CITTA' DI TORINO

CLICC
Climate City Contract

Climate City Contract
Città di Torino
2030 Climate Neutrality Action Plan

Protocol
NET ZERO CITIES
EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

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These Commitments have been adapted to incorporate the vision for striving toward climate neutrality developed by the Città di Torino and to fit with the peculiar context of the city.

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NET ZERO CITIES

People of CLICC

Città di Torino

Prof. Stefano Lo Russo, Mayor of Torino

Dr. Eng. Chiara Foglietta, Councilor for the Ecological and Digital Transition, Innovation, Mobility and Transport

Dr. Alessandra Cimadom, General Director

Dr. Antonino Calvano (Vice General Director), Dr. Gaetano Noè (Director of the Environment and Ecological Transition Department), Dr. Gianfranco Presutti (Director of the European Funds and PNNR Department)

Eng. Mirella Iacono (Project Manager "EU Mission: Climate-Neutral and Smart Cities")

Dr. Fabrizio Barbiero, Dr. Roberta Bertero, Dr. Alessia Cerchia, Dr. Elena Ceretto, Dr. Elena Deambrogio, Eng. Luca Marasco Belcastro, Eng. Luca Sobrino (Development Team)

Arch. Bruna Cavaglià, Dr. Gianmichele Cirulli, Eng. Antonio D'Arpa, Dr. Giulia Maria Datta, Arch. Alessandra De Matteis, Dr. Marco Ferrero, Arch. Francione Marcello, Dr. Agata Grasso, Eng. Wassel Labed, Arch. Angela Nasso, Dr. Mariangela Pastorello, Dr. Giuseppe Pentasuglia, Dr. Davide Dimitri Quattrin, Arch. Isabella Quinto, Dr. Giulio Raneri, Eng. Lucia Reda, Dr. Laura Ribotta, Dr. Tiziana Tota, Dr. Antonio Vita (Support Team).

EST@energycenter, Politecnico di Torino

Prof. Ettore Bompard (coordinator), Prof. Michele Bonino, Prof. Stefano Corgnati, Prof. Francesco Laio, Dr. Marcelo Masera, Prof. Francesco Profumo (Scientific Committee)

Dr. Daniele Campobenedetto, Dr. Maria Ferrara, Dr. Daniele Grosso (coordinator), Prof. Tao Huang, Dr. Marta Tuninetti (Executive Scientific Board)

Prof. Tao Huang (scientific methodology and IT supervisor), Dr. Arch. Monica Naso (project manager)

Dr. Massimiliano Alberici, Dr. Caterina Barioglio, Arch. Irene Carrozzo, Dr. Pietro Colella, Dr. Claudia Concaro, Dr. Erminia Consiglio, Dr. Luca Ferraris, Eng. Vittorio Giordano, Dr. Mahmood Hosseini, Eng. Lorenzo Solida (Research Team)

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Summary

As stated in the Commitments, the vision of a sustainable and resilient city is realized through a diverse array of activities, including emissions mitigation and climate change adaptation, among others. The Climate City Contract (CCC) of the Città di Torino[1] stems from a general vision that steers the ecological transition of the city with an in-house dynamic and multilayer model. In parallel with the framework of activities encompassed in the "Torino Vivibile" webpage (mentioned in the Commitments, Section 1), which focuses on sustainability, the current Administration, under the motto "Torino Cambia"[2], has implemented an initiative to collect and carry out over 300 actions for the regeneration of the urban fabric. These actions are diverse, physical and immaterial, and occur at various scales. The "Torino Cambia" initiatives are supported by the National Recovery and Resilience Plan, European funds, and national funds.

In the framework of the CCC implementation, we have developed a work process based on **three pillars**: ① a **process governance** for managing the transition process; ② a City's **actors involvement process,** for a coordinated engagement of the heterogeneous players (Municipality, utilities, research institutions, industrial and financial companies, and organizations, citizens) in the road towards climate neutrality; ③ a **science-based support** to the City's policy decision-making, for quantitatively assessing ex-ante and "in silico" (through ad hoc models and IT tools) the costs/to identify the most appropriate ones.

In particular, the proposed vision aims at being: **integrated,** i.e. based on analyses of the interrelationships between the GHG emission sources and the different domains involved (environmental, social, economic); **science-based**, i.e. based on scientific approaches, models and tools, quantitatively describing the urban systems and the other intertwined domains, comparing (through scenario analyses) the impacts of possible alternative strategic choices; **dynamic**, i.e. able to consider and track the evolutionary trajectory of the urban systems and to compare it with the ideal trajectory to be followed for reaching the set targets, thus identifying the possible differences and allowing

1 Città di Torino is the institutional name of the Città di Torino.

2 See https://www.torinocambia.it/

for interventions on policy actions in order to realign them; **quantitative,** i.e. able to quantify, by means of indicators and Key Performance Indicators (KPIs), the current status of the urban systems and its evolution over time, thus monitoring the energy transition trend with respect to the set targets; **inclusive**, i.e. able to create a dialogue with the social fabric of the city, involving the citizens and making them aware of the cost/benefit ratio of the energy transition; **transversal**, i.e. integrating the communication with the players and stakeholders, and synthesizing visions and competencies in different domains.

In 2019 (chosen as reference year for the CCC as the most recent one for which data are available, leaving aside 2020 to exclude anomalous trends associated with the COVID-19 pandemic, against which to quantify the impacts of the designed policy strategies for decarbonization and climate neutrality), the CO_2 **emission inventory of Torino** accounted for **2.4 Mt/y**, mainly due (about 82%) to **residential, tertiary, industry** and **private transport** in terms of sectors and to **natural gas** (33%) and **refined petroleum products** (25%) in terms of energy commodities.

To reduce this value, in coherence with the European and national environmental sustainability goals and by the targets of the New Covenant of Mayors for Climate and Energy that the Città di Torino signed in 2019, the Municipality already implemented several policy actions, like those included in the **Piano d'Azione per l'Energia Sostenibile e il Clima** (PAESC – Sustainable Energy and Climate Action Plan, by 2023)[3] ; the **Torino Action Plan for Energy**(TAPE, by 2010 with a Third Monitoring Report in 2021[4]), identifying public and private buildings and transport as priority areas of intervention; the **Piano Regolatore per l'Illuminazione Comunale** (PRIC – Regulatory Plan for Municipal Public Lighting, by 2012)[5]; the **Piano Urbano per la Mobilità Sostenibile** (PUMS – Urban Plan for Sustainable Mobility, by 2022)[6]; the **Piano Strategico dell'Infrastruttura Verde** (Strategic Plan for Green Infrastructure, by 2020).[7]These plans already contribute to improving urban sustainability, as demonstrated by the continuous reduction trend in the city's historical series of emission inventory.

The inclusion of Torino in the set of cities of the "EU Mission: Climate Neutral and Smart Cities" represents a unique opportunity for significantly **boosting** this **decarbonization process** and building an integrated sustainability strategy involving all the actors of the city system.

3 Città di Torino (2023) PAESC – Piano d'Azione per l'Energia Sostenibile e per il Clima. Available at http://www.comune.torino.it/ambiente/bm~doc/piano_azione_energia_sostenibile_clima_paesc.pdf

4 Città di Torino (2021) TAPE – Torino Action Plan for Energy. Terzo Rapporto di Monitoraggio. Available at http://www.comune.torino.it/ambiente/bm~doc/report_terzo_monitoraggio_ec1.pdf

5 Città di Torino (2012) PRIC – Piano Regolatore per l'Illuminazione Comunale. Available at http://www.comune.torino.it/canaleambiente/pric/

6 Città Metropolitana di Torino (2023) PUMS – Piano Urbano della Mobilità Sostenibile della Città Metropolitana di Torino. Available at http://www.cittametropolitana.torino.it/cms/risorse/trasporti-mobilita-sostenibile/dwd/pums/DEL_CONS-42-2022-TESTO_ATTO.pdf

7 Città di Torino (2020) Piano Strategico dell'Infrastruttura Verde. Available at http://comune.torino.it/torinosostenibile/documenti/piano_strategico_infrastuttura_verde_2021.pdf

The three pillars have been concretely implemented with a structured set of activities.

