NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

City Climate Contract

Vilnius City Climate Neutrality Action Plan by 2030

VILNIUS

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Content

Note: In Lithuanian, Vilnius Climate City Contract is called Vilniaus miesto klimato susitarimas (English: Vilnius City Climate Agreement). The term "agreement" is chosen in the Lithuanian version of the document to address the iterative and strategic characteristics of the document; that it is a "live document" that can be amended due to long term circumstances.

Summary

The Summary outlines the contents of the 2030 Climate Neutrality Action Plan (the "Action Plan"), which is being jointly developed by local authorities, local businesses, and other stakeholders.

Description
Europe, like the rest of the world, faces a wide range of climate change challenges every day – environmental, infrastructural, social, and others. Vilnius Municipality is taking action to address these challenges, which has given the city the opportunity to participate in the EU Mission "Climate-Neutral and Smart Cities". The Lithuanian capital's target is to achieve a reduction of at least 80% in GHG emissions by 2030 compared to 2021 (base year*) emissions. Drastic reductions in GHG emissions require action in the areas of energy, transport, buildings, waste and green, nature-based solutions, both through the creation of new infrastructure or the transformation of existing infrastructure, and through social measures to educate the public and encourage more climate-neutral behaviour or lifestyles. Innovative, experimental and potentially unprecedented solutions are also being sought – pilot projects that may lead to new smart methodologies that could be applied on a larger scale in the future. According to the GHG inventory data of Vilnius City, the focus should be on promoting the use of renewable energy sources, improving energy efficiency, and implementing sustainable mobility measures. Energy and transport are critical areas that generate the largest carbon footprint in the city. The actions set out in the city's Climate Neutrality Action Plan would also have the co-benefits of transforming Vilnius into a more sustainable, environmentally friendly city with reduced pollution; fostering the sense of community in the municipality; and strengthening green economy, which would also bring financial benefits. Climate neutrality targets will not be achieved without the mobilisation of different groups in society. To reduce GHG emissions in the city, the municipality will engage a wide range of stakeholders in an integrated manner – Vilnius City Municipality Administration and its subordinate bodies, national government, business and industry, non-profit organisations, scientific institutions, and the city's residents and organisations representing them. Reducing climate impacts also requires political will, a coherent legislative framework, and changes in everyday consumer behaviour, business and industry activities. Systematically changing energy consumption and daily city travel habits in cities to more environmentally friendly ones, applying circular economy and sustainable management principles as widely as possible in business and industry, and promoting a just transition of different city systems in the context of climate change mitigation, would lead to a long-term outcome of minimum GHG emissions and climate neutrality. This Climate Neutrality Action Plan may be supplemented and adjusted as the situation evolves (for example, technological innovation, increased adaptability of innovation, etc.). *2021 saw a recovery of GHG emissions to around 2019 levels, which were recorded before the onset of the COVID-19 pandemic and its associated constraints.

List of Figures

The list of figures includes the names and locations (page numbers) of all visual elements used in the Action Plan: figures, drawings, photographs, maps, etc.

Abbreviations and Acronyms

The list of abbreviations and acronyms includes abbreviations (a shortened form of a word used in place of the full word) and acronyms (a word made up of the first letters of each word in the name phrase) used in the Action Plan.

Abbreviations and Acronyms	Definition
AB (JSC)	Akcinė bendrovė (Joint stock company)
RES	Renewable energy sources
EPMA	Environmental Project Management Agency
DH	District heating
EBRD	European Bank for Reconstruction and Development
EU	European Union
MBT	Mechanical biological treatment
IHP	Independent heat producers
ODS	Ozone-depleting substances
SĮ	Savivaldybės įmonė (Municipal company)
GHG	Greenhouse gases
SECAP	Sustainable Energy and Climate Action Plan
SUMP	Sustainable Urban Mobility Plan
UAB (CJSC)	Uždaroji akcinė bendrovė (Closed joint stock company)
VAATC	Vilniaus apskrities atliekų tvarkymo centras (Vilnius County Waste Management Centre)
VCHPP	Vilnius Combined Heat and Power Plant
VCM	Vilnius City Municipality
VCMA	Vilnius City Municipality Administration
VšĮ	Viešoji įstaiga (Public entity)
VŠT	Vilniaus šilumos tinklai (Vilnius Heat Networks)
PT	Public transport
VVT	Vilniaus viešasis transportas (UAB) (Vilnius public transport)

Introduction

The introduction should describe the local policy context in which the Action Plan is being prepared and outline the gap it addresses.

Introduction

Climate change, or the climate crisis, has been a prominent issue on political agendas for years. It represents one of the most significant challenges we face—locally, nationally, and globally—posing a severe threat to both nature and humanity while increasing risks to national security and societal stability. In 2023, the Earth's average surface temperature reached its highest level since records began in 1880 (source: NASA/GISS), standing approximately 1.36°C warmer than the pre-industrial average (1850-1900). The past decade has been the warmest in recorded history, with the years from 2015 to 2023 being the hottest in Lithuania. In Vilnius, the average annual air temperature rose more rapidly than the global average, with a 2.7°C increase from 1951 to 2022. This sharp rise is partly due to the urban heat island effect, where cities' artificial surfaces trap heat, exacerbating the climate crisis.

Urbanisation adds complexity to this issue. While cities cover only about 4% of the European Union's (EU) land area, they are responsible for approximately 75% of the EU's greenhouse gas (GHG) emissions[1]. With urban populations expected to rise—projected to reach 85% of Europeans by 2050—the pressure on both the environment and infrastructure will only intensify. Vilnius, already home to over 20% of Lithuania's population, continues to expand at a rate of around 2% each year, contributing roughly 12% of the country's total GHG emissions. The transport sector is the largest contributor, generating about 38% of the city's emissions and accounting for approximately 15% of Lithuania's overall transport-related GHG emissions.

Given these stark realities, addressing climate change demands action not only at the national level but also at the local level, with the active involvement of the community—businesses, academia, citizens, and other stakeholders. In cities like Vilnius, solutions must tackle both the growing population and the worsening environmental challenges, working collectively towards a more sustainable future.

Vilnius is literally a green city. Its public green spaces cover 40.3% of the city's territory (25.7% are in the city centre), while the city's green spaces in general cover around 61.0%. Most of the city's green spaces are forest parks, but about 17.5% of the area is agricultural land, which forms a more open meadow landscape. These green spaces, the Neris River and other rivers flowing through the city form a functional network of ecological corridors for the city's biodiversity. As a result, 18 Natura 2000 sites have been established in Vilnius City to protect 19 species and 18 habitat types of EU importance.

In 2023, Vilnius was honoured with the title of "European Green Capital 2025", a prestigious recognition from the European Union that opens doors for engaging a broad range of stakeholders. This title not only promotes participation in European Green Capital events but also encourages active involvement in shaping a climate-neutral city. By aligning with Vilnius' mission, it helps spread the message of climate-neutral cities to a wider audience, particularly external stakeholders such as citizens, businesses, and national institutions. This creates a valuable opportunity to raise public awareness about the impact of climate change on everyday life, emphasising the importance of climate neutrality and inspiring citizens to take action in reducing their environmental impact. Collectively, these efforts can lead to significant benefits, from lowering greenhouse gas emissions to fostering a greener, more sustainable city for future generations.

Vilnius' commitment to remaining a modern, open and environmentally friendly city has been recognised with various awards and nominations. It was nominated for a World Summit Award (2021) in the *Smart Settlements & Urbanisation* category and received the European Capital of Innovation Award (3rd place, 2021). The newly designed Paupis district has been nominated for the prestigious

[1] Source: https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe/climate-neutral-and-smart-cities_en

MIPIM Award for Urban Regeneration as one of the best and most sustainable architectural projects in the world. These achievements demonstrate Vilnius' commitment to sustainability and its efforts to address the environmental challenges facing the city. In addition to individual projects, the city is involved in initiatives related to climate change and environmental protection:

- In 2013, Vilnius signed the Covenant of Mayors, committing to climate mitigation and energy targets by 2020. In 2023, the commitment was renewed.
- The Green City Accord was signed in 2021.
- In April 2022, Vilnius became a participant in the EU Mission "100 Climate-Neutral and Smart Cities by 2030".
- It signed the EU Mission Charter on Adaptation to Climate Change in 2023.

With an ambitious GHG emissions reduction target set in the cities mission, Vilnius will strive to implement bold actions covering all areas. These actions can only be successfully implemented if every municipal employee, resident, business and politician takes responsibility and makes every effort. Therefore, the aim will be to ensure that the institutional framework functions efficiently, that comprehensive and regular information is continuously collected and processed in compliance with mission reporting requirements, and that it is useful to the municipality's decision-makers and relevant stakeholders who will implement the actions set out in the Action Plan.

The main areas for action in this document are:

- Promoting the use of renewable energy sources (RES),
- Energy efficiency;
- Sustainable mobility,
- Reducing energy consumption,
- Increasing greening.

Energy reduction actions are mainly focused on the renovation of municipal offices and businesses as well as residential buildings and on the efficiency of public lighting. In the heat production sector, the aim will be to improve the efficiency and renovation of outdated heat networks, boiler houses and other infrastructure, and to phase out the use of fossil fuels for heat production by 2030. Equally important is to increase the production and consumption of electricity from RES in the municipality, which will encourage the installation of solar power plants on the roofs of buildings or investment in remote solar (or wind) power plants. A major challenge and opportunity for the city is the growing number of cars. Therefore, the first priority will be to replace fossil fuel vehicles (both public transport and private/commercial) with environmentally friendly electric or hydrogen vehicles. Secondly, Vilnius City Municipality aims and will continue to make travelling by public transport a priority and will continue to improve the city's cycling and pedestrian infrastructure as well as to develop the charging infrastructure for electric vehicles in the city. In addition, further greening of Vilnius city spaces, planting trees, involving local communities or businesses, and increasing the amount of green infrastructure, especially along the city's streets, will remain a priority.

Vilnius City is making good progress in mitigating climate change, but the current situation is not sufficient. Participating in the EU mission "100 Climate-Neutral and Smart Cities by 2030" is an invaluable experience for knowledge exchange between cities and opportunities for cooperation. The Vilnius City Climate Neutrality Action Plan by 2030 is part of Vilnius Climate City Contract, which consists of two other documents: an investment plan directly linked to the Action Plan and a commitment document. The documents have been drafted in accordance with the NetZeroCities guidelines and templates provided.

This Action Plan integrates much of the information from all available city strategy documents and, in consultation with experts from different sectors, plans additional actions that will reduce emissions in the Vilnius city area by at least 80% by 2030 compared to 2021 (base year). Experts from the municipality and municipal companies, as well as other stakeholders, have been involved in the preparation stage of this Action Plan. It is important to note that as Vilnius is a dynamic, innovative

and vibrant city, this Action Plan will be continuously updated with new actions and actions already planned can be updated or amended.

I-1.1: Climate Neutrality Target by 2030			
Sectors	**Scope 1**	**Scope 2**	**Scope 3**
Stationary energy	Included (Heat production)	Included (electricity consumption)	-
Transport	Included (Passenger and commercial vehicles, public transport)	-	-
Waste/wastewater	Included (wastewater management, biological waste management)	Not applicable	Included (landfilling)
Industrial processes and product use	Included (production of mineral products and products used as ODS substitutes)	Not applicable	-
Agriculture, forestry and other land use	Excluded	Not applicable	-
Geographical boundaries	**The same as the administrative boundary of the city**	**Smaller than the administrative boundary of the city**	**Greater than the administrative boundaries of the city**
	+		

Map

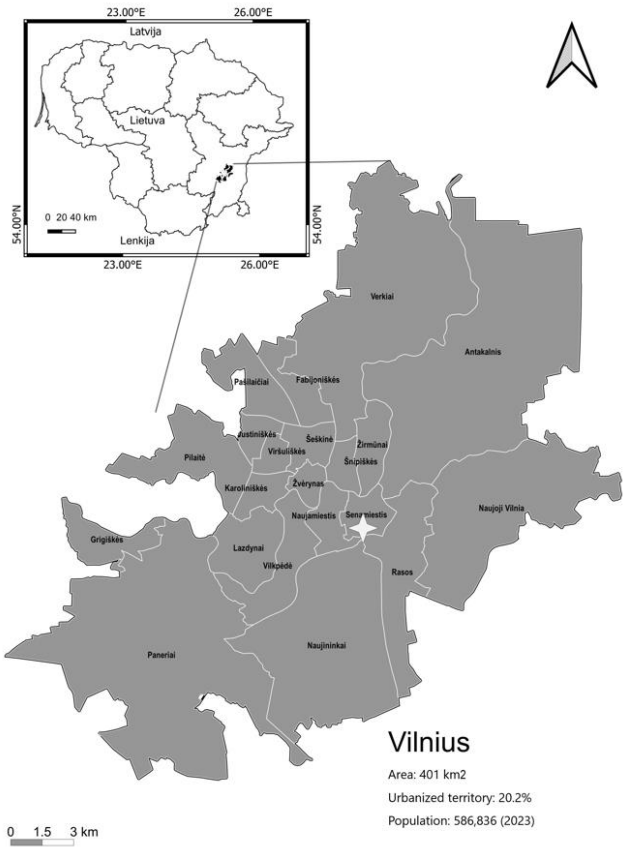


Fig 1. Map of Vilnius City

1 Workflow

This section should list the work stages that have been completed, for example, in the context of the NZC Climate Transition Map, or the associated stages planned, as well as the timetable for the ongoing development of the Action Plan and the stages for future iterations.

Workflow – A Combination of Text and Visual Elements

Vilnius City Municipality, which was successfully included in the EU Mission "100 Climate-Neutral and Smart Cities by 2030", has focused on developing a climate city contract. To implement this crucial task, the municipality established the public entity "Neutralus klimatui Vilnius" (in English "Climate Neutral Vilnius"). This organisation is tasked with coordinating all activities related to the EU mission, ensuring a smooth and efficient process.

Climate-Neutral Vilnius works on the principles of inclusiveness and co-development, i.e. promoting the participation and involvement of different stakeholders. The team actively engages with key stakeholders and citizens, holding one-to-one meetings and workshops to gather insights, build a strong mandate and collaboratively develop a comprehensive list of actions to drive the desired transformation towards climate neutrality.

The Vilnius City Climate Neutrality Action Plan by 2030 has drawn on content and data from existing strategic planning documents of Vilnius City and the city's businesses, ensuring consistency with the city's broader objectives (Fig 2).

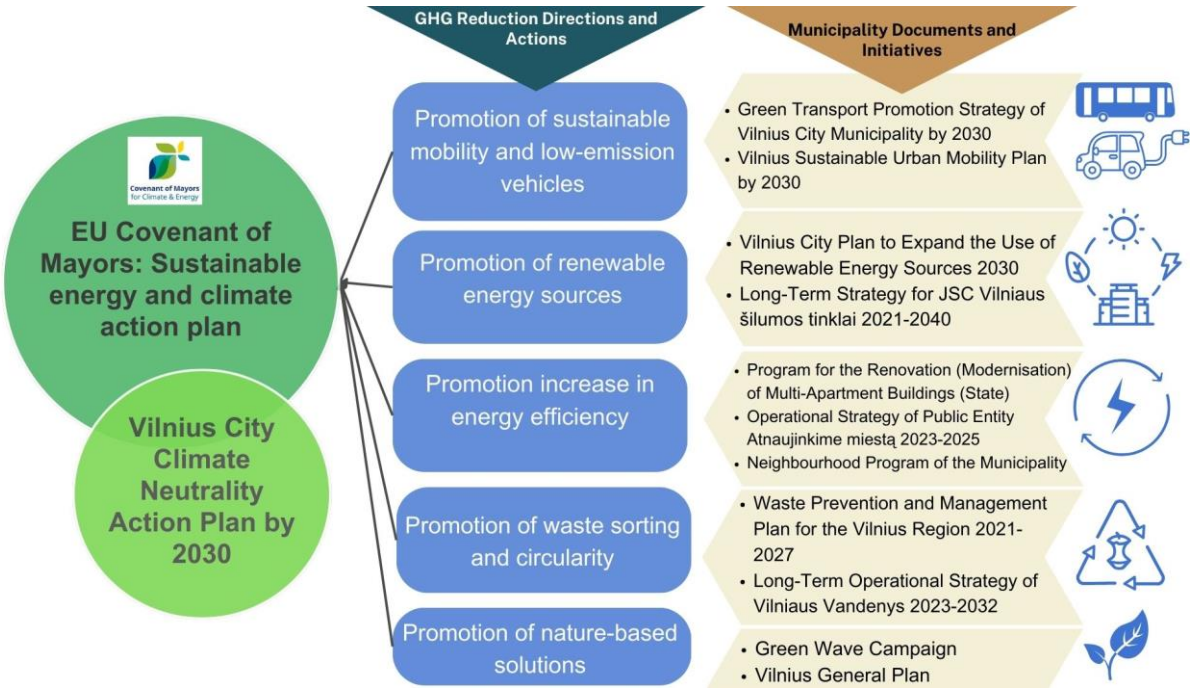


Fig 2. Key Integrated Municipal Planning Documents and Initiatives in the Development of the 2030 Vilnius City Climate Neutrality Action Plan

The analysis of the current situation—inventory of climate mitigation policies and measures, GHG emissions—was carried out in the context of the preparation of the Sustainable Energy and Climate Action Plan (SECAP) between April and December 2023. This plan also analysed different mitigation scenarios and identified possible directions for Vilnius City Municipality to move towards becoming a climate-neutral city. Representatives from different municipal departments and municipally-owned enterprises were

involved in the preparation of the SECAP, providing data and comments. This document is the basis for the Vilnius Climate City Contract (CCC) by 2030.

To further the success of the CCC and the Action Plan, the city understands the need to bring Vilnius society – various experts and citizens – together. Designing and implementing CCC is not possible without collaboration of all stakeholders and citizens active in the city – including various private businesses and service providers, NGOs, civic societies and organizations, scientific institutions, national government institutions. Public entity "Neutralus klimatui Vilnius" was established by the city council exactly for the purpose to gather everyone together for the climate neutrality goal 2030. The entity is responsible for creating a strategy how to engage stakeholders to take climate actions and coordinate all the processes related to CCC development and it's implementation.

In the first step of creating CCC, two dedicated working groups were established to share their expertise – a Steering Group and an Expert Group (Fig. 3). The Steering Group is composed of municipal decision-makers, thus ensuring the feasibility of the action plan. The Expert Group is composed of professionals in various fields, including district heating, mobility, street lighting, waste management, wastewater treatment, energy efficiency, building and modernisation development, and green infrastructure.

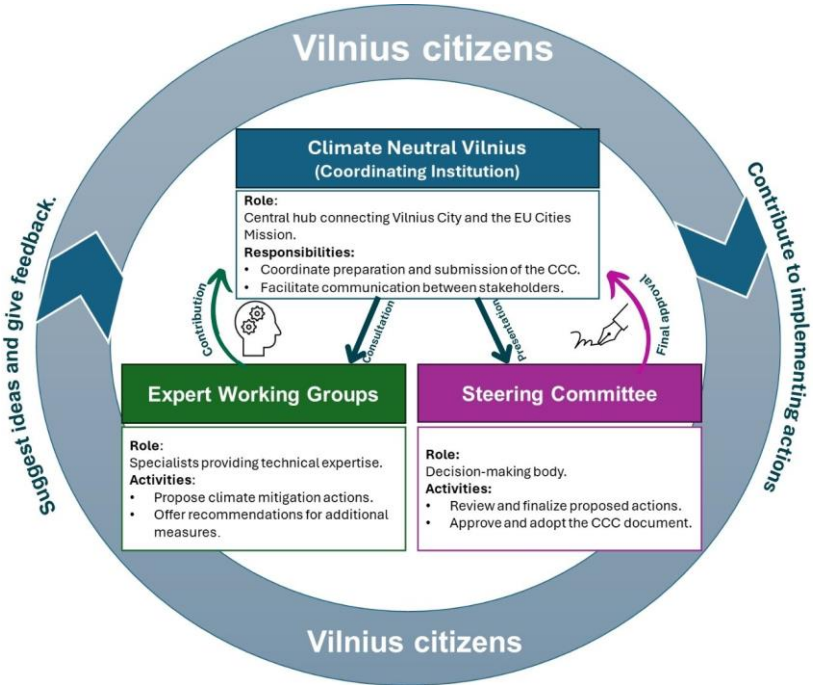


Fig 3. Development and implementation of Vilnius Climate City Contract Action Plan by 2030

In the last stage of the preparation of the document, five sectoral meetings (energy, buildings, transport and mobility, waste management, and green infrastructure) were organised with members of the Expert Group from different sectors. These meetings discussed the selected actions and included new ones based on expert insights and future perspectives. Once all actions were agreed with the Expert Group and corrections made, they were submitted to the Steering Group for final approval.

The phase of designing CCC is continued and followed by active engagement of Vilnius citizens. All groups of city's society are invited to review the document and suggest ideas that could accelerate the movement towards net-zero in the most feasible and smartest way. At the same time, citizens are inspired to contribute to implementing the actions stated in the CCC.

Vilnius has started organizing meetings with citizens – events dedicated to presenting Vilnius goals and ideas on how everyone could contribute to take an active role in decreasing GHG emissions and making the city greener and more sustainable to live in. Even though the municipality is having very first direct

dialogs with the citizens about climate neutrality and it's importance, Vilnius is determined to have a solid long term strategy of citizens' engagement. As the city feels the need and find it important to hear the citizens voice and opinions on nowadays sensitive topics related to climate change, some forms of engagement are being seriously explored as potential options – one of the most interesting and most discussed is a **climate assembly.** It would give citizens a voice, focusing on a variety of groups, including vulnerable groups that are often forgotten in policy making. This gathering of citizens would contribute to developing recommendations for decision-makers that will expediate a socially just and democratic transition towards a low carbon society. The assembly could possibly:

- Gather 1-2 people from different societal groups, indicated by experts (so that no one would be left behind) into one room;
- Take place in premises of Vilnius City Municipality Administration;
- Frequency of the meetings: 2 gatherings / a year + plus other occasions for the meetings when the necessity is being observed.

The come-together meetings in this or other potential form will help Vilnius' citizens to follow climate neutrality journey, propose and share ideas or feedback, and get deeply involved by implementing actions that leads the city to net-zero.

Vilnius is also in the process of exploration of various other – more active and even proactive – ways to truly engage citizens and other stakeholders in the CCC implementation phase. One of the examples that could evolve into a bigger scale long term initiative supporting implementation of climate actions is the **Climate Fund**. Vilnius is about to start piloting the idea of gathering donations and financial support from various businesses and organisations active in the city, so that this financial support could be used to implement net zero ideas that are created by groups and organizations of citizens.

As part of the monitoring of Vilnius Climate City Contract by 2030, it is planned to update Vilnius City's GHG emissions data on an annual basis and to collect additional data on progress towards the targets. These indicators have been selected according to the measures chosen and set out in the plan. The implementation of the plan is to be reported to the City Mission Coordination Working Group, which is composed of representatives of the municipality administration and municipal companies. An assessment of progress will determine whether there is a need to supplement the existing Action Plan. It is also important to mention that the strategic documents of the municipal companies may be updated during the planning period and supplemented by actions not yet planned, so we will update this plan in the process. This plan will be monitored by VšĮ "Neutralus klimatui Vilnius".

2 Part A – Current Situation in the Area of Climate Change

"Current Situation in the Area of Climate Change" describes where the city has started on the path to climate neutrality, including commitments and strategies from key local businesses, and builds on the subsequent modules and the specified ways to accelerate climate action.

2.1 Module A-1. Greenhouse Gas Inventory

In 2013, following the signing of the Covenant of Mayors, Vilnius started reporting its GHG emissions, which were updated every two or three years. At that time, the base year was 2003. The GHG inventory was prepared in accordance with IPCC guidelines and SECAP recommendations (see for more information in Annex I). GHG emissions are calculated for the entire territory of the municipality, including direct and indirect GHG emissions. GHGs included are CO_2, CH_4, N_2O, HFCs.

The latest GHG inventory report for 2018-2021 was finalised in August 2023 and the historical calculations have been updated due to changes in the emission factors used and improvements in the methodology. This document provides information for the most recent calculation year, 2021, which has been chosen as the base year to monitor the municipality's GHG reduction progress until 2030.

A-1.1: Final Energy Use by Source Sector				
Base year	2021			
Units of measurement	MWh/year			
	Scope 1	Scope 2	Scope 3	Total
Buildings				
District heating (Note: Includes households connected to district heating)				
Natural gas	1,615,179			1,615,179
Biofuel	1,409,016			1,409,016
Municipal waste (non-renewable part)	186,126			186,126
Municipal waste (renewable part)	154,655			154,655
Mazut	45,442			45,442
Electricity		16,711		16,711
Diesel fuel	812			812
Liquefied natural gas	176			176
Individual heating				
Biofuel	1,392,886			1,392,886
Natural gas	833,901			833,901
Electricity		1 952 554		
Transport (private cars + public transport + trains)				
Petrol	1 227 951			1 227 951
Diesel Fuel	2 223 354			2 223 354
Liquefied petroleum gas (LPG)	179,012			179,012
Liquefied natural gas (LNG)	57,129			57,129
Bioethanol	85,338			85,338
Biodiesel	148,345			148,345
Electricity	24,115			24,115

Industry				
Natural gas	308,250			308,250
Biofuel	295,856			295,856
Coke	113,448			113,448
Coal	519			519
Diesel fuel	2,022			2,022
Agriculture, forestry and land use	Not included (relatively insignificant quantity)			

A-1.2: Adjusted Emission Factors	
Calculating t or MWh of primary energy	
Methodology used: IPCC and National GHG Inventory data; emission factor includes GHGs as CO_2, CH_4, N_2O as it covers only Energy sector. More information on emission factors *see* in Annex I.	
Energy source (fuel type)	
Electricity	**tCO_{2eq}/MWh**
Fuel mix factor	0.385
Fossil fuel	**tCO_{2eq}/MWh**
Natural gas	0.199
Liquefied natural gas	0.241
Diesel fuel	0.263
Petrol	0.253
RES	**tCO_{2eq}/MWh**
Biofuel	0.256
Biogas	0.211

A-1.3: Activities by Source Sector			
Base year 2021			
	Scope 1	Scope 2	Scope 3
Sector: Buildings			
Activities	District heating Individual heating (gas, biofuel, other fuels)		
Sector: Transport			
Activities	Private, commercial and public transport		
Sector: Waste			
Activities	Wastewater management		Landfilling
Sector: Industrial processes and product use (IPPU)			
Activities	Use of fluorinated gases in air conditioning and refrigeration systems Manufacture of mineral wool		
Sector: Agriculture, forestry, and other land use (AFOLU)			
Activities	Tree planting, land use areas (agricultural emissions not counted as negligible)		
Sector: Electricity consumption			

Activities		Electricity consumption in buildings, private and public transport, industry, services providing companies, etc.	

A-1.4: GHG Emissions by Source Sector				
Base year	2021			
Pcs	tCO_2equivalent/year			
	Scope 1	Scope 2	Scope 3	Total
Buildings				
District heating	421,993 (of which 76,084 due to incineration of municipal waste in a combined heat and power plant)			
Individual heating	209,023			
Transport	948,088			
Waste and wastewater management	24,403 (wastewater management)		47,475 (landfilling)	
Electricity		633,631		
Other sectors (industry, services, etc.)	208,354			
Total	1 811 861	633,631	47,475	2 492 967

A-1.5: Graphical Part

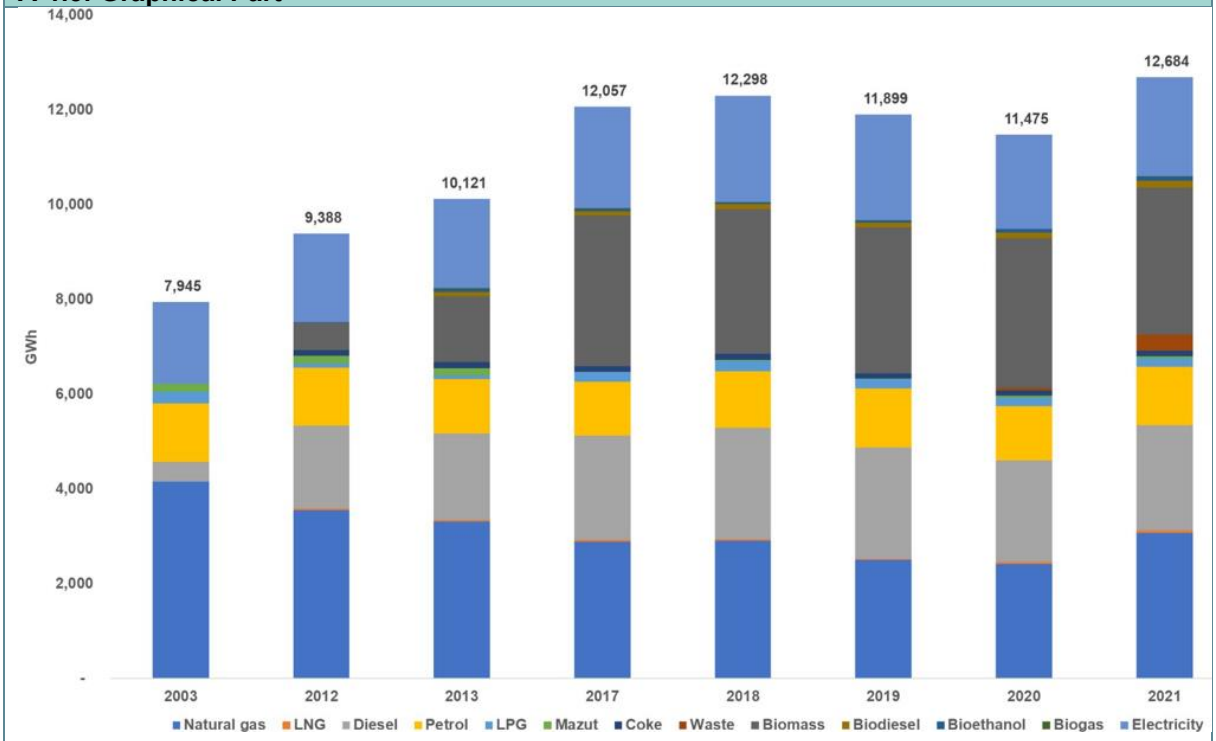
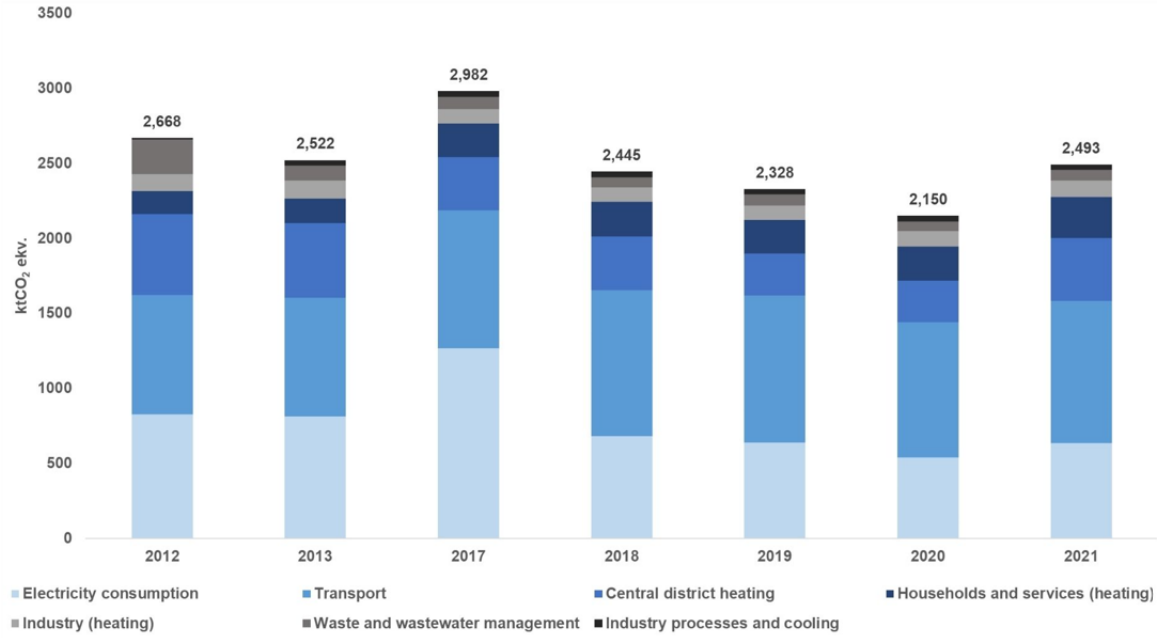


Fig 4. Distribution of Fuel Consumption in Vilnius City from 2012 to 2021, GWh



*For 2014, due to lack of data, GHG emissions from electricity consumption are averaged over 2012-2013.

Fig 5. Distribution of Vilnius City GHG Emissions by Sector from 2012 to 2021 (excluding GHG removals), $ktCO_2$ eq.

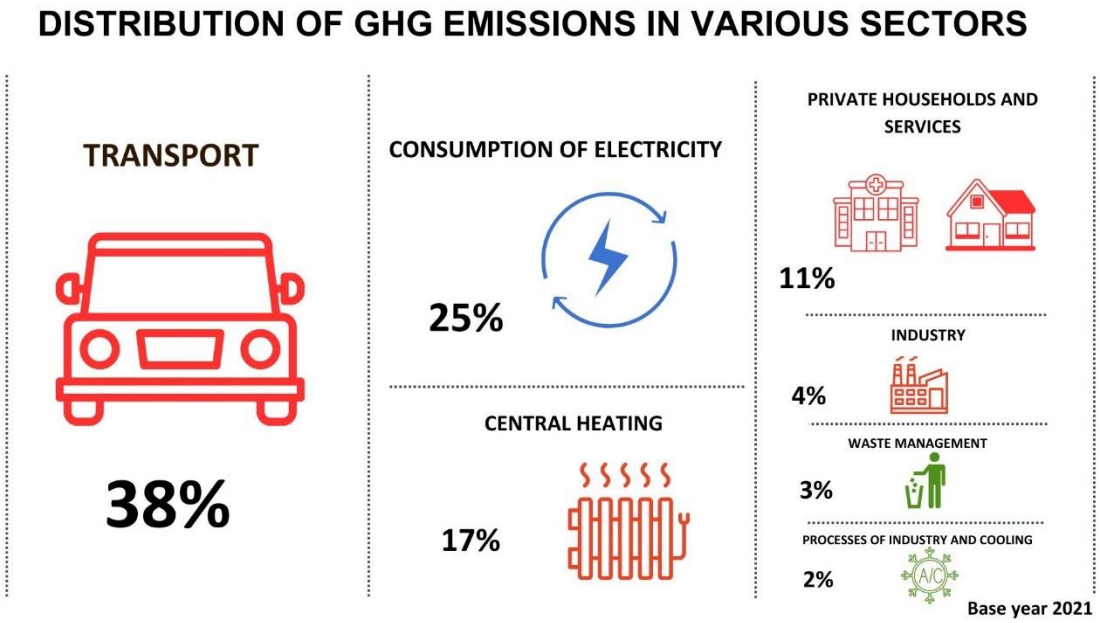


Fig 6. Distribution of GHG emissions in various sectors of Vilnius City in 2021 (baseline year)

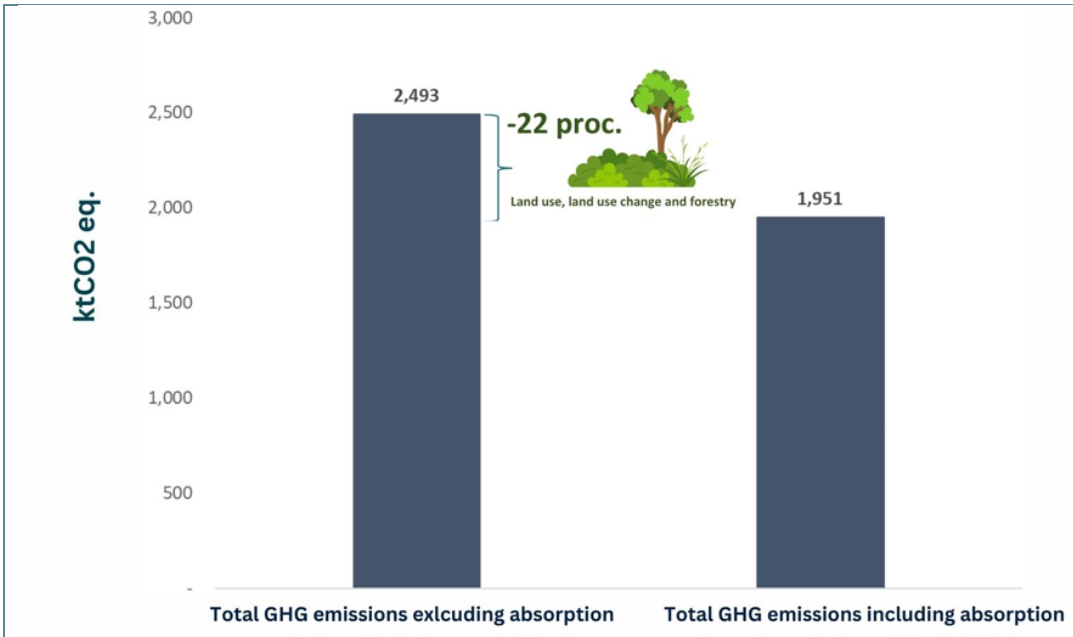


Fig 7. GHG emissions of Vilnius City in 2021 without and with GHG sinks (forests, grasslands, individual trees), thousand tCO_2 eq.

