Ltd
32	Recovery of heat loss	Binding energy criteria for City facilities
33	Allocating energy and waste treatment costs to end users	Not to be implemented (input-output ratio not feasible)
34	Monitoring the energy efficiency of facilities	The system is in use; part of the City's official work
35	Piloting a demand response system	Part of the City's official work

No	Action	After the update
36	Opportunities for energy storage	Part of the official work of Helen Ltd and the City
37	Preparing a target programme for renewable energy for the City's buildings	Binding energy criteria for City facilities
38	Procurement criteria for construction and maintenance	Binding energy criteria for City facilities
39	Increasing competencies in construction and maintenance	Part of the City's official work
40	Procedures for prioritising interests	Part of the City's official work
41	Developing project planning	Binding energy criteria for City facilities
42	Minimising lifecycle emissions	Partial energy criteria for City facilities
43	Energy-plus construction	Part of the City's official work
44	Increasing the proportion of recycled materials in construction	Action Plan for Circular and Sharing Economy
45	Principles of groundwork	Action plan on utilising excavated earth, rock material and demolition material in groundwork
46	Zero-emission worksite machinery	Green Deal
47	Improving heat recovery in renovation projects	Binding energy criteria for City facilities
48	Energy efficiency in the City's renovation projects	Binding energy criteria for City facilities
49	Long-term maintenance plans and renovation projects	Binding objectives for City facilities
50	Upgrading the property automation systems of Helsinki City Housing Company Ltd, KOy Auroranlinna and Helsingin Asumisoikeus Oy	Part of the official work of Helsinki City Housing Company Ltd, KOy Auroranlinna and Helsingin asumisoikeus Oy
51	Renewable energy in City-owned building stock	Part of the official work of Helsinki City Housing Company Ltd
52	Geothermal/ marine heating pilot	Part of the Helen Ltd's official work
53	Promoting renovation projects through conceptual solutions	ELENA project
54	LED street lighting	Helsinki LED project
55	Taking renewable energy production into account in detailed planning	Part of the City's official work
56	Energy-efficient infill and renovation construction	Part of the City's official work

No	Action	After the update
57	Guidance for residents' energy consumption	Part of the City's official work
58	Developing regulations on land use planning	Part of the City's official work
59	Energy efficiency conditions for plot conveyance	Part of the City's official work
60	Smart energy solutions in plot conveyance conditions	Part of the City's official work
61	Plot conveyance competitions based on the carbon footprint	Part of the City's official work
62	Plot conveyance conditions focused on carbon neutrality and S&C growth	Part of the City's official work
63	Proactive guidance provided by the building control services	Part of the City's official work
64	Renovations of protected buildings	Part of the City's official work
65	Building code and climate objectives	Part of the City's official work
66	Developing guidance for construction	Part of the City's official work
67	Energy Renaissance Programme	The Energy Renaissance model is in use
68	Ending oil heating and replacing electric heating with renewable sources	State programme
69	3D Energy and Climate Atlas	Part of the City's official work
70	Improving energy competencies among decision-makers in housing companies	Part of the Helsinki Region Environmental Services' official work
71	Helen Ltd achieving carbon neutrality by 2035	Helen Ltd's Development Programme
72	Acquiring renewable district heating	Not to be implemented
73	Acquiring renewable electricity	Not to be implemented
74	Key measurements of water consumption	Not to be implemented
75	Assessment tool for buildings' energy efficiency (as a part of the 3D Atlas)	Part of the City's official work
76	Two-way district heating	Helen Ltd's Development Programme
77	Promoting hybrid heating	Helen Ltd's Development Programme
78	Taking the needs of renewable energy production into account in land use	Part of the City's official work
79	Utilising heat waste	Binding energy criteria for City facilities

No	Action	After the update
80	Utilising local renewable energy (e.g. geothermal)	Part of the City's official work
81	Surveying areas suitable for geo-energy (survey for geothermal heating potential)	Land use planning and survey on geothermal heating
82	Utilisation of landfill gases	Part of the of Helsinki Region Environmental Services' official work
83	Promoting funding for energy renovations	Not to be implemented
84	Financial obstacles to energy efficiency	Part of the City's official work
85	New funding and procurement models	Part of the City's official work
86	ESCO piloting	Part of the City's official work
87	Supporting energy renovations	Part of the City's official work
88	Promoting wooden construction through detailed planning	Part of the City's official work
89	The City will promote wooden construction in its own projects.	Part of the official work of the City, Helsinki City Housing Company Ltd, KOy Auroranlinna and Helsingin asumisoikeus Oy
90	Climate change in schoolwork	Part of the City's official work
91	Cooperation with schools and other educational institutions	Part of the City's official work
92	Environmental education	Part of the City's official work
93	Climate change education	Action Plan for Circular and Sharing Economy
94	Promoting urban agriculture	Complete; guide for urban agriculture
95	Adding climate-friendly dishes in menus	Part of the City's official work
96	Increasing the proportion of vegetarian meals in schools, day-care centres, healthcare facilities, home meal services and personnel lunches	Part of the City's official work
97	Reducing food waste in the City's food services	Action Plan for Circular and Sharing Economy
98	Climate emissions of food transport	Completed; emission criteria, optimising order and delivery occasions and routes
99	Utilising surplus food in the City's operations	Action Plan for Circular and Sharing Economy
100	Reducing the environmental impact of events	Helsinki Tourism and Event Operating Plan 2022–2026