As for the governance, an integrated **Mission Team** – with the goal of managing the definition of the decarbonization pathways of Torino, their impacts and costs, and the monitoring of the evolutionary trajectories of the city itself towards the set goals – has been created, merging two working groups: ① the **Transition Team of the Municipality of Torino**, in turn involving two different Departments (the Dipartimento Ambiente e Transizione Ecologica - Department of Environment and Ecological Transition and the Dipartimento Fondi Europei e PNRR - European Funds and PNNR Department), supported by the **Interdepartmental Working Group "Climate Change"**, composed of internal technical representatives with expertise in the fields of action of the CCC; ② the working group established at the **Energy Center of the Politecnico di Torino** under the scientific coordination of the **EST@energycenter Lab** – a multidisciplinary team involving different competencies in the energy, environmental and architectural domains, with expertise in modelling and analysis of energy systems at different spatial and time scales, assessment of the environmental impacts of alternative policy scenarios, quantification of GHG skinks due to urban green infrastructures, modelling of building physics, urban morphology and regulations.

Concerning the involvement of the City's actors, a **co-design process** with local stakeholders has been set up, also exploiting the experience already carried out through three "framework initiatives" under way, i.e. Torino City Lab, CTE Next, Torino Social Impact (described in Section 5), gradually including an increasingly large number of public and private subjects, to engage them as active participants in the challenge. In particular, the **local "ecosystem"** involved encompasses multilevel players: **institutional bodies** besides the Municipality of Torino (namely, the Regione Piemonte and the Città Metropolitana di Torino [8], which enables a vertical multi-level external governance), **public multi-utility companies**, the private sector (corporate, banking system, trade associations), the **Third Sector Entities** and non-profit organizations, the **academic world** and the **citizens**, with a specific focus on the younger generations and vulnerable targets. The **involvement of the local ecosystem** has been implemented through various instruments, including: ① **working tables** with the territory's leading actors, aiming at informing on the Mission and promoting a common action perspective for the climate

8 The Città Metropolitana di Torino (Metropolitan Città di Torino) as an administrative territorial entity has replaced the Province of Torino in 2015.

transition; ② **a cycle of workshops** with thematic stakeholders (business world, Third Sector Entities, investee companies) to co-create the framework of knowledge on the City's carbon footprint and to initiate the co-design of the portfolio of actions and the engagement for the implementation of initiatives; ③ **meetings addressed to young people and youth associations**, aiming at raising awareness of the challenges that the City will have to face to achieve the 2030 targets and at building a dialogue between young people and the City Administration; ④ **activities to engage vulnerable subjects.**

Eventually, for what concerns the science-based support to the City's policy decision-making, the proposed vision has been implemented along a sequence of steps.

First, a **data management approach** has been defined for systematically collecting, polishing, validating, and updating all the existing data that characterize the various sectors and sub-sectors forming the urban system. In this framework, the design of an "Energy & Transition Data Room," located at the Energy Center of the Politecnico di Torino, intended as a "research mirror" for hosting a copy of all the relevant data of the City, is currently in phase of implementation. The Data Room is conceptually based on the coupling of a data lakehouse approach, which allows for storing and managing structured, semi-structured, and unstructured data, and a distributed database approach, which allows for higher resilience (because data are not stored on a single physical machine, but distributed across multiple nodes physically located in different machines and replicated in such a way as to ensure redundancy) and performance (for balancing the workload across different servers, even in the presence of numerous simultaneous queries) concerning traditional databases. This infrastructure is based on an hyperconverged cluster and a distributed architecture with five nodes (and three copies of all the data distributed on these nodes).

Secondly, the design and implementation of a **web-based IT platform CLICC** (CLImate City Contract) have provided the means to assess ex-ante and "in silico" the impacts, in terms of CO2 emissions avoided and related costs, of different possible policy actions and strategies, based on ad hoc models and algorithms, thus permitting the City's decision makers to verify and compare them quantitatively and objectively. The platform also makes it possible to compile the various sections of the CCC itself automatically. Furthermore, this tool – fed by the data of the

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Energy & Transition Data Room to be built – will allow for tracking the evolution of the urban systems and the related emissions, for checking the coherence between them and what is expected by the Torino's CCC, and for implementing (when needed) corrective actions for realigning the evolutionary trajectory with the one requested for reaching the set targets.

This approach has made it possible to define a **set of macro-actions** (presented in this Action Plan, in Part B). These macro-actions are not intended as specific punctual interventions, with a limited area of application and consequent limited impacts in terms of contribution to the reduction of CO_2 emissions in the city. Instead, they are **wide-scale actions able to impact the overall urban system significantly,** leading to relevant effects on Torino's emission inventory. The macro-actions cover all the macro-areas emitting CO_2, namely **stationary energy** (including municipal buildings, public lighting, residential, tertiary, and industrial sectors), **transport** (including municipal fleet, private and public transport), waste (including landfill, wastes, and wastewater treatment). For the **AFOLU - Agriculture, Forestry and Other Land Uses** sector (which includes the urban green infrastructure that acts as a CO2 sink), the macro-action approach was adopted for offsetting residual emissions. A set of 27 macro-actions has been defied for what concerns the CO2 emission reduction; moreover, 4 macro-actions have been identified for addressing the residual emissions.

The overall set of interventions for both emission reduction and compensation include: energy requalification of buildings (residential, tertiary, industrial and municipal); expansion of the district heating network; electrification of a part of the heating systems through heat pumps; creation of Renewable Energy Communities; efficiency improvement of the industrial processes; increase in efficiency of public lighting; enhancement of the share of photovoltaic (PV) electricity production; electrification of the private vehicles fleet, of the buses for public transport and the municipal fleet; implementation of zones with limitations to private traffic; promotion of alternative mobility modes (bicycles, carsharing, carpooling); construction of a second metro line; reduction in waste generation and increase in separate waste collection; installation of Carbon Capture and Storage (CCS) systems on the waste-to-energy plant and district heating generation plants; increase in urban forestry and development of green roofs.

For each **macro-action,** related **co-benefits** have been identified in various fields, from improving air quality to combating energy poverty and social inequalities to positive effects on health.

Moreover, a mapping (portfolio) of 227 micro-actions already in progress or to be developed in the City has been created, associating them with the different fields of action and collecting them under the related macro-actions domain (see Annex I to this Action Plan). All the micro-actions have been uploaded to the CLICC web platform to monitor their evolution.

The overall effect of implementing the macro-actions for emissions reduction has been quantified to a reduction of 1.6 Mt/y of CO_2 emissions (-66.7%) concerning the reference year (2019) value of 2.4 Mt/y. The investment cost associated to the macro-actions for emission reduction is estimated at 21.8 G€, as detailed in Torino's CCC's Investment Plan.

Likewise, the overall effect of implementing the macro-actions for residual emissions compensation has been quantified to a compensation of 55.4% of the residual emissions, i.e., 442,318 t/y (corresponding to 18.5% of the 2019 baseline emissions). The investment cost associated to the macro-actions for emission compensation is estimated at 5.3 G€, as detailed in Torino's CCC's Investment Plan.

The vision and the methodological approach defined and implemented for the preparation of the Climate City Contract of Torino aim at constituting a sort of "Torino Model" for the science-based support to Cities in the energy/environmental policy decision-making field, which could be made available and reproducible, in a scalable way, in other national and international contexts.