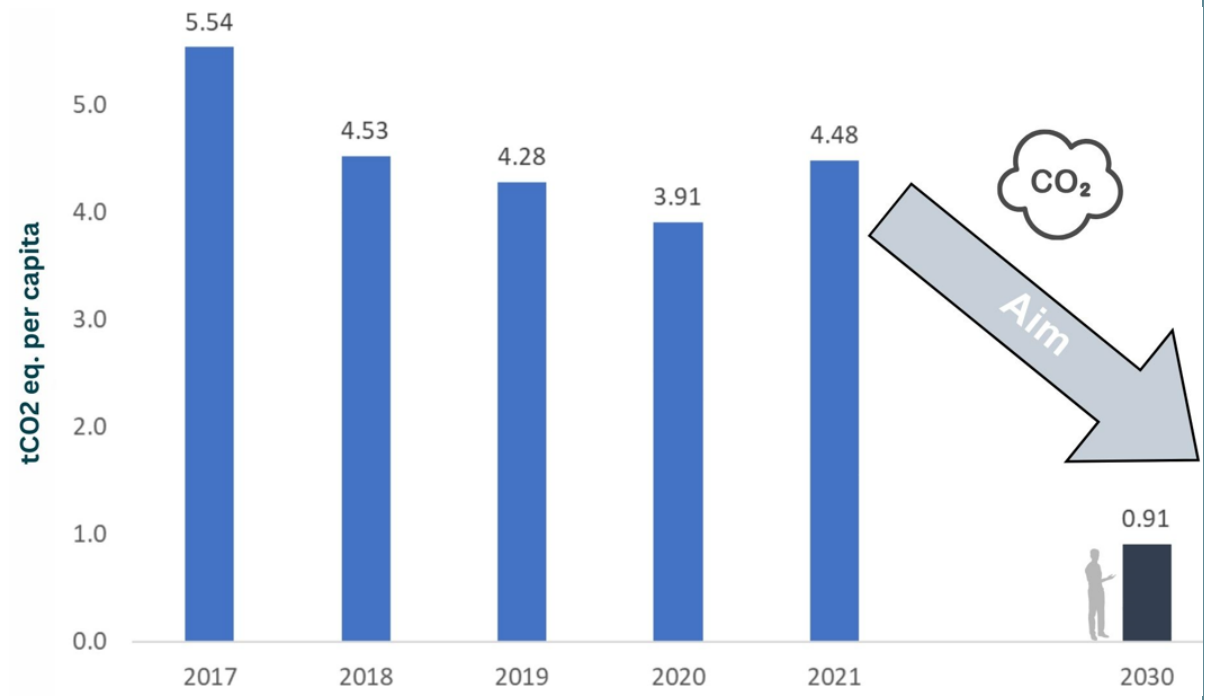


Fig 8. GHG Emissions of Vilnius City Per Capita from 2017 to 2021 and the 2030 Target

A-1.6: Description and Assessment of Greenhouse Gas Inventory

The GHG emission inventory was prepared in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines) and the methodology proposed by the Covenant of Mayors. Since the IPCC Guidelines do not cover GHG emissions from electricity consumption, the recommendations of the Covenant of Mayors were applied. To standardize all GHG values, the global warming potential (GWP) values for a 100-year period from the IPCC's Fifth Assessment Report (AR5) were used, converting emissions into the common unit of CO_2 equivalent (CO_2eq). A detailed

description of Vilnius City's GHG emission evaluation methodology can be found **in Annex I of this document.**[2]

In the base year of 2021, Vilnius City's total fuel consumption was 12.5 GWh, representing a 35% increase compared to 9.3 GWh in 2012. Despite this, GHG emissions decreased by 9.9% over the same period, from 2,668 $ktCO_2eq$ in 2012 to 2,493 $ktCO_2eq$ in 2021. Significant increases were noted in diesel and liquefied petroleum gas usage in road transport and biofuels for heat production. However, a rise in GHG emissions from electricity consumption was observed in 2017 due to higher emission factors, primarily because the imported electricity was generated from fossil fuels.

It's important to note that GHG removals were estimated only for 2021, so total emissions are shown without removals for all other years. Using the Ministry of the Environment's GHG spreadsheet for municipalities, the GHG removals in 2021 were calculated to be -542.53 $ktCO_2eq$ (Fig. 7). When removals are accounted for, the net total GHG emissions in 2021 were 1,951 $ktCO_2eq$, indicating that vegetation in Vilnius City absorbed approximately 22% of its total emissions that year.

Per capita GHG emissions in 2021 were 4.48 tCO_2eq. per capita. Projections based on the chosen GHG reduction target estimate that this number will decrease to approximately 0.91 tCO_2eq by 2030, assuming no significant change in population size.

District heating

The main supplier of district heating in Vilnius is the municipally owned enterprise **AB Vilniaus šilumos tinklai (VŠT)**. In 2021, VŠT supplied 99.45% of the total heat to the network. VŠT produces about 52% of the total heat energy supplied from its own sources, mainly using natural gas in its production processes. The remaining part is purchased from **independent heat producers (IHPs)**, which mainly use biofuels for heat production. The exception is the Vilnius Combined Heat and Power Plant, where a waste incineration unit has been in operation since 2020 (the plant became fully operational in 2021, while in 2020, testing was carried out and only a small amount of heat was produced and supplied). District heating is supplied to the residents of Vilnius City Municipality through 758 km of pipeline. The average age of the pipeline is 30 years, but in some places, it can be more than 50 years. Naturally, pipelines of this age are worn and leaking, which results in higher heat losses during the supply process and contributes to the greenhouse effect. Heat losses in 2021 accounted for ~11.9% of the total heat supplied to the networks. The final consumption of DH transferred by VŠT in 2021 amounted to 2,793 GWh (the total amount fed into the network, together with other heat suppliers, was 3,189 GWh). More than 65% of this heat was consumed by domestic consumers (households). Vilnius City Municipality owns around 600 mixed-use properties, which consume around 4.5% of the total heat transferred through the DH networks each year. The largest number of buildings are educational and health care institutions. These institutions consume 3.7% of the total heat supplied to Vilnius City. Educational establishments consume the largest share of heat energy – more than 80% of the total heat energy consumed in municipally-owned buildings.

Between 2012 and 2021, the share of natural gas in the fuel balance of the DH sector dropped from 80% to 47%, resulting in a reduction of GHG emissions from 542 to 422 $ktCO_2eq$. (22%) over the same period. The main contributing factor was the purchase of heat energy from IHPs, which mainly use biofuels for heat production (which reduced the consumption of natural gas in the main supplier's heat production facilities). However, from 2020 onwards, waste incineration was started at the VCHPP (initially for testing purposes only, with full operation starting in 2021), leading to a renewed increase in GHG emissions. Based on 2021 data, GHG emissions from the combustion of waste to produce heat amounted to 76 $ktCO_2eq$. It is important to note that in terms of weight of waste incinerated, renewable and non-renewable waste (classified as an environmentally polluting fuel) represent the same proportion. Electricity is also used for heat production but is accounted for separately in the total electricity consumption.

Autonomous (individual) heating

In households, fuels are used for home heating, hot water preparation, and cooking. As there is no municipality-wide data on energy consumption for each of these uses separately, the distribution is

[2] Note: The GHG inventory methodology is continuously evolving. Data provided in future monitoring reports may differ due to re-estimations.

based on overall Lithuanian statistics. According to the State Data Agency, the average consumption of natural gas for cooking is about 22.6% of the total. In this sector, the main fuels are natural gas, biofuels and electricity (the emissions of which are assessed under the electricity consumption sector).

In households, biofuels are the most popular choice for heating (around 65%). GHG emissions followed an upward trend between 2012 and 2021, from 102 to 209 ktCO_2eq. (105%). The increasing GHG emissions are partly explained by the increase in the consumption of biofuel, which, although CO_2-neutral, when burned in households emits large amounts of methane, which contributes to the overall GHG increase. Fuel consumption (and hence GHG emissions) is also influenced by the average annual air temperature, which in 2021 was lower than the year before.

Service and industrial sectors

In the service sector, fuel consumption has changed only slightly, but natural gas consumption has increased by 32% over ten years. Biogas consumption has decreased by 62% since 2013 (2012 data not available). Total GHG emissions from the sector have increased from 47 to 62 ktCO_2eq.

The largest industrial enterprises in Vilnius are the paper producer AB “Grigeo”, the glass wool producer UAB “Paroc”, and AB “Vilniaus Gelžbetonių Konstrukcijų Gamykla Nr. 3”. UAB “Dvarčionių keramika” had also been operating in the city until 2014 but ceased operations in 2016. These enterprises are participants in the EU Emissions Trading System (EU ETS). This sector also includes other industries not participating in the ETS, based on information provided by the Environmental Protection Agency on the types and quantities of fuels they consume.

Industrial GHG emissions are from the combustion of fuels for heat production and industrial processes. From 2012 to 2021, only UAB “Paroc” caused GHG emissions from industrial processes, i.e. the production of glass wool using dolomite. Natural gas consumption decreased by 8% between 2012 and 2021 to 308 GWh. Total emissions from the sector decreased by 4% over this period. Total emissions from the sector in 2021 amounted to 120 ktCO_2eq. (including industrial processes), of which 60% were from companies participating in the EU ETS. In the last year under review, coke accounted for 16% of the fuel balance and as much as 41% of the sector’s GHG emissions (the total is net of GHG emissions from industrial processes and CO_2 emissions from the combustion of biofuel).

Transport

According to the data of SĮ Regitra, in 2021 the total number of registered cars in Vilnius Municipality was 385,000 (86% of which were passenger cars (M1 category)). The share of electric vehicles in the total fleet was only 0.8%. The largest share of registered vehicles was diesel (56%) and petrol (39%). Total GHG emissions from the transport sector in 2021 were 948 ktCO_2eq. (including rail transport).

Fuel consumption of private/commercial vehicles (M1 and N1 categories) was calculated based on the results of monitoring the intensity of intersections in the city to determine the total car mileage in Vilnius City, which in 2021 amounted to 3,610 million km compared to 2013. The mileage of road transport in the city increased by 28% (from 2,831 million km). Total fuel consumption in Vilnius City from 2013 to 2021 grew at a lower rate than the distance travelled – around 19%, and the amount of emitted GHGs grew by about 16%. The lower growth rate of GHG emissions compared to fuel consumption is due to the higher share of biofuels in the total supply of petrol and diesel and the increase in the consumption of petroleum gases from 2.1% to 4.6%. The total GHG emissions of the private/commercial transport sub-sector (including rail transport) in 2021 amounted to 912 ktCO_2eq.

In 2021, public transport services in the municipality were provided by two companies: UAB “Vilniaus viešasis transportas” (VVT) and UAB Transrevis. In 2021, the public transport fleet consisted of 537 buses and 257 trolleybuses. The main fuels used were diesel, compressed natural gas, and electricity. The total distance travelled was 39 million km (32 million km in 2012). Thus, total public transport mileage has increased by 22% in the ten years since 2012, while energy consumption has increased by 54%. GHG emissions have increased by around 44% over the same period. This is due to an increase in distance travelled and the replacement of trolleybuses by gas and diesel buses. The share of diesel in the fuel balance has been decreasing from 2020 onwards, but it is still the majority fuel and the largest contributor to GHG emissions. In 2021, diesel accounted for 60% of total fuel consumption but accounted for 68% of the sub-sector’s GHG emissions, which amounted to 36 ktCO_2eq. that year.

Waste management

Since 2007, all waste from the Vilnius region that is unsuitable for other uses has been disposed of at the Kazokiškės landfill site (outside Vilnius City Municipality). Since 2013, the landfill has been operating a landfill gas capture and filtration system, which uses the captured biogas to generate heat and electricity at a nearby power plant. According to information provided by UAB VAATC, more than 7.4 million m^3 of landfill gas (more than 55% CH_4, 39% CO_2, and the rest other gases) has been produced at this landfill in 2021.

Mechanical biological treatment (MBT) facilities, which have been in operation since 2016, treat more than 200 kt of mixed municipal waste (MMW) per year. After treatment, the remaining waste continues to be buried in landfill, but as the treated waste becomes non-biodegradable, this means that no methane is emitted into the environment when the waste is disposed of in landfill. Also, the introduction of waste incineration at the VCHPP has reduced the amount of waste to be landfilled by a factor of about 3 (over 245 kt of waste was buried in 2012 and only 88 kt in 2021).

GHG emissions from the waste and wastewater sector decreased from 230 to 72 ktCO_2eq. (66%) between 2012 and 2021. The main contributors to this have been the reduction in landfilling due to the use of MBT facilities to treat mixed municipal waste in a way that minimises biodegradable waste going to landfill, and the use of landfill gas capture units, which capture around 60% of the total landfill gas emissions. However, since 2012, GHG emissions from the biological treatment (composting) of sludge and green and household waste have almost doubled.

As an increasing proportion of the population in Vilnius City is connected to a centralised wastewater treatment system, GHG emissions from wastewater management have decreased by 8% over ten years (GHG emissions have increased slightly due to an increase in protein consumption of the population, which leads to higher N_2O emissions from wastewater management).

Electricity consumption

Total electricity consumption in Vilnius City Municipality (including grid losses) was 2.1 TWh. Total electricity consumption in Vilnius Municipality grew by 12% between 2012 and 2021 (from 1.9 TWh to 2.1 TWh). All electricity generated in Vilnius City Municipality is from RES. It amounted to 94.9 GWh in 2021. Most of this energy (94%) is generated by Vilnius Heat Plant (Vilnius Power Plant-2, VPP-2) of VŠT, which also produces heat from biofuel. As VPP-2 has an installed capacity of more than 20 MW, the electricity produced there is not counted in the amount of electricity produced and consumed in the municipality; therefore, based on the amount produced by solar and hydro power plants only, the total amount of electricity produced in Vilnius City is only 0.26% of the total electricity demand.

In 2021, only about 34% of the total electricity demand was generated in Lithuania (48.4% from RES), with a higher share imported from neighbouring countries. In order to estimate the GHG emissions associated with electricity consumption in Vilnius City Municipality, the residual mix value for Lithuania is applied to the imported electricity. The residual mix value in 2021 was 0.384 tCO_2/MWh, but it is important to consider that the emissions factor for electricity changes from year to year. Due to lack of data, 2014 is not included. Over ten years, electricity consumption has been growing, but the use of renewable energy sources for generation has been increasing, resulting in a lower emission factor in 2021 and a 23% reduction in GHG emissions (from 826 to 634 ktCO_2eq.).

2.2 Module A-2. Assessment of Current Policies and Strategies

Module A-2 "Current Policies and Strategies" lists relevant policies, strategies, initiatives or legislation at local, regional and national level related to the city transition to climate neutrality.

A-2.1: List of Relevant Policies, Strategies and Regulations				
Type	**Level**	**Name**	**Description**	**Relevance**
Strategy	National	National Climate Change Management Agenda	It aims to eliminate all fossil fuels by 2050 in the energy production and supply, agriculture, industry and small-scale energy sectors. Road transport should be fossil fuel-free from 2045 onwards, and transport emissions should be reduced by 90% by 2050 compared to 1990 levels. Industries not participating in the EU ETS should be fossil fuel-free by 2040.	National short- and long-term emission reduction targets and objectives are set. Thus, strong support at national level is maintained.
Strategy	National	National Energy Independence Strategy (*currently being updated*)	It sets out the main objectives, directions and targets of the national energy sector policy until 2030 and a vision until 2050. The Ministry of Energy has now set more ambitious targets than in the current strategy: to reach 55% of RES in final energy consumption and 100% of RES in total electricity consumption by 2030.	Vilnius is directly dependent on electricity produced and imported in the country, so changes in the electricity market at national level have a direct impact on the municipality's GHG emission reductions in electricity consumption.
Law	National	Law of the Republic of Lithuania on Energy from Renewable Sources	This law establishes a general framework for promoting the use of RES in Lithuania. Municipalities: (1) Draw up and, in agreement with the Government or the authority authorised by it, approve and implement action plans for the development of the use of renewable energy sources; (2) In organising the provision of heat energy in the territory of the municipality, aim to use renewable energy sources for the production of heat energy; (3) Develop and implement public information and awareness-raising measures, advice and training programmes on the practicalities and benefits of the development and use of renewable energy sources. The Law obliges municipalities to assess and publish on their	The law obliges municipalities to draw up RES development plans, as well as to inform the public about the support, projects, etc. related to RES.

A-2.1: List of Relevant Policies, Strategies and Regulations				
Type	**Level**	**Name**	**Description**	**Relevance**
			websites information on land plots and other sites owned by them on which community energy production facilities for renewable energy may be built or installed.	
Law	National	Law of the Republic of Lithuania on Alternative Fuels	The aim of this law is to reduce the impact of the transport sector on climate change and air pollution. The main objectives are as follows: (a) by 2025, cities with more than 50,000 inhabitants must establish low emission zones. (b) From 2026, for contracting authorities, 100% of all M1, M2, N1 and M3 class vehicles procured will have to be clean. (c) The share of renewable energy in the final energy consumption of the transport sector in 2030 must be at least 15%. (d) By 2030, at least 50% of all M1 cars purchased must be electric vehicles and 100% of N1 cars must be electric vehicles.	Municipalities are obliged to designate low-emission zones. They must also ensure that public bodies carry out green procurement and buy only low-emission vehicles. These measures will encourage an increase in the number of low-emission vehicles at municipal level and limit the use of polluting vehicles in the central part of the city, reducing the attractiveness of the car option and hopefully encouraging the use of public transport or other alternative mobility measures.
Strategy	National	Long-Term Renovation Strategy of Lithuania	It sets a target that by 2050, all public and private buildings and residential buildings in Lithuania will have to become completely independent of fossil fuels and have a zero carbon footprint.	The ambitious target set at national level ensures that the modernisation of multi-apartment buildings in municipalities will continue to be promoted and funding will continue to be made available.
Law	National	Law of the Republic of Lithuania on Construction	All new buildings must be nearly energy-neutral as defined by the Law on Energy from Renewable Sources. The normative energy performance of such buildings would be A++.	New buildings under construction and their energy consumption are affected. The Law ensures that new buildings are more efficient and sustainable.
Law	National	Law of the Republic of Lithuania on Environmental Air Protection (2023 amendment, not adopted)	From May 2026, the use of solid fossil fuels—coal, lignite, peat—will be banned in Lithuania. Thus, municipalities could introduce restrictions as early as next year. From May 2024, municipalities could restrict or ban the use of one or more fuels in one or more parts of their territory where the air quality does not meet the World	The Law empowers municipalities to take action and impose control measures on residents who still burn solid fossil fuels, which particularly worsen air quality and also increase GHG emissions.

A-2.1: List of Relevant Policies, Strategies and Regulations				
Type	**Level**	**Name**	**Description**	**Relevance**
			Health Organisation's (WHO) recommended one-year average air pollution levels.	
Plan	Local	Vilnius City General Plan	The priority objective of the General Plan is to create the conditions for sustainable, economically and socially motivated growth in the quality of life and the reduction of territorial disparities. The development directions and the territory development concept of the General Plan have been prepared for the period up to 2050, and the specific solutions have been prepared for the period up to 2030. The Plan gives priority to the creation of a compact city, the development of green spaces, the competitiveness of public transport, the development of cycling and walking routes, etc. Some of the objectives are to ensure that in high intensity residential areas, the nearest green space is within 200 m of the residential building and at least 3.5 sq. m per capita; newly constructed or reconstructed buildings with a total area of more than 5,000 sq. m must be certified in accordance with a building certification system chosen by the builder and recognised in Lithuania or in another European Union country.	The solutions envisaged will contribute to increasing absorption and ensure that, at least in the central part of the municipality, the construction of new buildings is sustainable.
Plan	Local	Vilnius City Strategic Development Plan 2021-2030	The Strategic Development Plan of a municipality is a long-term (4-10 years) planning document designed to plan the environmental, social and economic development of the municipality's territory, and is drawn up in the context of other planning documents at the strategic and programming level.	It is one of the key documents in the city's strategic management, which then guides the shorter-term strategic planning documents. The Plan may be revised as circumstances change.
Strategy	Local	Long-Term Strategy for "Vilniaus šilumos tinklai" 2021-2040	By 2030, "Vilniaus šilumos tinklai" should switch away from fossil fuels.	GHG emissions from heat production and consumption are reduced.
Plan	Local	Strategic Action Plan of UAB "Vilniaus apšvietimas" 2022-2024	The number of LED luminaires should be 100% of the total number. The network of charging stations for electric vehicles in luminaires is expanded.	Replacing public lighting luminaires with LEDs reduces electricity consumption for lighting, which has led to the initiation of the installation of charging access points for

A-2.1: List of Relevant Policies, Strategies and Regulations				
Type	**Level**	**Name**	**Description**	**Relevance**
				electric vehicles in street light poles.
Plan	Local	Waste Prevention and Management Plan for the Vilnius Region 2021-2027	By 2027: • At least 60% of the municipal waste produced (by weight) must be prepared for reuse and recycling. • No more than 8% of all municipal waste produced (by weight) must be disposed of in landfill. By 2030, no more than 5% of all municipal waste produced (by weight) should be disposed of in landfill.	Measures focus on waste prevention, promotion of sorting.
Plan	Local	Sustainable Urban Mobility Plan (SUMP)	Key indicators for the plan: (a) By 2030, at least a 20% reduction in CO_2 emissions from road transport compared to 2014 levels must be attained. (b) The number of car trips in Vilnius must be reduced from 49% to 30% by 2030 and increase the choice of other travel modes. (c) The quality of public transport must be improved so that its share of total trips rises to 30%. (d) The cycling infrastructure network must be developed so that the share of trips made by cyclists rises to 7.5% of the total trips. (e) By 2030, at least 55% of the total public transport fleet should be electric and the minimum share of conventional fuel vehicles should not exceed 20%.	The actions set out in the Plan will lead to significant reductions in GHG emissions from the transport sector.
Strategy	Local	Green Transport Promotion Strategy of Vilnius City Municipality (15 December 2021, No 1-1270)	It is dedicated to the development of electric vehicles and charging stations in Vilnius.	This is expected to increase the attractiveness of purchasing electric vehicles in the city.
Plan	Local	Strategic Action Plan of VŠĮ "Atnaujinkime miestą" 2023-2025	Vilnius City's strategic goal is to renovate half of all multi-apartment buildings to be renovated by 2030. That is around 2,400 multi-apartment buildings.	Refurbishing old multi-apartment buildings built before 1993 would reduce heat energy demand, save money on fuel purchases, improve quality of life, etc.
Plan	Local	Strategic Action Plan for UAB "Vilniaus viešasis transportas" 2020-2030	Public transport fuels are set to be 100% RES by 2030.	Achieving the target would reduce GHG emissions in the transport sector.

A-2.1: List of Relevant Policies, Strategies and Regulations				
Type	**Level**	**Name**	**Description**	**Relevance**
Plan	Local	Vilnius City Air Quality Management Programme and Action Plan 2020-2025	It lists the main measures implemented in Vilnius that have an impact on reducing air pollution, including more than 250 different measures to improve air quality.	Measures to reduce air pollution correlate with measures to reduce GHG emissions, especially in the transport sector.
Contract/Plan	Local	"Agreement on Cooperation in Vilnius City Council" of 17 April 2023 (Vilnius Coalition Programme)	A cooperation agreement between political parties, setting out the main aims and objectives of the term of office. It includes targets to make Vilnius a climate-neutral city by 2030, to balance mobility policy in Vilnius and to improve accessibility on foot and by different modes of transport.	Political support for climate mitigation measures in the City Council is maintained.

A-2.2: Description and Evaluation of Policies

The Climate City Contract (CCC) serves as a strategic framework that consolidates and enhances Vilnius' existing policies and strategies, creating coherence across a variety of initiatives aimed at achieving climate neutrality. By aligning local plans with national and European Union legislation (Table A2-1), the CCC integrates earlier efforts, unifying diverse policies into a cohesive roadmap for Vilnius' sustainable future.

A key feature of the CCC is its ability to build on existing plans such as the **Master Plan** and the **Sustainable Urban Mobility Plan (SUMP)**. For example, while the SUMP set the target for electrifying 55% of the public transport fleet by 2030, the CCC expands this goal to 100%, further accelerating the city's transition toward sustainable mobility. This highlights how the CCC elevates previous initiatives, aiming for even more ambitious outcomes in line with its goal of achieving climate neutrality by 2030—20 years ahead of the EU target.

Additionally, the CCC addresses gaps in existing strategies. National policies already aim for Lithuania to fully transition to renewable energy sources (RES) by 2030. Vilnius, through the CCC, takes this further by committing to source its electricity from RES. Given that the city still relies on the national grid for its energy needs, this commitment requires significant local investment in infrastructure and public education. By focusing on the specifics of local implementation, the CCC ensures that Vilnius contributes meaningfully to national goals while addressing its unique challenges.

The **renovation of multi-apartment buildings** is another area where the CCC unifies national and local efforts. Building on national support for building modernization, the CCC empowers the city-owned company VšĮ "Atnaujinkime miestą" to accelerate renovations through administrative assistance and public education. This initiative complements the national drive for energy efficiency by tackling local barriers such as financial and bureaucratic obstacles.

The **Green Wave of Vilnius campaign (100,000 trees, 10 million shrubs and 300,000 climbing plants)**, already in motion, is seamlessly integrated into the CCC. While the General Master Plan focuses on creating green spaces and reducing pollution, the CCC aligns this initiative with the EU's broader goal of planting 3 billion trees, contributing locally through the planting of trees, shrubs, and climbing plants across the city. In this way, the CCC not only strengthens ongoing environmental efforts but also ensures they align with wider European objectives.

Moreover, **Vilnius' commitment to using only non-fossil fuels for district heating and hot water by 2030** is a critical component of the CCC's energy strategy. This transition will involve assessing the use of waste heat, heat pumps, and storage tank projects to ensure the city's district heating system is fully

powered by RES. By emphasizing renewable energy in district heating, the CCC addresses one of the city's largest sources of emissions, contributing directly to both local and national climate targets.

In the transportation sector, Vilnius' CCC tackles one of the most significant sources of GHG emissions—private car use. Building on the national incentives for electric and low-emission vehicles, the CCC aims to expand the city's electric vehicle infrastructure, reduce car traffic into the city centre by implementing low-emission zones. These measures, combined with the city's **SUMP**, underscore the CCC's role in connecting past efforts with future goals, transforming Vilnius into a city where public transport, cycling, and walking are prioritized over private car use.

In summary, the CCC serves as the central framework that unifies Vilnius' existing plans and policies. By increasing targets, addressing gaps, and coordinating efforts across sectors such as transport, energy, and urban greening, the CCC brings coherence to the city's diverse initiatives. This unified approach creates a clear and progressive path toward the ultimate goal of climate neutrality by 2030.

Table A 2.1 GHG emissions target, gap and residual emissions

Sector	(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	
	Baseline year 2021			Baseline scenario[1]		(4) = (2) – (3)		Mission scenario[2]		(6) = (1) – (3) – (5)	
	$ktCO_2$ eq.	$ktCO_2$ eq.	(%)	$ktCO_2$ eq.	(%)	$ktCO_2$ eq.	(%)	$ktCO_2$ eq.	(%)	$ktCO_2$ eq.	(%)
Buildings (heat production)	802.75	642.20	80	360.61	45	281.59	35	329.65	41	112.49	14
Transport	948.09	758.47	80	437.97	46	320.50	34	197.19	21	312.93	33
Waste	71.88	57.50	80	35.94	50	21.56	30	0.00	0	35.94	50
Industrial Process and Product Use	36.62	29.30	80	0.00	0	29.30	80	0.00	0	36.62	100
Electricity consumption	633.63	506.90	80	405.39	64	101.51	16	228.24	36	0.00	-
Agricultural, Forestry and Land Use	-536.72 *	-	-	-2.62*	-	-	-	-	-	-	-
Total	**2492.97**	**1994.38**	**80**	**1239.91**	**50**	**754.47**	**30**	**755.09**	**30**	**497.98**	**20**

Notes

1. In the case of Vilnius, we conducted a modeling exercise to develop various scenarios. Column (3) of the table presents the modeling results which incorporates the objectives and actions outlined in Section A 2-1 (adopted strategic or planning or regulatory documents) - the Baseline scenario. This column represents the GHG reduction results not the remaining emissions.

2. The Mission scenario, shown in column (5), was developed using the Baseline scenario as a foundation but with adjusted assumptions to achieve an 80% emissions reduction target by 2030 compared to 2021. Column (5) reflects the differences of GHG emissions in 2030 between the Baseline and Mission scenarios.

Note: Some actions described in Section A 2-1 are also included in Module B-2. Since the Mission scenario builds upon the Baseline scenario, many of the same actions are applied but with an expanded scope. For example, in the Baseline scenario, central heating is assumed to be produced from 90% non-fossil fuel, whereas, in the Mission scenario, central heating is expected to be entirely produced from non-fossil fuel.

*Not included at this stage in the calculation of the target. This sector includes GHG emissions from livestock, land use and forestry.

2.3 Module A-3. Systemic Barriers and Opportunities for Achieving 2030 Climate Neutrality

Module A-3 "Systemic Barriers and Opportunities for Achieving 2030 Climate Neutrality" should document the results of the mapping of stakeholders, systems and ecosystems and the identification of systemic barriers and opportunities.

A-3.1: Description of City Systems, Systemic Barriers and Opportunities – Textual Elements

To achieve climate neutrality in Vilnius, it is important to reduce GHG emissions in a wide range of sectors across the city, the most significant of which are energy, transport, buildings, and waste. Neutralising the negative climate impacts of these sectors requires systemic changes in a number of areas, including infrastructure design and deployment, financing, stability of political will, and the everyday behaviour of consumers (residents). Moreover, these areas are closely interlinked, for example, without sufficient investment from the private or public sector, infrastructure development would not be possible.

Stakeholders and their inter-relationships are illustrated in figures 9 and 10.

Vilnius city climate neutrality transition team is the key element that connects and supports various stakeholders in the journey towards net-zero. It consists of various experts that work closely within the municipality and municipal companies. The team is actively engaged in the process of CCC development and its iterations, exploring new possibilities to reach climate neutrality in the most feasible way and even directly contributing to implementation of actions determined in the CCC.

A better perspective of Vilnius city climate neutrality transition team's relations and connectivity to various stakeholders is presented in figure 9.

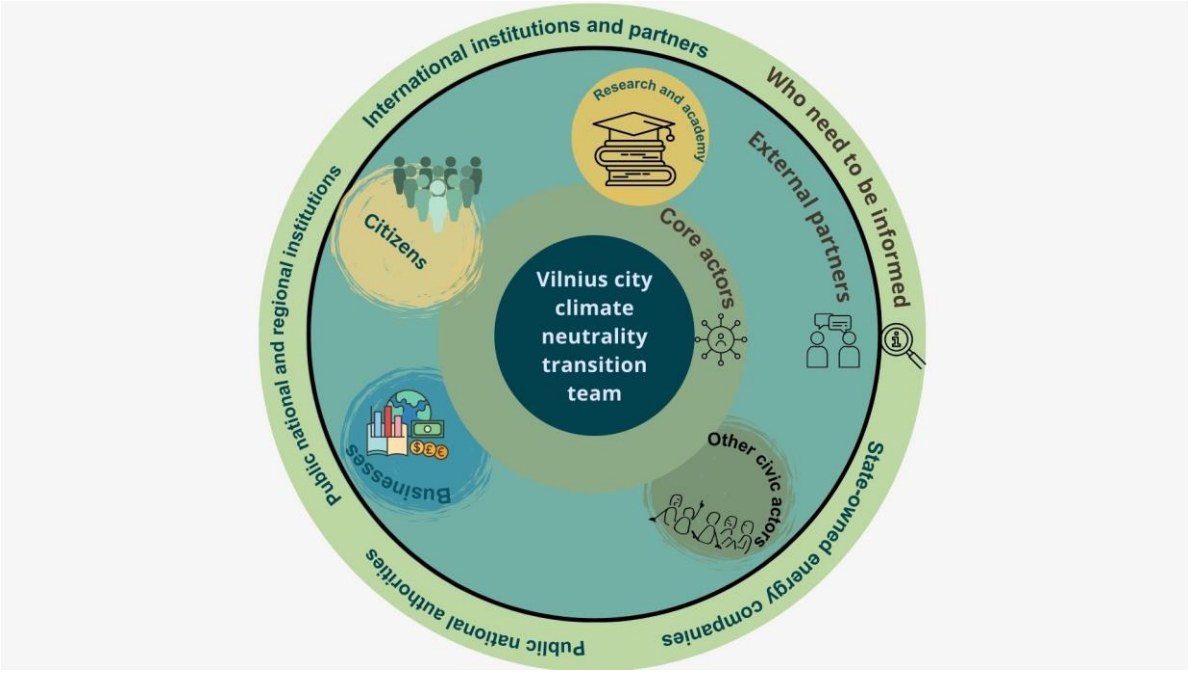


Fig 9. Vilnius city climate neutrality transition team's relations with various stakeholders

As mentioned before, the team has gathered core actors – experts that are active in various fields related to climate neutrality – energy, transport, buildings, green infrastructure, waste management and circular economy. They are already working closely together with external partners, such as businesses, research and academy institutions, citizens and other civic actors. The core actors and external partners are having a constant contact – an ongoing long term "conversation": the purpose –

NetZeroCities received funding under the H2020 Research and Innovation Programme, grant agreement no. 101036519.

to ensure a smooth transition to climate neutrality with having everyone “heard” and empowered to take an action. Sharing knowledge, ideas and finding the best solutions on how to reduce GHG emissions in the city by 2030 in the most sustainable way, implementing relevant actions are the key aspects of collaboration of the transition team and with the external partners. Moreover, the core actors together with external partners make sure to engage, involve in the process and keep informed other specific institutions, such as state-owned energy companies, public national authorities, various other national and regional institutions, international institutions and partners. These aspects empower all citizens and other stakeholders to join forces and take an active role in achieving climate neutrality in the city – only united we can make Vilnius a net zero city.

In Vilnius City Municipality Administration (VCMA), the main departments responsible for the organisation and coordination of the implementation of the set mitigation measures are: the Infrastructure Group, the Energy Department, and the City Environment Department (figure 10). Each of these administrative departments coordinates the work of the municipal companies that implement the municipality’s objectives in different sectors. For example, the Energy Department of the VCMA coordinates the activities of companies such as VšĮ “Atnaujinkime miestą”, which is responsible for promoting the renovation of multi-apartment buildings in the city, and AB “Vilniaus šilumos tinklai”, which is the main supplier of district heating in the city, etc. The VCMA Infrastructure Group coordinates the provision of services in the city by the companies responsible for sustainable mobility or traffic regulation (SĮ “Susisiekimo paslaugos”) and public transport (UAB “Vilniaus viešasis transportas”). The VCMA City Environment Department is responsible for planting works and maintaining biodiversity in the city. In 2022, VšĮ “Neutralus klimatui Vilnius” was established, coordinated by the VCMA Infrastructure Group, which is responsible for the preparation of the Vilnius City Climate Neutrality Action Plan, the monitoring of its implementation, and other activities related to the successful implementation of climate change mitigation and adaptation actions in the city.