No	Action	After the update
101	Personal emission trading	Not to be implemented (emissions trading is not a feasible model)
102	Maritime Strategy	Completed; Helsinki Maritime Strategy 2030
103	Waste sorting at source	Part of the City's official work; required by law
104	Optimisation of waste transport	Completed; piloted with Helsinki Region Environmental Services
105	Allocating the expenses of waste management	Not to be implemented (input-output ratio not feasible)
106	Increasing the number of customers at Pakila Work Centre, Uusix workshops, Stara Reuse Centre and Metropolitan Area Reuse Centre	Action Plan for Circular and Sharing Economy
107	Developing climate criteria for procurements	Procurement Strategy 2020
108	Identifying and assessing the climate emissions from procurements	Part of the City's official work; work is also carried out within the Canemure project
109	Innovative procurements, pilots and business cooperation	Part of the City's official work
110	Updating the objectives related to the procurement strategy	Completed; Procurement Strategy 2020
111	Cooperation between public operators on sustainable procurements	Part of the City's official work
112	Developing guidelines and reporting for procurements	Part of the City's official work; Procurement Strategy 2020
113	Climate criteria for food and meal service procurements	Environmental policy (update)
114	Roadmap for Circular and Sharing Economy	Completed
115	Facility and equipment booking platform	Action Plan for Circular and Sharing Economy
116	The library network as a pioneer in sharing economy	Action Plan for Circular and Sharing Economy
117	Recycling of furniture within the City organisation	Action Plan for Circular and Sharing Economy
118	Use of surplus food	Action Plan for Circular and Sharing Economy
119	Utilisation of green waste	Action Plan for Circular and Sharing Economy
120	Sharing economy in the Property Strategy	Completed, Property Strategy

No	Action	After the update
121	Cooperation on circular economy	Circular economy cluster
122	Participatory budgeting	Part of the City's official work
123	Increasing Smart & Clean business	Part of the City's official work
124	Promoting the S&C market	Part of the City's official work
125	Residents' opportunities to participate in the development of Smart & Clean solutions	Part of the City's official work
126	Economic development policy and emissions reductions	Part of the City's official work
127	Company participation	Part of the City's official work
128	Co-development of Smart & Clean business	Part of the City's official work
129	Carbon neutrality plans of the City's subsidiary communities	Completed; the ownership strategy requires that relevant subsidiaries have a plan in place
130	Maintaining carbon storage in green areas and the urban environment	Climate change adaptation policies for 2019–2025
131	Network of urban forests and wooded areas	Climate change adaptation policies for 2019–2025
132	Viable forests	Climate change adaptation policies for 2019–2025
133	Vegetation on plots	Complete; guide for urban cultivation
134	Green factor method	Climate change adaptation policies for 2019–2025
135	Information about carbon storage and carbon sinks	Completed; review in 2020
136	Assessing emissions compensation methods	Part of the City's official work
137	Finishing the preparation of the adaptation policies and bringing them into decision-making	Completed; approved by the City Board on 27 May 2019
138	Communication and interaction plan for the action plan	Completed
139	Using engagement and interaction models	Completed
140	Borough liaisons	Part of the City's official work
141	Carbon Neutral Helsinki 2035 steering group	Completed
142	Division-specific objectives	Part of the City's budget process

No	Action	After the update
143	Business forum	Not to be implemented; there are several other networks
144	Open policy practice	Completed
145	Assessment tools for the action plan	Completed
146	Reporting emissions reductions	Completed
147	Assessment of the Action Pan	Completed

APPENDIX 3:

Cost effects of emissions reductions

Action	Emissions reduction	Cost of the emissions reduction	Cost per tCO ₂ e
CATEGORY 1: Actions that reduce emissions			
Adjusting the ventilation in City facilities to an appropriate level.	-20,000 tCO ₂ e/year in comparison to a situation where the ventilation system is running full-time. There is no information available on the current usage rate of the ventilation systems.	-11 million euros/year in comparison to a situation where the ventilation system is running full-time. There is no information available on the current usage rate of the ventilation systems.	€-550 per tCO ₂ e
Low-emission concrete in infrastructure projects.	-15% (GWP.85) compared to conventional concrete.	+10–20% compared to conventional concrete. The estimate is based on the experiences from the Kalasatama–Pasila project. As competition increases, the price difference is expected to diminish. Furthermore, it must be taken into account that the price of concrete is only a fraction of a project’s total costs. In the pilot site, the cost effect of low-emission concrete was only parts per thousand in the overall costs of the project. The price of conventional concrete will increase in the future, which will reduce the price difference even further.	

Action	Emissions reduction	Cost of the emissions reduction	Cost per tCO ₂ e
Reducing the emissions from the preconstruction at the former Malmi Airport area by 50%.	-64,000 tCO ₂ e by 2030 (-50% from the reference level of 2020–2030).	Lower-carbon preconstruction will likely incur lower costs than the conventional option. The costs of burnt lime will increase significantly due to the EU's emissions trading, which will contribute to a positive cost effect.	
Replacing outdoor lights with LED lights	Direct impact on emissions reductions in relation to the City's total target for emissions reductions: less than 1%. The energy saving estimated for a single lamp is 50–75% compared to a discharge-based light source.	Additional cost €2.5 M/year in 2023–2025 and €2 M/year in 2026–2030. Depending on the type of lighting fixture, the repayment period is 5–7 years.	
Lowering temperatures in City-controlled facilities	If the temperature could be decreased by 2°C in half of the properties, the consumption of district heating would drop by 5%, or 20 GWh (with the assumption that a drop of 1°C in indoor temperature corresponds to a drop of 5% in heating energy consumption). With the emissions of 2021, the drop equals an emissions reduction of 3.7 kt CO ₂ e.	Lowering the temperature will reduce the consumption of heating energy. When calculated using the assumptions above, the savings achieved would be 5% of the district heating costs of properties directly owned by the City.	

Helsinki