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Glossary of Terms

ABI	Associazione Bancaria Italiana Italian Bank Association
ACI	Automobile Club Italia Automobile Club Italy
AFOLU	Agriculture, Forestry and Other Land Use
AMP	Agenzia della Mobilità Piemontese Piedmont Mobility Agency
AMSvS	Agenda per lo Sviluppo sostenibile della città Metropolitana di Torino Agenda for the Sustainable Development of the Metropolitan Città di Torino
ANCE	Associazione Nazionale Costruttori Edili National Builders' Association
ARPA Piemonte	Agenzia Regionale per la Protezione Ambientale
ATC	Agenzia Territoriale per la Casa Territorial Agency for Housing
ATECUE	Attività Economica delle Utenze Elettriche Economic Activity of Electric Utilities
ATOR	Associazione d'ambito Torinese per il governo dei Rifiuti Torino Area Association for Waste Management
BICIPLAN	Piano della Mobilità Ciclistica Cycling Mobility Plan
CAI	Club Alpino Italiano Italian Alpine Club
CCC	Climate City Contract
CCS	Carbon Capture and Storage
CDP	Cassa Depositi e Prestiti
DH	District Heating
ETS	Emission Trading System
FAI	Fondo per l'Ambiente Italiano
FENEE	Fattore di Emissione Nazionale per l'Energia Elettrica National Emission Factor for Electricity
FUA	Funcitonal Urban Areas

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GTT	Gruppo Torinese Trasporti
GVW	Gross Vehicle Weight
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
IRES	Istituto di Ricerche Economico Sociali del Piemonte Institute for Socio-Economic Research of Piemonte
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale Institute for Environmental Protection and Research
ISTAT	Istituto Nazionale di Statistica Italian National Statistical Institute
MSP	Metropolitan Strategic Plan
PAESC	Piano d'Azione per l'Energia Sostenibile ed il Clima Action Plan on Sustainable Energy and Climate
PEAR	Piano Energetico Ambientale Regionale
PENCO	Piano ENergetico Comunale Municipal Energy Plan
PMI	Piccole e Medie Imprese Small and Medium Enterprises
PNIEC	Piano Nazionale Integrato per l'Energia e il Clima Integrated National Energy and Climate Plan
PNRR	Piano Nazionale Ripresa e Resilienza National Recovery and Resilience Plan
PPR	Piano Paesaggistico Regionale Regional Landscape Plan
PRG	Piano Regolatore Generale General Urban Development Plan
PRIC	Piano Regolatore di Illuminazione Pubblica Comunale Municipal Public Lighting Plan
PRQUA	Piano Regionale di Qualità dell'aria Regional Air Quality Plan
PTA	Piano Tutela delle Acque Water Protection Plan
PUMS	Piano Urbano per la Mobilità Sostenibile Sustainable Urban Mobility Plan
PV	Photovoltaic
SAGAT	Società Ordinaria e Gestione Aeroporto Torino Torino Airport Ordinary and Management Company
SMAT	Società Metropolitana Acque Torino Torino Metropolitan Water Company

SRSvS	Strategia Regionale per lo Sviluppo Sostenibile Regional Strategy for Sustainable Development
TAPE	Torino Action Plan for Energy
TEST	Torino Energy Strategy
TRM	Trattamento Rifiuti Metropolitani *Metropolitan Waste Treatment*
UNESCO	United Nations Educational, Scientific and Cultural Organization

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1. Introduction

Torino, the capital of the Regione Piemonte and the Città Metropolitana of the same name, boasts a population of 860,973 inhabitants (as of December 31, 2023) and covers an area of 130 km^2, divided into eight districts (Figure I-1.1). It stands as the fourth-largest economic and productive complex in Italy and serves as a pivotal hub for industry, universities, arts, tourism, sciences, and culture.

With an ancient history dating back to the 3rd century, Turin was transformed into a Roman colony, known as *Iulia Augusta Taurinorum*, in the 1st century B.C. It has played a significant role in the history of Italy, serving as its capital between 1861 and 1865.

Torino's territory encompasses significant historical sites, including those listed in the UNESCO World Heritage List as part of the Savoia Dynasty residences in Piedmont, as well as the natural ecosystem formed by the collinear areas surrounding the Po River, designated as a biosphere reserve.

Throughout its recent history, Torino has hosted numerous cultural and sporting events, such as the Universal Exposition in 1911 and the 20th Winter Olympic Games in 2006. Additionally, it serves as the epicenter of Italy's automobile industry and is a vital hub for publishing, banking, insurance, information technology, cinema, food and wine, aerospace, industrial design, sports, fashion, and artificial intelligence industry.

The city's growing importance on the international stage has earned it the status of a global city, placing it as the third-largest Italian city after Milano and Roma in the Gamma category of the GaWC 2020 classification.

Demographics and employment

Torino has undergone significant economic and demographic changes in recent decades, with the effects further compounded by the COVID-19 pandemic.

Since its peak in 2012, the resident population has been on a decline, with figures standing at 860,973 as of December 31, 2023. This trend is mirrored in the Città Metropolitana and at the regional level, with a 4% decrease in the overall population. The demographic makeup remains fairly balanced, with 446,947 females and 414,026 males. However, analysis by age group reveals an aging population, characterized by a decline in the younger demographic and an increase in the elderly population (65 years and older).

In 2022, employment in Torino experienced a 2% increase from the previous year, reaching 361,000 employed individuals. This growth surpassed that of Milano and Genova, largely attributed to the contributions of the city's female workforce. However, a comparison with 2019, the last pre-COVID year, reveals a persistent negative gap (-3.1%), indicating only partial recovery and unfavorable demographic trends.

Education

In the 25-39 age group, the proportion of graduates in Torino stands at 30%, surpassing the Italian average of 27%. However, this figure is relatively lower compared to other metropolitan areas in Northern Italy, such as Bologna (41%) and Milano (40%). Despite this, enrollments in Torino's universities are on the rise, indicating strong appeal both nationally and internationally. In 2021, the Università di Torino boasted 77,000 enrolled students, while the Politecnico di Torino had 34,000 students.

Manufacturing

The process of deindustrialization, which has affected Torino and other European cities in recent decades, has had significant impacts on various manufacturing supply chains. This has led to negative repercussions in terms of employment, which, only now, appear to have been partially but not entirely absorbed by other sectors, resulting in a structural change in the city's economic landscape.

Nevertheless, compared to other European metropolitan cities, Torino's manufacturing sector still holds significant importance, with a total of 8,978 activities (7,399 headquarters and 1,579 local offices). The entrepreneurial system in Torino is heavily characterized by small and micro-enterprises. However, the relatively low presence of medium and large enterprises complicates both technology transfer processes and the retention of local human capital created by the network of local academic institutions.

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Political-administrative directions: a metropolitan Green Deal

The current municipal administration, led by Mayor Stefano Lo Russo, was elected in 2021 from among center-left forces.

Recently, Torino has committed to embarking on the path towards ecological and related transitions, including energy, digital and IT, economic-productive, and socio-cultural transitions. Specifically, the city is evaluating strategies to promote and oversee the urban energy transition. The urgency of the energy transition is highlighted by the significant presence of fossil fuels in the city's energy mix, encompassing buildings, equipment, facilities, and transportation. This reliance on fossil fuels has notable implications for greenhouse gas (GHG) emissions and air pollutants.