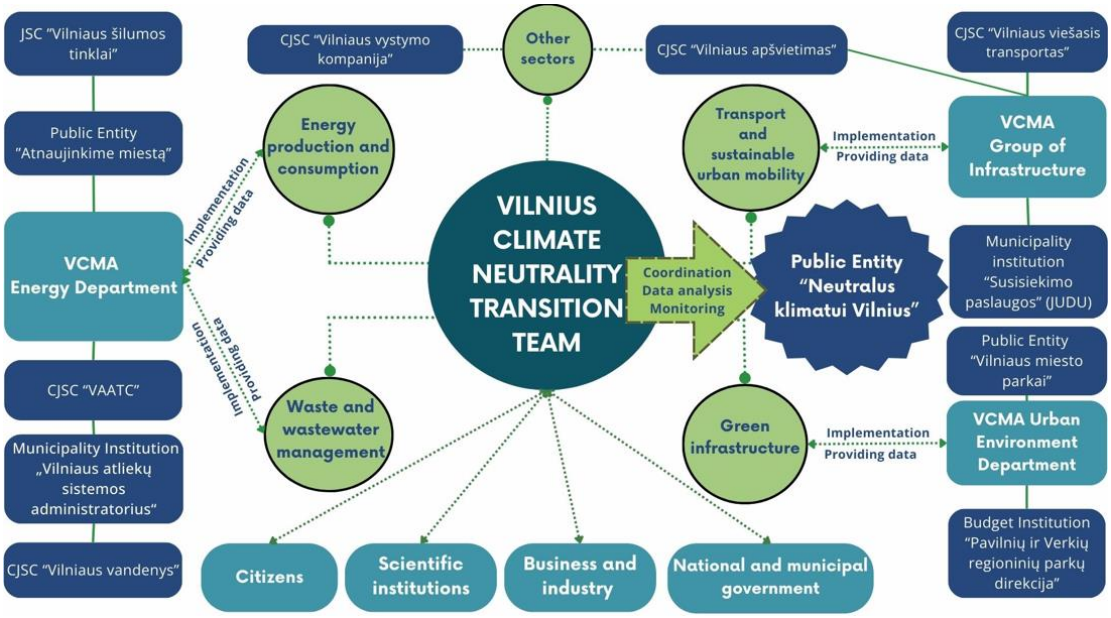


Fig 10. Simplified Diagram of Vilnius City Stakeholders involved in the Implementation of the Climate Neutrality Action Plan

In addition to Vilnius City Municipality Administration and municipal companies, the successful implementation of climate mitigation measures and the achievement of climate neutrality in 2030 is also the responsibility of the different companies or institutions operating in the city territory and, of course, of the residents.

The main stakeholders involved in the above-mentioned areas are:

- VCMA Energy Department, Infrastructure Group, City Environment Department;
- Companies under the authority of the VCMA:
  - AB “Vilniaus šilumos tinklai”;
  - VšĮ “Atnaujinkime miestą”;

  - SĮ “Susisiekimo paslaugos”;
  - UAB “Vilniaus viešasis transportas”;
  - UAB VAATC;
  - UAB “Vilniaus vandenys”;
  - UAB “Vilniaus apšvietimas”;
  - UAB “Vilniaus vystymo kompanija”;
  - VšĮ “Neutralus klimatui Vilnius”.
- Institutions at national level:
  - Ministry of Environment of the Republic of Lithuania;
  - Ministry of Energy of the Republic of Lithuania;
  - Ministry of Transport and Communications of the Republic of Lithuania;
  - Association of Lithuanian Municipalities;
  - Lithuanian Green Municipalities Network.
- Business and industry:
  - Lithuanian Confederation of Industrialists;
  - Lithuanian Responsible Business Association;
  - Various private sector companies.
- Scientific and research institutions:
  - Vilnius University;
  - Vilnius Gediminas Technical University;
  - Mykolas Romeris University;
  - Vilniaus kolegija (Vilnius University of Applied Sciences);
  - Lithuanian Energy Institute;
  - Research Council of Lithuania.
- City residents and associations representing them:
  - Association of Vilnius Communities;
  - Vilnius City wards.

Achieving significant reductions in city GHG emissions is expected to be challenging. The following barriers are likely to be encountered in the implementation of this objective:

- Insufficient investment in infrastructure development due to lack of funds in the city budget, insufficient private investment to develop projects in the city, etc;
- Unfavourable economic circumstances due to inflation, the geopolitical situation (war in Ukraine, unrest in the Gaza Strip, etc.), which has a negative impact on supply chains of goods and raw materials;
- Residents’ unwillingness or inability (due to financial constraints) to change their daily habits and decisions that contribute to increasing GHG emissions (for example, driving their own cars, refusing to renovate their homes, etc.);
- Lack of political will to encourage systematic action on climate mitigation. This could lead to inconsistent adoption of laws and regulations, which would hamper the effective implementation of actions to reduce climate change impacts. This barrier is possible both at the level of the national government and at the level of the municipal government. Lack of political will can be manifested by a change of political forces following elections;
- The challenges of changing existing climate-unfriendly legislation and introducing new laws to reduce GHG emissions.

These and other barriers are described in more detail in Table A-3.2.

Despite the potential barriers, VCMA welcomes Vilnius’ goal to become a climate-neutral municipality by 2030. The management of the Administration, together with the City Council, supports and endorses participation in the EU Mission “100 Climate-Neutral and Smart Cities”.

The identified barriers can be overcome with relevant actions and interventions presented in this document. Lack of investments for various scale (company, household, etc.) hard and soft measures can be eliminated with preparing solid projects of the outlined actions and applying for subsidies and financial support from various sources – for instance, local municipal and national funding opportunities, European Union funds. Financial opportunities are described more detailed in Vilnius Climate City Contract’s Investment Plan.

One of examples how to overcome the lack of investment is creation of Climate Fund dedicated to small scale climate action projects proposed by local communities. The fund, financially supported by private businesses, creates a chance to bring different stakeholders – such as individual communities of citizens and private companies – closer together and understand a common reason to take climate action. This brings an opportunity not only to develop social innovations, but also a potential possibility to scale up local projects

With the help of the Climate fund and other investment supports, residents' unwillingness to change their habits and lack of finances can be overcome. Moreover, social engagement activities and interventions that are foreseen in the portfolio of actions will inform, educate and inspire various city's communities to contribute to climate change mitigation and reduce their carbon footprint.

Various events dedicated to the city's citizens – including the municipality's administration and politicians – are defined in the Action Plan. Meetings and interactive gatherings such as workshops dedicated to climate change and its mitigation topics will help continuously engage city council members. These events could strengthen their political will to make the right decisions and create legislation that protects climate and support measures which help to decrease GHG emissions.

Furthermore, Vilnius Coalition Programme, an agreement on cooperation in Vilnius City Municipality Council, adopted in April 2023, identifies the goal of becoming a city with zero climate impact by 2030 as one of the most important directions for change.

Other factors also contribute to the climate neutrality objective.

Vilnius has been awarded the European Green Capital Award 2025 by the European Commission in recognition of the city's commitment to building a sustainable future and its ambition to become a climate-neutral city by 2030. The award will support the implementation of measures to improve the city's environmental sustainability by educating, more actively informing and engaging the city's residents.

Vilnius is currently participating in the European Bank for Reconstruction and Development's (EBRD) Green Cities Programme. The objectives of this programme are to improve the quality of environmental resources (air, water, land, biodiversity, etc.) and to mitigate the risks posed by climate change processes.

Vilnius is also part of the Covenant of Mayors, an initiative to improve energy efficiency and promote renewable energy in the municipality.

The majority of municipal companies managed by VCMA are also positive about Vilnius' climate mitigation goals. This is also reflected in the long-term strategic documents of these companies, which place a strong emphasis on sustainable business operations, minimising negative impacts on the environment and thus on the climate.

Under the EU's Corporate Sustainability Reporting Directive, large public-interest companies—those with more than 500 employees—are required to submit sustainability reports. This encourages companies to set environmental targets that reduce their climate impact. To achieve these targets, most large companies in Vilnius are developing sustainability agendas.

Vilnius already has communities of residents who are working on environmental initiatives that reduce negative impact on the climate. Communities involved in various projects are particularly active in greening the city by planting trees, shrubs and climbing plants (the Green Wave of Vilnius), and by setting up community city gardens. As a result of information dissemination, more and more residents are using energy more efficiently (promotion of renovation of multi-apartment buildings) and choosing alternative, more environmentally friendly energy sources (for example, solar energy, heat pumps). This encourages residents to become directly involved in creating a neutral climate in their city.

Only by bringing stakeholders together, overcoming various systemic barriers and seizing the opportunities that arise, can a municipality's climate neutrality goal be achieved. The pace and speed of change in the city can be periodically assessed by setting up a monitoring system, including relevant monitoring indicators (see Module B-3 "Indicators for Monitoring, Evaluation and Learning"). By analysing the changes in these indicators, it is possible to assess whether there is sufficient implementation of climate action and whether the city is moving in the right direction towards becoming a climate-neutral city.

A-3.2: Stakeholder Map		
Field	**Stakeholders Involved**	**Influence/Impact on Achieving Climate Neutrality in the City**
Vilnius City Municipality	Various VCMA departments (energy department, infrastructure group, city environment department)	VCMA is an institution directly involved in the pursuit of climate neutrality in the city, committed to the EU Cities Mission. The Municipality Administration manages the municipality's institutions and companies and contributes to strategic decision-making. The main potential barrier to achieving climate neutrality in the city is a lack of political will. As the composition of the City Council changes, political forces that may be sceptical about climate change may become the ruling majority. This could hinder the processes of transforming the city towards climate neutrality.
Energy	AB VŠT, UAB "Vilniaus kogeneracinė jėgainė" (managed by UAB Ignitis), UAB "Vilniaus vandenys", VCMA Energy Department	These stakeholders, who supply the majority of heat and hot water, are responsible for a significant share of GHG emissions in Vilnius' energy sector. These companies (with the exception of UAB Ignitis) are under the authority of VCMA, which would facilitate a coordinated and systematic approach to the climate neutrality objective. Cooperation between these entities and openness to technological and operational changes is essential to drastically reduce GHG emissions. Potential barriers: UAB Ignitis, which operates at national level, is not subordinate to VCMA, so its objectives are not directly related to achieving climate neutrality in Vilnius by 2030. There may be barriers to reducing the negative climate and environmental impacts of the VCHPP. On the other hand, the strategy of UAB Ignitis is closely linked to the climate goals of Vilnius city – promotion of RES and zero GHG emissions.
Mobility and Transport	SĮ "Susisiekimo paslaugos" (JUDU), UAB VVT, car sharing companies: Citybee, Bolt Drive, Spark, VCMA Infrastructure Group	The transport sector accounts for the largest share of GHG emissions in the city in terms of Scope 1 emissions. Working together, these stakeholders have a significant impact on reducing negative climate impacts. The implementation of JUDU and VVT strategies and the memorandum between VCMA and the car sharing companies operating in the city are improving public transport links, developing infrastructure for electric vehicles and encouraging the increase in the number electric or other low-emission vehicles. This facilitates the residents' transition from driving their own cars to alternative modes of transport. Main barriers: - Lack of investment to accelerate the development of the necessary infrastructure to enable residents to travel in the city in climate-neutral ways; - Lack of personal funds and lack of adequate compensation. Some residents lack the income to switch from a conventional car running on polluting fuel to an electric vehicle, even with a national compensation scheme in place. - It is difficult to change the habits of the population.
Waste and the Circular Economy	UAB VAATC, VCMA Energy Department	UAB VAATC ensures the functioning of the regional waste management system in order to minimise negative environmental impacts and to manage waste in a sustainable way based on circular economy. A well-functioning system adapted to waste sorting and recycling would contribute to reducing GHG emissions. The main barriers relate to innovative technological solutions and the necessary investments required to

A-3.2: Stakeholder Map		
Field	**Stakeholders Involved**	**Influence/Impact on Achieving Climate Neutrality in the City**
		recycle difficult to recycle waste (for example, textile waste). Changing people's waste management habits is also crucial. It is essential that as many people as possible sort their waste properly and live more sustainable, less consumerist lifestyles that produce less waste.
Buildings and Related Infrastructure	VšĮ "Atnaujinkime miestą", UAB "Vilniaus apšvietimas", UAB "Vilniaus vystymo kompanija", VCMA Energy Department	The above-mentioned institutions are the main stakeholders which, together with the initiative of the residents, improve the energy efficiency of the city's buildings. Renovation and modernisation of buildings reduces the need for fuel consumption and changes the type of fuel used in heating systems to less polluting or environmentally friendly fuels (for example, efficient biofuel boilers, heat pumps, etc.). This also reduces GHG emissions. In addition, energy poverty in the municipality is reduced. The main barriers are related to the lack of rapid renovation of buildings. It is particularly important to focus on the renovation of multi-apartment buildings, many of which have low energy efficiency ratings. Many residents still consider the renovation of buildings to be too financially burdensome or have a lack of confidence in the quality of the work. In addition, external factors such as price hikes for building materials, lack of staff in the renovation companies, etc. can also hinder the process.
Business and Industry Cooperation	Private sector companies, Lithuanian Confederation of Industrialists, Lithuanian Responsible Business Association, VCMA	Achieving the 2030 climate neutrality target in the city requires the systematic involvement of business and industry. Businesses in different sectors should base their activities on climate-neutral and smart solutions that do not have a negative impact on the environment. Awareness of the emerging climate challenges among businesses and a commitment to adopting new management or technological innovations to reduce GHG emissions could accelerate the emergence of Vilnius as a climate neutral city. The apathy and inaction of these stakeholders to the challenges of climate change would be an obstacle to achieving climate neutrality.
Social Innovation	City residents, Association of Vilnius Communities, Vilnius City wards, VCMA, VšĮ "Neutralus klimatui Vilnius"	City residents are a very important and large stakeholder group, whose members could drastically reduce GHG emissions and achieve climate neutrality by changing their consumption habits. VCMA encourages getting involved and participating together in the design and planning of various initiatives related to nature conservation in the city. One illustration of Vilnius' open and inclusive approach to governance is the participation of residents in the budgeting process. City residents can contribute their ideas to the planning of the greening of Vilnius. In addition, Vilnius residents can report any damage to the city's infrastructure, give feedback and suggestions, such as how and where public lawns and meadows could be trimmed, to the city administration on the www.tvarkaumiesta.lt platform. Potential barriers are related to the indifference of the city population to climate change due to lack of knowledge and awareness, lack of education, and weak will to change everyday habits that negatively affect the climate and the environment.

A-3.2: Stakeholder Map		
Field	**Stakeholders Involved**	**Influence/Impact on Achieving Climate Neutrality in the City**
Research and Innovation	Vilnius University, Vilnius Gediminas Technical University, Mykolas Romeris University, Vilniaus kolegija (Vilnius University of Applied Sciences), Lithuanian Energy Institute, Research Council of Lithuania, VCMA, UAB ID Vilnius, VšĮ "Neutralus klimatui Vilnius"	Higher education institutions located in Vilnius have been active in taking environmental action on their campuses to reduce GHG emissions locally. Universities are key hubs for ongoing research, where solutions developed and applied on a city scale can contribute to reducing negative climate impacts and thus achieve climate neutrality. Members of the higher education community are open to working with VCMA to drastically reduce GHG emissions. The national institutions Lithuanian Energy Institute (LEI) and the Research Council of Lithuania are also contributing to Vilnius' ambition to become a climate-neutral municipality. LEI, together with VCM and VšĮ "Neutralus klimatui Vilnius", would develop joint projects to reduce negative impacts on the climate and environment. The Research Council of Lithuania would contribute by sharing information on calls for proposals for projects that would reduce GHG emissions. It is the main research funding body for public competitive funding of research. The main potential barrier is the lack of investment needed to introduce advanced technological and social innovation in the city. This could slow down the reduction of GHG emissions in the city.

3 Part B – Pathways to Climate Neutrality by 2030

Part B is the framework for an action plan developed by local authorities, local businesses and stakeholders, with key elements such as scenarios, strategic objectives, impacts, portfolios of actions and indicators for monitoring, evaluation, and learning.

3.1 Module B-1. Climate Neutrality Scenarios and Impact Pathways

Module B-1 "Climate Neutrality Scenarios and Impact Pathways" should list the impact pathways, early and late outcomes and direct and indirect impacts (co-benefits) according to the NZC Theory of Change and the AP Guidelines, as well as those adapted from them, and broken down by areas of activity.

The pathways to achieving climate neutrality have been carefully developed through a comprehensive process combining analytical rigour and inclusive stakeholder engagement. Section B-1.1 provides a detailed overview of these efforts, integrating the regulatory actions outlined in Section A-2.1 with additional ambitious initiatives. The primary goal is to achieve an 80% reduction in greenhouse gas (GHG) emissions from 2021 to 2030. Central to this vision is the Climate Change Contract (CCC), which targets the elimination of fossil fuels in heating energy production. Furthermore, the plan aims to significantly reduce fossil fuel use in individual homes and achieve a remarkable transformation in private transport, with more than half of Vilnius's private car fleet expected to become electric by 2030.

The climate neutrality pathways focus on five interconnected fields of activity: energy, mobility and transport, waste and the circular economy, green infrastructure and nature-based solutions, and buildings with related infrastructure. These areas align with the emission sources identified in Table A-2.1 and address both immediate and long-term challenges. Actions in the energy sector aim to decarbonise electricity and heating systems while improving the efficiency of heat production, reducing emissions primarily in the building and electricity sectors. Meanwhile, mobility and transport strategies emphasise diversifying urban mobility options and transitioning public transport systems to non-fossil

fuel sources. Over time, the electrification of private vehicles is expected to play a crucial role in achieving the sector's emission reduction targets.

Efforts to improve waste management and advance the circular economy are equally important. While Table A-2.1 reflects emission reductions from landfill closures, the broader impact of circular economy practices on GHG emissions is yet to be fully explored. Recognising this, the current plan incorporates additional measures to strengthen waste-related emission reductions. In contrast, the focus on green infrastructure and nature-based solutions is less about direct reductions and more about enhancing or maintaining the city's capacity to absorb GHGs. Although only one specific action is included in this area, its potential for offsetting emissions and improving long-term resilience is significant.

Buildings and related infrastructure remain one of the most challenging areas due to the number of old, inefficient buildings in the city. Planned actions include retrofitting older buildings and adopting energy-efficient technologies. These measures are critical to addressing the emission gaps in the buildings sector identified in Table A-2.1. Additionally, monitoring energy use in both existing structures and newly constructed buildings is emphasised to ensure sustained progress in this sector.

Methodological notice: It is important to note that data in Table A-2.1 includes GHG reductions resulting from biofuel use in diesel and gasoline in the transport sector, as well as the natural decrease in emissions from waste due to the closure of landfills. In addition, the model considers the base projections on energy demand caused by climate warming and projected GDP growth. However, while these reductions are factored into the overall analysis, they are not explicitly detailed in the table. This omission contributes to discrepancies between datasets, with the total imbalance between Table A-2.1 and B-1.1 estimated at approximately 134.9 $ktCO_2e$. These underlying assumptions highlight the complexity of aligning various datasets and projections in a consistent framework.

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
Energy (Heat Production and Electricity Consumption)	Technology and Infrastructure	By 2026, 80% of district heating will be fossil fuel-free.	By 2030, district heating will be ensured without the use of fossil fuels.	1 261.7	More reliable heat supply More efficient use of energy Reduced risk of accidents in heat supply networks Improved air quality Increasing energy independence
			To encourage 90% of individual heat in households to be produced from RES or electricity by 2030.		
		Reconstruction of deteriorated heat supply networks in Vilnius City			
		Modernisation of the operation of Vilnius district heating networks by installing smart meters.	Development of the digital twin deployment in Vilnius heat networks.		
		Modernisation of residential heat substations and heating systems (a programme for modernising dependent heat	To continue modernising residential heat substations and heating systems.		

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
		substations is planned by 2025)			
			Municipality Administration and other municipally-owned buildings should use 100% solar energy by 2030.		
			UAB “Vilniaus vandenys” aims to use sludge mono-incineration for energy production by 2028.		
		By the end of 2024, it is planned to replace some of the existing street lights and reach the LED lighting indicator of 97%.	In 2030, the number of LED street lights in Vilnius City should reach 100% of the total number.		
			In 2030, the installation of lighting controllers in Vilnius City (i.e. the level of automation of lighting control) will reach 90% of the total.		
	Governance and Policy	The Vilnius Heat Sector Specific Plan 2024 was updated.			
		The Long-Term Strategy for “Vilniaus šilumos tinklai” 2021-2040 was updated.			
		To encourage the connection of new and existing buildings to district heating.			
		To prohibit the use of solid fossil fuels: coal, lignite, peat. This ban would apply to entities (households, service sector companies, etc.) not connected to district heating	Further monitoring of compliance with prohibitions		

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
		networks. To promote the use of renewable energy sources in heat production.			
		Promotion of the reduction of natural gas consumption for food production			
	Social Innovation	Education and raising awareness on sustainable energy among the public (natural and legal persons, operators, etc.) through information campaigns and the creation of a climate fund.	To continue to actively promote the use of heat and electricity from RES by creating an information and advisory centre.		
	Scientific Innovation		Identification of technological solutions for the capture of GHG emissions from the Vilnius Combined Heat and Power Plant (VCHPP)		
		Assessment of the potential of waste heat recovery in the city			
Mobility and Transport	Technology and Infrastructure	Renewal and modernisation of public transport vehicles and related infrastructure	By 2030, 100% of the public transport fleet should consist of vehicles powered by electric, hydrogen or other alternative fuels.	556.1	Sustainable mobility measures in the city reduce air pollution and noise pollution.
		Production of green hydrogen to fuel buses			
		Expansion of street lanes for public transport.	Further expansion of street lanes for public transport if needed.		
		Deployment of smart traffic light control infrastructure on the main PT routes	To continue the development of smart traffic light control infrastructure on the main PT routes.		

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
		Development and expansion of cycle path infrastructure	By 2030, the planned infrastructure improvements should increase the share of cycling in the overall distribution from 1.5% to 7.5%.		
		Development of a public bike sharing system.	To maintain and develop city bike sharing services as needed.		
		To develop multi-modal hubs with the necessary infrastructure: - Park your car and use public transport (Park&Ride); - Leave your bike and use public transport/car sharing (Bike&Ride).			
		To create and develop bicycle storage and rack infrastructure in the city.	To continue to develop bicycle and other micro-mobility device storage facilities in the city's public spaces, institutions and residential areas, as required		
			To upgrade the Municipality Administration's car fleet to clean vehicles, to encourage municipal companies to replace their vehicles with clean ones		
		Development of car sharing	To continue to promote car-sharing trips.		
		Development of a network of public charging stations and access points for electric vehicles in the city	To continue to expand the network of EV charging stations and access points in Vilnius City to the peripheral districts.		
		Development of pedestrian infrastructure	To continue to expand and improve pedestrian		

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
		(pavements, footpaths) to encourage walking and increase pedestrian comfort.	infrastructure where needed.		
	Governance and Policy	Promotion of the acquisition of electric vehicles or other alternative non-fossil fuel cars through regulatory, information, and incentive measures.	To continue to promote the acquisition of electric vehicles or other alternative non-fossil fuel cars in the total car fleet in Vilnius by 2030: at least 62% of private vehicles should be powered by electricity or alternative fuels.		
		To establish a low emission zone in Vilnius Old Town by 2025.	To expand low-emission zones in Vilnius.		
			Promotion of the use of alternatively fuelled medium-sized commercial vehicles in the city		
		Increase of parking fees.			
	Social Innovation	Creation of a climate fund to stimulate innovation in mobility and transport.	Creation of an information and competence centre for city residents to encourage a change in city travel habits.		
Waste and the Circular Economy	Technology and Infrastructure	Assessment and implementation of food waste treatment options	To further improve food waste treatment processes	-	Promotion of the circular economy.
		Improvement of municipal waste sorting processes			
		Production of hydrogen vehicle fuel from municipal waste			
	Social Innovation	Promotion of municipal waste sorting and waste prevention by educating the population			
		Installation of additional DĖK'UI stops.	Further expansion of the network of DĖK'UI stops as needed		
		To promote green waste sorting by educating the city's			

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
		population, while expanding the network of green waste collection and management stations			
		Establishment of a waste education centre supervised by UAB VAATC			
	Scientific Innovation	Identification (feasibility study) of recycling technologies for textile waste	Application of textile waste recycling technologies in the municipality		
Green Infrastructure and Nature-Based Solutions	Infrastructure	Promotion of the planting of trees and shrubs and the expansion of green spaces in the city	Further planting of trees and shrubs in the city and expansion of green infrastructure	2.6*	Increase of city resilience and reduction of air pollution.
Buildings and Related Infrastructure	Technology and Infrastructure	Renovation of municipal buildings and their utility systems	100% renovation of municipally-owned buildings below energy performance class B by 2030	73.0	Renovation of old buildings improves living conditions and reduces energy poverty.
		Centralisation of the management and monitoring of energy consumption in municipally-owned buildings			
	Governance and Policy	To promote the renovation of multi-apartment buildings. To renovate 480 multi-apartment buildings per year in 2024 and 2025. The Coalition Programme foresees the creation of a special VCM fund to provide financial support for the renovation of multi-apartment buildings.	To promote the renovation of multi-apartment buildings. By 2030, 2,400 multi-apartment buildings should be renovated (at least 480 per year). The Coalition Programme foresees the creation of a special VCM fund to provide financial support for the renovation of multi-apartment buildings.		
		To increase the rate of renovation of multi-apartment buildings and other buildings by promoting block and panel renovation through the neighbourhood programme.	To continue to promote block renovation and encourage the choice of panel renovation. A special VCM fund is foreseen to provide financial support for the renovation of		

B-1.1: Impact Pathways					
Areas of Activity	Systemic Levers	Early Changes (1-2 Years)	Late Outcomes (3-4 Years)	Direct Impacts (GHG Emission Reductions, kt CO_2e)	Indirect Impacts (Co-Benefits)
			multi-apartment buildings.		
		Promotion of the development of sustainable buildings by going beyond the minimum energy efficiency requirements for new buildings and applying the “lean, clean, green” principle.	To continue to promote the development of sustainable buildings by going beyond the minimum energy efficiency requirements for new buildings.		

*excluded from the total GHG reduction effect

B-1.2: Description of Impact Pathways – Textual and Visual Elements

According to the plan set out in this document, successful implementation of the short- and long-term actions foreseen should lead to an 80% reduction in GHG emissions in Vilnius City by 2030 compared to 2021 (Fig 10).

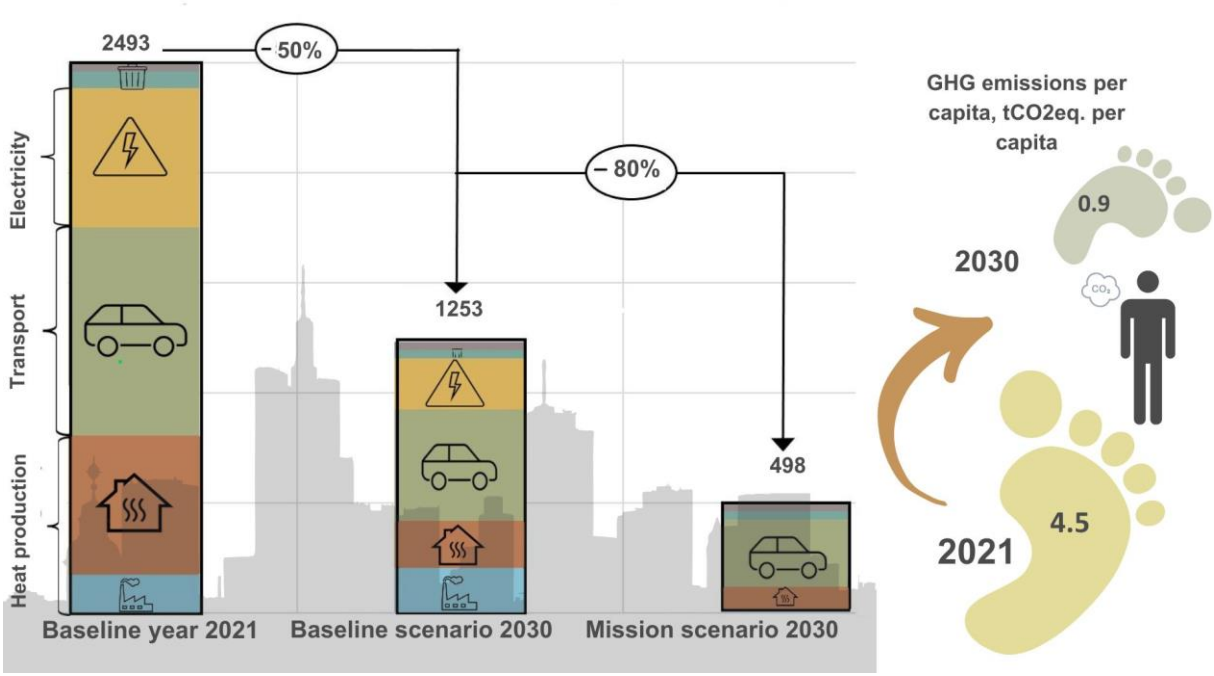


Fig 11. Total GHG emission in the baseline year 2021 and projected GHG emission for 2030 according to the Baseline and Mission scenario.

To begin, we developed a **Baseline scenario** where we assessed the impact of actions that had already been adopted or were in the process of being implemented on reducing GHG emissions. This analysis showed that, if these measures are fully and successfully implemented, GHG emissions would decrease by 50% between 2021 and 2030. However, this would leave an emission gap of approximately 30%.

Table B1-2. The comparison of main actions between two scenarios: Baseline and Mission, based on the GHG mitigation effect and the scope.

No	Action name	Unit	Baseline scenario	Mission scenario	CCC Action code
Heating and building sector					
1.	Modernization of municipality buildings	Proc.	-	100	P1, P2
		ktCO₂e		**4.7**	
2.	Multi-apartment modernization	Vnt.	2 400	2 400	P3, P4, P5, E4
		ktCO₂e	**68.3**	**68.3**	
3.	Renovation of district heating network	Proc.	9,5	9,5	E3, (E4, E5)
		ktCO₂e	**2.6**	**2.6**	
4.	Non-fossil fuel use in district heating	Proc.	90	100	E1, (E4, E5), E10, E15, E16
		ktCO₂e	**219.4**	**312.2**	
5.	RES use promotion in household heating	Proc.	80	90	E2, E10, E11
		ktCO₂e	**42.7**	**70.2**	
6.	RES use promotion in heating in service sector	Proc.	-	90	E14 (linked with E9)
		ktCO₂e		**67.2**	
7.	RES use promotion in heating in industry sector	Proc.	-	100	E13
		ktCO₂e		**111.7**	
8.	Promote the elimination of the use of natural gas for cooking in households	Proc.	-	20	E12
		ktCO₂e		**20.7**	
9.	Encouraging Vilnius City Municipality administration and other municipal companies to use energy from RES	Proc.	**-**	**-**	E6
		ktCO₂e		**10.0**	
10.	UAB “Vilniaus vandenys” employing sludge mono-digestion for energy production	-	-	-	E7
		ktCO₂e	**2**	**2**	
Trasport sector					
11.	Implement the Vilnius City Sustainable Mobility Plan to reduce car driving trips	Proc.	30	30	H1: T3, T4, T5, T6,T7, T8, T10, T12, T14, T16
		ktCO₂e	**225.2**	**225.2**	
12.	Upgrade public transport in Vilnius to environmentally friendly vehicles	Proc.	100	100	T1, T2
		ktCO₂e	**43.4**	**43.4**	
13.	Upgrade the municipal administration's car fleet to environmentally friendly vehicles	Proc.	100	100	T9
		ktCO₂e	**0.1**	**0.1**	
14.	Encourage people to replace polluting vehicles with zero-emission ones	Proc.	20	62	T11, T13, (T15)
		ktCO₂e	**90.2**	**287.4**	
Electricity sector					
15.	Ensure that Vilnius Lighting UAB implements the lighting network modernisation programme	Proc.	100	100	E8, E9
		ktCO₂e	**1**	**1**	
16.		Proc.	70	100	H1, E6

	Promote and ensure that the municipality uses only electricity generated from RES	**ktCO₂e**	**405.39**	**633.63**	
Total GHG emissions reductions under the scenarios					
Total, ktCO₂e			**1 100.29**	**1 860.3**	

Note: The table does not include actions related to the waste sector or their associated GHG reduction effects. At the time of this evaluation, emissions from the waste sector are expected to decrease naturally by 35.9 $ktCO_2e$, primarily because organic waste is no longer being landfilled. Additionally, the impact of biofuel usage, estimated at 69.61 $ktCO_2e$, is also not reflected in the table. It is also important to note that discrepancies between the data in the tables may arise due to other factors identified during the modelling process. For instance, base trend also includes the economic development and climate effects on energy balance from 2021 to 2030. In case of the Mission scenario the model estimated reduction from 2021 to 2030 in total is 1995 $ktCO_2e$.

Next, we used a GHG projection model to create a new scenario, called the **Mission scenario**, which builds upon the baseline. This scenario incorporates both existing and new actions (Table B1-2) . In some instances, it became clear that certain existing measures would need to be expanded to achieve the desired reductions. We also recognised that some strategies from the baseline might fall short or remain unimplemented without sufficient financial backing or due to other constraints. Therefore, these existing measures were reintegrated into the portfolio alongside new, more targeted actions specifically designed to meet the emission reduction targets.

By combining existing efforts with fresh initiatives, this approach ensures a cohesive strategy where both previous and new actions contribute to bridging the emission gap and achieving the overall climate goals. The integration of both sets of actions creates a more robust and adaptable plan that addresses potential shortcomings while pushing forward new solutions.

Achieving this ambitious goal requires changes in energy, transport and mobility, waste, and everyday consumer behaviour. Particular attention must be paid to promoting renewable energy sources and improving energy efficiency. Alternative, cleaner and more climate-friendly energy sources such as solar and wind energy, heat pumps, geothermal energy should be encouraged through a range of information and educational measures. The establishment of an interdisciplinary Vilnius climate neutrality information and advisory centre could help to promote this change. This centre would provide city residents, businesses and other institutions with easily accessible advice on how to make changes to their daily habits or practices to reduce negative impacts on the climate and the environment.

Renewable energy sources such as solar and wind energy, biofuels, and other non-fossils fuels are to be used in district energy supply until 2030. To achieve energy efficiency, it is necessary to renovate heating networks and Soviet-era multi-apartment buildings by upgrading heat substations and properly insulating building foundations, walls and roofs to prevent energy waste. Around 480 multi-apartment buildings should be renovated annually to achieve climate neutrality in the city by 2030.

It is also mandatory to facilitate the implementation of the city's Sustainable Mobility Plan, promoting sustainable mobility within the municipality. One of the objectives of the Sustainable Mobility Plan is to achieve a minimum of 420,000 trips by public transport every working day in 2030, i.e. an increase of more than 84,000 trips per day (24%). Another target to be achieved by 2030 is to have a safe, seamless, coherent, high-quality, non-motorised transport network accessible within 300 m to 75% of the city's population. This should lead to the growth of micro-mobility and the decrease in the number of trips by private cars (from 49% to 30%), together with the decrease in greenhouse gas emissions. Encouraging the replacement of polluting cars by electric or alternative fuel vehicles, together with the development of the necessary infrastructure, would also contribute to the reduction of GHG emissions.

The implementation of the 15-minute city idea in certain parts of the municipality should be considered in order to further minimise negative climate impacts. Vilnius is a compact and easily navigable city with lots of green spaces. These features perfectly suit the 15-minute city idea – the citizens of Vilnius could reach most of daily necessities and services, such as work, shopping, education, healthcare, and leisure, by a 15-minute walk, bike ride, or public transit ride from many points in the city. However, to implement the 15-minute city idea, some crucial changes need to be made in the city – more efficient and faster public transport, decreased usage of private cars and less traffic jams on the streets, changed mindset of citizens – not being afraid to spare their cars and use other means of mobility.