As of 2019, fossil fuels, including natural gas and refined petroleum products, accounted for over 60% of Torino's final energy consumption. Fossil fuels also played a substantial role in the generation mix of electricity and heat for the city's district heating network. The emission factors for electricity generation and district heating were estimated at 0.245 tCO_2/MWh and 0.161 tCO_2/MWh, respectively. Torino's district heating network, established in 1982, is one of Europe's most extensive systems, consisting of a double line of pipelines spanning over 700 km and serving nearly 500,000 inhabitants.

As outlined in the City's Guidelines, environmental sustainability and ecological transition are explicitly recognized as top priorities, serving as essential tools to propel the city, in collaboration with municipalities in the metropolitan area, towards a new phase of growth.

Key aspects related to achieving environmental objectives include energy production from renewable sources, fostering energy communities, implementing measures for energy reduction and upgrading of both public and private building stocks, promoting separate waste collection, and reducing emissions.

Addressing air quality and environmental emergencies stands at the forefront of structural policies, particularly concerning the energy conversion of buildings and public and private transportation vehicles.

Investee companies are also integral to this effort, and their role must be reinforced to function effectively as a network within the metropolitan area. Collaboration among these entities is essential for advancing environmental sustainability goals across the entire metropolitan territory.

The administration is committed to embracing the challenge posed by the Green New Deal, initiated by the European Commission in 2020, aimed at reducing CO_2 emissions and achieving climate neutrality. This involves supporting innovation in industry, transportation, and heating systems, with a focus on investing in electric mobility and enhancing energy efficiency.

To this end, there are plans to develop a comprehensive strategic plan, in collaboration with all municipalities in the Città Metropolitana, to facilitate the ecological and energy transition. This metropolitan Green Deal will encompass initiatives related to the management and implementation of green infrastructure, as well as the execution of large-scale urban reforestation projects.

Furthermore, a key aspect of territorial development involves bolstering measures for hydrogeological risk mitigation through increased investment. This proactive approach aims to enhance the resilience of the metropolitan territory against potential hydrogeological hazards.

In addition, the administration has identified, among the objectives to be pursued, the preparation of a definitive protection and enhancement plan for city rivers to improve their environmental conditions, encourage navigation, and develop sports and recreational activities.

Addressing air pollution reduction is of utmost importance, especially considering the frequent exceedance levels observed. To combat this issue, coordinated efforts are underway to reduce traffic emissions across the entire metropolitan area. Additionally, incentives are being provided for the replacement of the most polluting vehicles.

Furthermore, energy efficiency initiatives targeting both public and private buildings are being prioritized, along with tax incentive policies aimed at promoting the widespread adoption of renewable energy sources.

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Table I-1.1 outlines the various macro-areas of the urban system considered in the development of the current Action Plan, categorized according to different emission scopes. This provides a comprehensive overview of the scope of analysis conducted to identify strategic pathways for the city towards achieving the 2030 target of climate neutrality.

Table I-1.1 Targets for climate neutrality by 2030

Macro-areas	Scope 1	Scope 2	Scope 3
Stationary energy	Included	Included	-
	Only CO_2 is considered	Only CO_2 is considered	-
Transport	Included	Included	-
	Only CO_2 is considered	Only CO_2 is considered	-
Waste/wastewater	Not applicable	Not applicable	Included
	CO_2 equivalent is considered	Not applicable	CO_2 equivalent is considered
IPPU	Excluded	Not applicable	-
	-	Not applicable	-
AFOLU	Included	Not applicable	-
	Only CO_2 absorption from existing green areas and trees is considered	Not applicable	-
Other	-	-	-
Geographical boundary	Same as city administrative boundary	Smaller than city administrative boundary	Larger than city administrative boundary
(Tick correct option)	X		
Specify excluded/ additional areas	-	-	-

Figure 1.1: Map of Torino

2. Work Process

The work process adopted for defining the CCC's Action Plan is rooted in the Vision outlined in the Section 4 of the CCC Commitments. This approach integrates interdisciplinary methods and closely intertwi es a science-based approach with governance strategies. The focus lies on assessing the city's environmental sustainability, specifically in terms of greenhouse gas (GHG) emissions, limited to CO_2 for the purposes of the Action Plan.

The implementation of the Vision revolves around three conceptual pillars outlined in the Summary. These pillars underpin the creation and formalization of the work process, guiding the city through its transition towards sustainability. They are translated into a series of actions, which are graphically synthesized in Figure 2.1.

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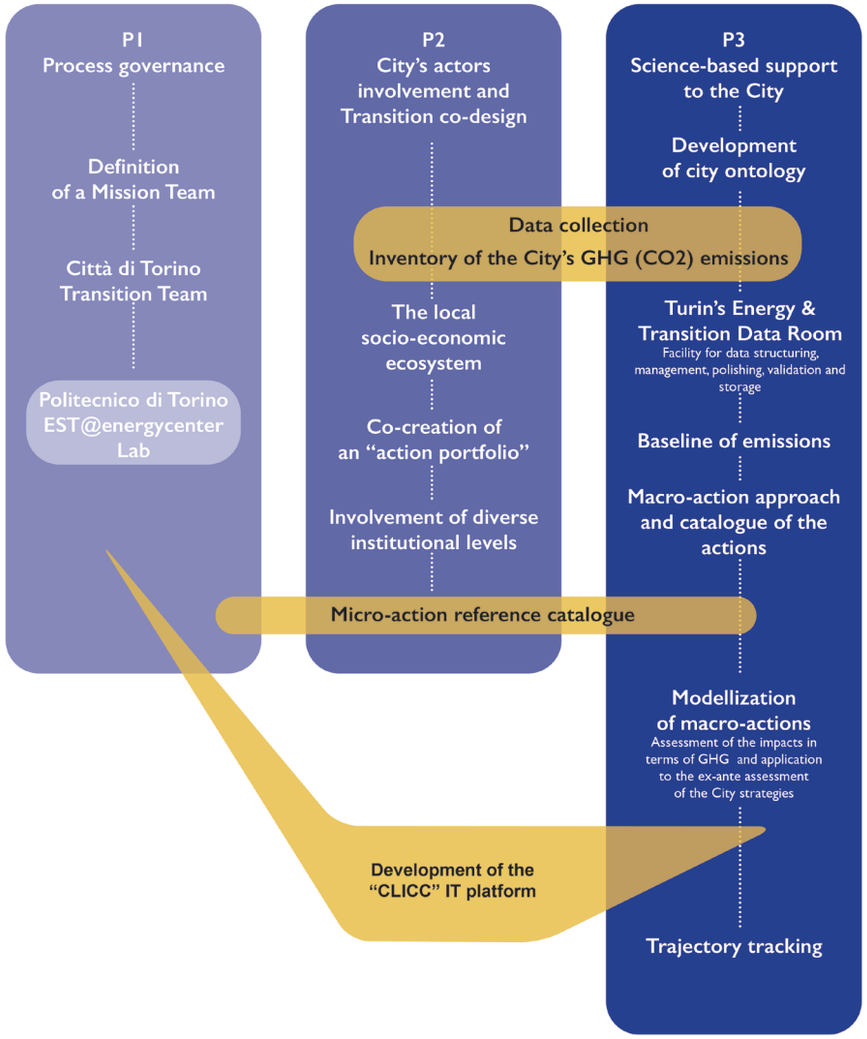

Figure 2.1 – The structure of the work process.

In particular, we consider three flows that encapsulate and organize the work process:

P1) **Process governance:** defining structured groups and a network of responsibility and interrelations to manage the governance process supporting the Action Plan.

P2) **City's actors' involvement and Transition co-design**: coordinated engagement of all the actors and stakeholders of the city involved in the transition process towards climate neutrality project at different levels and roles (municipality, utilities, research and educational institutions, industrial and financial companies, and institution, citizens associations and individuals).