To reduce negative climate impacts, the Vilnius Combined Heat and Power Plant should install additional infrastructure measures to reduce GHG emissions. A specific assessment study could be carried out to achieve this objective. Unfortunately, the operation of this plant does not promote the idea of circularity, and a lot of waste that could be recycled and recovered as raw material is burned. There should be a municipal and national debate on the sustainability of the operation of these installations and how to encourage the population to sort their waste properly so that as little recyclable waste as possible ends up in the currently operating VCHPP.

3.2 Module B-2. Development a Climate-Neutral Portfolio

Module B-2 "Development a Climate-Neutral Portfolio" should include a project description for each planned intervention, including local business and industry interventions, in accordance with template B-2.1, including actions to increase carbon sinks to address residual emissions. Descriptive analysis and comments can be provided in B-2.2. A summary of how residual emissions are addressed should be provided in B-2.3.

B-2.1: Description of the Portfolio		
Areas for Action	Description of the Portfolio	
	List of Actions	Description
Energy (Heat Production and Electricity Consumption)	E1 Promoting the elimination of fossil fuels in district heating system E2 Promoting the use of renewable energy sources (RES) in non-centralized heating systems of private households E3 Reconstruction of heating networks E4 Modernisation of heat networks' operations E5 Modernisation of residential heating points and heating systems E6 Encouraging Vilnius City Municipality administration and other municipal companies to use energy from RES E7 Mono-incineration of sewage sludge E8 Install LED lighting in the city E9 Automation of control of city lights E10 Promotion of connection of buildings to district heating system E11 Prohibition of use of solid fossil fuels - coal, lignite, peat - for consumers not connected to district heating system E12 Promoting reduction of natural gas consumption for food production E13 Encouraging industrial sector consumers to use more fuel from RES for heat production E14 Encouraging service sector consumers to use more fuel from RES for heat production E15 Identification of technological solutions for capturing GHG emissions of the Vilnius Cogeneration Power Plant E16 Assessing the potential of waste heat recovery in the city	In the energy sector, the implementation of the measures would contribute to targeted reductions in direct GHG emissions through a shift to non-fossil fuel, the upgrading of DH networks and residential heat substations, and the application of smart technologies. A strong focus must also be placed on informing and advising the population to encourage them to use more environmentally sustainable and climate-friendly energy sources. The implementation of these actions would help to increase the efficiency of heat and electrical energy consumption. In the field of lighting, rapid projects to convert to LEDs are already underway to achieve energy efficiency.
Mobility and Transport	T1 Renewal and modernisation of public transport vehicles and related infrastructure	Vilnius aims to develop a transport system based on sustainable mobility principles that minimises GHG emissions from the system's

B-2.1: Description of the Portfolio		
Areas for Action	Description of the Portfolio	
	List of Actions	Description
	T2 Production of green hydrogen for bus fuel T3 Development of street lanes for public transport T4 Implementation of intelligent traffic light regulation infrastructure on main public transport routes T5 Developing and expanding cycle path infrastructure T6 Development of the public bicycle sharing system T7 Development of infrastructure for multimodal points T8 Development of bicycle storage and rack infrastructure T9 Upgrading the car fleet of Vilnius City Municipality Administration to low-emission and zero-emission vehicles T10 Development of carsharing services T11 Expansion of the network of public charging stations and charging points for electric cars T12 Development of pedestrian infrastructure T13 Promoting the purchase of low-emission and zero-emission vehicles T14 Identification of low emission zones T15 Promoting the use of medium-sized commercial vehicles powered by alternative fuels in the city T16 Increasing parking fees	operations. It is important to develop and improve the PT system throughout Vilnius City in order to make it a less polluting and climate-neutral mode of travel, more attractive and more convenient for the population. City residents are also encouraged to use other environmentally friendly and climate-friendly modes of travel, such as cycling, walking, and using multi-modal hubs. Changing people's travel habits would reduce the number of private cars in the city. The electrification of public and private vehicles is being promoted to reduce GHG emissions in the city, including the development of infrastructure for electric vehicles. These actions would directly reduce GHG emissions.
Waste and Circular Economy	A1 Assessment and implementation of food waste treatment options A2 Improvement of municipal waste sorting processes A3 Production of hydrogen from municipal waste A4 Promotion of municipal waste sorting and prevention of waste generation by educating the population A5 Expanding the network of DĖK'UI stations A6 Promotion of green waste sorting by expanding the network of green waste collection and handling stations and educating the population A7 Establishment of a waste education center sponsored by UAB VAATC A8 Identification and application of textile waste recycling technologies in a municipality	GHG emissions in the city would be reduced by applying the principles of the circular economy, promoting waste sorting and recycling, and reuse, reducing consumerism and adopting new technologies, and introducing more environmentally friendly waste management solutions.
Green Infrastructure and Nature-Based Solutions	Ž1 Development of green infrastructure - planting of trees and bushes in the city of Vilnius	Vilnius has been riding the green wave since 2021, with more than 100,000 trees, thousands of shrubs and vines planted in the city between 2021 and 2023. The aim is to continue this city greening initiative, which not only makes the city environment cosier,

B-2.1: Description of the Portfolio		
Areas for Action	Description of the Portfolio	
	List of Actions	Description
		provides shade, reduces noise and air pollution in the living environment, but also absorbs GHG emissions.
Buildings and Related Infrastructure	P1 Upgrading municipal buildings and their systems P2 Centralisation of municipal building management and building energy consumption monitoring P3 Promoting the modernisation of multi-apartment buildings P4 Promoting panel modernisation of buildings P5 Promoting quarterly modernisation of residential buildings P6 Promoting the development of sustainable buildings	In Vilnius, the vast majority of buildings have low energy efficiency, due to historical circumstances where buildings were constructed with materials with poor thermal insulation properties. There are 7,562 multi-apartment buildings in the city, of which 5,280 need renovation, representing about 70% of the buildings. To increase the energy efficiency of buildings and thus reduce GHG emissions, a strong focus is being placed on building renovation. New buildings must be environmentally sustainable, with an A++ energy performance class mandatory from 2021.
Horizontal Actions	H1 Establishment of Vilnius Climate Neutrality Information and Consultancy Centre H2 Establishment of Climate Fund	Interdisciplinary actions across all the sectors discussed above—the creation of a climate neutrality information and advisory centre and a climate fund—would engage and empower the public (citizens, businesses, etc.) to take action to reduce their negative impacts on climate. This would promote a smooth transformation towards climate neutrality in a wide range of areas: energy, transport, building use, waste, etc.

3.2.1 Energy (Heat Production and Electricity Consumption) Actions

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E1 Promoting the elimination of fossil fuels in district heating system**
	Action Type	Hard Measure Soft (Social) Measure Direct GHG Emission Reductions
	Action Description	By 2026, around 80% of district heating will be produced from renewable energy sources (RES). By 2030, climate neutrality in district heating using RES is expected to be achieved. Two new boiler plants are planned to be in operation by 2030: the RK-8 boiler plant (planned capacity of 25 to 60 MW) and the RK-2 CHP plant (planned capacity of 10 to 15 MW for biofuels and 2.6 MW to 3.0 MW for electricity). Projects are also planned to contribute to heat production from RES and market balancing, such as the use of waste heat, the installation of heat pumps and storage tanks. These measures would

		contribute to the phase-out of fossil fuels in district heating.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Two new boiler plants are planned to be in operation by 2030: the RK-8 boiler plant (planned capacity of 25 to 60 MW) and the RK-2 CHP plant (planned capacity of 10 to 15 MW for biofuels and 2.6 MW to 3.0 MW for electricity). Projects are also planned to contribute to heat production from RES and market balancing, such as the use of waste heat, the installation of heat pumps and storage tanks. These measures would contribute to the phase-out of fossil fuels in district heating.
Implementation	Responsible Institutions/People	District heating suppliers
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The scope covers the entire city area.
	Stakeholders Involved	AB “Vilniaus šilumos tinklai”, VCMA, residents and companies/institutions of Vilnius City – consumers of heat and hot water
	Comments on Implementation	DH RES are already replacing the use of environmentally polluting fuels (for example, gas) for heat energy production.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	312,184.39 tCO_2eq. DH
	Total Costs and Costs per Unit of CO_2eq.	Total Capex: 62,039,000€ 200.83 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E2 Promoting the use of renewable energy sources (RES) in non-centralized heating systems of private households**
	Action Type	Hard Measure Soft (Social) Measure Direct GHG Emission Reductions
	Action Description	According to the State Data Agency, the homes of around 20% of the population in Vilnius are not connected to district heating. According to the Law of the Republic of Lithuania on Energy from Renewable Sources, by 2030 the share of heat produced from RES in the fuel balance of non-centralised household heating will have to be at least 80%. Vilnius City Municipality would encourage non-centralised heating consumers to switch to RES by using various publicity/financing measures and would strive for a 90% share of RES in the fuel balance of non-centralised heating.
	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure

Connection to the Impact of the Actions	Results (Based on Table/Section B-1.1)	Projects are planned to help residents choose RES for heat production at home, for example, installing heat pumps, choosing more efficient biofuel boilers, etc.
Implementation	Responsible Institutions/People	Non-centralised heat producers for their own use (residents, business etc.)
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The scope covers the entire city area.
	Stakeholders Involved	AB "Vilniaus šilumos tinklai", VCMA, residents and companies/institutions of Vilnius City – consumers of heat and hot water
	Comments on Implementation	A subsidy measure is currently being implemented at national level. Residents can receive financial support to replace inefficient biomass or fossil fuel boilers with more efficient, RES-based heat production technologies in individual homes not connected to a district heating system. According to the Lithuanian Energy Agency, it is planned to allocate EUR 118.2 million in total (including the administration of the measure) from the Investment Programme of European Union Funds for the period from 2021 to 2027 to the measure for the replacement of inefficient and polluting boilers over a six-year period (up to QIII 2029). The VCMA provides additional subsidies for the replacement of polluting heating boilers in households or for the connection to DH.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	70,180.41 tCO_2eq. autonomous (non-centralised) heating
	Total Costs and Costs per Unit of CO_2eq.	Total Capex: 398,056,500€ 5,671.90 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E3 Reconstruction of heating networks**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	District heating is supplied to the residents of Vilnius City Municipality through 758 km of pipeline. To increase the efficiency of heat supply, the DH networks need to be upgraded. The average age of the pipeline is 30 years, but in some places it can be more than 50 years. Naturally, pipelines of this age are worn and leaking, which results in higher heat losses during the supply process and contributes to the greenhouse effect. Heat losses in 2021 accounted for ~11.9% of the total heat supplied to the networks.
	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure

Connection to the Impact of the Actions	Results (Based on Table/Section B-1.1)	Reconstruction of heat networks, with about 10 km of heat networks renewed each year.
Implementation	Responsible Institutions/People	District heating suppliers
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The scope covers the entire city area.
	Stakeholders Involved	AB "Vilniaus šilumos tinklai", VCMA, residents and companies/institutions of Vilnius City
	Comments on Implementation	Work is already underway. Every year, the Vilnius heat supply company reconstructs about 10 km of heat networks. Each year, AB VŠT allocates around EUR 20 million for these works.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector,	2,620 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 140,000,000€ 53,435.11 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E4 Modernisation of heat networks' operations**
	Action Type	Hard Measure Indirect GHG Emission Reductions
	Action Description	The modernisation of the operation of heating networks is implemented through the following measures: 1) Installation of smart meters; 2) Application of the principles of digital twin. Smart meters are already being installed in the district heating system. Currently, there are about 189,200 VŠT-owned remotely readable smart hot water meters installed in Vilnius city. This measure, integrated with the digital twin, will help to improve the efficiency of the whole network; the aim is to have a digitalised control system for the whole integrated network. Extensive use of digital twin technology in the district heating system of Vilnius City is planned. It is estimated that the application of digital twin would increase energy efficiency by around 20%.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	By 2025, it is planned to reach 40% of hot water meters read via the IoT platform of UAB VŠT (% of total). In 2028, 100% smart hot water meters are planned to be installed (the exact number is not yet known).
Implementation	Responsible Institutions/People	District heating suppliers

	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The scope covers the entire city area.
	Stakeholders Involved	AB “Vilniaus šilumos tinklai”, VCMA, residents and companies/institutions of Vilnius City
	Comments on Implementation	Currently, there are about 189,200 VŠT-owned remotely readable smart hot water meters installed in Vilnius city. There is also a pilot project at the district boiler house in Naujoji Vilnia.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Indirect effect related with E1, E3 actions
	Total Costs and Costs per Unit of CO_2e	Total Capex: 16,500,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E5 Modernisation of residential heating points and heating systems**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	In Vilnius City, 349 (non-automated) heat substations of the dependent system are connected to the district heating network. The total capacity of the heat substations is 115,255 kW. According to theoretical calculations, the total energy savings from renovating a single heat substation is 4%. If all heat substations are renovated, the savings would be 4,610 kW. The Vilnius City Municipality programme for the modernisation of heat substations supports the modernisation of heat substations in multi-apartment and individual (single and two-apartment) residential buildings with a dependent system and the installation of balance valves on heating and hot water risers. The potential support intensity is up to 50 %. There is also a national mini-renovation programme: residents of multi-apartment buildings built before 1993 can receive financial support for upgrading the buildings’ internal heating and hot water systems.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Most heat substations and heating systems should be modernised by 2030
Implementation	Responsible Institutions/People	District heating suppliers
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The scale covers residential buildings with heat substations to be renovated throughout the city.
	Stakeholders Involved	AB “Vilniaus šilumos tinklai”, VCMA, residents of Vilnius City

	Comments on Implementation	By 2025, a programme for the modernisation of dependent heat substations is planned to be drawn up, with a phased timetable for the modernisation of the heat substations in order of priority, taking into account the reconstruction of the heat supply network.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Indirect effect related with E1, E3 and P3 actions
	Total Costs and Costs per Unit of CO2e	Total Capex: 3,005,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E6 Encouraging Vilnius City Municipality administration and other municipal companies to use energy from RES**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	Solar energy infrastructure is being promoted and widely deployed in Vilnius. This increases energy independence, reduces GHG emissions and environmental impacts. Municipal companies are also active in deploying solar energy infrastructure. The possibility of developing solar energy infrastructure at the closed landfills of Fabijoniškės and Lentvaris in Vilnius is being explored. Solar power plants of around 12.5 MW could be installed in the landfills. This would generate about 12,045 MWh of electricity per year.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Municipality Administration and other municipally-owned buildings should use 100% solar energy by 2030.
Implementation	Responsible Institutions/People	Electricity suppliers (for example, Ignitis), VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and for electricity consumers.
	Stakeholders Involved	Electricity suppliers (for example, Ignitis), VCMA, residents and companies/institutions of Vilnius City
	Comments on Implementation	By the end of 2024, 41 municipally-owned buildings will have installed solar panels on their roofs; 106 municipally-owned buildings will have purchased remote solar power plants. Some examples of solar energy infrastructure in municipal companies: - AB “Vilniaus šilumos tinklai” plans to use solar power plants of around 730 kW installed at various company facilities in Vilnius; - UAB VAATC plans to install a 99 kW on-site power plant in 2024 and a 500 kW remote

		power plant in 2024 (covering about 50% of the company's energy needs); a 1 MW remote power plant is planned for purchase in 2026 to cover the rest of the company's energy needs; - By August 2024, UAB "Grinda" plans to install a 24 kW stand-alone solar power plant with a 40 kWh storage system on the roof of the Vilnius Animal Shelter (L. Giros St 114, Vilnius), which will allow it to store energy during the "cheapest" exchange hours and consume it during the "most expensive" hours. This power plant will meet about 25% of the facility's demand.
Impact and Cost	Renewable Energy Generated (If Applicable)	35 MW
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	9,964.99 tCO_2eq. (Note: The GHG emission reduction effect was excluded from E14)
	Total Costs and Costs per Unit of CO_2e	Total Capex: 49,625,000€ 4,979.93 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E7 Mono-incineration of sewage sludge**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	Natural gas is used in the drying process of sludge produced by the operations of UAB "Vilniaus vandenys". The aim is to use sludge mono-incineration for energy production by 2028. The construction of a sludge mono-incineration plant by UAB "Vilniaus vandenys" would use the heat generated to dry the sludge, resulting in a closed process. The estimated investment needed to implement this project amounts to EUR 88.625 million. The projected mono-incineration plant will have the capacity to process 12,000 t of dry material per year, i.e. the capacity of the plant will be about 30% higher than at present.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	This measure would reduce GHG emissions by 2 $ktCO_2e$ in 2030.
Implementation	Responsible Institutions/People	VCMA, UAB "Vilniaus vandenys"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB "Vilniaus vandenys", city residents
	Comments on Implementation	A feasibility study for the project has been carried out and funding is being sought.
Impact and Cost	Renewable Energy Generated (If Applicable)	

	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	2,011.00 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 88,625,000€ 44,070.11 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E8 Install LED lighting in the city**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	The city's lighting system is to be upgraded to more energy-efficient LED technology, replacing conventional city lights with LED lamps. Currently, there are 63,567 light spots (street lights) in Vilnius City managed by UAB "Vilniaus apšvietimas", of which ~95% are LED luminaires. There are currently around 5,500 architectural lights in the city, which are Na-type lights. Replacing these lights with more environmentally friendly ones is a complex process due to the technical and quality requirements of the lighting.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	In 2030, the number of LED street lights in Vilnius City should reach 100% of the total number. This measure contributes to more efficient use of electricity and reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA, UAB "Vilniaus apšvietimas"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB "Vilniaus apšvietimas"
	Comments on Implementation	In 2024, it is planned to replace some of the existing luminaires and reach the LED lighting indicator of 97%.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	961.25 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,822,000€ 3,933.50 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E9 Automation of control of city lights**
	Action Type	Hard Measure Direct GHG Emission Reductions

	Action Description	It is estimated that by 2030, the installation of lighting controllers in Vilnius City will reach 90% of the total. The controllers will dim the luminaires according to a remotely set schedule and measure the luminaires' electrical parameters, making the use of electricity more economical and sustainable.
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	More efficient use of electricity and reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA, UAB "Vilniaus apšvietimas"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB "Vilniaus apšvietimas", residents
	Comments on Implementation	Currently (in 2024), there are around 27,000 controllers installed in the city (with an additional 36,000 controllers needed to reach the 2030 target).
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Effect linked to the E8 action
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,440,000€ 3,393.50 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E10 Promotion of connection of buildings to district heating system**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	To encourage the connection of new and existing buildings to district heating. To create a favourable legal environment for the implementation of the measure, it is recommended to periodically revise the DH zones and the heat supply regulations established in the special plan for the heat sector, taking into account technological progress and changes in the legal and economic environment. It is proposed to prepare an analysis and recommendations for Vilnius City Municipality Administration and VŠT on what changes (technological, socio-economic, etc.) are needed to effectively encourage residents to connect to district heating.

		To encourage residents to connect their homes to DH, information and education events on the possibilities and benefits of connecting to DH will be organised. There could be potentially two larger events per year for all residents of the city and 5-7 smaller events—workshops—per year for communities in the city.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	More consumers connected to DH, potentially higher energy efficiency and lower GHG emissions.
Implementation	Responsible Institutions/People	AB “Vilniaus šilumos tinklai”, VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	AB “Vilniaus šilumos tinklai”, VCMA, heat energy consumers (residents, companies, etc.)
	Comments on Implementation	The impact of the measure cannot be predicted. During calls for the subsidies, the state provides financial support for those wishing to connect to DH. Currently no calls are active – there is a potential that the subsidies could be offered again.
Impact and Cost	Renewable Energy Generated (If Applicable)	-
	Energy Removed/Replaced, Volume or Fuel Type	-
	GHG Emission Reduction Value (Total) per Source Sector	Effect included under the E1 and E2 actions
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan 200.83 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E11 Prohibition of use of solid fossil fuels - coal, lignite, peat - for consumers not connected to district heating system**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	The decision of Vilnius City Municipality Council of 29 October 2021 bans the use of solid fossil fuels such as coal, lignite and peat. For this decision to enter into force, legislation at national level must be adopted. This ban would apply to entities (households, service sector companies, etc.) not connected to district heating networks. The measure has been approved by the government and has yet to be approved by the Seimas of the Republic of Lithuania – the measure has not yet been officially adopted.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Reduced GHG emissions, air pollution and negative environmental impacts through the

		use of non-polluting fuels by customers not connected to DH.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents who are not connected to DH.
	Stakeholders Involved	VCMA, city residents
	Comments on Implementation	For those who change to a less polluting heating method, the state already offers various compensation mechanisms. For those who decide to replace their fossil fuel boilers with renewable energy equipment, a national programme run by the Lithuanian Energy Agency (LEA) provides partial funding for the replacement. Vilnius City Municipality, for its part, can cover a further 15% of the costs under each compensation programme.
Impact and Cost	Renewable Energy Generated (If Applicable)	-
	Energy Removed/Replaced, Volume or Fuel Type	-
	GHG Emission Reduction Value (Total) per Source Sector	Effect counted under the E2 action
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan 200.83 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E12 Promoting reduction of natural gas consumption for food production**
	Action Type	Soft Measure Hard Measure Direct GHG Emission Reductions
	Action Description	Nationally, natural gas consumption for food production accounts for around 20-21% of total gas consumption. Governance (for example, legislation), economic (for example, subsidies), etc. could be used to encourage people to switch away from natural gas used for cooking.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Reduced consumption of natural gas, reduced dependence on this fuel and reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents
	Stakeholders Involved	VCMA, city residents

	Comments on Implementation	This measure is not yet in place.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	27,510.58 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 50,395,000€ 1,832.20 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E13 Encouraging industrial sector consumers to use more fuel from RES for heat production**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	Through financial and regulatory incentives, encourage industry to switch from fossil fuel boilers to heat pumps or efficient biofuel boilers that use 100% RES fuels through financial and regulatory incentives.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Improved energy efficiency, use of more sustainable fuel, reduced GHG emissions
Implementation	Responsible Institutions/People	Industrial companies operating in the area of Vilnius City
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents
	Stakeholders Involved	-
	Comments on Implementation	This measure is more related to the implementation and regulation of the National Climate Change Objectives.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	111,694.85 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan 0.09 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E14 Encouragement of service sector consumers to use more RES for heat production**
	Action Type	Soft Measure Direct GHG Emission Reductions

	Action Description	Vilnius City Municipality would use various publicity/financing measures to encourage service sector companies that are not connected to district heating to switch to RES - e.g. financial support for the replacement of fossil fuel boilers with heat pumps or efficient biofuel boilers. This measure would result in at least 100% of non-centralised heating industrial and service sector consumers using RES by 2030.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Improved energy efficiency, use of more sustainable fuel, reduced GHG emissions
Implementation	Responsible Institutions/People	VCMA, companies providing services
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents
	Stakeholders Involved	VCMA, companies providing services, city residents
	Comments on Implementation	-
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	67,231.97 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan 0.71 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E15 Identification of technological solutions for capturing GHG emissions of the Vilnius Cogeneration Power Plant**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	This is a proposal to prepare a study to analyse the possibilities of minimising or eliminating GHG emissions resulting from the operation of Vilnius Combined Heat and Power Plant (VCHPP).
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Scientific Innovation
	Results (Based on Table/Section B-1.1)	Preparation of a study and possible adaptation to minimise or eliminate GHG emissions from the operation of the VCHPP.

Implementation	Responsible Institutions/People	VCMA, UAB Ignitis
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB Ignitis
	Comments on Implementation	This action is not in place.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Effect counted under the E1 action
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan 200.83 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**E16 Assessing the potential of waste heat recovery in the city**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	This is a proposal to prepare a study that quantifies and qualitatively assesses the potential sources of waste heat – industrial or energy production facilities, the service sector. It analyses the possibilities of using this heat for city purposes.
Connection to the Impact of the Actions	Field of Activity	Energy
	Systematic Leverage	Scientific Innovation
	Results (Based on Table/Section B-1.1)	Preparation of a study and possible adaptation to reduce energy waste, increase energy use efficiency and reduce GHG emissions.
Implementation	Responsible Institutions/People	VCMA, UAB VŠT
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VŠT, various companies generating waste heat, residents
	Comments on Implementation	The first projects on waste heat recovery are already underway. One of the most prominent examples: Vilniaus šilumos tinklai (VŠT) (Vilnius Heat Networks) promises to collect waste heat from the state data centre to be used to produce hot water and heat the homes of Vilnius residents. The municipal company “Vilniaus vandenys” has included heat recovery from wastewater in its strategic objectives.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	

	GHG Emission Reduction Value (Total) per Source Sector	Effect counted under the E1 action
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan -

3.2.2 Mobility and Mobility Actions

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T1 Renewal and modernisation of public vehicles and related infrastructure**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	By 2030, it is planned that electric, hydrogen and other alternative fuel vehicles will account for 100% of the total public transport fleet operated by UAB "Vilniaus viešasis transportas" (which currently provides 80% of the city's public transport services). The operation of electric buses requires a sufficient, strategically located network of charging stations that correlates with the number of electric buses in the city. Therefore, this action includes the creation of charging infrastructure for electric buses in the city.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	By 2030, it is planned that Vilnius will have 367 electric buses and 164 new trolleybuses (belonging to the VVT fleet). The average age of vehicles in the VVT fleet is expected to be 6 years. By 2030, VVT expects to have around 250 electric bus charging stations. (Note: These plans are not confirmed but are estimates.) Modernisation and optimisation of the overhead contact lines and substations needed to operate the trolleybuses is expected to be completed by 2029.
Implementation	Responsible Institutions/People	VCMA, JUDU, UAB "Vilniaus viešasis transportas"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB "Vilniaus viešasis transportas"
	Comments on Implementation	In August 2024, Vilnius public transport fleet plans to put 20 new trolleybuses into service. Sixteen hydrogen buses are planned to be procured in 2024. Currently, VVT has installed five electric bus charging stations in Vilnius) – the procurement has already been completed.
Impact and Cost	Renewable Energy Generated (If Applicable)	

	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	43,433.45 $tCO_2eq.$
	Total Costs and Costs per Unit of CO_2e	Total Capex: 308,652,000€ 7,291.80 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T2 Production of green hydrogen for bus fuel**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	The procurement of 16 hydrogen buses is planned for 2024. Therefore, the production of green hydrogen to fuel the buses is planned to start in 2026 on the territory of Vilniaus šilumos tinklai (Vilnius Heat Networks), Elektrinės St 2. VCMA and its partner AB "Vilniaus šilumos tinklai" have signed a contract to produce green hydrogen for use in public transport. The project also includes the installation of a hydrogen storage facility. A public access hydrogen station with hydrogen refuelling stops will be installed within the city limits.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	This measure will contribute to the development of an environmentally friendly public transport system in the city. The annual production of green hydrogen is planned at 1,140,000 m^3. The surplus fuel not used by Vilnius public transport could be used for other heavy-duty vehicles. This could provide an incentive for municipal companies and private business to purchase hydrogen-fuelled heavy-duty vehicles.
Implementation	Responsible Institutions/People	VCMA, UAB "Vilniaus viešasis transportas", AB "Vilniaus šilumos tinklai"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB "Vilniaus viešasis transportas", AB "Vilniaus šilumos tinklai", city residents
	Comments on Implementation	VCMA, together with its partner AB "Vilniaus šilumos tinklai", signed an agreement with the Central Project Management Agency for the production of green hydrogen, which will be used in public transport. The value of the project is ca. 8 million EUR.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Effect counted under the action T1

	Total Costs and Costs per Unit of CO_2e	Total Capex: 8,056,000€ 7,291.80 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T3 Development of street lanes for public transport**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	This would allow faster movement of public transport (PT) and thus encourage people to choose PT instead of their own cars.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	It is expected that by 2030 47.9 km per 100 thousand residents of PT lanes will be installed. This measure could encourage residents to use PT instead of driving their own cars, as it would reduce travel times.
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	This measure has already been launched. Further development of this measure is possible if needed.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 30,777,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T4 Implementation of intelligent traffic light regulation infrastructure on main public transport routes**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	By 2030, 96 intersections are to be reconstructed, to give right of way to public transport. This measure would help to speed up the movement of PT in the city and improve the quality of PT communication.
	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure

Connection to the Impact of the Actions	Results (Based on Table/Section B-1.1)	This would increase the appeal of PT. It is possible that more residents would use PT instead of their own cars, and the motor vehicle flows in the city would decrease.
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	In 2022, Vilnius City had one traffic light section intended for public transport and giving right of way. Further development of this measure is planned.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 27,700,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T5 Developing and expanding cycle path infrastructure**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	By 2030, the planned infrastructure improvements should increase the share of cycling in the overall distribution from 1.5% to 7.5%. This would contribute to reducing car traffic in the city, with a consequent reduction in GHG emissions.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Until 2030, a total of about 320 km of inter-district bicycle routes should be built (reconstructed), which together with the main routes would form a coherent network of about 390 km of main bicycle routes for daily cycling throughout the city.
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.

	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	In 2023, the total length of cycle paths in Vilnius was 155 km. The target is to add 35 km of additional cycle paths by 2025, bringing the total length of cycle paths to 190 km by 2025.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 226,573,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T6 Development of the public bicycle sharing system**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	The implementation of a convenient public bike sharing system would encourage residents to choose cycling for trips in the city. The implementation of this measure would contribute to the reduction of motor vehicle flows in the city. It could also attract a service provider that would not require fixed bike sharing locations.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Reduced car traffic and GHG emissions. 111 public bike sharing locations are planned to be installed by 2030 (currently none are installed, and no funding is foreseen).
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	This measure is not yet in place, as the city currently has an electric bike sharing service run by Bolt. RIDE Mobility, an electric bicycle rental service, is also planning to start operations in Vilnius.
Impact and Cost	Renewable Energy Generated (If Applicable)	

	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,426,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T7 Development of infrastructure for multimodal points**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	To develop multi-modal hubs with the necessary infrastructure: - Park your car and use public transport (Park&Ride). To ensure the possibility to park a car at designated multi-modal parking spaces and transfer to PT; - Leave your bike and use public transport/car sharing (Bike&Ride). To provide locked cycle parking, storage facilities to ensure safe bicycle parking for the whole day, or filmed parking areas protected from rain. The development of multi-modal hubs would encourage the development of a more sustainable city transport system, reduce car traffic flows, and improve transport communication in the city (making city trips faster).
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	The development of multimodal hubs would encourage the development of a more sustainable city transport system, reduce car traffic flows, and improve transport communication in the city, making city trips faster.
Implementation	Responsible Institutions/People	VCMA, SĮ “Susisiekimo paslaugos”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ “Susisiekimo paslaugos”, city residents
	Comments on Implementation	There are currently three Park&Ride multimodal points in the city. One additional Park&Ride multi-modal hub is planned. The development of Bike&Ride multi-modal points is not yet planned.

Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,534,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T8 Development of bicycle storage and rack infrastructure**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	To create and develop bicycle storage and rack infrastructure in the city. To provide bicycle storage facilities (racks) in the city's public spaces and in the vicinity of business centres/office buildings, train stations, PT stops; to provide bicycle parking and storage facilities for other micro-mobility devices, including electric ones, in all schools, other educational institutions; to provide bicycle storage facilities in the territories of multi-apartment buildings. An estimated 30 additional bicycle storage facilities are planned by 2030 (note: the installation of these facilities has not yet been approved).
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Increased number of cycling trips in the city, when this climate-neutral mode of travel is chosen over private car travel.
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	This measure—the provision of bicycle storage facilities in the city—is ongoing. Currently, 18 bicycle storage facilities are installed in the city.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	

	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 2,868,300€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T9 Upgrading the car fleet of Vilnius City Municipality Administration to low-emission and zero-emission vehicles**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	The cars belonging to the VCM administration (61 cars in total, including 8 leased; 5 vehicles, including 2 leased, of 61 are electric vehicles) should be upgraded by 2030 to low-emission vehicles: electric vehicles, vehicles powered by alternative low-pollution fuels. This action is foreseen in the strategic plans of the VCMA.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	The use of environmentally friendly, low-emission passenger cars for VCMA uses would contribute to reducing GHG emissions in the city. It would also encourage municipal companies to replace their cars with low-emission vehicles. It would set a good example for residents and businesses, potentially encouraging people to switch from fossil-fuelled cars to electric cars or vehicles powered by alternative low-pollution fuels.
Implementation	Responsible Institutions/People	VCMA, SĮ “Susisiekimo paslaugos”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ “Susisiekimo paslaugos”, city residents
	Comments on Implementation	In 2024, five internal combustion engine cars in the VCMA fleet will be replaced by 5 all-electric vehicles.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	94.00 tCO_2eq.

	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,400,000€ 14,893.62 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T10 Development of carsharing services**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	To encourage car-sharing trips, thereby reducing the use of private cars. This measure, implemented together with private businesses (for example, City Bee, Bolt Drive and Spark), could contribute to reducing the number of private cars and reduce traffic flows in the city.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	In 2030, the car-sharing indicator—the number of trips per resident per year—should reach 24 in 2030, following the implementation of the Sustainable Mobility Plan. The proposed target is for 80% of car-sharing companies' fleets to be all-electric vehicles by 2030 (note: this target is proposed by experts from VšĮ "Neutralus klimatui Vilnius").
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos", businesses (City Bee, Bolt Drive, Spark)
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	In June 2022, a mobility cluster was set up to find common solutions to promote the sharing of services. The establishment of the cluster will help partners to share data, which will help improve road safety. Businesses and institutions will work together continuously to find ways to combine proven road safety measures and share travel statistics, collaborate in planning infrastructure solutions, and respond together to emerging challenges.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 320,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T11 Expansion of the network of public charging stations and charging points for electric cars**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	The development of a network of charging stations for electric vehicles will encourage an increase in the number of electric vehicles in the city, replacing cars running on fossil fuel. This will help reduce GHG emissions in the city.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	More electric vehicles, fewer polluting, fossil-fuel powered cars. Reduced GHG emissions. A total of 7,100 charging access points for electric vehicles are expected to be installed by 2030 (inclusive): 5,500 medium power (22 kW) and 1,600 high power (50 kW).
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos", UAB "Vilniaus apšvietimas"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", UAB "Vilniaus apšvietimas", city residents
	Comments on Implementation	On 1 February 2024, there were a total of 535 charging access points in Vilnius: 299 medium-power (up to 22 kW) and 236 high-power (above 22 kW).
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Effect has not been assessed; an action to enable the increase of the number of electric vehicles in the city **– included in action T13**
	Total Costs and Costs per Unit of CO_2e	Total Capex: 12,538,100€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T12 Development of pedestrian infrastructure**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	Development of pavements and footpath infrastructure to encourage walking and improve pedestrian comfort.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Increased number of pedestrians in the city. Increase in the number of people choosing this alternative mode of travel instead of driving. Between 2025 and 2030 (inclusive), an

		additional 90 km of footpaths are planned each year.
Implementation	Responsible Institutions/People	VCMA, SĮ "Susisiekimo paslaugos"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ "Susisiekimo paslaugos", city residents
	Comments on Implementation	This action is now underway.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 86,400,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T13 Promoting the purchase of low-emission and zero-emission vehicles**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	Encouragement of the acquisition of clean cars—electric, alternative fuel vehicles—mainly through purchase support/compensation.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	If incentives are successfully applied, the share of electric vehicles or other alternative non-fossil fuel powered light-duty vehicles (M1 and N1) in the total fleet of Vilnius should reach at least 62% by 2030. In order to achieve climate neutrality in the city, Vilnius should have 155,000 all-electric vehicles in 2030.
Implementation	Responsible Institutions/People	VCMA, Ministry of Transport and Communications of the Republic of Lithuania
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, Ministry of Transport and Communications of the Republic of Lithuania, city residents
	Comments on Implementation	Measures to promote the use of electric vehicles at national level: promotion of the acquisition of electric vehicles by natural and

		legal persons by providing compensation for the purchase of electric vehicles.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	287,368.04 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,681,365,000€ 5,850.95 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T14 Identification of low emission zones**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	Vilnius is one of the cities where the Law on Alternative Fuels requires the establishment of low-emission zones by 1 January 2025 at the latest. The Municipality Council will have to determine the area of the city in which vehicle traffic is restricted or completely banned, with the exception of clean vehicles. The low-emission zone is planned to be located in the Old Town. The options for expanding these zones are set out in the Sustainable Mobility Plan of Vilnius City Municipality.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Reduced traffic flows in parts of the city where low-emission zones have been introduced and reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA, SĮ “Susisiekimo paslaugos”, Ministry of Transport and Communications of the Republic of Lithuania
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ “Susisiekimo paslaugos”, Ministry of Transport and Communications of the Republic of Lithuania, city residents
	Comments on Implementation	This measure is not being implemented in Vilnius yet - implementation is being planned. A pilot project to test a low-emission zone in Vilnius Old Town is underway. The project will help to determine areas that are the most feasible to create this zone. It is expected that the pilot project will lead to a successful establishment of the low-emission zone in the Old Town area of Vilnius by the end of 2024.
Impact and Cost	Renewable Energy Generated (If Applicable)	

	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 257,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T15 Promoting the use of medium-sized commercial vehicles powered by alternative fuels in the city**
	Action Type	Soft Measure Direct GHG Emission Reductions
	Action Description	To encourage the replacement of fossil-fuel powered medium-sized commercial vehicles with RES-powered vehicles. By 2030, only alternative fuel vehicles (N2 class) could enter the territory of Vilnius City Municipality (N3 class vehicles are practically excluded from most of Vilnius). From 2030 onwards, only RES-powered vehicles that do not emit any GHG could enter the city. This action is also linked to the expansion of low-emission zones: as the size of these zones grows, the trucks that drive in them will have to be clean.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Potential reductions in medium-sized commercial vehicle flows, air pollution and GHG emissions.
Implementation	Responsible Institutions/People	VCMA, SĮ “Susisiekimo paslaugos”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ “Susisiekimo paslaugos”, city residents
	Comments on Implementation	This measure is not being implemented in Vilnius yet.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect included in T13 (we do not consider changes by 2030 for the heavy-duty vehicles)
	Total Costs and Costs per Unit of CO_2e	Total Capex: 790,300€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**T16 Increasing parking fees**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	In order to reduce private car traffic in the city centre and other parts of the city, parking charges are planned to be increased, thus creating less favourable conditions for private car use. There are also plans to expand the number of paid parking zones in the city and to change the pricing.
Connection to the Impact of the Actions	Field of Activity	Transport
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Reduced traffic flows in parts of the city where parking charges are levied and reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA, SĮ “Susisiekimo paslaugos”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, SĮ “Susisiekimo paslaugos”, city residents
	Comments on Implementation	This measure is already in progress. By 2025, it is planned to increase the parking charges in all charging zones of the city.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Actions related to the implementation of SUMP are placed under the **H1** action. SUMP actions are infrastructural. However, the highest GHG reduction effect will be reached by raising awareness, informing, engaging, and educating citizens to change their transportation preferences.
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan -

3.2.3 Waste management actions

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A1 Assessment and implementation of food waste treatment options**
	Action Type	Hard and Soft Measures Direct GHG Emission Reductions
	Action Description	From January 2024, city residents collect food waste separately at the place of production. The food waste separated by Vilnius residents in orange bags is put in shared mixed waste containers. A feasibility study on food waste treatment is proposed to explore alternative, more efficient

		ways of processing food waste. The possible implementation of the alternative food waste treatment options presented in the study would further reduce GHG emissions, further optimise processes and bring bigger economic advantages.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Proper separation and treatment of this biodegradable waste reduces the amount of organic waste in the mixed municipal waste stream and reduces GHG emissions.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	The action started in January 2024. Special bags and buckets are given to residents to collect food and kitchen waste separately. Energesman, the Vilnius region's food waste management company, which operates the Vilnius Mechanical Biological Waste Treatment (MBA) Plant, invested 1 million EUR in insect larvae technology at the beginning of 2024. This technology recycles collected food waste to produce proteins for industry, biofuels and fertilisers.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect at this stage of the plan development was not evaluated due to lack of data, but it can be evaluated in the later stages
	Total Costs and Costs per Unit of CO_2e	Total Capex: 11,500,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A2 Improvement of municipal waste sorting processes**
	Action Type	Hard Measure Indirect GHG Emission Reductions
	Action Description	Residents already sort their municipal waste – the city has a well-developed waste sorting system (a system of containers for sorting plastic, paper, metal and glass, collection of sorted waste, etc.). UAB VAATC waste treatment site at Graičiūno St 36D, Vilnius, will ensure the separation and preparation for use of waste streams with a high

		reuse potential. The aim of this action is to separate successfully as many waste streams as possible and prepare them for recycling.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Reduced recyclable municipal waste streams going to the VCHPP and landfill. Increased circularity of materials.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	Residents already sort their municipal waste – the city has a well-developed waste sorting system (a system of containers for sorting plastic, paper, metal and glass, collection of sorted waste, etc.), however, the engagement of the citizens needs to be improved.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect at this stage of the plan development was not evaluated due to lack of data
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A3 Production of hydrogen from municipal waste**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	Treating 11,000 tonnes of municipal waste per year would produce 700-800 tonnes of hydrogen. This hydrogen would be used as fuel for vehicles such as public transport buses.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	City buses would use hydrogen fuel instead of diesel. GHG emissions would be reduced. As this project is still being developed, it is unclear how many buses will be purchased and use the hydrogen fuel produced from municipal

		waste. Therefore, the reduction of GHG emissions is not estimated too.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC, UAB VVT, residents
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, UAB VVT
	Comments on Implementation	The feasibility of this measure is being analysed.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect at this stage of the plan development was not evaluated due to lack of data, however, the effect might be evaluated latter
	Total Costs and Costs per Unit of CO_2e	Total Capex: 65,000,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A4 Promotion of municipal waste sorting and prevention of waste generation by educating the population**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	To promote municipal waste sorting and waste reduction by organising educational events and activities in the city's communities. It is also important to reduce waste by encouraging consumers to choose durable, reusable packaging and to avoid single-use plastic, paper and other types of packaging. The planned educational events and activities would encourage even more people to sort municipal waste properly and contribute to waste reduction. There would be potentially two larger events per year, as well as seven smaller events or educational workshops targeting different communities or groups in the city, with a strong focus on their local needs.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Social Innovation
	Results (Based on Table/Section B-1.1)	Reduced recyclable municipal waste streams going to the VCHPP and landfill; this waste would be recycled, which would increase the circularity of materials.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC, residents

	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC
	Comments on Implementation	Various initiatives are currently underway at national level to promote the sorting of municipal waste and to prevent the production of waste.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	No direct reduction of GHG emissions is considered
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A5 Expanding the network of DĖK'UI stations**
	Action Type	Soft Measure Hard Measure (Infrastructure Development) Indirect GHG Emission Reductions
	Action Description	DĖK'UI stops are drop-off and exchange points where residents can leave items they do not use. Items that are functional, in good condition but no longer needed can be used by other people, thus reducing the likelihood of items becoming waste. A total of 11 item sharing stops are expected to be established in the city by 2027. Later on, the network of stops can be expanded as needed.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Social Innovation
	Results (Based on Table/Section B-1.1)	Reduced waste production, promotion of the circular economy.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	There are currently 5 DĖK'UI stops in the city.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	

	GHG Emission Reduction Value (Total) per Source Sector	No direct reduction of GHG emissions is considered
	Total Costs and Costs per Unit of CO_2e	Total Capex: 1,000,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A6 Promotion of green waste sorting by expanding the network of green waste collection and handling stations and educating the population**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	To promote the separation of green waste by setting up green waste reception and management sites in the city and surrounding areas. At least one green waste management site could potentially be set up within the city. Attention must also be paid to organising educational events and activities in city communities. This would encourage residents to properly manage the green waste produced in their yards.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Social Innovation
	Results (Based on Table/Section B-1.1)	Reduced green waste entering the overall mixed waste stream, reducing GHG emissions.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	The city's residents already separate their green waste, but the collection infrastructure needs to be further promoted and improved, and the number of composting sites needs to be increased.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect at this stage of the plan development was not evaluated due to lack of data, however, the effect might be evaluated latter
	Total Costs and Costs per Unit of CO_2e	Total Capex: 500,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A7 Establishment of a waste education center sponsored by UAB VAATC**

	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	The waste preparation site located at Graičiūno St 36D, Vilnius, will be adapted for waste prevention activities by setting up an education centre. The purpose of this centre is to educate the public, especially school children, about the waste management system in the Vilnius region, and to carry out various educational activities on waste issues. The education centre will also include workshops to teach how to repair, refurbish and renovate items and other activities to encourage the reuse of items. The education centre will be built with administrative premises needed for the centre. Implementation is planned by 2026.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Social Innovation
	Results (Based on Table/Section B-1.1)	Increased residents' awareness, improved waste culture, possible reduction of waste streams, increased use of circularity principles.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	Implementation of this action is planned.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	No direct reduction of GHG emissions is considered
	Total Costs and Costs per Unit of CO_2e	Total Capex: 2,000,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**A8 Identification and application of textile waste recycling technologies in a municipality**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	The textile industry is one of the most polluting industries, so recycling as many textiles as possible is essential to make the use of textiles more sustainable and to reduce environmental impacts and GHG emissions. To achieve this, it is necessary to identify the most advanced

		recycling technologies that can be applied at municipal level. Textile waste is already collected separately in special containers. Private companies collecting textiles from special containers export clothes in better condition to third countries, while those in worse condition are made into rags. However, there is a lack of innovative solutions to recycle textile waste as efficiently as possible, avoiding it ending up in the VCHPP or landfill. With the involvement of private business, research institutions, UAB VAATC and VCMA, a feasibility study could analyse the development and applicability of innovative textile recycling facilities.
Connection to the Impact of the Actions	Field of Activity	Waste and the Circular Economy
	Systematic Leverage	Scientific Innovation
	Results (Based on Table/Section B-1.1)	Reduced textile waste entering the overall mixed waste stream and the VCHPP, increased recycling of textile waste, promotion of circular economy.
Implementation	Responsible Institutions/People	VCMA, UAB VAATC
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, UAB VAATC, residents
	Comments on Implementation	Textile waste is already collected separately in special containers, but there is a lack of innovative solutions for recycling this waste to avoid it ending up in the VCHPP or landfills.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The GHG reduction effect at this stage of the plan development was not evaluated due to lack of data, however, the effect might be evaluated latter
	Total Costs and Costs per Unit of CO_2e	Cross-cutting Capex costs – see the Investment Plan -

3.2.4 Green Infrastructure and Nature-Based Solutions

B-2.2: Description of an Individual Action		
Action Description	Action Name	**Ž1 Development of green infrastructure - planting of trees and bushes in the city of Vilnius**
	Action Type	Hard Measure

		Direct GHG Emission Reductions
	Action Description	The Green Wave initiative in Vilnius is systematically planting trees, shrubs and other plants in the city. The Vilnius City General Plan calls for green spaces to be within 200-300 metres of the city's residents and for major city parks to be within 2,000 metres. The aim of Vilnius City Municipality is that every one of the 2,000 kilometres of Vilnius streets should be green, with green spaces adorning both the horizontal and vertical surfaces of the city. At least 3,000 trees and 20,000 shrubs are to be planted in the city each year.
Connection to the Impact of the Actions	Field of Activity	Green Infrastructure and Nature-Based Solutions
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	The implementation of this action contributes to the absorption of GHGs, adaptation to climate change (for example, the cooling effect of vegetation in the face of more frequent heat waves), and the humanisation of city streets.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, residents
	Comments on Implementation	Between 2021 and 2023 (inclusive), 66,000 trees and 174,000 shrubs were planted in Vilnius in cooperation with communities, businesses, and other institutions. In 2024, the Vilnius City Municipality Administration plans to plant, at its own expense, around 3,000 trees and 42,000 shrubs.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	2,600 tCO_2eq. (GHG emission compensation)
	Total Costs and Costs per Unit of CO_2e	Total Capex: 8,909,000€ 3,426.54 EUR/tCO_2e

3.2.5 Buildings and Related Infrastructure

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P1 Upgrading municipal buildings and their systems**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	Energy efficiency is achieved when buildings are energy efficiency class B or higher.

		Buildings in Vilnius City Municipality with energy efficiency class B and higher account for only 17.13% of the total building area assessed. Upgrading all municipal buildings below energy efficiency class B and their utility systems to energy efficiency class B or higher would reduce energy demand by at least 40%. In order to ensure the smooth and systematic implementation of the renovation of municipal buildings, it is proposed to develop an internal standard for the renovation of municipal buildings.
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Increased energy efficiency of buildings, reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, residents
	Comments on Implementation	Renovation of municipal buildings is already underway, with schools, kindergartens, hospitals, etc. being renovated, but 83% of the area of municipally-owned buildings still need to be renovated (the total area of municipally-owned buildings is 1,173,804 m^2).
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	4,719.03 tCO_2eq.
	Total Costs and Costs per Unit of CO2e	Total Capex: 583,639,000€ 123,677.75 EUR/tCO2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P2 Centralisation of municipal building management and building energy consumption monitoring**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	To centralise professional management of municipally-owned buildings. To install a centralised automatic system for reading and analysing building meters and sub-meters. To optimise building utility systems and energy consumption on the basis of continuously collected and analysed data. To calculate the

		CO2 emissions of owned buildings, with the aim of reducing the emissions of each building on an annual basis (thus obliging both the manager and the users of the buildings to pursue a common goal).
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Increased energy efficiency of buildings, systematic data collection, reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, residents
	Comments on Implementation	The action is not being implemented yet – the idea and its details are still being discussed and developed by relevant stakeholders.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	Action related with P1; no direct impact on GHG emissions
	Total Costs and Costs per Unit of CO_2e	Total Capex: 4,475,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P3 Promoting the modernisation of multi-apartment buildings**
	Action Type	Hard Measure Direct GHG Emission Reductions
	Action Description	By 2030, 2,400 multi-apartment buildings should be renovated (at least 480 per year). Residents can apply for state support for the modernisation of multi-apartment buildings. To qualify for this funding, owners of apartments and other premises must approve an Investment Plan, in which the renovated multi-apartment building should save at least 40% of heat energy). The Vilnius Coalition Programme foresees the creation of a special fund for the renovation of multi-apartment buildings and the additional financing of renovation projects on top of the state support. This could encourage more residents to renovate their homes.

Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Technology and Infrastructure
	Results (Based on Table/Section B-1.1)	Increased energy efficiency of buildings, reduced GHG emissions.
Implementation	Responsible Institutions/People	VCMA, VšĮ “Atnaujinkime miestą”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, VšĮ “Atnaujinkime miestą”, residents
	Comments on Implementation	This action is in progress.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	68,349.82 tCO_2eq.
	Total Costs and Costs per Unit of CO_2e	Total Capex: 3,920,000,000€ 57,357.14 EUR/tCO_2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P4 Promoting panel modernisation of buildings**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	The EPMA of the Ministry of Environment of the Republic of Lithuania coordinates the calls for applications for state financial support for the panel renovation of buildings. The VCMA could promote this action by raising awareness among city residents, educating them during various information events, assisting in the preparation of the necessary documentation, organising procurement, etc. The Vilnius Coalition Programme foresees the creation of a special fund for the renovation of multi-apartment buildings and the additional financing of renovation projects on top of the state support. This could encourage more residents to renovate their homes. If residents increasingly opt for panel renovation, this would speed up the modernisation of buildings, achieve energy efficiency of buildings and reduce GHG emissions.
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	If residents increasingly opt for panel renovation, this would speed up the modernisation of buildings, achieve energy

		efficiency of buildings and reduce GHG emissions.
Implementation	Responsible Institutions/People	VCMA, VšĮ “Atnaujinkime miestą”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, VšĮ “Atnaujinkime miestą”, residents
	Comments on Implementation	Pilot projects for panel renovation of two multi-apartment buildings in Vilnius were approved.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The effect is added to the total number of modernized buildings in action P3
	Total Costs and Costs per Unit of CO_2e	Total Capex: 90,000,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P5 Promoting quarterly modernisation of residential buildings**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	The implementation of complex block renovation projects is one of the government’s priorities. Renovating groups of multi-apartment buildings and other public buildings as well as improving the living environment, access roads, street lighting and other infrastructure leads to greater energy efficiency. The improvement of an entire block of multi-apartment buildings includes upgrading the above-ground and underground utilities and cleaning up the environment. Projects for partial funding can be prepared at national level. VCMA provides financial support to encourage block renovation through the neighbourhood programme. The municipality gives EUR 10 per square metre of undeveloped neighbourhood area. Neighbourhood area renewal measures: - Security of the yard area; - Sports fields and children’s playgrounds; - Renewed pavements; - Parking facilities; - Greening. *Note: During the City Council meeting held on 12 June 2024, it was approved to amend the Council Decision No 1-1058 of 26 July 2017 "On the Approval of the Programme for the Renewal of Neighbourhood Areas of the City of Vilnius and the Description of the Implementation of this Programme". Amendment: "For the design and installation of*

		the measures specified in Annex 1 (including technical supervision), the amount of EUR 70 incl. VAT shall be allocated per 1 sq. m. of undeveloped area of the neighbourhood area." This amount is not included into the total of Implementation Costs, presented in Investment Plan.
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Increased levels of block renovation in the city. Modernisation of multi-apartment building systems, such as heating pipelines, to reduce heat losses. Improved energy efficiency of buildings. GHG emissions are reduced. In addition, the sense of community is fostered and social exclusion is reduced.
Implementation	Responsible Institutions/People	VCMA, VšĮ "Atnaujinkime miestą"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, VšĮ "Atnaujinkime miestą", residents
	Comments on Implementation	The implementation of this action is being delayed as the communities that own old multi-apartment houses are dealing with rather difficult and bureaucratic system that creates not wanted challenges in implementing this action. The national government together with local authorities are working on overcoming current obstacles.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	The effect is added to the total number of modernized buildings in action P3
	Total Costs and Costs per Unit of CO_2eq.	Total Capex: 100,000,000€ -

B-2.2: Description of an Individual Action		
Action Description	Action Name	**P6 Promoting the development of sustainable buildings**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	Promotion of the development of sustainable buildings by going beyond the minimum energy efficiency requirements for new buildings and applying the "lean, clean, green" principle. Once the Vilnius General Plan has been approved, all newly constructed or reconstructed buildings with a gross floor area > 5,000 sq. m must be certified according to a

		system of sustainable building certification criteria recognised in Lithuania or another country of the European Union, chosen by the builder. In Lithuania, the EU recognises the certification of buildings according to systems (standards) of sustainable development criteria. At the municipal level, it is proposed to draw up rules for the development of new sustainable buildings as a guideline for property developers.
Connection to the Impact of the Actions	Field of Activity	Buildings and Related Infrastructure
	Systematic Leverage	Governance and Policy
	Results (Based on Table/Section B-1.1)	Energy efficiency in buildings is achieved and GHG emissions are reduced.
Implementation	Responsible Institutions/People	VCMA
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, residents
	Comments on Implementation	The VCM is not yet subject to laws or regulations directly related to this action. It is expected that sustainability provisions will be developed at a higher (national) level, in this case by the Ministry of Environment of the Republic of Lithuania.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	GHG reduction effect considered to be indirect
	Total Costs and Costs per Unit of CO_2e	Total Capex: 3,595,300€ (per assessment) -

3.2.6 Horizontal Actions

B-2.2: Description of an Individual Action		
Action Description	Action Name	**H1 Establishment of Vilnius Climate Neutrality Information and Consultancy Centre**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	To establish an interdisciplinary information and advice centre to educate the public on climate neutrality actions. This centre/platform would become an important knowledge hub providing guidance and information on how residents, businesses, etc. can contribute to mitigating the impacts of climate change in the city and adapting to a changing climate. It would provide information on the use of renewable energy sources, sustainable transport options, the

		importance of energy efficiency in the buildings sector, environmentally friendly lifestyles, etc.
Connection to the Impact of the Actions	Field of Activity	Interdisciplinary Action
	Systematic Leverage	Interdisciplinary
	Results (Based on Table/Section B-1.1)	Increasing public awareness of climate change and its impacts, encouragement of climate action, and contribution to the goal of climate-neutral cities. Reduced GHG emissions in various sectors: energy, transport, buildings, waste, etc.
Implementation	Responsible Institutions/People	VCMA, VšĮ "Neutralus klimatui Vilnius"
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, VšĮ "Neutralus klimatui Vilnius", residents
	Comments on Implementation	This measure has not been launched yet.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	225,163.97 tCO_2eq. (Note: implementation of Sustainable mobility urban plan actions to decrease the trips with individual vehicles) 633,630.88 tCO_2eq. (Note: includes the electricity consumption switch from fossil fuel to RES and increased use of electricity use in transport and heating sector)
	Total Costs and Costs per Unit of CO_2e	Total Capex: 200,000€ 0.41 EUR/tCO2e

B-2.2: Description of an Individual Action		
Action Description	Action Name	**H2 Establishment of Climate Fund**
	Action Type	Soft Measure Indirect GHG Emission Reductions
	Action Description	The main objective of the climate fund is to raise capital from the private/business sector to implement climate action. This will enable financial support to be provided to small-scale climate change mitigation initiatives. Ideas for these projects will be offered by city communities, businesses, and other stakeholders.
Connection to the Impact of the Actions	Field of Activity	Interdisciplinary Action
	Systematic Leverage	Interdisciplinary
	Results (Based on Table/Section B-1.1)	Increasing public awareness of climate change and its impacts, encouragement of climate action, and contribution to the goal of climate-

		neutral cities. Reduced GHG emissions in various sectors: energy, transport, buildings, waste, etc.
Implementation	Responsible Institutions/People	VCMA, VšĮ “Neutralus klimatui Vilnius”
	Scope of the Action and Facilities Concerned (Facilities in which Implementation Takes Place)	The action is significant for the whole city area and city residents.
	Stakeholders Involved	VCMA, VšĮ “Neutralus klimatui Vilnius”, residents
	Comments on Implementation	This action has not been launched yet – it is on the preparatory phase. The climate fund is part of a project “Climate Funding 4 Cities” that is sponsored by NetZeroCities Pilot Cities programme.
Impact and Cost	Renewable Energy Generated (If Applicable)	
	Energy Removed/Replaced, Volume or Fuel Type	
	GHG Emission Reduction Value (Total) per Source Sector	GHG impact is indirect (the concept of the fund is related to increase of the awareness and engagement of citizens in the climate neutrality topic)
	Total Costs and Costs per Unit of CO_2e	-

B-2.3: Summary of the Residual Emissions Strategy

Successful implementation of the listed GHG emission reduction measures could lead to a 80% decrease of GHG emissions by 2030 compared to 2021 levels. This goal – and even bigger than 80% reductions in GHG emissions – could be reached if all relevant stakeholders concentrate efforts and actively take climate action.

Vilnius is dedicated to addressing the remaining 20% of residual emissions to reach climate neutrality (see Fig 11). We will continue to advance the Green Wave initiative, which incorporates nature-based solutions to stabilize and enhance GHG absorption capacity.

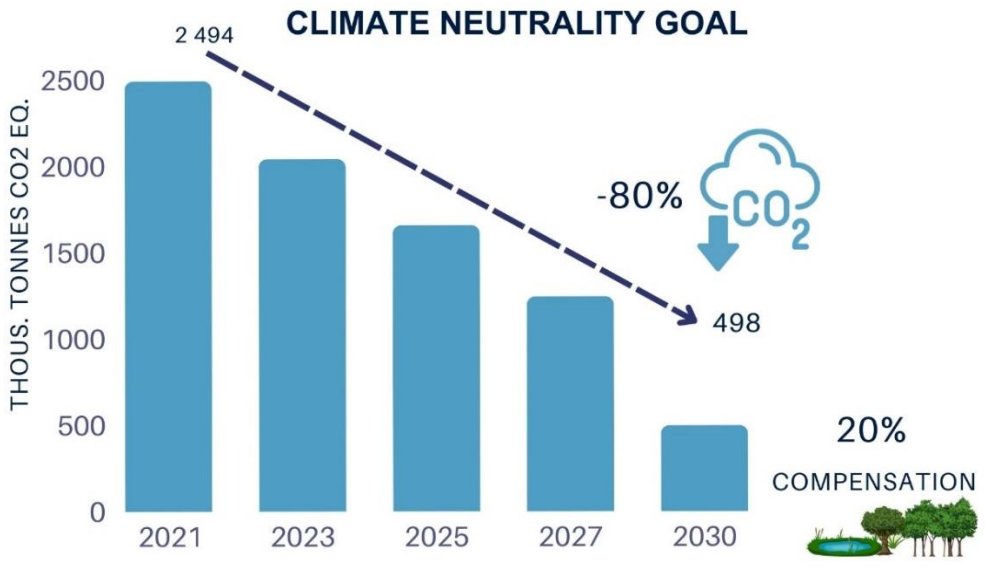


Fig 12. Climate Neutrality goal for 2030

In the case of Vilnius, residual greenhouse gas (GHG) emissions are projected to account for 20% of total emissions by 2030. The largest share of these emissions - 63% - will come from the transport sector, followed by the building and heating sector (23%), and the remaining 14% from waste, wastewater management, and industrial processes (see Fig. 12). These figures highlight the key challenges Vilnius faces on the path to climate neutrality.

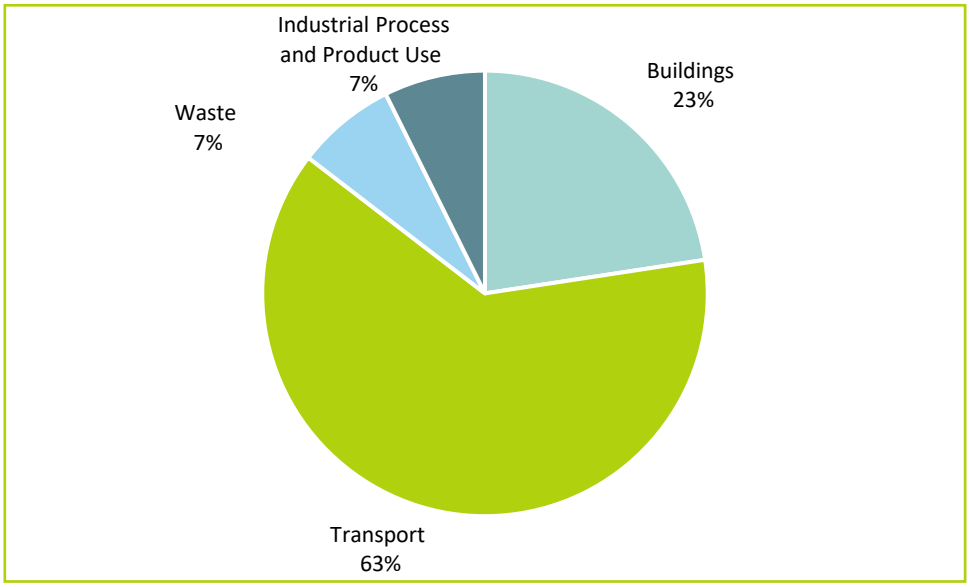


Fig 13. Composition figure of residual GHG emissions in 2030

Residual emissions from transport dominate due to the complexity of transitioning a sector influenced by numerous decision-makers and diverse mobility patterns. Fossil fuel-driven private cars are expected to make up a significant portion of these emissions. While this Action Plan includes measures to encourage citizens to switch to cleaner alternatives, achieving substantial reductions will remain challenging. Heavy-duty vehicles present another significant obstacle, as the Mission scenario does not anticipate a major fuel shift in this category by 2030. However, potential reductions are substantial. If the heavy-duty industry transitions to alternative fuels, Vilnius could reduce total GHG emissions by approximately 118.17 $ktCO_2eq$, or 24%. Actions planned in the Climate City Contract (CCC), such as **T15: Promoting alternative-fuel commercial vehicles** and **T2: Green hydrogen production for buses**, aim to accelerate progress in this area.

Residual emissions in Buidings sector are primarily linked to individual heating systems. Many households in Vilnius still rely on natural gas for heating, and while biomass is often suggested as an alternative, it does not result in zero emissions due to methane (CH_4) and nitrous oxide (N_2O) emissions. Encouraging the adoption of cleaner heating technologies will require a multifaceted approach, including financial incentives, education, and support for retrofitting. Special attention will also be needed to address challenges in multi-apartment buildings, where joint decisions among apartment owners are often hindered by differing financial situations and priorities.

Reducing residual emissions from waste and wastewater management presents unique challenges due to the natural processes involved. Vilnius has ceased landfilling organic waste, but composting is increasing, which presents both opportunities and complexities. Innovative solutions to close the waste management loop, alongside improvements in wastewater treatment, will be crucial (and the actions facing this task are planned in this action plan). However, a lack of data and knowledge currently limits the ability to assess the full impact of proposed actions in this sector.

According to preliminary estimates, Vilnius greenery currently absorbs approximately -542.53 $ktCO_2eq$ annually. Maintaining and enhancing this level of absorption will be vital to achieving neutrality. The city will continue advancing the **Green Wave initiative**, which integrates nature-based solutions to stabilize and expand GHG absorption capacity. Additionally, Vilnius will explore sector-specific measures to further increase carbon absorption and compensation potential.

While Vilnius does not yet have a comprehensive residual emissions strategy, the municipality is committed to monitoring the implementation of this Action Plan and adapting as necessary. Should further measures be required, a detailed strategy will be developed to address residual emissions and ensure progress toward climate neutrality.

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

Module B-3 "Indicators for Monitoring, Evaluation and Learning" contains a selection of indicators to monitor and evaluate progress along the selected impacts pathways and fields of action described in Module B-1. as well as a monitoring and evaluation plan, i.e., metadata on each indicator selected, in addition to milestones and timeline.

Table B-3.1 contains comprehensive set of indicators that covers all main sectors discussed in the Action Plan. Baseline values of indicators are provided in the table as well as year 2030 targets. The set of indicators can be amended due to the changing situation in the following years until 2030. Moreover, the set of indicators is currently being reviewed and discussed with stakeholders whose activities and strategies are related to the indicators presented in table B-3.1.

B-3.1: Evaluation Indicators for Monitoring and Implementation of Actions

Action Name	Responsible authority	Indicator	Fact (year)	2030 Target
GHG emissions from energy production and use (electricity and heat)	VCMA Energy Department / AB "Vilniaus šilumos tinklai" / electricity suppliers at national level	$ktCO_2e$	1436 (2021)	112
To continue the reconstruction of Vilnius City's heat supply networks.	VCMA Energy Department / AB "Vilniaus šilumos tinklai"	Network loss indicator, % (it indicates what % of enegy is lost – doesn't reach the consumer – in the process of energy transfer via heat supply networks)	11.5 (2023)	9.5
To encourage the majority of heat supplied by DH to be produced from RES.	VCMA Energy Department / Infrastructure Department / VšĮ "Neutralus klimatui Vilnius"	Percentage of heat produced from RES in relation to total heat supplied through DH	54.16 (2019)	100
To encourage non-centralised heating household consumers to use more RES.	VCMA Energy Department / Infrastructure Department / VšĮ "Neutralus klimatui Vilnius"	Share of heat produced from RES in total heat production, %	48.55 (2019)	90
UAB "Vilniaus vandenys" would use mono-incineration of	VCMA Energy Department / UAB "Vilniaus vandenys"	Implemented / Not implemented (successful	Not implemented (2024)	Implemented

B-3.1: Evaluation Indicators for Monitoring and Implementation of Actions				
Action Name	**Responsible authority**	**Indicator**	**Fact (year)**	**2030 Target**
sewage sludge for energy production.		implementation - use mono-incineration of sewage sludge for energy production)		
UAB "Vilniaus apšvietimas" replaces all old luminaires with LED luminaires in order to modernise the lighting system in Vilnius.	VCMA Energy Department / UAB "Vilniaus apšvietimas"	Percentage of LED luminaires compared to all luminaires in Vilnius	95 (2023)	100
Municipality administration and municipal institutions switch to consuming green electricity from RES for their own use.	VCMA Energy Department / Organisation Development Group	Percentage of consumed electricity from RES in relation to the total amount of consumed electricity	(Currently not estimated)	100
To encourage people to consume electricity from RES.	VCMA Energy Department / Infrastructure Department / VšĮ "Neutralus klimatui Vilnius"	Percentage of electricity from RES purchased by the residents in relation to total electricity purchases	36.2 (2023)	100
GHG emissions from city transport	VCMA Infrastructure Department / SĮ "Susisiekimo paslaugos"	$ktCO_2e$	948 (2021)	313
GHG emissions from public transport	VCMA Infrastructure Department / SĮ "Susisiekimo paslaugos"	ktCO2e	44.2 (2021)	0
To implement the Vilnius City Sustainable Mobility Plan to reduce the share of car trips in total trips to 30%.	VCMA Infrastructure Department / SĮ "Susisiekimo paslaugos" / UAB "Vilniaus vystymo kompanija"	Share (percentage) of private car trips in total trips	51 (2023)	30
To upgrade public transport in Vilnius.	VCMA Infrastructure Department / UAB "Vilniaus viešasis transportas" / SĮ "Susisiekimo paslaugos"	Percentage of clean vehicles in the total VVT fleet	39	100
To upgrade the car fleet of the VCMA to clean vehicles.	VCMA Organisation Development Group	Percentage of clean vehicles in	8	100

B-3.1: Evaluation Indicators for Monitoring and Implementation of Actions				
Action Name	**Responsible authority**	**Indicator**	**Fact (year)**	**2030 Target**
		the total VMSA fleet		
Encouragement of the acquisition of clean vehicles	VCMA Infrastructure Department / SĮ "Susisiekimo paslaugos"	Percentage of clean vehicles in the total fleet of vehicles registered in Vilnius City Municipality	3	62
To expand the network of electric vehicle charging stations in Vilnius.	VCMA Infrastructure Department / SĮ "Susisiekimo paslaugos" / UAB "Vilniaus apšvietimas"	To install 5,000 medium power (22 kW) charging points for electric vehicles and 1,600 high power (50 kW) charging points for electric vehicles	299 (22 kW) / 236 (50 kW) (2024)	5,000 (22 kW) / 1,600 (50 kW)
To establish a low emission zone in Vilnius old town.	VCMA Infrastructure Department / City Environment Department / SĮ "Susisiekimo paslaugos" /	Implemented / Not implemented (successful implementation - low emission zone establishment in Vilnius old town)	Not implemented (2024)	Implemented
GHG emissions from waste	VCMA Energy Department / UAB VAATC	$ktCO_2e$	71 (2021)	36
To continue planting trees in the city.	VCMA City Environment Department	Number of new trees planted between 2024 and 2025	66,000 (2023)	100,000
To renovate all VCMA-owned buildings to energy efficiency class B or higher by 2030.	VCMA Energy Department / VšĮ "Atnaujinkime miestą" / UAB "Vilniaus vystymo kompanija"	Percentage of class B or higher VCMA buildings as a percentage of the area of all VCMA buildings.	17	100
To continue the renovation of multi-apartment buildings, with at least 300 multi-apartment buildings renovated each year until 2030 (2,400 in total).	VCMA Energy Department / VšĮ "Atnaujinkime miestą"	Number of multi-apartment buildings renovated per year (from 2023) / total number of renovated multi-apartment buildings in 2030	283 / 2,400 (2023)	480 / 2,400

B-3.1: Evaluation Indicators for Monitoring and Implementation of Actions				
Action Name	**Responsible authority**	**Indicator**	**Fact (year)**	**2030 Target**
To ensure that all new private buildings are nearly energy-neutral. The normative energy performance of such buildings would be A++.	VCMA Energy Department / Infrastructure Department / VšĮ "Neutralus klimatui Vilnius" / VšĮ "Atnaujinkime miestą"	Implemented / Not implemented (successful implementation - all newly constructed buildings are nearly energy-neutral)	Not implemented (2024)	Implemented
To continue to promote the development of sustainable buildings. New construction could be carried out under international certifications supporting the application of sustainable and energy-efficient building standards, for example, BREEAM, LEED.	VCMA Energy Department / VšĮ "Atnaujinkime miestą";	Implemented / Not implemented (successful implementation - the development of sustainable buildings according to relevant standards)	Not implemented (2024)	Implemented
To reduce GHG emissions per resident	VCMA Energy Department / VCMA Infrastructure Department	tCO_2e per resident	4.5 (2021)	0.89

Interim values of indicators (for 2025 and/or 2027) are being discussed with the relevant engaged stakeholders, and thus the methodology of these interim values is being developed now. Therefore, baseline values of the indicators are presented in table B-3.1.