P3) **Science-based support to the city:** definition of a "data lakehouse" for collecting, storing, and managing the data that characterize the urban system and mathematical modeling and algorithms for assessing/monitoring the status and the evolution of the city in terms of GHG – evaluating ex-ante and "in silico" the impacts and cost/benefit ratio of the actions in a strategy and pinpointing the most appropriate ones.

These three pillars are intertwined: their actions proceed in parallel, but some sections (Inventory of the City's GHG emissions, micro-action reference catalog, creation of the CLICC platform) are transversal and represent a common link in the work process : they are pivotal sections of convergence between governance, city actor involvement and science-based support.

P1 – Process governance

Definition of a "Mission Team"

The process undertaken by the Città di Torino in building the CCC and achieving climate neutrality by 2030 starts with the definition of a **Mission Team**. The Mission Team is an integrated bilateral working group formed by the City's in-house operational core (Transition Team) and the Politecnico di Torino interdisciplinary group at the EST@energycenter Lab.

The main goal of the Mission Team is to ensure a systemic and synergetic approach to governing climate action. It engages, with a different level of involvement, 45 people from the Città di Torino and 25 from the EST@energycenter Lab.

The **Transition Team** is the Mission Team component within the City Administration. It is composed of ① Department for Ecological and Digital Transition, Innovation, Mobility and Transport (which coordinates, on the political side, the different departments involved in the Mission's activities); ② Referees of the Environment and Ecological Transition Department and the European Funds and NRP Department. The Team operates under the guidance of the General Management of the Città di Torino, the competent Councillor, and the Mayor and ensures the full involvement of all cross-functional skills within the administration through the activation of the **Interdepartmental Working Group "Climate Change"** composed of technical representatives of the different City Services – that works at the construction and updating of the common framework of actors, networks, barriers and main levers towards climate neutrality.

The Città di Torino has activated the "Climate Change" working group to overcome internal governance barriers with an integrated multidisciplinary approach. Under the leadership of the Environment and Ecological Transition Department, it involves all the components whose activities may influence the pathway to climate neutrality.

The working group of the **EST@energycenter Lab** has been established at the Energy Center of the Politecnico di Torino. It involves a multidisciplinary team merging different energy, environmental, and architectural competencies.

The team embodies the operational convergence and cultural diversity of three departments of the Politecnico di Torino: the **Department of Architecture and Design (DAD)**, the **Department of Energy (DENERG)**, and the **Department of Environment, Territorial and Infrastructure Engineering (DIATI)**.

The expertise of the team ranges from the modelling and analysis of the energy systems at different spatial scales (urban, national, supranational, global) and over different time horizons (short, medium, and long term) to the assessment of the environmental impacts associated to the various energy mixes, alternative policy scenarios, and the quantification of the GHG sinks due to urban forestation, to the modeling of building physics, to the evaluation of the role played by urban morphology and regulations in the effective implementation of decarbonization policies

The working group supports the Municipality of Torino in guaranteeing the scientific validity of the initial knowledge framework and of the actions/measures defined within the general strategy to contrast greenhouse gas emissions – building ad hoc models and IT tools for assessing their effects and tracking

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the evolution of the city energy system over time.

The EST@energycenter Lab also represents a physical space: it is the venue where the Mission Team can meet and work together, directly sharing knowledge and competencies in different domains – jointly defining targets and methodologies in designing strategies, pathways, and actions for the transition of Torino towards the climate neutrality.

The close synergy between the Città di Torino and the EST@ energycenter Lab allows a better understanding of the urban energy balance's starting conditions (data, relationships, and barriers) and related emissions – thus building the basis for the subsequent strategy definition and monitoring phases.

Mission Team Goals Toward 2030

In particular, from an operational point of view, the Mission Team is in charge of coordinating the governance activity of the transition phase of the City towards climate neutrality. In this framework, several specific activities are encompassed, including preparing and drafting the CCC in the following phases, in terms of future further revisions/integrations of the contract itself to follow the implementation of the various decarbonization actions of the City coherently with what defined in the CCC, also detecting the possible barriers to their implementation (and, therefore, to the achievement of the target) and evaluating the possible options for decreasing them, and identifying the main levers of change that support the transition process; to define ad hoc Key Performance Indicators and track the evolutionary trajectory of the system; to monitor the financial aspects related to the implementation of the various actions; to manage the strategies for the involvement of the different City's actors.

In the phase following the signing of the CCC, in particular, the Mission Team will continue its activity of coordinating and monitoring the actions necessary for the achievement of climate neutrality, continuing to ensure (and, where possible, to strengthen) the moments and spaces for periodic discussions between representatives of the Transition Team and EST@ energycenter Lab Team.

Meetings with citizens and stakeholders, progressively identified by the City to support the path to climate neutrality, will also continue.

Finally, the Mission Team will be tasked with offering periodic reports to the Mayor and the Council to ensure the most comprehensive sharing of data on the progress of planned actions toward full implementation of the CCC. Through the construction of this dual channel of communication, to the outside world and civil society, on the one hand, and to the inside and the local government, on the other, the political and administrative leadership of the Entity will benefit from all the data necessary to keep the guidance toward climate neutrality firmly in place and adopt corrections where necessary.

P2 – City's actors' involvement and Transition co-design

Along with the Mission Team, an articulated system of actors in the territory, internal and external to the Administration, is engaged in the contract.

The local socio-economic ecosystem

A systemic and multi-level approach involves the entire local ecosystem, composed of the city's different public and private actors, down to individual citizens (see Section 5).

The path outlined by the Città di Torino envisages different levels of involvement and is based on network governance. In particular, it was decided to gradually and transversally embrace the local ecosystem, stemming from an initial group (the "Core Team") – made up of actors pooled together in networks already involved in other processes and with a high potential in terms of direct/indirect effects on the reduction of climate-changing gas emissions –, up to individual citizens and fragile/vulnerable subjects. [9]

Specifically, the local ecosystem currently includes multi-level institutional actors: public authorities-companies, the private sector (corporate, banking system, trade associations, etc.), the

9 In this document, the notion of "fragile/vulnerable subjects" broadly refers to social groups that are marginalized and/or exposed to inequalities/obstacles that jeopardize them to being granted full socio-economic status (e.g., people in energy poverty, young people and foreigners).

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Work Process

Third Sector and associative world, the academic world and citizens, with a specific focus on the younger generations and fragile/vulnerable subjects.

The involvement of the local ecosystem is being implemented through different approaches: ① Meetings of the Interdepartmental Working Group on Climate Change; ② Targeted meetings with the services/offices within the municipal Administration; ③ Working tables with the territory's leading actors, municipal subsidiaries companies and thematic stakeholders, representative spheres of action of the Climate City Contract; ④ Workshops with thematic stakeholders to co-design a "portfolio of actions" – implementing the knowledge on the city's carbon footprint, and the identification of initial strategies towards climate neutrality by 2030 and beyond; ⑤ Meetings addressed to young people and youth associations with the aim of promoting the dialogue between young people and the city; ⑥ Activities to engage fragile/vulnerable subjects; ⑦ involvement of the private sector through the support of the Management Department of the University of Torino – in cooperation with other institutions, productive entities and the Third Sector.

This initial core is set to gradually grow through the reinforcement of engagement initiatives, information, and communication activities involving targets identified in barriers (see Section 3) and levers for change and the actors' mapping (see Section 5) – to promote, support, and broadening the active involvement of the local ecosystem.

The CCC will be gradually enriched by co-creating new actions and alliances. New opportunities will stem from confrontation, co-design with the territory, and integration with other ongoing policies and projects. "Widespread territorial workshops" will be set up as an opportunity to reflect on the most suitable solutions. At the same time, meetings addressed to young people and youth associations will consolidate the relationship between the younger generations and the municipal Administration.

Co-creation of a portfolio of actions

For the drafting of the CCC, the Città di Torino has started a co-design process with local stakeholders, gradually involving an increasingly large number of public and private subjects as active participants in the challenge undertaken by the city.

The first phase of the process involved about 16 representatives of public entities, 40 participants from private companies, 35 participants from non-profit organizations, and also 20 associations for vulnerable people to arrive at a joint definition of the actions and investments that could be activated in the short, medium and long term to achieve the Mission's goals.

Also, thanks to the dialogue with the different stakeholders of the city and to the inputs received from them, according to a co-creation approach, a set of macro-actions (wide-scale actions able to significantly impact the overall urban system and leading to relevant effects on the emission inventory), covering all the sectors was set. For each macro-action, possible co-benefits were identified in various fields, from improving air quality to contrasting energy poverty and social inequalities to critical positive effects on health (see Section 4).

A portfolio of all the "micro-actions" already in progress or to be developed in the city[10] was then created, associating them with the different fields of action and collecting them under the related macro-actions domain (see Annex I).

Involvement of other institutional levels

Within the framework of the local coalition, the involvement of the Regione Piemonte and the Torino Città Metropolitana is crucial in defining a vertical multi-level external governance that allows for the development of actions both in coordination with the regional strategies and in full connection with a supra-local scale.

Such an interaction has made it possible to systemize the reconstruction of the baseline emission framework and the potential impact of future strategies. The interaction with the Città Metropolitana has deepened the effect on the municipal territory of policies promoting accessible, safe, and less polluting mobility towards environmental, economic, and social sustainability, such as the Piano Urbano per la Mobilità Sostenibile (PUMS – Urban Plan for Sustainable Mobility) issued in 2022 (see Section 3 – Part A). In a regional framework, the interaction with the Regione Piemonte was an opportunity to explore the interlocking of Municipal and Regional paths towards climate neutrality. In this sense, the definition of the Regional Climate Change Strategy in 2022 [11] aims to direct regional administrative and political actions to counter climate change along a double-edged trajectory: on the one side, by adopting mitigation strategies to reduce climate-altering gas emissions; on the other, by increasing both resilience

10 The PAESC issued in 2023 had already systematised actions and projects initiated and/or financed and to be implemented by 2030, mainly triggered by the municipal administration and the investee companies that manage the main local public services.

11 The first draft was approved in February 2022.

12 In this document, we refer to the notion of "resilience" as the ability to survive and elaborate prompt recovery strategies from extreme weather/meteorological/ natural events due to climate change; and to "adaptation" as the capacity urban societies to ensure the city's functioning in an environmentally sustainable, energy efficient and economically affordable manner in the face of mutations in the environmental setting as a result of ongoing climate change.

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and adaptation approaches[12] to prepare the territory and its inhabitants to face the inevitable consequences of global warming.

Supra-local cooperation expands nationally by launching working tables and agreements with ministries involved in the energy transition. In 2022, a Memorandum of Understanding was signed between the Ministero delle Infrastrutture e delle Mobilità Sostenibili (Ministry of Infrastructure and Sustainable Mobility) and nine Italian cities involved in the path towards climate neutrality – which sees Torino as part of an expanded network sharing potentials and barriers in the path towards climate neutrality, but also methodologies for engagement, data collection/sharing, and the definition of new financial instruments to support the achievement of the objective. In this framework, the Let's GOv project, launched on 1 June 2023 with a duration of 24 months and in which the Città di Torino is a consortium partner and the EST@energycenter Lab is a scientific partner (see Section 5 and Annex II), represents an opportunity for the nine Italian cities (which jointly applied to the related call) to share good practices and projects – to create a knowledge base to other municipalities, public administrations or public bodies to move more quickly and efficiently towards the goals of the Mission of the Cities. [13]

13 See https://netzerocities.eu/italys-pilot-activity-letsgov-governing-the-transition-through-pilot-actions/

P3 – Science-based support to the city

The science-based approach provided by EST@energycenter Lab of the Politecnico di Torino to the city supports the first two pillars of the work process in quantitatively assessing – ex-ante and in silico, through ad hoc models and IT tools – policy actions and overall strategies towards carbon neutrality. Such cooperation is essential to building a shared vision, creating an operational approach, implementing concrete and measurable actions, and accompanying the city along the transition trajectory.

Developing a City Ontology

The overarching action upstream of the P-3 structure is the creation of a "City Ontology." The City Ontology (Fig.2.2) allows the formalization of several correlations and interactions among the domains participating in Torino's energy transition. The ontology conceptualized by the EST@energycenter Lab of the Politecnico di Torino comprises classes and relationships, including individuals, classes, attributes, relations, functions, terms, restrictions, rules, axioms, and events. The Ontology is the basis of the definition of the single actions and, consequently, is preparatory to implementing a "what if" analysis scenario.

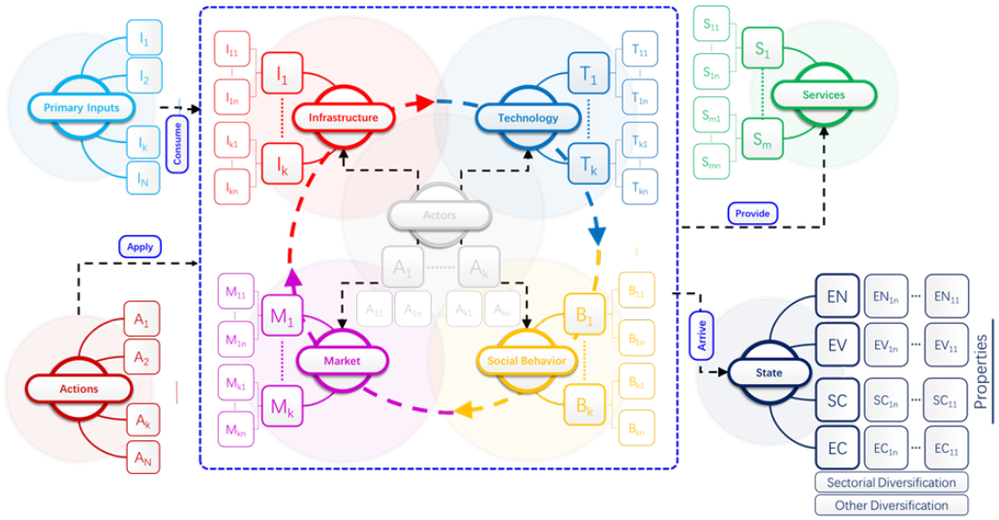

Fig. 2.2 – Scheme of the City Ontology

Data collection and data lakehouse

Systematized data collection and classification are pivotal to creating cognitive and decision-making value through open-source data intelligence. Data and information that characterize the city are organized and stored in a data lakehouse,[14] gathering and managing structured, partially structured, and completely unstructured data. The data lakehouse ensures a shared data hub for hosting all the relevant data of the city, which helps manage the energy transition and the sustainability process to feed the models for scenario analyses and allow for the evolutive tracking of the urban system.

Inventory of the City's GHG (CO_2) emissions

The Greenhouse Gas Emissions Baseline is the "zero degree" of the decarbonization process of the urban system towards climate neutrality – indicating the amount of greenhouse gas emissions to be removed from the urban energy system by 2030 to reach the climate neutrality condition.

The reference year for constructing the Greenhouse Gas Emission Baseline Inventory is 2019, [15] corresponding to the PAESC (Piano di Azione per l'Energia Sostenibile e il Clima – Sustainable Energy and Climate Action Plan)[16] and the Third Monitoring Report of the TAPE – TorinoAction Plan for Energy.[17] Also, 2019 is considered by the European Commission as an acceptable reference year for all cities that have joined the NetZeroCities protocol.