As the monitoring system, consisting of interim and target values, is still being developed, the metadata for the indicators will be presented after the development process is complete.

The monitoring system is being created together with relevant stakeholders such as Vilnius City Municipality Energy Department and Group of Infrastructure, municipal companies responsible for various sectors: SĮ „Susisiekimo paslaugos", UAB VVT (transport), AB VŠT (energy), UAB „VAATC" (waste management), etc. The monitoring system will be managed in collaboration of experts from Vilnius City Municipality Administration and Public Entity "Neutralus klimatui Vilnius".

Moreover, the city is open to accept opinions, suggestions and ideas from a wider ecosystem of stakeholders – including various groups of people, such as businesses, academia, citizens. Therefore, during the process of fully designing the monitoring system, Vilnius is ready to hear, analyze and incorporate feedback from citizens and other relevant stakeholders. This co-creation process that could be carried out in special working groups (see more in section C.1.2: Empowering Organisational and Management Interventions) will help the municipality administration and municipal companies to get well connected with various groups of Vilnius's society. The conversations and interconnections between these various stakeholders will inspire processes of learning and designing the monitoring system that suits every stakeholder in the city – so that citizens' needs will be reflected in this system of indicators.

In this manner, the detailed management system is being developed together with the monitoring system.

4 Part C – Achieving Climate Neutrality by 2030

Part C "Achieving Climate Neutrality by 2030" aims to describe any favourable interventions, i.e. related to the organisational environment, collaborative governance models or social innovation, to support and enable the climate actions described in Module B-2, as well as to achieve the co-benefits outlined in the impact plan (Module B-1).

4.1 Module C-1. Organisational and Management Innovation Interventions

Module C-1 "Organisational and Management Innovation Interventions" consists of a section for more detailed descriptions and comments (C-1.1) and a summary table listing organisational and management initiatives and describing their impact (C-1.2).

C-1.1: Description of Empowering Organisational and Management Interventions

The National Energy and Climate Action Plan has been adopted by the government at national level. The Plan correlates with Vilnius' ambition to reduce drastically the negative climate impact of various activities in the city.

By 2030, Lithuania is expected to reach its GHG reduction target of 21% compared to 2005 (note: in non EU ETS sectors – transport, agriculture, small energy, waste, small industry). It will also achieve 70% renewable energy sources in total final energy consumption and 100% in electricity consumption. To achieve these national targets, a Climate Change Programme has been set up to finance projects ranging from the installation of energy efficiency infrastructure to public information and education on climate change. The implementation of these actions would also contribute to the achievement of Vilnius' climate neutrality target.

Alongside national mitigation measures, the Lithuanian Green Municipalities Network can help to implement climate neutrality on a city scale. Established in early 2023, the national organisation aims to bring together Lithuanian municipalities, industry, business, science, non-governmental organisations and civil communities to develop innovative technologies and solutions for smart cities while reducing GHG emissions. The network thus has the ambitious task of fully cooperating to make at least five municipalities in Lithuania climate-neutral by 2030.

In order to meet the objectives of the EU Cities Mission, the municipality has set up a Climate City Contract working group, which brings together experts from the relevant department of the VCMA and municipally-owned companies. Competent experts from various fields would systematically and periodically assess the implementation of the city climate action. The working group would also provide ideas on how to accelerate the city's transformation to become a climate-neutral municipality by 2030.

Moreover, Vilnius is determined to expand the idea of creating working groups – such as implementing the idea of creating a working group consisting of so called "external", not municipal, stakeholders. Vilnius is exploring an idea of having a citizen / societal working group that could bring new ideas and share everyday knowledge what works the best for most of the people in this complex process of aiming net-zero in the city.

These organisations would help to involve and encourage private businesses and city residents to take action to reduce their climate impact. This could be achieved through an initiative of the National Green Municipalities Network and the municipal working group to encourage businesses and residents in the city to learn more about climate change, the actions that can reduce climate change impacts, and the potential environmental, social and economic benefits of taking these actions.

C.1.2: Empowering Organisational and Management Interventions					
Intervention Name	Description	Responsible Company/Person	Stakeholders Involved	Empowering Effect	Co-Benefits
Lithuanian Green Municipalities Network	An organisation of 24 municipalities in Lithuania, encouraging municipalities to become climate-neutral	Lithuanian Energy Institute	The Lithuanian Energy Institute, the VCMA and other Lithuanian municipalities that have joined the Green Municipalities Network, relevant business and industry entities	Development of innovative green and sustainable technologies and solutions for smart cities, with the aim of making at least five municipalities in Lithuania climate-neutral by 2030	Enhanced cooperation between Lithuanian municipalities, industry and business, non-governmental organisations, academia and civil communities; reduced GHG emissions and improved quality of life.
Climate City Contract Working Group	Setting up a working group. This group of experts from VCMA and its subsidiaries would monitor and evaluate the implementation of the actions set out in the Climate City Contract. (This group could also include external experts.)	VCMA	The VCMA and municipal companies (AB "Vilniaus šilumos tinklai", SĮ "Susisiekimo paslaugos", UAB VVT, etc.), other stakeholders	Monitoring of the implementation of the Climate City Contract, based on indicators for measuring the implementation of actions	Sustainable and climate-neutral energy and transport systems are ensured, the energy efficiency of buildings is increased and greening of the city is carried out.
Climate neutrality citizens working group	Setting up a working group consisting of various citizens that belong to different groups of society (associations, NGOs, businesses, etc.)	VCMA, Neutralus klimatui Vilnius	Citizens and representatives of civic societies, representatives of businesses	Having all the voices heard, taking the most feasible ideas into account to improve CCC	Sharing the knowledge, cooperation of various stakeholders strengthens relationships and creates a more united society.

4.2 Module C-2. Social and Other Innovation Interventions

Module C-2 "Social and Other Innovation Interventions" consists of a summary table listing the organisational and co-management interventions and describing their impact (C-2.1) and a section for more detailed descriptions and comments (C-2.2).

C.2.1: Empowering Social Innovation Interventions					
Intervention Name	Description	Responsible Company /Person	Stakeholders Involved	Empowering Effect	Co-Benefits
Education of the population and dissemination of information through the creation of competence centres/online platforms, trainings and workshops	An information centre/platform for city residents to systematically provide information on climate change, its impacts and what can be done to reduce its negative impacts. The education sessions will foster a mutual learning from each other, generating and sharing new ideas.	VCMA, VšĮ "Neutralus klimatui Vilnius"	VCMA, VšĮ "Neutralus klimatui Vilnius", city residents	Residents will be encouraged to have a dialog with the educators (organized by VCMA and "Neutralus klimatui Vilnius"), so that mutual knowledge and ideas exchange between various involved stakeholders will take place. These initiatives will help Vilnius society (citizens, businesses, municipality administration, etc.) to get inspired and change various every day habits to more climate-friendly ones through various educational and informative events. This would contribute to reducing GHG emissions.	Fostering of the sense of community, building of a closer relationship between residents and the various institutions involved, and uniting to tackle climate change and other environmental issues.
Creation of a climate fund	Creation of an innovative climate fund. This fund would be created by residents, businesses, etc. Stakeholders. The fund would be used to implement community-based climate protection ideas and projects	VCMA, VšĮ "Neutralus klimatui Vilnius"	VCMA, VšĮ "Neutralus klimatui Vilnius", city residents	The projects would directly and indirectly reduce GHG emissions in the city.	Encouragement of the creation of resident communities that empower people to take climate action; fostering of cooperation between different communities in the city; building closer relationships between resident communities and businesses.

C-2.2: Description of Empowering Social Innovation Interventions

There are a number of obstacles to creating a climate-neutral city, including lack of infrastructure, lack of political support at national and municipal level, and the reluctance of citizens to take climate action.

Innovative actions that involve residents in creating a neutral city can help overcome some of these barriers.

A competence centre (or online platform) could be created in Vilnius—the Vilnius Climate Neutrality Information and Advisory Centre—to educate residents and systematically provide all the necessary information on climate change, its consequences and the possibility to change the situation by reducing GHG emissions and changing the daily habits of the residents. Particular attention should be paid to topics such as sustainable use of resources, sustainable mobility, energy efficiency, the benefits of using RES and how all these measures can help not only to reduce the negative impact on the climate, but also to bring economic benefits. This competence centre/online platform should also clearly provide information on the availability of national or municipal financial support (subsidies). This would help people who are facing financial difficulties to take climate action as well: renovating their homes to reduce energy poverty, purchasing solar power plants, replacing their cars with clean ones, etc.

Together with the city of Klagenfurt and the Gozo Region, Vilnius is taking part in the Net Zero Cities Pilot Cities project, which will create an innovative climate fund to implement a range of community-driven climate ideas. City communities submitting their own projects to reduce their climate impacts will be able to compete with other communities for financial support from the fund to implement their ideas. The fund could be built up by receiving financial support from private businesses and residents or visitors. The implementation of this project can stimulate the development of new, innovative environmental ideas, cooperation between individual communities and the involvement of different social groups, without leaving vulnerable groups behind. Every person and every individual's way of life is important to achieve and sustain the goals we have set ourselves.

These social innovations, if implemented consistently, could contribute to long-term GHG emission reductions. It would also create the conditions for a just transition to more sustainable, climate-friendly practices in various areas such as energy, transport, etc., without leaving behind the most vulnerable groups in society.

Prospects and Next Steps

This section should provide any necessary conclusions on the above Action Plan and outline the next steps and plans for further development of the Action Plan under the Climate City Contract.

Plans for the Next Versions of the CCC and Action Plan – Textual Elements

The Vilnius Climate Neutrality Action Plan is a comprehensive roadmap document that sets out the actions that the city can take to achieve climate neutrality. It can be continuously reviewed, adjusted and continuously updated to take account of changing situations. In a dynamic market, technological innovations and improvements to existing infrastructure solutions are constantly emerging, as well as social and inclusive innovations, which are increasingly effective in involving all sections of society – the financially deprived, the elderly, ethnic minorities, etc. This ensures the implementation of the just transition concept, involving vulnerable groups in the development of the Vilnius City Climate Strategy.

Systematically engaging all stakeholders in the implementation of the Climate Neutrality Action Plan is crucial to implementing the actions set out in the document. Only by working and changing together can we achieve the ultimate goal of transforming city systems to drastically reduce GHG emissions. This must involve the Vilnius City Municipality Administration and its subordinate companies, public authorities, business and industry, academia and residents and organisations representing them.

CCC implementation phase is strongly connected to the policy makers. One of the key aspects that is responsible for creating and even managing the implementation of climate mitigation policies is governance structure that is dependent both on municipality administration and national government. Vilnius is actively searching for the opportunities to implement governance-oriented innovations that could improve collective, inclusive, cross-sectoral and multi-level governance that could inspire a faster and smoother transition towards climate neutrality. This exploration is still being carried out, however, hopefully first results will emerge soon – Vilnius is expecting it will create a necessary capacity, capability and mandate for a creation of net-zero city by 2030.

Vilnius has already shown that it is a city committed to change. The Green Wave of Vilnius, winning the prestigious title of the European Green Capital 2025, and the award-winning digitalisation solutions related to the city's systems demonstrate the city's ambition to find solutions to create a sustainable and environmentally friendly municipality. In addition, the long-term strategies of many different organisations operating in Vilnius include various sustainability and environmental objectives, one of the main ones being to contribute to the global fight against climate change and to reduce the negative impact on the climate.

Participation in the EU Mission Climate Neutral and Smart Cities further ensures that Vilnius is committed to becoming a municipality with a minimum climate impact. This Climate Neutrality Action Plan, together with the Investment Plan and the Stakeholder Commitment Document, provides a strategic roadmap for Vilnius to achieve at least an 80% reduction in GHG emissions and become a climate-neutral city by 2030. On the way to achieving this goal, the city's society would also be positively impacted because of the growing sense of community, engagement in the generation and implementation of new ideas, social equality and the elimination of exclusion – a neutral climate for all.

As we are facing various effects of climate change – from rapid floodings to extreme heat waves – more and more intensively, many experts call the current situation a climate crisis. Therefore, it is important to take climate action urgently if we want to reduce risks of extreme weather conditions, environmental degradation and natural disasters. Vilnius, together with other Mission Cities, are "flagmen" that are experimenting to find the best, most sustainable and feasible ways to mitigate negative impacts on climate.

Moreover, achieving the vision of climate neutral cities – and eventually a climate neutral continent – will bring many crucial co-benefits. With taking climate action and reaching net-zero in Vilnius, the society will thrive: green, clean, sustainable and innovative solutions adopted in energy, transport, buildings and waste sectors will create less polluted and overall healthier environment, as well as economic prosperity and a just and engaged society that become more aware, creative and bold to take climate and environment protection actions. First major steps towards all these goals have been taken – Vilnius, as one of the greenest cities in Europe, is becoming even greener in other fields than nature. Zero-emission efficiently used energy, sustainable urban mobility, circular economy and adaptation of zero waste principles are on their way!

Annex I

GHG emission inventory methodology of Vilnius city

NetZeroCities received funding under the H2020 Research and Innovation Programme, grant agreement no. 101036519.

Abbreviations

EPA	Environmental Protection Agency
RES	Renewable energy sources
DH	District heating
EF	*Emission factor*
EU	European Union
EU ETS	European Union Emissions Trading Scheme
UNFCCC	United Nations Framework Convention on Climate Change
LT-NIR2022	Lithuania's national GHG inventory report 2022. Greenhouse gas emissions 1990-2020
MBT	Mechanical biological treatment
IHP	Independent heat producer
ODM	Ozone-depleting substances
CNG	Compressed natural gas
LPG	Liquefied petroleum gas
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
VAATC	Vilnius County Waste Management Centre
GWP	Global Warming Potential
VKJ	Vilnius CHP plant
VMSA	Vilnius City Municipality Administration
VP	CJSC Vilniaus Plan (currently ID Vilnius)
VŠT	JSC Vilniaus šilumos tinklai
VVT	CJSC Vilniaus public transport

Content

1 Introduction

Greenhouse gases (GHGs) are natural and anthropogenic gases that absorb and emit waves in the infrared spectrum, trapping heat near the Earth's surface. According to Annex A of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC), GHGs are those gases whose concentration in the atmosphere is rapidly increasing as a result of human activities: Carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and the fluorinated gases hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6), and, from 2012, nitrogen trifluoride (NF_3).

The GHG emissions accounting methodology is designed to illustrate the rationale for the calculation of Vilnius City's GHG emissions, the assumptions made, the data sources, and the calculation principles.

The 2012-2021 Vilnius City GHG emissions were calculated based on the amount of fuel burned within the administrative boundaries of Vilnius City Municipality, electricity consumption and the amount of waste and wastewater generated (waste generated is disposed of outside Vilnius City Municipality, but the GHG emissions associated with it are included in the city's GHG inventory).

The GHG emission accounting is carried out in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter "IPCC Guidelines") for the preparation of National Greenhouse Gas Inventories and the methodology proposed by the Covenant of Mayors.

GHG emissions are calculated for the sectors relevant to Vilnius City as defined by the IPCC. As the assessment of GHG emissions related to electricity consumption is not described in the IPCC guidelines, the recommendations of the Covenant of Mayors are used. The sectors that have been assessed for the 2017-2021 Vilnius City GHG inventory are presented in the table below.

Table 1. Sectors of relevance to Vilnius City with significant GHG emissions

Sector	Description
1. Fuel combustion 1.1. Energy production 1.2. Industry and construction 1.3. Transport 1.4. Other sectors (services and households).	The sector covers GHG emissions from fuel combustion. This sector includes the combustion of fuels in heat and power generation plants, central boiler plants, industrial plants, the transport sector, households and commercial buildings that burn fuels in on-site boilers.
2. Electricity consumption	Fuel combustion is a direct source of GHG emissions within the municipality (Tier 1), while Tier 2 covers GHG emissions that are not direct, but arise from the purchase and consumption of energy produced outside the municipality. As all the heat required is produced within Vilnius City Municipality, the report only assesses electricity consumption based on the market approach[3].

[3] The market approach calculation assumes that there are consumers in the city who prefer "green electricity" and that the purchased amount is not subject to the emission factor. The alternative approach is based on GHG emissions related to the overall level of 'dirty' electricity on the grid, without taking into account the quantities of 'green' electricity purchased.

3. Industrial processes and product use 3.1 Industrial processes 3.2. Products used as ODS substitutes.	The industrial process sector covers GHG emissions from chemical reactions in industrial processes. The production and consumption of fluorinated gases are also included in this sector. The sector also includes indirect emissions resulting from releasing methane-free VOCs, using solvents in households, using adhesives and adhesive materials, and graphic arts.
4. Waste and wastewater management 4.1 Disposal of waste in landfill 4.2 Biological treatment of waste 4.3 Wastewater treatment.	The waste and wastewater management sector covers GHG emissions resulting from the landfilling of municipal waste, biological treatment of waste and wastewater management. In Vilnius City, waste is not incinerated for non-energy purposes. As GHG emissions from landfilling occur outside the geographical boundaries of the municipality, emissions from this sector are classified as Tier 3.

GHG emissions are generally calculated by multiplying the amount of fuel or energy consumed (activity data) by the fuel or energy emission factor. This is illustrated by the formula below:

GHG emissions = activity intensity x emission factor (1),

where:

GHG emissions - GHG emissions, tCO_2eq;
activity intensity - amount of fuel consumed (by fuel type), TJ;
emission factor - GHG emission factor for the activity indicator (by fuel type), tCO_2eq/TJ.

Activity data in the formula for calculating GHG emissions are measured in terajoules - TJ. The methodology presents fuel balance data in units of TJ as emission factors are presented using this unit. In the document, fuel consumption is presented in gigawatt hours – GWh. The conversion factors used to convert the energy units are 277,778 MWh/TJ and 23,885 tne/TJ. The conversion of the natural units of fuel into energy values is shown in the table below. The calculations use all decimals and the tables are rounded values, so the totals may not add up to within 1 unit.

Table 2. Thermal equivalents[4]

Fuel type	Energy value, TJ	Energy value, tne
Coke, t	0,0293	0,700
Firewood and wood waste for fuel, m^3	0,0082	0,196
Charcoal, t	0,0308	0,735
Liquid fuels (fuel oil) with less than 1 % sulphur, t	0,0399	0,950
LPG, t	0,0458	1,094
Motor gasoline (with biofuels), t	0,0439	1,049
Bioethanol, t	0,0270	0,645
Road transport diesel (with biofuels), t	0,0429	1,025

[4] State Data Agency. Thermal equivalents, 2022. (Nuoroda)

Fuel type	Energy value, TJ	Energy value, tne
Heating and other gas oils (with biofuels), t	0,0429	1,025
Biodiesel - methyl (ethyl) ester, t	0,037	0,884
Liquefied petroleum gas, t	0,0459	1,096
Natural gas, MWh	0,0032	0,077
Landfill biogas, 1 000 m3	0,0200	0,480
Sewage sludge biogas, 1 000 m3	0,0200	0,480
Industrial waste (renewable), t	0,0090	0,214
Municipal waste (renewable), t	0,0103	0,247
Municipal waste (non-renewable), t	0,0124	0,297
Electricity, MWh	0,0036	0,086
Thermal energy, MWh	0,0036	0,086

To convert all emissions to the aggregate unit of CO_2 equivalent (CO_2e), the global warming potential (GWP) values for the 100-year period presented in the 5th IPCC publication (AR5) were used) [5].

Table 3. Global warming potentials of different GHGs (AR5, 100 years)

Name	Symbol	IPCCC 5AR GWP_{100}, tCO_2e/t
Carbon dioxide	CO_2	1
Methane	CH_4	28
Nitrous oxide	N_2O	265
Pentafluoroethane	HFC-125	3 500
Tetrafluoroethane	HFC-134a	1 300
Difluoroethane	HFC-152a	138
Trifluoroethane	HFC-143a	4 800
Difluoromethane	HFC-32	677
Sulphur hexafluoride	SF_6	23 500

The fuel emission factors used to calculate emissions from fuel combustion are those presented in the 2022 National GHG Report, which reflects activity data for 2020. The level of accuracy of the emission factor accompanies the source:

- D is the default value (according to the IPCC) (Default);
- CS - Country specific emission factor;

[5] TKKK 5 vertinimo ataskaita. 8 skyrius. 8.7 lentelė (Nuoroda). Naudojamos VAP reikšmės, kurios neatsižvelgia į klimato kaitos sukeltus pokyčius anglies ciklui (angl. *climate-carbon feedback*)

- CR - values determined by the COPERT method.

Table 4. Fuel emission factors used in the National GHG inventory report

Fuel	t CO_2/TJ	Source	kg CH_4/TJ	Source	kg N_2O/TJ	Source
Mazut	78,40	NIR 2022, CS	3,00	NIR 2022, D	0,60	NIR 2022, D
Liquefied petroleum gas	66,81	NIR 2022, CS	-	NIR 2022, CR	-	NIR 2022, CR
Natural gas	55,34	NIR 2022, CS	1,00	NIR 2022, D	0,10	NIR 2022, D
Liquefied natural gas	55,34	NIR 2022, CS	1,00	NIR 2022, D	0,10	NIR 2022, D
Biofuels, wood*	101,34	NIR 2022, CS	30,00	NIR 2022, D	4,00	NIR 2022, D
Biofuels, other (wood waste)	109,30	NIR 2022, CS	30,00	NIR 2022, D	4,00	NIR 2022, D
Municipal waste	109,03	NIR 2022, CS	30,00	NIR 2022, D	4,00	NIR 2022, D
Petrol	70,13	NIR 2022, CS	-	NIR 2022, CR	-	NIR 2022, CR
Bioethanol (petrol additive)	70,80	NIR 2022, D	3,00	NIR 2022, D	0,60	NIR 2022, D
Diesel	72,80	NIR 2022, CS	-	NIR 2022, CR	-	NIR 2022, CR
Biodiesel	70,80	NIR 2022, D	3,00	NIR 2022, D	0,60	NIR 2022, D

*Based on the 2022 Lithuanian GHG inventory report, biofuel combustion in the household and service sector releases more methane into the environment, resulting in emission factors of 260 kg/TJ and 300 kg/TJ for GHG emissions from these sectors respectively.

The following sections describe the data sources, activity levels, emission factors and assumptions for each sector. A conversion factor of 277.778 MWh/TJ was used to convert the energy units.

2 GHG monitoring system

The GHG emissions are calculated by the developed methodology adjusted to Vilnius city. The main ccoridnating insitution which will be responsible for activity data collection nad further estimation od the GHG emissions is Public entity Cliamte Neutral Vilnius. The schematic grapgh respresents that maina ctors involed in the data collection and GHG emission of Vilnius monitoring process.

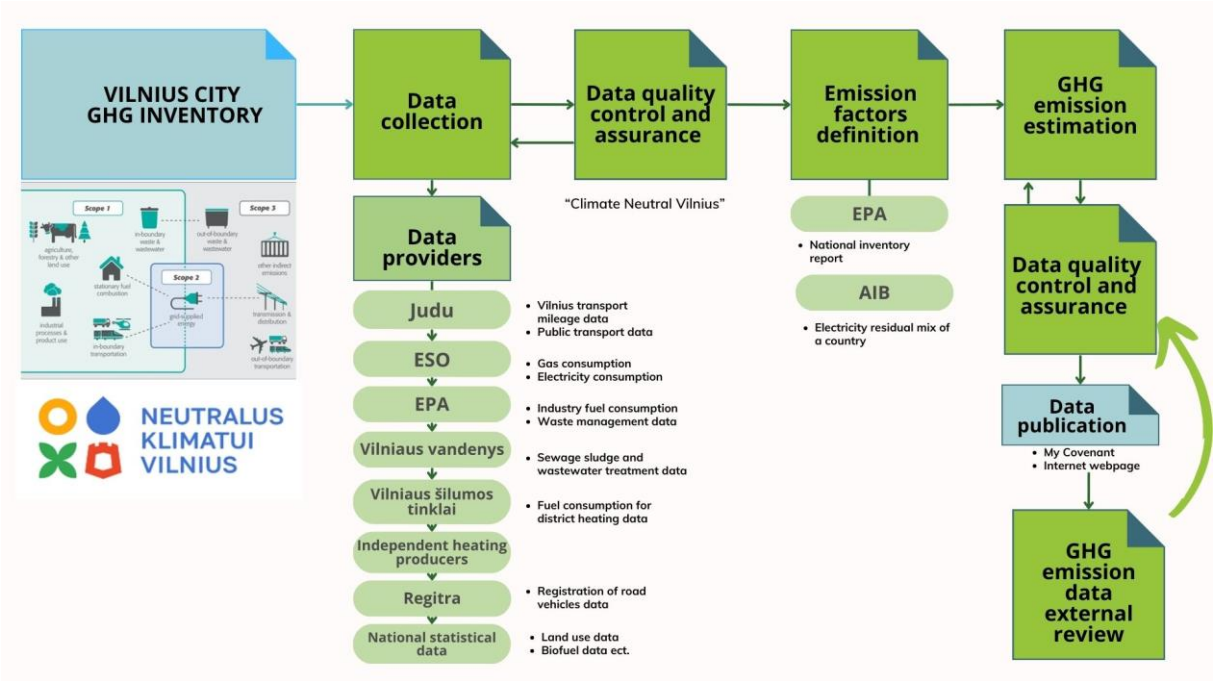


Fig 2.1 Vilnius GHG emissions monitoring process

3 Fuel combustion

3.1 Fuel combustion in district heating

This chapter summarises the data on district heating in Vilnius in 2012-2014 and 2017-2021, which are obtained from the reports of heat suppliers operating in Vilnius and the Lithuanian Heat Suppliers Association. The main district heating supplier in Vilnius is AB Vilniaus šilumos tinklai. Less than 1 % of the required amount of heat energy is supplied to CHS by UAB ,,Vilniaus valda" and UAB ,,Balterma ir ko", therefore the amount of heat produced by them is not separately identified and is only included in the total amount of heat supplied to CHS. The district heating producer produces part of the required heat energy itself and buys part of it from independent heat suppliers (hereinafter referred to as 'IHS'). Information on district heat production and supply was obtained from AB Vilniaus šilumos tinklai and independent heat producers.

Table 5. Summary of district heat production in Vilnius City in 2012-2021

Parameter	2012	2013	2014	2017[6]	2018	2019	2020	2021
Generation in heat sources of the main heat supplier (LHS), GWh	2 830	2 669	2 111	2 035	2 090	1 761	1 539	1 816
Purchased heat from Independent heat suppliers, GWh	0	55	504	836	826	991	1 133	1 357
Heat supplied through district heating, GWh	2 841	2 736	2 626	2 887	2 932	2 767	2 687	3 189

In 2021, the main heat supplier supplied 51.8% of the total heat to the grid, compared to 100% in 2012. Heat producers have provided the fuels used for district heating and their volumes, which are shown in

[6] 2017 metais centralizuotą šilumą tiekė AB Vilniaus energija ir AB ,,Vilniaus šilumos tinklai". Pateikiama konsoliduota reikšmė abiejų įmonių. Duomenys paimti iš LŠTA ataskaitos. (Nuoroda)

Table 6 below. For the assessment of waste incineration, it is assumed that renewable and non-renewable waste has the same share (by weight) in the total amount of waste incinerated (in 2021, a total of 160,000 tonnes of municipal waste was incinerated). It is important to mention that the Vilnius CHP plant (hereafter referred to as "the CHP") also produces electricity from waste incineration, which is sold to the common grid, so it is important to distinguish the amount of energy consumed from waste incineration only for heat production. In order to determine the energy consumption, a formula was used to determine the GHG emissions from the cogeneration plant to produce the relevant energy. The formula used for the GHG emissions from the CHP plant for heat production only is given in Part 2 of the European Commission's Guide to the Preparation of the Climate Plan[7]:

$$CO_2e_{šil} = \frac{\frac{P_{šil}}{\eta_{šil}}}{\frac{P_{šil}}{\eta_{šil}} + \frac{P_{el}}{\eta_{el}}} \times CO_2e_{viso} \quad (2),$$

where:
CO2ešil - the total GHG emissions associated with the production of energy in the CHP plant;
CO2ešil - the GHG emissions associated with the production of heat in the cogeneration plant;
CO2eel is the GHG emissions associated with the production of electricity in the cogeneration plant;
Pšil' means the amount of thermal energy produced (MWh);
Pel - electricity produced (MWh);
ηšil is the efficiency index when only heat is produced (90 %);
η el - efficiency index when only electricity is produced (46%).

Table 6. Fuel consumption for district heating

Parameter	2012	2013	2014	2017	2018	2019	2020	2021
Natural gas, TJ	8 887	8 162	6 375	6 185	6 162	4 827	4 387	5 815
Biofuels (wood), TJ	1 554	1 629	3 247	4 776	4 712	5 439	5 612	5 072
Fuel oil, TJ	593	541	490	11	114	37	133	164
Municipal waste (renewable part), TJ	-	-	-	-	-	-	85	557
Municipal waste (non-renewable part), TJ	-	-	-	-	-	-	103	670
Diesel fuel, TJ	5	-	2	3	7	8	3	3
Liquefied natural gas, TJ	-	0,5	0,5	0,6	0,5	0,5	0,5	0,6
Electricity, TJ	-	-	-	0,7	1	1	93	60
Total fuel, TJ	**11 040**	**10 339**	**10 114**	**10 978**	**10 996**	**10 312**	**10 417**	**12 341**
GHG emissions (excluding biofuels and bio-	**542**	**498**	**398**	**353**	**360**	**281**	**276**	**422**

[7] "Kaip parengti tvarios energijos ir klimato kaitos veiksmų planą" gairės (angl. SECAP), Europos komisija, 2018 m. (Nuoroda)

Parameter	2012	2013	2014	2017	2018	2019	2020	2021
waste fraction), kt CO2eq.								

Under the IPCC methodology, biomass net CO_2 emissions are not included in the sector's total GHG emissions, but the climate impact of CH_4 and N_2O is reflected in the calculations. This is because when trees are planted, they capture the carbon dioxide in the atmosphere and lock it away as biomass - when we burn it, we simply release it back, leaving the net CO_2 emissions unchanged.

According to the data presented, GHG emissions have fallen by 22% in 10 years. This is based on increased biomass consumption, thereby replacing natural gas and fuel oil. This change is mainly due to the increasing number of independent heat producers, whose main fuel used for heat production is biofuel (wood).

Table 7. GHG emissions associated with the consumption of district heating in municipally managed buildings 2012-2021

Parameter	2012	2013	2014	2017	2018	2019	2020	2021
Thermal energy consumption in municipally managed buildings, GWh	-	-	-	94,3	114,9	107,9	95,0	125,9
GHG emission factor related to the consumption of heat supplied through CHP, tCO2e/MWh	0,191	0,182	0,152	0,122	0,123	0,102	0,103	0,132
GHG emissions, $ktCO_2eq$	**-**	**-**	**-**	**11,5**	**14,1**	**11,0**	**9,8**	**16,7**

As more than 80% of all buildings in Vilnius City Municipality are supplied through CHP networks, GHG emission factors related to heat consumption have been determined for each year. This factor is obtained by dividing the GHG emissions (tCO_2eq) from heat production for the year in question by the amount of heat energy produced (MWh). This indicator is relevant for assessing GHG emissions in municipally managed buildings (2017-2021). Data on heat energy consumption was collected from the municipality's institutions located in the buildings. The results obtained are shown in the table below.

3.2 Combustion of fuels in the industrial sector

Information on fuel consumption for energy production in industry was collected from GHG emission reports submitted to the Environmental Protection Agency (EPA) by companies participating in the Emissions Trading Scheme (ETS). For companies not participating in the ETS, fuel consumption was estimated based on information provided by the EPA. Data on natural gas consumption in the industrial sector were obtained from ESO AB. Fuel consumption in the industry is presented in the table below. The CHP heat generation section accounts for the fuel consumption of industrial plants, which also operate as NHPs (section 2.1). All data have been converted using the current calorific value and GHG emission factors, as presented at the beginning of the chapter.

Table 8. Fuel consumption in the industrial sector

Parameter	2012	2013	2014	2017	2018	2019	2020	2021
Natural gas, TJ	1 208	1 167	1 231	793	817	867	965	1 110
Biofuels, TJ	533	1 199	2 542	2 427	1 880	1 051	941	1 065
Coke, TJ	426	466	361	428	436	406	417	408

Coal, TJ	-	-	-	-	-	-	1	2
Diesel fuel, TJ	-	-	-	8	-	-	5	7
Coke briquettes, TJ	2	12	7	-	-	-	-	-
Total fuel, TJ	**2 169**	**2 844**	**4 141**	**3 655**	**3 133**	**2 324**	**2 330**	**2 592**
GHG emissions (excluding biomass), kt CO2eq	**115**	**120**	**114**	**96**	**97**	**95**	**102**	**109**

The industrial sector's fuel consumption increase between 2012 and 2021 was 19.5%, while GHG emissions decreased by 5.2%.

3.3 Fuel combustion in the transport sector

To assess the fuel consumption of the transport sector in the municipality, the fuel consumption of the road transport sector is analysed in terms of the following vehicle characteristics:

1. the number of vehicles registered in the municipality by category;
2. the distribution of vehicles by fuel type;
3. the mileage and average fuel consumption of the different vehicles.

The actual data provided by AB Lietuvos geležinkeliai on fuel consumption in the territory of the Vilnius City Municipality and the actual data on fuel consumption in buses and trolleybuses provided by two companies providing public transport services in the municipality, UAB Vilniaus viešasis transportas, UAB Transrevis were also assessed.

The data on the number of vehicles registered in Vilnius was obtained from the State Enterprise Regitra website. Based on the information provided, vehicles' distribution by fuel type is calculated.

The number and distribution of vehicles by fuel type in 2021 are presented in Table 9 below. The calculations have not included vehicles whose fuel use is not identified in the statistics. Vehicles that are identified in the statistics as using more than one fuel type have been classified accordingly:

- Petrol: all vehicles that specify petrol, except where LPG or CNG is also specified;

- Diesel: all vehicles that specify diesel, except where LPG or CNG is also specified;

- Electricity: only pure electric vehicles (hybrid cars and hybrid cars with external charging capability are included in the fossil fuel category of petrol or diesel), as hybrid cars are not broken down by type in the statistics;

- LPG, CNG: all vehicles for which this fuel is reported.

Table 9. Distribution of vehicles by fuel in 2021 in Vilnius City Municipality

Vehicle type	Vehicle number	Pasiskirstymas pagal kuro rūšį, proc.				
		Petrol	Diesel	Electricity	LPG	CNG
Passenger and light-duty vehicles (M1+N1)	319 531	38.6	55.7	0.8	4.9	0.0
Heavy-duty vehicles (N2+N3)	17 256	0.6	98.8	0.0	0.4	0.2

Motorcycles (L1-L7)	12 497	98.0	0.5	1.5	0.0	0.0
Buses (except Vilnius transport) (M2+M3)	1 002	0.0	99.0	0.7	0.2	0.1
Vilniaus viešasis transportas	781	-	52.8	33.1	-	14.1

As the State Data Agency does not collect information on road transport fuel consumption at the municipal level, the fuel consumption data was calculated by considering the annual mileage of different vehicles and their average fuel consumption.

The annual mileage for 2017-2018 was calculated based on in-kind surveys of traffic volumes on the main routes (conducted in January 2017, September-November 2018) during the morning and evening peak hours. The traffic flow surveys were carried out by specialists of the SE Vilniaus Plan (at the time of the preparation of the Plan, UAB Vilniaus Plan) in accordance with the requirements of the GIS database of the transport system. The observations were made to record the traffic structure. According to the information provided by SĮ Vilniaus Plan, the annual mileage in 2019 was 0.12% higher than in 2018.