The definition of the Baseline Inventory mirrors and encapsulates the peculiarities of the local situation and conditions characterizing the Città di Torino; therefore, the PAESC and the Third Monitoring Report of the TAPE represent the primary reference documents. However, to overcome the limitation in the available data and to increase the level of reliability of the presented emission inventory, a complete revision process of the energy consumption and emissions values for all the macro-areas (stationary energy, transport, waste, IPPU and AFOLU) and sectors, with further ad-hoc analyses and calculations, has been performed with respect to the preliminary assessment presented into the Climate-Neutral and Smart Cities Mission Call for Expression of Interest. In particular, for what concerns the industrial sector (for which, in the Expression of Interest all the emissions related to the sectorial energy consumption were attributed to the IPPU macro-area, not complying with the indications provided by the NetZeroCities 2030 Climate Neutrality Action Plan Guidance and Explanation

14 Considering the complexity of managing widely heterogeneous data, the evolution of data management is leading to the migration from traditional data warehouses to more flexible and scalable solutions like data lakes, and to the new approach of data lakehouses. With the increasing volume, variety, and velocity of data, in fact, data warehouses face limitations in handling unstructured and raw data. Data lakes provide, instead, a scalable solution for storing vast amounts of both structured and unstructured data in its native format. They offer advantages such as flexible schema, support for real-time and batch processing, and the ability to incorporate new data sources seamlessly. Due to the need for bridging the gap between data storage and data analytics, the concept of a data lakehouse has thus emerged – combining the benefits of both data warehouses and data lakes, and providing a unified platform that enables data storage, data processing, and analytics in a single architecture.

15 As of 31 December 2019.

(p. 8, pp. 31-32), furthermore including both ETS industry – for which only the consumption of natural gas was considered – and Non-ETS industry – for which both natural gas and electricity consumptions were taken into account) a fully revised assessment has been performed, taking into account that emissions from energy use in manufacturing and industrial facilities, construction activities and energy industries fall under the stationary energy macro-area, and not under the IPPU one. In particular, in this new estimation, only non-ETS (Emissions Trading System) industries have been considered.[18]The electricity consumption has been evaluated starting from the consumption data provided by the IRETI S.p.A. company[19](belonging to the Iren Multi-utility company and devoted to the management of the urban electricity distribution network) via the Regione Piemonte and filtering and aggregating them according to a clustering of the different industrial facilities based on the ATECUE code (that identifies and allows to classify the all the various economic and productive activities). Concerning natural gas, data have been provided by the Regione Piemonte (based on data from SNAM and Italgas companies[20]), classified according to the intended use. From them, the industrial component has been first extracted, and the consumption of the ETS industry (obtained through a direct request to the industries classified as ETS) has been subtracted from this component to get the non-ETS industrial consumption only. Eventually, the related emissions have been calculated by multiplying the electricity and natural gas consumption values by the related emissions factors adopted by the PAESC.

The division of the Baseline into Scopes, Macro-areas, and Sectors follows the guidelines developed by the *Global Protocol for Community-Scale Greenhouse Gas Inventories V.1.1*.[21]The categorization into Scope 1, Scope 2, and Scope 3 refers to the geographical location of energy consumption and emissions, using the administrative boundaries of the Città di Torino as a reference. [22]

In particular, the following macro-areas and sectors have been considered:

① Stationary energy (sectors: residential, tertiary, industrial and municipal buildings, industrial processes, waste-to-energy plant, and public lighting)

② Transport (sectors: municipal vehicles, private transport, and public transport)

16 Città di Torino (2023) PAESC – Piano d'Azione per l'Energia Sostenibile e per il Clima. http://www.comune.torino.it/ambiente/bm~doc/piano_azione_energia_sostenibile_clima_paesc.pdf

17 Città di Torino (2021) TAPE – Torino Action Plan for Energy. Terzo Rapporto di Monitoraggio. Available at http://www.comune.torino.it/ambiente/bm~doc/report_terzo_monitoraggio_ec1.pdf

18 ETS industries are those that participates to the Emission Trading System (ETS) of the European Union. The ETS is a cap & trade mechanism, setting the overall maximum value (cap) on the emissions permitted on European territory in the sectors covered by the ETS scheme, which corresponds to an equivalent number of allowances (1 ton of CO2eq. = 1 allowance) that can be purchased/sold on a specific market (trade). Each industrial operator active in the sectors covered by the scheme must compensate its actual annual emissions with a corresponding quantity of allowances. As requested in the Guidelines, only non-ETS industries have been considered for the calculation of the baseline.

③ Waste (sectors: landfill, waste and wastewater treatment systems)

④ Industrial Processes and Product Use (IPPU)

⑤ Agriculture, Forestry, and Other Land Use (AFOLU)

The commodities considered in the calculation are electricity, district heating, natural gas, refined petroleum products (GPL, fuel oil, diesel, petrol for internal combustion engines), biomass, solar thermal, and municipal solid waste.

Implementation of a facility for structuring & management, polishing & validation, and data storage (Torino's Energy & Transition Data Room – ETDR)

The data lakehouse is implemented by developing ad hoc web crawler systems for collecting and constantly updating the stored data and coding functions for data association among different datasets in different data sources. Contextually, data validation algorithms are developed – aiming to test the data's consistency and make any anomalies apparent to the users. Data are then validated and polished, when necessary, through dedicated software. The objective is the creation of an "Energy & Transition DataBase" of Torino – relational, integrated, and multi-domain – that allows data to be hosted on dedicated servers, validated, and made available for consultation or as input to both the models for scenario and impact assessment analyses and to the tracking of the evolutionary trajectory of the urban system. A prototype database version is already available and will be further developed.

In this framework, a "Torino's Energy & Transition Data Room" and visualization center (intended as a "research mirror" for hosting a copy of all the most relevant data of the city), which will be hosted at the EST@energycenter Lab of the Politecnico di Torino, has been designed and is currently in the implementation phase, with specific hardware and software equipment and 24-hour dedicated servers (for online calculation, database management, pre-and post-calculation support, visualization). In this perspective, the data lakehouse approach is coupled with the distributed database approach, which allows for higher resilience (since data are not stored on a single physical machine but distributed across multiple nodes physically located in different machines and replicated in such a way as to ensure redundancy) and performances (as through proper load balancers it is possible to balance the workload between different servers, even in the presence of numerous simultaneous queries) in comparison with traditional databases. This infrastructure will be based on a hyper-converged cluster and a distributed architecture with five nodes (and three copies of all the data distributed on these nodes).

Macro-action approach and catalog of the actions

The setting up of a data lakehouse and the calculation of the Baseline is preparatory to the definition of the actions to be implemented for reaching the 2030 decarbonization goal: for each sector and subsector, one or more macro-actions were defined.

The Action Plan for the Climate City Contract for Torino defines a set of 31 macro-actions – 27 macro-actions for emission reduction and 4 macro-actions for emission compensation (See Section 4, Part B). Macro-actions constitute both conceptual and operational scaffolding. Conceiving a strategy for decarbonizing the city implies an integrated and cross-sectoral vision of all macro-areas, sectors, and scopes covered by the Baseline. This synoptic vision aims to identify the different types of interventions possible in each industry, assessing their potential impact on the city in quantitative (GHG reduction) and qualitative (co-benefits) terms. This approach makes it possible to define macro-areas of intervention, thus setting strategies and defining policies to achieve the city's 2030 target.

They are not punctual interventions, with limited application area (e.g., a single building, a small stock of public vehicles) and limited impacts on GHG emissions reduction and compensation. Instead, they are intended as a broader taxonomy of actions (e.g., heat pumps, PV systems) targeting macro-areas and sectors (e.g., buildings, transport, lighting) – able to impact the overall urban system significantly and leading to relevant effects on the emission inventory of Torino. These wide-scale actions thus represent the general reference framework in which all the already ongoing/planned policies and the possible future interventions must be collocated.