The annual mileage for 2020-2021 was calculated based on the intersection intensity study provided by the Transportation Services Enterprise and the change in intensity between 2019 and 2021. According to the observation data, the traffic intensity (mileage) in 2020 was 7.1% lower than in 2019, and in 2021 it was 5.5% higher than in 2020. As the methodology for the distribution of mileage in 2012-2014 was not detailed, the data differ from later years, and the total mileage in 2012 was not known in general, only the fuel consumption from the climate assessment report on the Vilnius City Sustainable Energy and Climate Change Indicators was taken.

Table 10. Annual vehicle mileage in Vilnius City Municipality 2012-2021

Parameter	2012	2013	2014	2017	2018	2019	2020	2021
Passenger and light-duty vehicles (M1+N1)	-	2 612.4	3 054.8	3 367.4	3 498.7	3 483.1	3 235.3	3 397.7
Heavy-duty vehicles (N2+N3)	-	94.6	110.7	138.6	153.7	168.2	155.7	177.9
Motorcycles (L1-L7)	-	6.7	7. 9	17.6	19.1	21.5	22.0	25.8
Buses (except Vilnius transport) (M2+M3)	-	117.3	137.2	11.3	11.0	12.2	10.5	10.3
Vilnius public transport	32,1	34.9	38.0	40.1	42.6	44.5	42.5	39.2
Total, mln. km	-	**2 866.0**	**3 348.6**	**3 574.9**	**3 725.1**	**3 729.6**	**3 465.9**	**3 651.0**

In the road transport category, for fossil fuel emissions, country-specific emission factors were used to calculate CO_2 emissions. In contrast, depending on the vehicle type, default emission factor values and annual mileage data were used to calculate CH_4 and N_2O emissions. Adjustments were made based on

the COPERT V model, which showed that no CH_4 and N_2O are released from the combustion of petrol, diesel and LPG, and therefore a factor of 0 kg/TJ is applied[8]

The municipality does not collect data on the fuel consumption of private vehicles, so to calculate the fuel consumption in the municipality, the recommendations on fuel consumption of light-duty vehicles in the Programme Support Action: Assistance to Member States in implementing the standard methodology for the comparison of unit prices of alternative fuels under Directive 2014/94/EU (hereafter referred to as "the Guidelines")[9]. have been followed. The Recommendations have been adapted to calculate the average fuel consumption of two-, three- and four-wheel (L-category) PTWs, buses and goods vehicles.

The Average Fuel Economy Guidelines propose to identify at least three manufacturers of the best-selling PTs in the relevant year and at least three best-selling models of these PTs, and to estimate the average fuel consumption of these PTs per 100 km.

Considering the recommendations and the information available on the State Enterprise Regitra website on the TPs registered in the municipality, the most frequently registered TPs in Vilnius City Municipality were identified. The assessment was carried out for one year of the analysis period, 2019, assuming that this year best reflects the average composition of vehicles for the analysis period 2017-2021 and that the calculation of the average fuel consumption of individual years would not significantly impact the results. For 2012-2014, the average fuel consumption assumptions were those reported in the respective year's GHG emission inventory reports. All fuel consumption assumptions are shown in Table 11.

Table 11. Average fuel consumption of the most frequently registered vehicles in the municipality for different periods.

Vehicles	Fuel type	Average fuel consumption (100 km) 2012-2014	Average fuel consumption (100 km) 2017-2021
Two-, three- and four-wheel vehicles (L)	Petrol, l	6.0	5.64
	Diesel, l	3.02	3.02
	Electricity, kWh	5.88	5.88
Passenger and commercial transport vehicles (cars; M1+N1)	Petrol, l	10.2	10.82
	Gas (LPG), l	12.2	15.19
	Diesel, l	7.1	8.52
	Electricity, kWh	20.0	15.07
Passenger transport vehicles (buses, minibuses except public transport, M2+M3)	Petrol, l	28.4	12.43
	Diesel, l	14.55	14.55
Vehicles for the transport of goods (N2+N3)	Petrol, l	35.0	35.1
	Gas (LGP), l	42.0	36.78
	Diesel, l	52.5	34.1

[8] Lietuvos nacionalinė ŠESD apskaitos ataskaita už 1990-2020, 2022 m. (Nuoroda)

[9] Assisting Member States with the implementation of Article 7.3. of Directive 2014/94/EU (fuel price comparison) (Nuoroda)

In order to avoid duplication of data for rail transport, fuel consumption for public transport (buses and trolleybuses) in the municipality has been established based on actual data provided by the companies. Electricity consumption in the transport sector is calculated but not declared as part of the GHG emissions from fuel consumption in the transport sector; it is included in the total electricity consumption in the municipality.

Table 12. Fuel balance and GHG emissions in the transport sector

Fuel	2012	2013	2014	2017	2018	2019	2020	2021
Petrol, TJ	4 401	4 125	47 07	4 070	4 293	4 454	4 153	4 421
Diesel, TJ	6 306	6 561	7 792	7 929	8 463	8 460	7 711	8 004
LPG, TJ	304	266	395	749	755	704	632	644
CNG, TJ	115	148	175	154	113	93	131	206
Bioethanol, TJ	226	180	159	159	148	179	276	307
Biodiesel, TJ	322	327	374	338	372	330	411	534
Electricity, TJ	93	86	76	82	85	96	87	87
Total of fuel, TJ	**11 767**	**11 693**	**13 678**	**13 482**	**14 228**	**14 315**	**13 400**	**14 203**
GHG emissions, $ktCO_2e$	**795**	**794**	**934**	**922**	**974**	**981**	**903**	**948**

Total fuel consumption in road transport increased by almost 20% between 2012 and 2021. This is due to the higher consumption of diesel, which increased by 27% over the same period. The increase in the number of diesel cars in the fleet, the increase in total mileage and the inclusion of rail transport data in the inventory resulted in an 18% increase in GHG emissions over the 10-year period.

3.4 Fuel combustion in other sectors

Fuel combustion in other sectors includes fuel consumption in the household, commercial and institutional sectors and in agriculture. The climate impact of the latter is not assessed, as this activity has not been developed in Vilnius City Municipality.

3.4.1 Fuel consumption in the service sector

This category covers fuel consumption in the wholesale and retail trade, car repair, hotels and restaurants, education and research establishments, health care institutions, real estate management and rental, public services, etc. Information on natural gas consumption in this sector was obtained from AB ESO. In contrast, information on the consumption of other fuels was obtained from information provided by the EPA on the establishments operating in Vilnius City, which provide data on emissions and fuel consumption of the facilities they manage.

Vilnius City Municipality owns around 600 buildings for various purposes (calculations are based on service sector buildings, of which there are around 480). On average, these institutions consume about 4.5% of the total heat disposed through the CHP network each year. The largest number of buildings are educational and healthcare facilities. These institutions consume 3.7% of the total heat supplied to Vilnius City. Educational establishments consume the largest share of heat energy - more than 80% of the total heat energy consumed in municipally owned buildings.

As Vilnius City Municipality does not collect detailed statistics on the fuel balance of buildings under its management, it was assumed that all heat consumption is supplied through CHP.

Table 13. Fuel balance and GHG emissions in the service sector

Fuel	2012	2013	2014	2017	2018	2019	2020	2021
Natural gas, TJ	850	847	630	1 126	1 094	987	886	1 120
Biogas, TJ	-	112	95	44	22	18	31	43
Total fuel, TJ	**850**	**959**	**725**	**1 170**	**1 117**	**1 006**	**917**	**1 163**
GHG emissions, $ktCO_2e$	**47**	**47**	**35**	**63**	**61**	**55**	**49**	**62**

3.4.2 Fuel consumption in the household sector

In households, fuel is used for space heating, hot water and cooking. In the territory of Vilnius City Municipality, most multi-family dwellings are centrally heated, and therefore, the fuel used for heating and hot water production in these buildings is accounted for under the fuel combustion in the district heating sector. For this reason, the household sector includes fuel consumption in buildings that are not centrally heated.

AB ESO provided information on households' consumption of natural gas. Biofuel consumption in the household sector has been estimated by expert judgement, based on the biofuel consumption values from the 2017 Climate Report and the Vilnius City RES Development Action Plan, by calculating a 2-year average change and applying it to 2020 and 2021. Other fossil fuels are burned by a combination of different fuels (with gas, biomass), and it is not, therefore, possible to determine the exact amount of this fuel consumed. However, in the total fuel consumption, according to the survey conducted by SIA "ELLE", only a small share of the population in Vilnius uses petroleum products or coal (~1%), so this does not have a significant impact on the final GHG emission calculations. Only about 1% of households not connected to CHP also use RES for their heating needs.

Table 14. Fuel balance and GHG emissions in the household sector

Fuel	2012	2013	2014	2017	2018	2019	2020	2021
Natural gas, TJ	1 837	1 734	1 616	2 279	2 395	2 324	2 471	3 002
Biomass, TJ	-	2 185	2 184	4 226	4 405	4 616	4 811	5 014
Total of fuel, TJ*	**1 837**	**3 919**	**3 800**	**6 505**	**6 799**	**6 940**	**7 282**	**8 016**
GHG emissions (excl. biomass), $ktCO_2e$	**102**	**115**	**108**	**162**	**170**	**168**	**178**	**209**

Household consumption of natural gas has increased by 31% since 2017. GHG emissions calculations do not take into account the amount of heat supplied through the CHP system, as these emissions are accounted for in Chapter 2.1. Overall, GHG emissions from the household sector have more than doubled since 2012, precisely due to the increased use of DG. However, due to the significantly lower fuel consumption between 2012 and 2014, it would not be appropriate to compare with the 2021 values. As the combustion of biofuels only contributes to GHG emissions by releasing CH_4 and N_2O, the increase in the use of these fuels has a very small impact on overall GHG emissions.

4 Electricity consumption

Electricity generation

In Vilnius City Municipality, electricity is produced exclusively from renewable sources (mainly biofuels). However, according to the Lithuanian Energy Agency data for 2021, only about 1.1% of the total electricity demand in the city was generated. The total installed capacity and the amount produced per year in Vilnius City Municipality is shown in Table 15. Since 2019, the Lithuanian Energy Agency has been collecting and organising data on the municipal energy sector, but to ensure comparability of data between years, all values are from data obtained from AB ESO. The table only provides information on installations that supplied electricity to the common grid - individual production and self-consumption is not provided.

In Vilnius City Municipality, the largest amount of electricity is generated by burning biofuels. In terms of installed capacity, this production has remained stable over the whole period 2012-2021 (29 MW) and the amount produced has been roughly constant, with around 110 GWh of electricity produced annually. The installed capacity of hydropower plants has decreased by 0.4 MW over the period considered, but it is difficult to assess the actual impact on the amount of electricity produced due to the large variation in the data from year to year. Since 2014, the most significant increase has been in the installed capacity of solar power plants, with an additional increase of around 4 MW over 10 years, and the electricity produced increasing from 1.6 GWh (2013) to 3 GWh (2021).

Table 15. Installed capacity and production of electricity generation facilities in Vilnius City Municipality

Parameter	2012		2013		2014*		2017		2018		2019		2020		2021	
	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *	Installed capacity, MW	Produced, MWh *
Sun	0.4	n/a	2.92	1 697	-	-	3.75	2967	3.75	3 386	4.25	3 529	4.25	3 409	4.67	3 085
Hydro	0.83	n/a	0.83	3 698	-	-	0.43	2 911	0.43	2 320	0.43	1 847	0.43	1 778	0.43	2 385
Biomass	29.00	n/a	29.00	118 835	-	-	29.00	103 701	29.00	103 616	29.00	102 066	29.00	104 450	29.00	89 469
Total	**30.23**	**115 55**	**32.75**	**120 836**	**-**	**-**	**33.18**	109 578	33.18	109 322	33.68	107 442	33.68	109 638	34.1	94 939

* data not available for this year.

Electricity consumption

Electricity consumption in Vilnius City is obtained from AB ESO, administrators of buildings managed by the municipality, UAB Vilniaus Lighting and UAB VVT. A summary of electricity consumption is presented below (Table 16).

Table 16. Electricity consumption in Vilnius City Municipality, GWh

Energy consumption trends	2012	2013	2014 *	2017	2018	2019	2020	2021
The industrial sector (service and industrial enterprises and establishments, urban public transport, rail transport and street lighting), including:	1 269.5	1 293.6	-	1 445.7	1 533.1	1 524.6	1 302.4	1 365.0
- *VMSA buildings*[10]	-	-	-	-	*25.8*	*28.9*	*24.7*	*24.3*
- *street lightning;*	*20.4*	*20.2*	-	*23.7*	*22.9*	*23.9*	*17.9*	*11.5*
- *trolleybuses;*	*25.7*	*23.8*	'-	*26.5*	*26.6*	*26.1*	*20.0*	*17.8*
- *services, industrial sector*	*1 222.9*	*1 248.94*	-	*1 399.6*	*1 449.5*	*1 471.78*	*1 239.7*	*1 311.4*
Households	477.94	469.93	-	531.41	552.31	537.61	573.96	587.6
Total electricity consumption	**1 747.4**	**1 763.6**	-	**1 977.1**	**2 085.4**	**2 062.2**	**1 876.4**	**1 952.6**
Technological losses in the network	119.59	120.69	-	164.13	160.36	169.86	109.23	131.33
Total final electricity consumption	**1 867.0**	**1 884.3**	-	**2 141.21**	**2 245.7**	**2 232.1**	**1 985.6**	**2 083.9**

* no data on electricity consumption for this year.

Table 17. Electricity balance and associated GHG emissions

Fuel	2012	2013	2014*	2017	2018	2019	2020	2021
Amount of electricity consumed, MWh[11]	**1 867 032**	**1 884 274**	-	**2 141 209**	**2 245 728**	**2 232 099**	**1 985 639**	**2 083 883**
Share of RES in Lithuania's electricity consumption, proc.	10,9	13,1	-	18,3	18,4	18,8	20,2	20,9
Electricity imported into Vilnius Municipality from fossil fuels, MWh	1 664 086	1 636 680	-	1 750 438	1 832 514	1 812 464	1 585 136	1 647 935

[10] 2018-2021 The data is based on the electricity consumption of municipal buildings by AB ESO. No analysis has been carried out for previous years.

[11] Atėmus mažos galios elektros gamybos įrenginių pagamintą elektrą ir tinklo nuostolius

GHG emission factor, tCO_2e/MWh[12]	0,4965	0,49559	0,48739	0,72339	0,37064	0,35193	0,34019	0,3845
GHG emissions, $ktCO_2e$	**826**	**811**	**-**	**1 266**	**679**	**638**	**539**	**634**

Since Vilnius produces a small amount of electricity, most of it is imported. Country-specific electricity emission factors were used for each year to assess the impact of electricity consumption on GHG emissions. The GHG emission factor for electricity consumption was obtained by subtracting all certified green electricity from the total electricity supplied. In Lithuania, the electricity supplied in 2021 (less certified green electricity) was mainly produced from fossil fuels (70%), and the corresponding emission factor was 0.384 tCO2e/MWh. The highest value of the factor was in 2017, with 0.723 tCO2e/MWh. The amount of electricity produced in the municipality from small-scale installations (the amount produced by the VŠT E-2 biofuel-fired power plant is not included in the calculation) was subtracted from the total electricity consumption before applying the emission factor.

This is due to the higher share of RES in the electricity sector and the increasing number of generating consumers.

5 Industrial processes and the use of ODS products

5.1 GHG emissions from industrial processes

GHG emissions from industrial processes are assessed in this sector. In the period analysed, two companies were active within the Vilnius city limits: the glass wool producer UAB Paroc and the ceramics company AB Dvarčionių keramika until 2014. Emissions from the production of glass wool are generated using dolomite in the production of glass wool and by the use of calcium or magnesium oxide in the firing of ceramics. Direct GHG emissions have been estimated based on emission monitoring reports submitted by the companies themselves to the Environmental Protection Agency. The GHG emission factor was determined by laboratory analysis and, therefore, varies slightly from year to year.

Table 18. Direct GHG emissions from the production of mineral products

Company	2012	2013	2014	2017	2018	2019	2020	2021
UAB „Paroc“, kt CO_2e	**10.0**	**11.9**	**11.3**	**12.8**	**13.4**	**11.6**	**11.6**	**11.1**
AB „Dvarčionių keramika”, kt CO_2e	**0.068**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**

5.2 Products used as ODS substitutes

The category of consumption of ozone-depleting substances (ODS) and specifically fluorinated GHGs covers a wide range of areas. Still, with limited statistical data at the municipal level, only the use of fluorinated gases in refrigeration and air-conditioning systems was assessed.

5.2.1 Refrigeration and air conditioning

The category covers the use of fluorinated GHGs in domestic, commercial, transport and industrial refrigeration, stationary and mobile (vehicle) air conditioning. For the purposes of this report, domestic refrigeration (fridges and freezers), air conditioning systems in vehicles and stationary air handling units

[12] https://www.aib-net.org/facts/european-residual-mix

(heat pumps) were included in the assessment. Industrial refrigeration was not included in the assessment. Only fluorinated gases released during the operation of the equipment were considered in the calculation of GHG emissions. Leakage of fluorinated gases during the pre-filling of the equipment and during the recovery of the equipment was not assessed.

5.2.1.1 Domestic refrigeration: refrigerators and freezers

The emissions of GHG emitted to the environment (leakage through leaks) during the operation of household refrigeration appliances (refrigerators and freezers) during the period analysed are included in the accounting. The majority of household refrigeration systems (freezers and refrigerators) are filled with R-134a refrigerant and only a small proportion are filled with R-152a refrigerant. With the increasing restriction of using these refrigerants over the last decade, new household refrigeration appliances are being filled with R600a isobutane, which does not contain fluorinated gases.

In calculating GHG emissions, the potential amount of refrigerators and freezers that contain fluorinated gases was first considered. For this purpose, information from the State Data Agency on the Vilnius City Municipality population and the average household size was used. Information on households with a fridge or freezer has not been collected since 2018, so it is conservatively assumed, based on the 2017 statistics, that 98.8% of households had a fridge during the period analysed, and 8.6% also had a freezer. Based on the analysis presented in LT-NIR 2022 and since the average lifetime of refrigerators is 10-15 years, it is estimated that only around 30% of refrigerators and 8% of freezers had fluorinated compounds in 2017. And this figure has been decreasing by 2% each year. The following parameters from LT-NIR2022 are used to calculate the amount of fluorinated compounds present in refrigeration equipment:

- Average amount of refrigerant in a refrigerator - 125 g

- Average amount of refrigerant in the freezer - 150 g

- The average annual leakage of refrigerant is 0.7%.

- 28% of refrigerators and freezers were filled with HFC-134a in 2017

- 5% of fridges and freezers were filled with HFC-152a in 2017.

The annual leakage through leaks is calculated according to the formula:

$$E_{\text{years of life,t}} = Bt \times nf \quad (3),$$

where $E_{\text{years of life, t}}$ – *per ataskaitinius metus į aplinką nutekėjęs fluoruotų dujų kiekis, t*;

B_t – *the amount of fluorinated gases present in existing systems in the reference year, t;*

n – *leakage factor, % (assumed 0.7%).*

5.2.1.2 Mobile air conditioning

The use of refrigerants in mobile air-conditioning systems is based on the number of cars with air-conditioning and the refrigerant charge. The number of cars with air conditioning and the type and quantity of refrigerant were calculated according to the information and recommendations of a study commissioned by the EPA entitled "Analysis and Verification of Fluorinated Greenhouse Gas Accounting". This study determined the amount of fluorinated substances in cars (no data was available for 2021).

Table 19. Refrigerant charge in vehicles

Vehicle refrigerant charge, kg	Year						
	Iki 2014	2015	2016	2017	2018	2019	2020
Passenger car	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Bus up to 5 t	8	7.5	7	6.5	6	5.5	5
Bus over 5 t	13	13	13	13	13	13	13
Lorry up to 3,5 t	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Lorry from 3,5 t to 12 t	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Goods vehicle over 12 t	1.2	1.2	1.2	1.2	1.2	1.2	1.2

In Lithuania, HFC-134a and R-404a have been used in vehicle air conditioning since 1993. R-404a is a mixture of fluorinated gases consisting of HFC-125 (44%), HFC-143a (52%) and HFC-134a (4%). The annual leakage is calculated according to the following formula:

$$E_{year\ of\ life,t} = Bt \times nf \quad (4),$$

where $E_{year\ of\ life,t}$: the amount of fluorinated gases released to the environment during the reporting year, t;

Bt is the amount of fluorinated gas present in existing systems in the reference year, t;

nf – leakage factor, % (assumed to be 15 % according to IPCC 2006 recommendations).

The number of vehicles with air-conditioning systems was calculated based on the age of the vehicles. Regitra does not collect information on the age of different vehicles in Vilnius and the number of vehicles with air conditioning, but assumptions are made about the number of vehicles with air conditioning based on available public information on vehicle technology and on the information provided in the study "Analysis and verification of fluorinated greenhouse gas accounting" commissioned by the EPA.

Table 20. Percentage of vehicles with air conditioning

Share of vehicles with air conditioning, 2020	Automobilių amžius, metais			
	0-2	2-5	6-10	10+
Passenger cars	95 proc.	83 proc.	80 proc.	44 proc.
Freight transport, special vehicles	93 proc.	83 proc.	50 proc.	6 proc.
Buses, public transport	98 proc.	70 proc.	50 proc.	6 proc.

According to LT-NIR2022, from 2018 onwards, air-conditioning systems for cars manufactured in 2017 and later years are assessed as being filled with HFO-1234yf instead of HFC-134a. Therefore, vehicles with production years later than 2017 are not included in the calculation.

5.2.1.3 Stationary air conditioning

In this category, refrigerant leakage from stationary air conditioning appliances such as heat pumps was calculated. The calculation of refrigerant leakage was carried out using the same principles as in the other categories of this sector:

1. estimating the quantity of heat pumps,
2. the quantity and type of refrigerant,
3. and the annual leakage.

The number of heat pumps in buildings is based on data from the Building Production Certification Centre of the State Enterprise on the number of dwellings with heat pumps installed (either as the main or as an alternative source of heat production). The coefficient for the percentage of leakage from the system is taken from the LT-NIR2022 report.

Table 21. Number of heat pumps in residential buildings

	2017	2018	2019	2020	2021
Number of heat pumps, pcs.	474	785	1 228	1 791	2 485

Table 22. GHG emissions associated with the use of fluorinated gases.

Įmonė/ Metai	2012	2013	2014	2017	2018	2019	2020	2021
GHG emissions, $ktCO_2e$	**-**	**22.3**	**20.4**	**23.6**	**22.7**	**24.0**	**24.6**	**25.5**

The total fluorinated gas-related emissions are shown in Table 22. No fluorinated gas releases were assessed in 2012, so no data are available.

6 Waste and sewage management

The waste management sector includes the categories of municipal waste disposal in landfill, biological waste treatment, open incineration and wastewater treatment. The incinerated municipal waste is accounted for as fuel for energy production and is already declared for fuel incineration in the DH sector (Chapter 2.1 of this document). Waste management in landfills is classified as Tier 3 emissions because although the landfills are outside the boundaries of the Vilnius city municipality, GHGs are generated due to the waste generated in the city of Vilnius. The total amount of GHG emissions in this sector 2021 reached 72 $ktCO_2e$.

6.1 Disposal of waste in a landfill

According to the 2017 greenhouse gas report of the municipal company "Vilniaus planas" of the city of Vilnius. Municipal waste collected in the territory of the Vilnius city municipality is buried in the regional landfill, which is outside the municipality's territory. In 2016, 3 of May, Jočioni waste mechanical biological treatment (hereinafter - MBT) facilities started operating in Vilnius. In these facilities, waste is sorted by separating secondary raw materials for further processing and use, and biodegradable waste is treated. The treatment is carried out by drying the waste in fully closed biodrying tunnels, with an average retention of 14 days. In such systems, methane emissions are reduced by up to 91 percent [13,14], according to various estimates, compared to the disposal of biodegradable waste in a landfill. The main waste stream in the landfill since 2017 is treated waste from MBA facilities that has been reduced to the point where it is not considered biodegradable. The only waste unsuitable for further processing

[13] De Gioannis, Giorgia & Muntoni, Aldo & Cappai, Giovanna & Milia, Stefano. (2008). Landfill gas generation after mechanical biological treatment of municipal solid waste. Estimation of gas generation rate constants. Waste management. 29. 1026-34. (Nuoroda)

[14] CIRCABS duomenų bazė (Nuoroda)

goes from the MBT to the regional landfill for non-hazardous waste. The amount of removed waste is provided by waste managers and is shown in Table 23.

Based on the above information, it is assumed that from 2017, in the composition of the waste disposed of in landfills, the largest part is about 98 per cent, consisting of plastics and other inert materials. The waste distribution in the table below applies to the analyzed period.

The Waste Management Center of Vilnius County provided the amount of waste disposed of at the landfill. The amount of waste disposed of in the landfill during the analysed period is presented in the table below.

The IPCC model is used to calculate the amount of methane formation from disposed waste. The parameters used in it according to NIR 2022 are presented in Table 25. It is important to mention that the amount of methane released due to buried waste is "delayed" and if the amount of waste brought to the landfill increases this year, the amount of methane will also increase in the same year.

Table 23. In the calculations, the composition of the waste disposed of in the landfill was accepted in 2016-2021.

Year	Food	Green waste	Paper	Wood	Textile	Plastic and other
By 2017, proc.	18	3	13.	3	9	53
From2017 m.,proc.	0	0	0,02	0	0,15	98,83

Table 24. The amount of waste generated in the city of Vilnius and disposed of at the landfill and the related amount of GHG emissions in 2012-2021.

Year	2012	2013	2014	2017	2018	2019	2020	2021
Amount of waste, t	162 704	151 657	147 387	113 025	109 200	128 647	122 754	58 086
GHG emissions, $ktCO_2e$	**209**	**182**	**82**	**60**	**46**	**51**	**42**	**47**

Also, since 2013, a gas capture system has been operating at the Kazokiškės landfill, which is later used to produce heat and electricity, which is supplied to Vievis. The amount of landfill gas produced and the fraction captured are shown in the table below. The average efficiency of the landfill gas capture system is about 60 percent.

Table 25. The first-order decomposition model uses different parameter values

Parameter	Value
DOC_f	0,5
Time lag	6 months
The proportion of methane in landfill gas	0,5
Methane correction factor MCF	1
Oxidation factor (OX)	0
Factors for the conversion of carbon to CH4	16/12

6.2 Biological treatment of waste

Composting of biodegradable waste and sewage sludge is evaluated in this category. Waste managers provided information on the amount of compostable waste and sewage sludge. The climate change reports for the years 2012-2014 did not separate the amount of compostable waste, so there is no data. Compostable waste consists of green waste collected in special sites and home composting.

Table 26. Quantities of compostable waste and sludge, 2012-2021.

	2012	2013	2014	2017	2018	2019	2020	2021
Amount of compostable waste, t	-	-	-	16 590	18 953	14 833	15 708	17 814
Amount of compostable sludge, t	10 351	9 077	10 350	9 020,4	8 191	6 000	5 547	4 127
Amount of GHG emissions, ktCO2e	**4,5**	**4,0**	**7,1**	**6,5**	**6,2**	**9,1**	**9,3**	**9,6**

The formulas below were used to calculate CH4 and N2O emissions from biological waste composting:

$$CH_4 \text{ emissions} = \sum(M \times EFCH4) \times 10^{-3} \quad (5),$$

$$N_2O \text{ emissions} = \sum(M \times EFN2O) \times 10^{-3} \quad (6),$$

where:

CH4 emissions – cumulative CH4 emissions during the reporting year, kt CH4;

N2O emissions – cumulative N2O emissions during the reporting year, kt N2O;

M – mass of biologically treated organic waste, kt;

EFCH4 – pollution factor, g CH4/kg; amount of waste;

EFN2O – pollution factor, g N2O/kg amount of waste.

The emission factors specified in the 2006 IPCC Guidelines, Volume 5, Chapter 4, 4.1 are used. in the table (10 g CH4/kg treated waste and 0.6 g N2O/kg treated waste).

6.3 Wastewater management

6.3.1 CH4 release during wastewater treatment

This category includes the amount of GHG emissions generated during the transportation of centrally collected wastewater through pipelines and treatment and the amount of GHG emissions released into the environment during wastewater treatment at local treatment plants. In the territory of the Vilnius city municipality, as in most Lithuanian wastewater systems, domestic and industrial wastewater is discharged into the common wastewater collection system, and BOD[15] measures the organic load of wastewater treatment. It is important to mention that, according to the IPCC 2006 methodology, when evaluating the wastewater management system operating in the Vilnius City Municipality, during the management of centrally collected wastewater, almost no amount of GHG emissions are generated (a

[15] **BOD** – biologinis deguonies suvartojimas yra parametras, kuris nurodo skaidžių organinių medžiagų kiekį vandenyje

small amount of GHG emissions are generated in primary settling tanks). Therefore, the amount of GHG emissions from non-centrally managed wastewater is calculated in this category.

The amount of GHG emissions resulting from non-centrally treated wastewater was calculated according to the formula:

$$CH_4 = \sum_i (EF_i \times (1 - k) \times TOW_i) \quad (7),$$

where:

TOWi - total amount of organic matter in a specific wastewater flow i (in wastewater collection tanks) per year, kg BOD/year;

k – the organic part that is removed as sludge, kg BOD/m (accepted value 0);

EFi - pollution factor, kg CH4/kg BOD.

The pollution factor was calculated according to the formula:

$$EFi = Bo \times MCF \quad (8)$$

where:

Bo – default CH4 generation capacity, CH4 per kg BOD (IPCC 2006, Volume 5, Table 6.4, equal to 0.6 kg);

MCF – methane content correction factor (accepted equal to 0.5 for sewage collection systems, according to NIR 2022 (Table 7-49).

TOW is calculated according to the formula:

$$TOW = P \times k \times BDS \times 0{,}001 \times I \times 365 \quad (9),$$

where:

P – population, number of persons;

k - part of the population not connected to the centralized wastewater collection infrastructure (based on the values [16] specified in the implementation programs of the special plan for the development of water supply and domestic wastewater management infrastructure of the territory of Vilnius municipality. The latest actual value is 6 per cent (2019). It continues also applies in 2020 and 2021);

BOD – formation of BOD per inhabitant (assumed 60 g/capita/day) [17];

I – correction factor for industrial wastewater (acceptable 1);

0.001 - BOD conversion from g to kg.

Table 27. Parameters for the collection and management of CH4 emissions from non-centralized sewage

Parameter	2017	2018	2019	2020	2021
Population (individuals)	545 280	547 484	552 131	561 836	556 490
Non-centralized sewage collection (percent)	9	7	6	6	6
GHG emissions, ktCO2e	**8,6**	**7,5**	**6,4**	**6,5**	**6,4**

[16] Vilniaus miesto savivaldybės teritorijos vandens tiekimo ir nuotekų tvarkymo infrastruktūros plėtros specialiojo plano sprendinių įgyvendinimo 2018–2021 metų programa (Nuoroda). Už 2019 m.

[17] 60 g/asmeniui/per dieną, pagal 2006 TKKK gairių, 5 tomo, 6.4. lentelę ir NIR 2022.

6.3.2 N2O release during wastewater treatment

This category includes the amount of GHG emissions resulting from protein breakdown. The amount of N2O was calculated based on the information on protein consumption in Lithuania, which is provided in LT-NIR2022 and by applying the formula:

$$N_2O = Baltymai \times Frac_{NPR} \times NR_{žmonės} \times EF_6 \times \frac{44}{28} \qquad (10),$$

where: Protein - annual protein consumption, kg/capita/year;

FracNPR – mass fraction of nitrogen in protein (default value 0.16 kg N/kg protein);

NRpeople - number of inhabitants in the considered territory;

EF6 – pollution factor (0.01 kg N2O-N/kg sewage nitrogen);

44/28 – conversion factor from nitrogen to N2O.

The protein consumption of the population required for the calculations was obtained from the State Environmental Health Center of the State Institute of Environmental Health.

Table 28. N_2O emissions associated with protein consumption in the wastewater sector

Parameter	2017	2018	2019	2020	2021
Population (individuals)	545 280	547 484	552 131	561 836	556 490
Average protein consumption, kg/capita/year.	24,6	24,9	25,3	25,6	25,6
GHG emissions, ktCO2e	**7,8**	**8,0**	**8,1**	**8,4**	**8,3**

7 Agriculture and land use, land use change and forestry

At the request of the Ministry of the Environment of the Republic of Lithuania, during the project "Preparation of guidelines for climate-neutral municipalities" (contract of August 28, 2023, with UAB "Vesta consulting" No. VPS-69), a GHG emission calculator for municipalities was prepared. The GHG emission calculator for municipalities (hereinafter - the Calculator[18]) is designed to calculate the amount of GHG emitted and absorbed (absorbed) within the municipality. The calculator is based on international methodological recommendations, such as the GHG protocol standard for communities, CIRIS2 (City inventory reporting and information system), a tool created based on the GHG protocol, which is intended for the management and reporting of GHG accounting data of a city or municipality. The calculator is adapted to provide GHG emission reports in accordance with the Covenant of Mayors initiative of the European Union and CIRIS formats. The calculator is prepared on the basis of the Excel program.

The calculator estimates GHG emissions (and absorption) according to the GHG protocol standard for communities divided into five sectors:

I. Energy;

II. Transportation;

[18] GHG emission calculators for municipalities: https://klimatokaita.lt/visuomenei/skaiciuokles/sesd-ismetimu-skaiciuokle-savivaldybems/

III. Waste;

IV. Industry;

V. Agriculture and land use, land use change and forestry (hereinafter - LULUCF). This sub-sector assesses the absorption or emission of CO2 in different land uses within the municipal boundaries. The CO2 absorption of individual trees is also evaluated.

The required data are the areas of forests, agricultural land (arable land, gardens, meadows and natural pastures) and built-up areas (roads, built-up area) in the municipality. The number of individual trees in the municipality. Data sources: Information on municipal land uses - National Land Service under the Ministry of Environment, Land Fund of the Republic of Lithuania. Data on land use is available at: Land Fund of the Republic of Lithuania - National Land Service under the Ministry of Environment report of the relevant year.

The number of individual trees is the data of the municipal plantation inventory.

NET ZERO CITIES

EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

Vilnius Climate City Contract

2030 Climate Neutrality Commitments

VILNIUS

NetZeroCities received funding under the H2020 Research and Innovation Programme, grant agreement no. 101036519.

Content

Note: In Lithuanian, Vilnius Climate City Contract is called Vilniaus miesto klimato susitarimas (English: Vilnius City Climate Agreement). The term "agreement" is chosen in the Lithuanian version of the document to address the iterative and strategic characteristics of the document; that it is a "live document" that can be amended due to long term circumstances.

1 Introduction

Introduction

Vilnius envisions itself as more than just a city—it's striving to become a living, breathing example of what the future could look like. A place where its people, businesses, and visitors not only coexist but thrive, surrounded by nature and supported by sustainable innovation. The city's passion for preserving its green spaces and encouraging an eco-conscious lifestyle has earned it a reputation as a forward-thinker, with the European Green Capital 2025 award standing as a testament to its bold approach.

But the journey doesn't end there. Vilnius, like many cities around the world, is feeling the weight of climate change. Rising temperatures, torrential rains, and other unpredictable weather events are not just headlines here—they're realities. The city recognizes that the time to act is now if it wants to protect its future. This urgency has ignited a deeper commitment to fast-track its transformation into a cleaner, greener, and more resilient urban space.

Determined to turn challenges into opportunities, Vilnius has set its sights on an ambitious goal: to become climate-neutral by 2030. This isn't just a promise but a plan in motion, driving the city to take part in the EU Mission "Climate-Neutral and Smart Cities" (hereinafter EU Cities Mission). Through this initiative, Vilnius is determined to lead by example, forging a path toward sustainability, not just for itself, but as a model for other cities.

To ensure the successful coordination of efforts under the EU Cities Mission, the Vilnius City Council has established a dedicated public entity, "Climate Neutral Vilnius." This institution is tasked with uniting and overseeing all areas related to the city's transition toward climate neutrality. It plays a crucial role in shaping the city's path by planning and implementing solutions that promote decarbonization. Additionally, "Climate Neutral Vilnius" actively consults with key stakeholders and represents the city in the EU Cities Mission, fostering collaboration at every level.

Vilnius has long been committed to environmental protection, the development of renewable energy, and building resilience against climate change. Since 2013, the city has been part of the EU Covenant of Mayors initiative, voluntarily aligning itself with the EU's climate and energy goals. In 2023, this commitment was renewed with even greater ambition, extending targets to 2030 and 2050. The city's overarching vision is clear: to create a future where citizens live in decarbonized, resilient cities, with universal access to affordable, secure, and sustainable energy. It is important to note that this vision can be implemented only through the joint efforts of all stakeholders. Thus, the contribution of all residents, institutions, business representatives operating in the city, is very important.

A detailed analysis of the current situation in the city, which includes the accounting of greenhouse gas (GHG) emissions, the assessment of climate change mitigation policies and measures, showed Vilnius City Municipality possible ways to become a climate-neutral city. Representatives of various municipal departments and municipal enterprises actively contributed by providing the necessary data and insights. This analysis laid solid foundations for Vilnius Climate City Contract, and identified the most problematic sectors in need of significant changes.

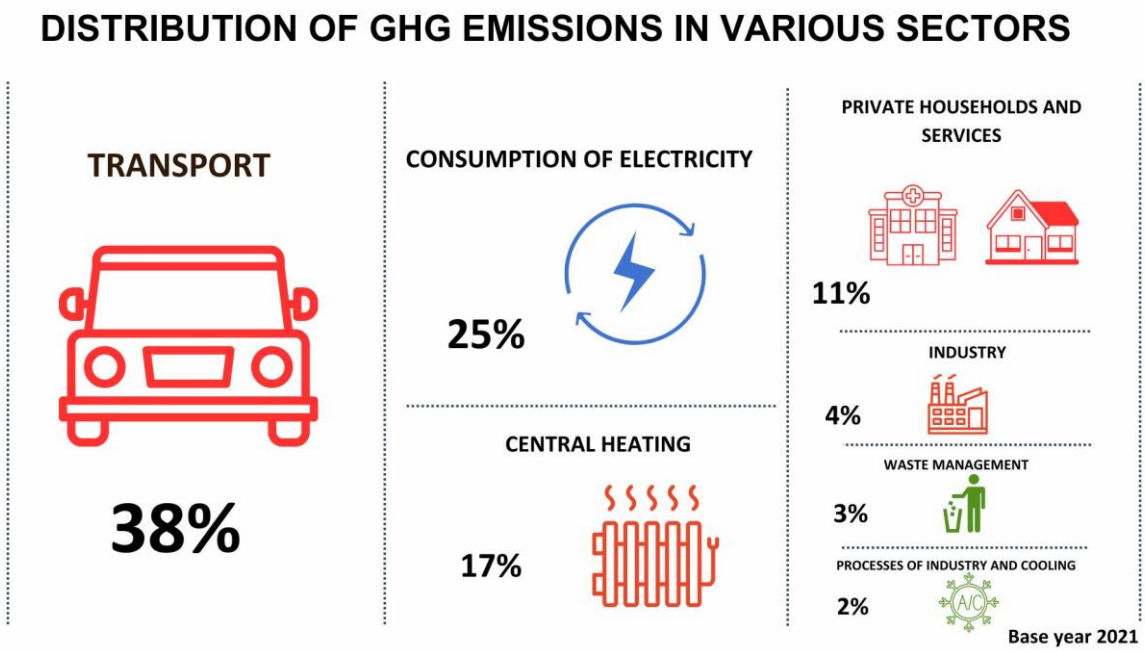


Figure 1. Distribution of GHG emissions in various sectors of Vilnius City in 2021 (baseline year)

Based on this analysis, in Vilnius, two of the most challenging sectors in the fight against GHG emissions are energy production and transport. Together, they account for 70% of the city's emissions, making them the focal point for urgent climate action. The city has already begun the journey toward reducing its environmental impact, for example, in the energy sector, JSC Vilniaus šilumos tinklai, Vilnius' central heating provider, has laid out an ambitious long-term strategy for 2021–2040. By 2030, the company aims to supply all centrally provided heat and hot water using only renewable energy sources. To achieve this, plans include exploring cutting-edge solutions like waste heat recovery, heat pumps, and energy storage systems—all designed to boost the use of renewable energy and ensure the energy market remains balanced. These initial steps are promising, but more investment and innovation are needed to reach the finish line.

In case of the private households, in response to citizens' concerns about air quality, the Vilnius City Council took a significant step in 2021 by banning the use of coal and peat briquettes in residential heating systems. This decision was aimed at shifting public attention toward more sustainable heating methods, such as heat pumps, biofuel boilers, or central heating systems. To support this transition, the city has also introduced a program to reimburse part of the heating costs for those adopting fewer polluting systems.

The transport sector, too, is seeing progress but still faces hurdles that require additional resources. JUDU, the municipal transportation management company, is working to bring the Sustainable Urban Mobility Plan (SUMP) for Vilnius to life by 2030. Approved in 2018, this plan envisions a city where public transport is the most convenient, eco-friendly choice for getting around. The plan goes beyond just promoting buses and trolleys—it's about reshaping the way people move, from pedestrian-friendly spaces to the integration of micromobility options like electric scooters and bikes. If fully implemented, SUMP could significantly reduce GHG emissions by encouraging citizens to leave their cars behind and adopt more sustainable travel habits.

Vilnius has already taken concrete steps in its public transport transformation. In 2020, the city's bus fleet was modernized, and further plans are in motion to renew its trolleybus fleet,

with 20 new vehicles arriving in 2024, followed by 70 more in 2025 and another 74 by 2026. By that year, nearly the entire trolleybus fleet will be upgraded. The city is also setting its sights on hydrogen-powered buses, with a plan approved by the Vilnius City Council in 2023 to develop hydrogen production for both public and private transport.

In terms of city lighting, CJSC Vilniaus apšvietimas, the municipal company responsible for public lighting, has committed to replacing all outdated streetlights with energy-efficient LED luminaires by 2024. This upgrade is expected to cut electricity consumption by up to 48%. Moreover, the lighting poles are being used for an additional purpose that could encourage people to use more zero-emission vehicles: integrated charging stations for electric vehicles are being installed in the lighting poles.

In addition to the strides being made in energy production and consumption, and transport, Vilnius is passionately pursuing a greener urban environment. In 2021, the city's Mayor launched the ambitious "Green Wave" initiative, aimed at transforming Vilnius into a lush, green oasis. The initiative encourages planting hundreds of thousands of trees, shrubs, and vines to make the city's streets more inviting and eco-friendlier. The "Green Wave" has already gained momentum, with 66,000 trees and 174,000 bushes planted between 2021 and 2023, thanks to collaboration with communities, businesses, and other institutions. Looking ahead to 2024, the Vilnius City Administration plans to add around 3,000 trees and 42,000 bushes at its own expense, with an annual goal of planting at least 3,000 trees and 20,000 bushes moving forward.

As the city implements various above-mentioned initiatives, policies and aspirations it has received the European Green Capital 2025 award. The award marks a significant commitment to inspire and even lead other cities to succeed in achieving environmental goals. Although the groundwork has been laid, Vilnius recognizes that achieving its climate goals will require further effort. Financial backing, technological advances, and community involvement will all play critical roles in this journey. The city is dedicated to seeing these plans through, but turning these ambitious visions into reality demands continued support and investment from all sectors. The road ahead is clear, but it will take a collective effort to fully realize Vilnius' climate neutrality and sustainability objectives. Participation in the Cities Mission is a useful tool in achieving these goals – it enables cities to exchange knowledge and success stories and overcome challenges while tackling problems and finding solutions together. Moreover, the Cities Mission helps cities to find the best financial opportunities for a faster and more effective implementation of the climate actions.

Vilnius, the capital of Lithuania, is home to about 20% of the country's population, and the city plays one of the main roles by achieving climate neutrality and setting the example for the rest of the country. The Cities Mission aims to integrate environmental and climate change challenges into policymaking at all levels, as well as to promote local initiatives. The implementation of these GHG reduction actions is expected to bring many positive results, including the creation of a more sustainable and vibrant city, and the engagement of various social groups, inspiring people to take climate action. Cooperation between the various stakeholders is essential not only for significant action on climate change, but also for solving other challenges that the city is currently facing and will face in the future.

It is important to note that achieving climate neutrality in Vilnius will also bring many indirect benefits, in line with the city's vision for a sustainable, vibrant and inclusive future. From an environmental point of view, the city will have better air quality, greater biodiversity and stronger resilience to climate change. From an economic point of view, the transition to renewable energy sources and increasing energy efficiency will create jobs, save energy and increase economic competitiveness. From a social point of view, the city will improve public health, promote social inclusiveness and engagement, and improve the overall quality of life. From a health point of view, less pollution and greater access to green spaces will

reduce health risks and promote an active lifestyle that is crucial to psychological health. All these benefits contribute to Vilnius becoming a more resilient and prosperous city, and demonstrate the city's commitment to sustainable development and the well-being of its residents.

2 Objective: Climate-neutral Vilnius by 2030

Objective

By joining the EU Cities Mission, Vilnius is voluntarily committed to achieving climate neutrality by 2030. An invitation for Vilnius to participate in the EU Cities Mission is a recognition of all previous environmental efforts. The chance to participate in this Mission strengthens the city's commitment to solving long-term climate change-related challenges.

The goal of Vilnius is to reduce GHG emissions in the administrative territory of the city by at least 80% by 2030, compared to 2021 (baseline year) (Figure 2).

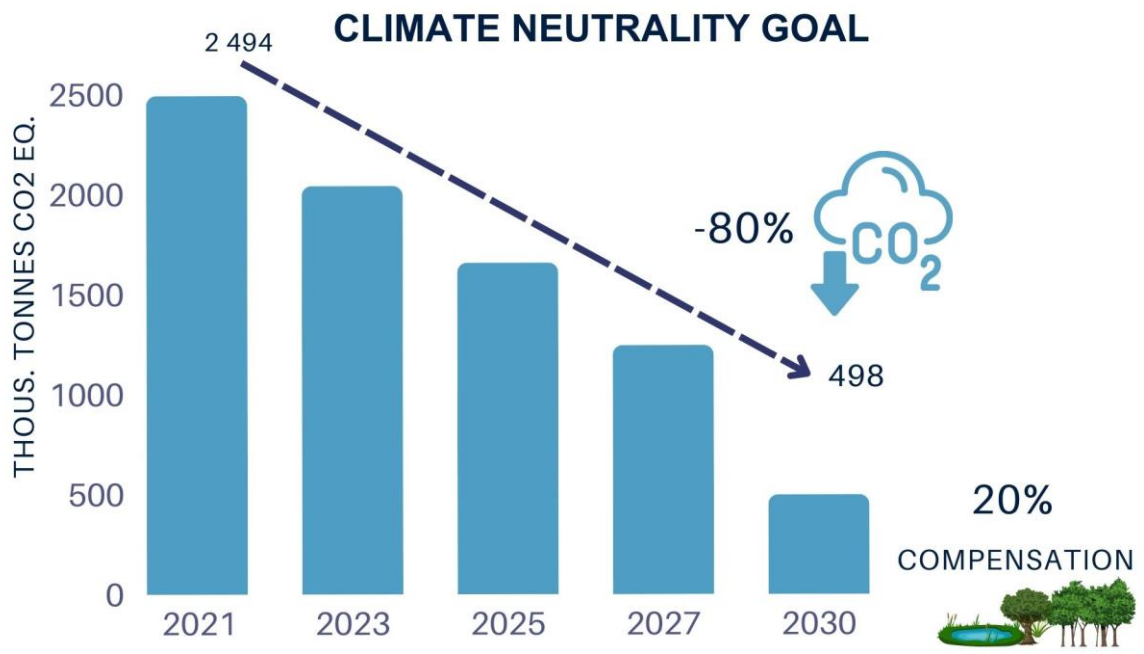


Figure 2. The goal of climate neutrality of Vilnius city until 2030

Why does Vilnius seek to reduce GHG emissions by 80%? The main goal of EU Cities Mission is to invite cities – and thus Vilnius – to commit to achieving climate neutrality by 2030 or significantly reducing GHG emissions in the city, by at least 80% of the baseline year chosen. It is understandable that a complete reduction in GHG emissions is difficult to achieve, and therefore cities are encouraged to compensate for the remaining 20% or to apply measures to absorb these emissions, i.e. by planting trees and creating green spaces or by advanced smart technologies.

Vilnius' GHG emissions assessment includes all sectors except agriculture (not relevant in the city), forestry, and land use. The covered sectors are energy (fuel combustion), transport (including passenger cars, heavy-duty vehicles, public transport, and railways), waste management, industrial processes and product use, and electricity consumption. This assessment also covers industries that participate in the EU Emissions Trading System (EU ETS), which is responsible for about 12% of Vilnius' total GHG emissions. A large portion of these emissions - 79% - come from installations operated by JSC Vilniaus šilumos tinklai, the city's district heating provider, which is primarily owned by the Vilnius municipality. Given the municipality's key role in decision-making, including EU ETS facilities in the goal was crucial to achieving Vilnius City's climate mitigation goals.

As Vilnius pursues its ambitious goal, it envisions a future where its transition to a sustainable, low-carbon economy becomes a leading example. This transformation extends beyond achieving targets; it is about reshaping the city to enhance public health, stimulate economic growth, and improve mobility. The city aims to be more resilient and cohesive while elevating its global reputation.

By embracing these changes, Vilnius seeks to demonstrate that addressing climate change is not only a necessity but also an opportunity for comprehensive urban development. The city believes this approach will lead to a brighter, more sustainable future for all, showing that climate action can drive significant progress and prosperity.

3 Strategic priorities

Strategic priorities

Strategic sectors

To achieve climate neutrality, Vilnius city focuses the efforts on the most important sectors where large and rapid changes are needed to reduce GHG emissions.

To achieve climate neutrality in the city, the main aims are distinguished in Vilnius Climate City Contract (see Figure 3).

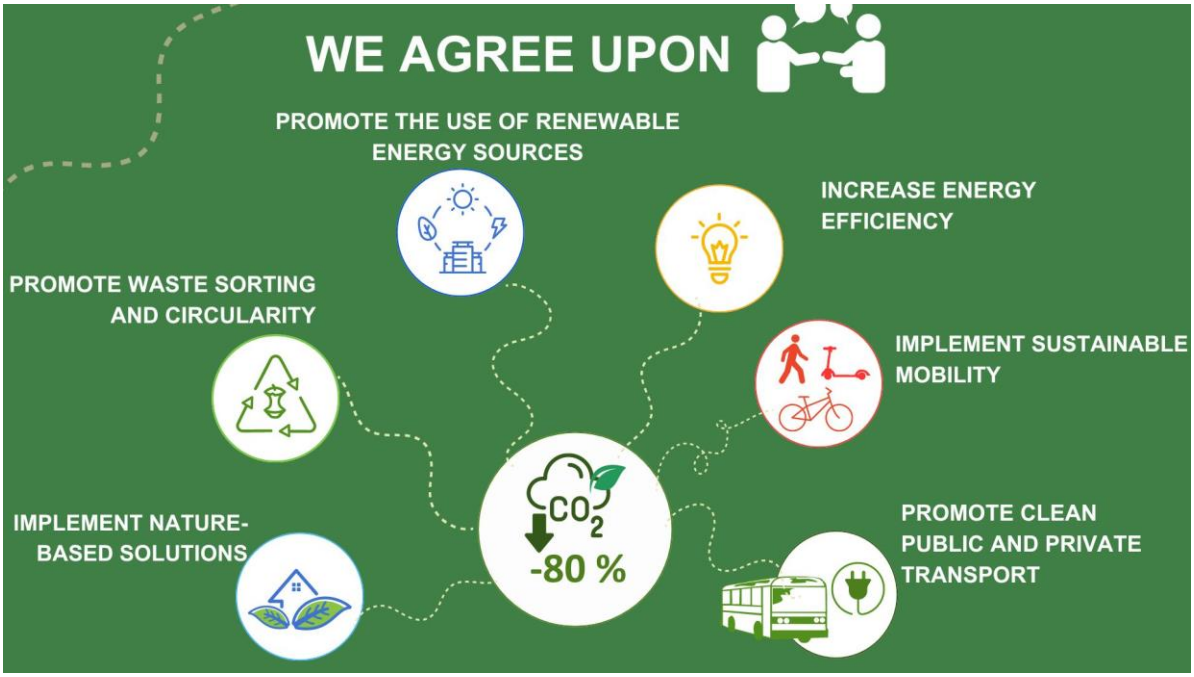


Figure 3. The main objectives of the agreement for achieving climate neutrality by 2030

1. Transport and mobility

Transport and mobility are a top strategic priority as this sector is responsible for the largest share of GHG emissions in Vilnius. However, this is also the most difficult area of transformation – it requires all city's citizens and companies to change their habits and mindsets.

Great attention is paid to the renewal of public transport to make it as attractive as possible to the population and encourage the transition from using a personal car to choosing public transport instead. Vilnius currently has a plan according to which electric and hydrogen-powered vehicles should make up 100% of the entire public transport fleet by 2030 and reduce about 36 kt CO_2eq by 2030. This plan is already being implemented – the first autonomous trolleybuses are expected to arrive in 2024. Actions in this area are carried out by the company CJSC Vilniaus viešasis transportas.

The Sustainable Urban Mobility Plan of Vilnius prepared by the company JUDU (another name of this entity – Municipal Company Susisiekimo paslaugos) is currently being implemented. According to this plan, by 2030 alternative means of mobility to private cars should be significantly improved in Vilnius. Therefore, the goals are to develop a more user-

friendly cycling and walking infrastructure, install additional lanes for public transport that will allow faster access to destinations by trolleybuses and buses. In addition, by 2025, the Old Town of Vilnius must become a low-emission zone. It is estimated that, in the years from 2021 to 2030, the implementation of these actions would reduce GHG emissions by 16%.

Together with several other institutions and companies, such as CJSC Vilniaus apšvietimas, the municipality is also actively seeking to increase the number of charging stations for electric vehicles in Vilnius, in order to make the use of electric vehicles as convenient as possible and thus contribute to the growth of the number of electric cars in the city.

2. Energy (heat production and electricity consumption)

Energy – heat production and consumption of electricity – is an important sector for achieving climate neutrality.

JSC Vilniaus šilumos tinklai has a strategic goal – to produce 100% of district heating from non-fossil fuels by 2030 and to reduce GHG emissions in Vilnius by 16.2% from 2021 to 2030. It is important to mention that the residents of Vilnius City Municipality are supplied with district heating through a 758 km long pipeline, which is on average 30 years old (parts of the network are 50 years old). To increase the efficiency of heat supply, it is necessary to renew the networks of central heating pipelines. Pipelines of this age are naturally worn out and leaky, therefore, when supplying energy, greater heat losses are experienced, and a stronger greenhouse effect occurs. It is also planned to install smart digital systems that would allow to manage the district heating supply system more efficiently. Consumers would be able to control the energy consumption of their homes according to their needs. Digitization of network management will also facilitate the use of homes as heat storage facilities, reduce the need for rapid energy consumption and gradually gas fueled energy systems will be eliminated.

It is planned to encourage residents to heat their private dwellings with more efficient boilers or electricity, which would reduce GHG emissions by 4% from the baseline year 2021 to 2030. Efforts will be made to encourage both new and existing buildings to connect to a district heating system or to replace inefficient fossil fuel boilers with more efficient biomass boilers or heat pumps.

The Administration of Vilnius City Municipality is taking significant steps towards sustainability to ensure that all municipal buildings and institutions will switch to 100% solar energy by 2030. In addition, the Administration actively encourages residents to install solar power plants by promoting support measures of the national government. It is foreseen that these joint efforts to encourage Vilnius residents to use renewable energy sources will have significant environmental benefits, which could reduce total GHG emissions by as much as 25%. Such initiatives not only contribute to climate change mitigation, but also promote citizens' environmental responsibility and innovation in the city.

3. Waste and the circular economy

Waste management and the circular economy play a crucial role in promoting environmental sustainability and economic development, increasing resource efficiency, protecting public health, and reducing the impact of climate change on cities.

Vilnius prioritizes the development of a separate network for the collection of recyclable waste, generated in the stream of municipal waste, expanding the network of waste collection facilities and using other methods convenient for waste holders (e.g. collection of

food waste, hazardous waste, textile waste, construction and demolition waste from households) for the collection of waste that must be disposed of separately. Since 2024, residents of Vilnius are obliged to sort food waste separately, and CJSC VAATC is responsible for collecting food waste from the residents in the most efficient and sustainable way. In the spring of 2024, the practice of feeding insect larvae with food waste collected from households began. Subsequently, the larvae will later be used in products of industrial proteins, biofuels and fertilizers. In addition, CJSC VAATC plans to conduct a study on how to recycle and use citizens' food waste in the most effective way. In addition to exploring the possibility of installing a biogas power plant, the study will also consider other alternative methods.

It is planned to further expand the network of used item exchange points, to establish an education center, to make more efforts to educate the population and thus gradually change the consumption habits and the culture of waste generation and management.

4. Buildings and related infrastructure

Buildings and related infrastructure play a key role in achieving climate neutrality by reducing energy consumption, GHG emissions and resource use, while increasing resilience to the impacts of climate change. The implementation of sustainable construction practices, the promotion of energy efficiency and investment in low-carbon technologies are the key steps towards creating climate-neutral cities and communities. Therefore, the modernization of old multiapartment buildings is one of the most important tasks in this sector.

Vilnius City Municipality is carrying out the modernization of buildings that belong to the Municipality and have energy efficiency class lower than B, with the goal of modernizing all such buildings by 2030. The aim is to set an example for residents and businesses by encouraging them to renovate their own buildings through national support programmes. The public entity Atnaujinkime miestą is intensively working on the inclusion of citizens in the program of modernizing multiapartment buildings and aids residents in the preparation of documents. It is planned to make even more efforts to encourage residents to renovate their multiapartment buildings – an ambitious goal is to renovate at least 300 multiapartment buildings every year, renovating a total of 2400 buildings by 2030, which would reduce GHG emissions by about 3% with regard to the baseline year 2021.

CJSC Vilniaus vystymo kompanija plans to prepare an internal standard for the modernization of buildings owned by the municipality. In addition, the company plans to create rules for the development of newly built sustainable buildings in the city of Vilnius – the rules would be a guidance dedicated to all developers.

Strategic stakeholders

Climate neutrality in Vilnius cannot be achieved without the involvement of various stakeholders. It is essential to promote transparency, include accountability in decision-making processes, build strong relationships, foster cooperation and achieve better results for all stakeholders involved.

Key stakeholders within Vilnius City Municipality, as illustrated in Figure 4, include various municipal entities that work closely with the city's academic institutions, business owners, and citizens. These collaborations are vital for fostering wider engagement and advancing the goal of climate neutrality.

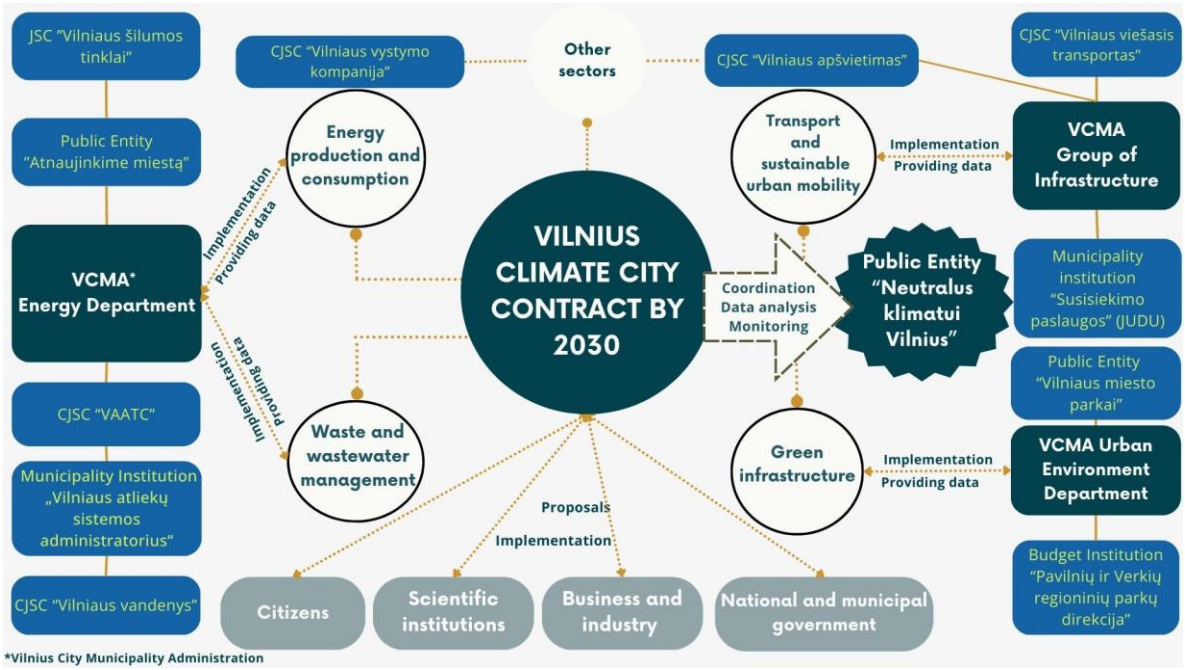


Figure 4. Strategic stakeholders and their relationship in the process of achieving climate neutrality

Roles of the key stakeholders are described below.

Municipal Entities: These bodies are responsible for implementing and overseeing climate policies and initiatives. They play a central role in coordinating efforts, ensuring compliance with regulations, and facilitating collaboration among different sectors.

Academic Community: Universities and research institutions contribute valuable expertise, conduct research, and provide innovative solutions to climate-related challenges. Their role is crucial in informing policy decisions and advancing scientific understanding.

Business Owners: Businesses are essential for driving economic growth and innovation. By adopting sustainable practices and investing in green technologies, they help reduce emissions and promote climate-friendly behavior. Their engagement is also pivotal in funding and supporting local climate initiatives.

Citizens: Public involvement is key to the success of climate initiatives. Empowering citizens to participate in climate actions, provide feedback, and engage in community-based projects enhances the effectiveness of environmental policies.

One of the new approaches is planned to be introduced is the establishment of a Climate Fund, designed to attract private capital from companies and provide financial support for small-scale projects within the city. This initiative, part of the "Climate Funding 4 Cities" project, aims to boost citizen engagement in climate action. Through awareness-raising and training programs, citizens and businesses will be encouraged to adopt more climate-friendly practices. These programs will foster closer collaboration between the public, businesses, and municipal representatives, driving meaningful progress in addressing climate change.

Vilnius City Municipality is already experienced in involving community members in environmental projects and supporting small-scale initiatives. An example of a successful

social initiative is the COPE project, which strengthens citizen involvement in the city's "green transformation" policies.

The municipality and its administration are committed to expanding cooperation with Vilnius residents, encouraging their active participation in various initiatives and training programs. By providing systematic consultations and increasing public knowledge about climate change and the urgent need for action, Vilnius aims to accelerate progress toward its climate goals.

Just Transition

A crucial aspect of Vilnius' climate strategy is ensuring a just transition for all its residents. This means that as the city shifts towards sustainability, it will also focus on making sure that no one is left behind. This involves addressing the needs of those who might be adversely affected by the changes.

The municipality is committed to integrating social equity into its climate policies, ensuring that vulnerable populations have access to new opportunities and resources. This includes providing support for ensuring affordable access to renewable energy solutions. By prioritizing these elements, Vilnius aims to ensure that the benefits of its climate actions are shared broadly, fostering an inclusive approach to environmental sustainability.

The municipality and its administration are dedicated to expanding cooperation with Vilnius residents, encouraging their active participation in various initiatives and training programs. By providing systematic consultations and increasing public knowledge about climate change and the urgent need for action, Vilnius aims to accelerate progress toward its climate goals while ensuring a fair and equitable transition for all.

4 Process and principles

Process and principles

The systematic work process, which the city of Vilnius started to implement in order to reach the goal of climate neutrality by 2030, includes several key steps and strategies (see Figure 5).

Figure 5. Ongoing processes to achieve climate neutrality by 2030

To achieve the GHG reduction targets, it is important to ensure continuous monitoring of implementation of the actions and the progress. Therefore, every year it is planned to update the data on the GHG emissions of Vilnius City and additionally collect data on the stated indicators. These indicators are selected according to the determined actions and measures presented in Vilnius Climate City Contract's Action Plan. It is planned to regularly inform the Vilnius Climate City Contract (CCC) Coordination Working Group, which consists of representatives of the municipal administration and municipal enterprises, about the progress in implementing the CCC. Progress assessment will help decide if it is necessary to amend the existing CCC. The changes in the document can also be done due to changing circumstances, e.g. new smart solutions being developed, new goals and actions being stated in the strategic documents of municipal companies, etc. The implementation monitoring of the CCC will be carried out by the public entity "Climate Neutral Vilnius" which was established by the municipality administration with the approval of the city council.

Vilnius Climate City Contract can be considered as implementation management guidelines that can help the city to overcome complex challenges, make the most beneficial decisions and ultimately accelerate progress in reducing GHG emissions in the most efficient and socially just way. These are the guiding principles that the city intends to follow in order to achieve the goal of climate neutrality (see Figure 6):

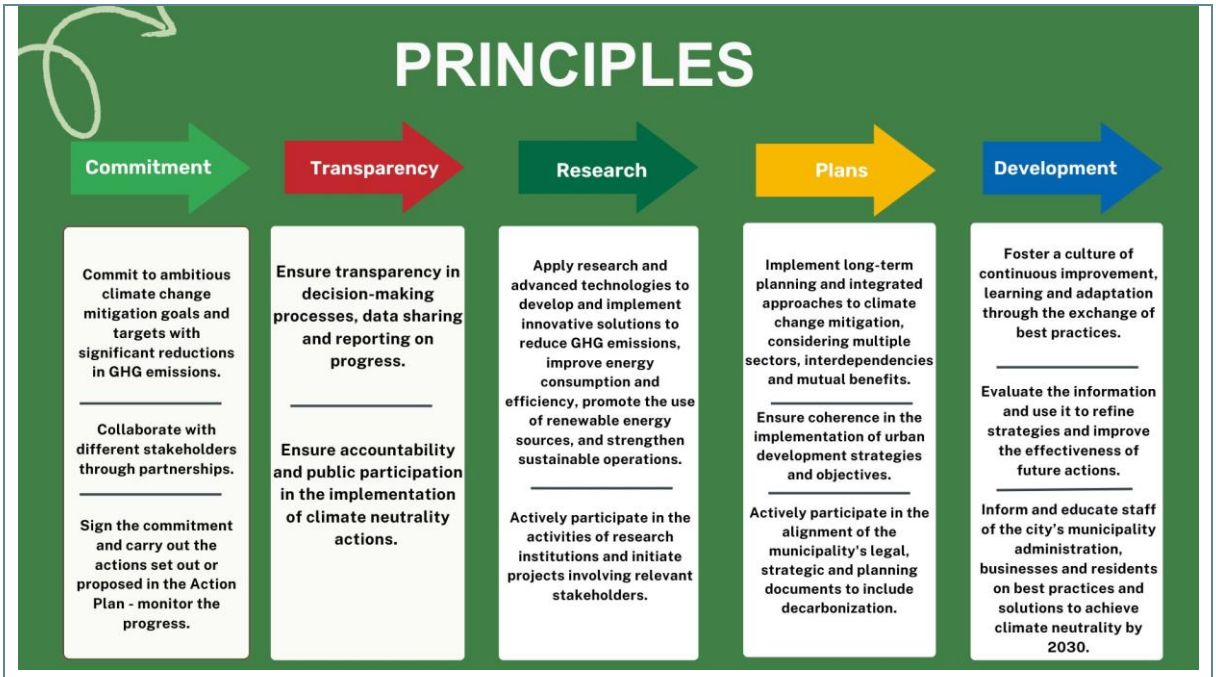


Figure 6. Guiding principles for achieving climate neutrality by 2030

By adopting the process of systematic work and main principles, stated in Figure 6, Vilnius City aims to:

- work efficiently and effectively to achieve its 2030 climate neutrality goal;
- accelerate progress and drive fundamental changes in mitigating GHG emissions;
- create a more sustainable, resilient and smarter city for current and future generations.

The most important task is to unite the whole community of Vilnius City – local authorities, the academic community, residents, businesses, non-governmental organizations, etc. It is crucial to engage various stakeholders as much as possible in the implementation phase of this critical and ambitious yet substantial aim. Some of our community members are already committing to helping to reach Vilnius's climate neutrality goal (see Annex I). Still, we are planning to continue the process of engagement, collect as many commitments from our city's community members as possible, and continuously raise awareness of this matter. We are committed to review Climate City Contact at least every two years and amend the document to the up-to-date situation with the aim to adopt the most feasible solutions to reach climate neutrality in the city, at the same time take into account the current social and environmental needs of Vilnius society. Only by acting together, as a united community, we will successfully take climate action, make the right changes in the city, and ensure a safe and vital environment for the society of Vilnius City.

5 Signatories

Name of the signatory (organisation)	Sector / Domain / Level of operation[1]	Legal form	Name of the responsible person	Position of the responsible person
Vilnius City Administration	Governance (local level)	Public Authority	Valdas Benkunstas	Mayor of Vilnius city
SĮ "Susisiekimo paslaugos" (JUDU)	Transport and mobility (local level)	Municipality Enterprise	Loreta Levulytė-Staskevičienė	General manager
UAB "Vilniaus viešasis transportas"	Transport and mobility (local level)	Municipal Enterprise	Ignas Degutis	CEO
UAB "Vilniaus šilumos tinklai" (central heating company)	Energy – heating (local level)	Municipality Enterprise	Gerimantas Bakanas	CEO
Public Entity "Atnaujinkime miestą"	Buildings (local level)	Public Entity	Eglė Randytė	Managing director
UAB "Vilniaus apšvietimas" (street lightning)	Energy – electricity (local level)	Municipality Enterprise	Andrius Deimantas	CEO
UAB "VAATC"	Waste management (regional level)	Public company	Tomas Vaitkevičius	CEO
JSC "Energesman"	Waste management (regional level)	Private company	Algirdas Blazgys	CEO
Vilnius Waste System Administrator	Waste management (local level)	Municipality Enterprise	Robertas Lavinskas	CEO
UAB "Vilniaus vandenys"	Wastewater management (local level)	Municipal Enterprise	Saulius Savickas	CEO

[1] Please mention if the organization is active at local, regional, national, or international level.

Public Entity “Neutralus klimatui Vilnius” (Climate Neutral Vilnius)	Governance (local level)	Public Entity	Indrė Jasionienė	Acting Director
Vilnius TECH	Academia (local / national level)	Academia	Dr. Adas Meškėnas	Vice-rector
Vilnius University Climate Change Group	Academia (local / national level)	Academia	Prof. Dr. Egidijus Rimkus Dr. Justinas Kilpys	Professor
Vilnius College of Design and Technologies	Academia (local / national level)	Academia	Rolandas Vitkūnas	Director

Annex 1: Individual / Cluster Signatory Commitments

MAYOR OF VILNIUS CITY

To Patrick Child
Cities Mission Manager, Deputy Director General for Environment
European Commission Directorate-General Environment

3rd September 2024

Vilnius City Municipality's Commitment to Climate Neutrality by 2030

We, Vilnius City Municipality, are committed to helping Vilnius City to become a climate neutral city by 2030. We agree on the common goal of significantly reducing greenhouse gas emissions and pledge to do our utmost to implement the climate neutrality pathways set out in Vilnius Climate City Contract 2030.

In accordance with Vilnius Climate City Contract 2030, the Vilnius City Municipality will allocate funds from the municipal budgets for the years 2025-2030 to support the implementation of climate neutrality initiatives within the municipality's responsibility areas.

Vilnius City Municipality commits to:

- Promote zero-emission public and private transport;
- Implement the sustainable urban mobility plan;
- Encourage the use of renewable energy sources;
- Improve energy efficiency;
- Promote waste sorting and circular economy;
- Implement nature-based solutions.

Yours sincerely,

Valdas Benkunskas
Mayor of Vilnius

VILNIUS
Municipality budget office
Code 188710061
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in the Register of Legal Entities
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