Along the macro-actions, different sets of micro-actions targeting punctual elements of the sectors (e.g., a single municipal building, a school) have also been considered concerning the macro-area they belong to exemplify the macro-actions and account for the already implemented activities for sustainability (See Annex II).

Models and algorithm for impact assessment

For the different macro-actions, ad hoc in-house models were

19 IRETI SpA is a company belonging to the IREN Group that manages the distribution of electricity in Torino's Municipality. See https://www.ireti.it/home

20 SNAM is an energy infrastructure company that manages transportation, storage and regasification of natural gas; Italgas is a company specialized in gas distribution.

21 World Resources Institute, C40 Cities Climate Leadership Group and ICLEI – Local Governments for Sustainability (2016) Global Protocol for Community-Scale Greenhouse Gas Inventories. An Accounting and Reporting Standard for Cities V.1.1. https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

22 Scope 1 accounts for direct consumption and emissions within the metropolitan boundaries; Scope 2 accounts for indirect consumption and emissions related to electricity and heating supply within the metropolitan boundaries; finally, Scope 3 accounts for energy consumption and emissions outside the metropolitan boundaries as a result of activities within the administrative boundaries.

developed and documented to quantify – before and after the implementation of each action – the impact in terms of energy commodity consumption and GHG emissions associated with the consumption of the various commodities. The mathematical functions implementing the models are formalized and implemented through scripts coded in Python, translating the algorithms and JSON files to define their parameters.

The functions are then incorporated into the CLICC IT platform – which can elaborate the simultaneous combination of different types of actions for the estimation of their impacts in terms of GHG emissions avoided and the assessment of the related costs, providing a pre-compiled template for the documents (i.e., Commitment, Action Plan and Investment Plan of the CCC).

Development of an ad hoc IT platform for CCC definition and formalization in the framework of a more general digital twin tool for the city

For supporting the definition and drafting phases of the CCC, the CLICC platform was specifically designed and implemented to quantitatively assess the impacts of actions and pathways in terms of GHG emission reduction and the related costs, allowing the City decision-makers to test in silico, interactively, different policy options and identifying the combination of them that mainly fits with their strategies for reaching the climate neutrality.

The CLICC platform is the initial stepping stone of a broader strategic framework in which Torino is developing a digital twin of the city (currently under construction), intended to: ① provide a comprehensive and synoptic view of the urban system ② elaborate integrated multi-level and multi-sector urban models – comprising environmental models, models of the city building stock, transport models, models of urban energy infrastructures, models of waste treatment and circular economy and including stakeholders/social interactions and behavioral models; ③ assessing, in a multidimensional way, the impacts of the possible energy transition pathways of the city.

The CLICC platform is able to explore different "what if?" scenario analyses and impact assessments of diverse implementable sustainability pathways and track the system's evolution concerning the set targets.

Through a continuous interaction between the Municipality and the EST@energycenter Lab, the IT tool is translated in a user-friendly interface: a web platform supporting the policy decision-maker in exploring and comparing different strategies and policies related to the definition of the CCC and to the quantitative tracking of the city system's evolution, with respect to the set sustainability goals – selecting the preferred one based on his/her preferences in a user-friendly environment.

Furthermore, once defined the set of actions and the pathway, the platform allows for an automatic completion of the various sections of the CCC itself.

The CLICC platform is intended for several types of users: technical staff, in charge of the system management and operation; officers and administrators of the City, which can access to and exploit all the functions of the platform; utilities, which can create and test a set of actions; citizens, which can access to general evolutive tracking of the urban system towards the transition goals.

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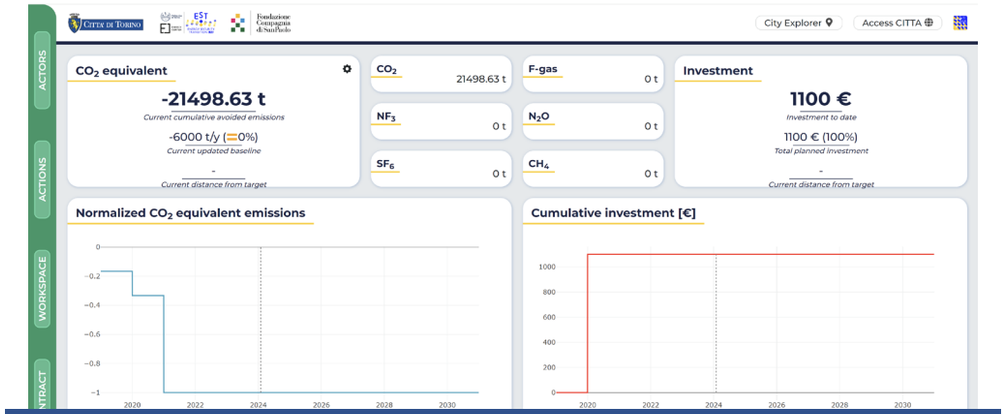
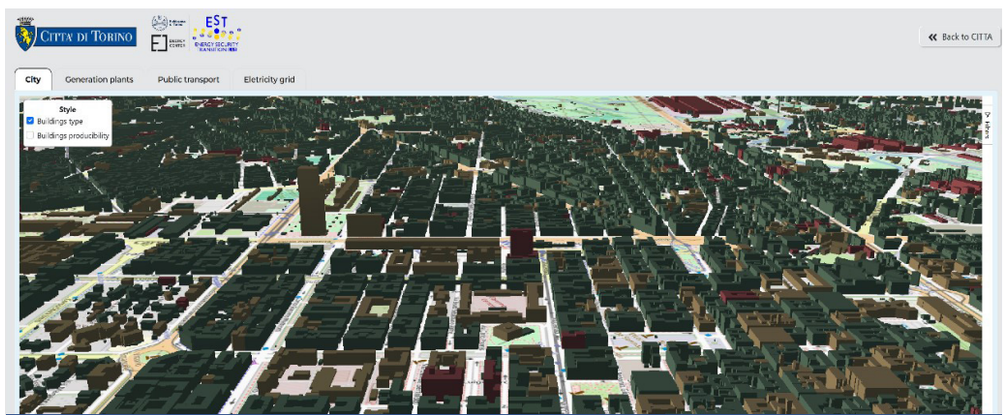
Work Process

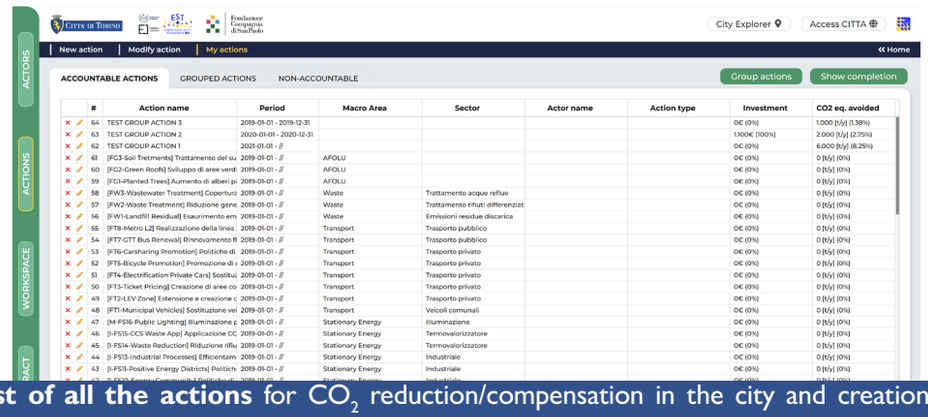
Online **accessibility** to different types of users with login **credential**



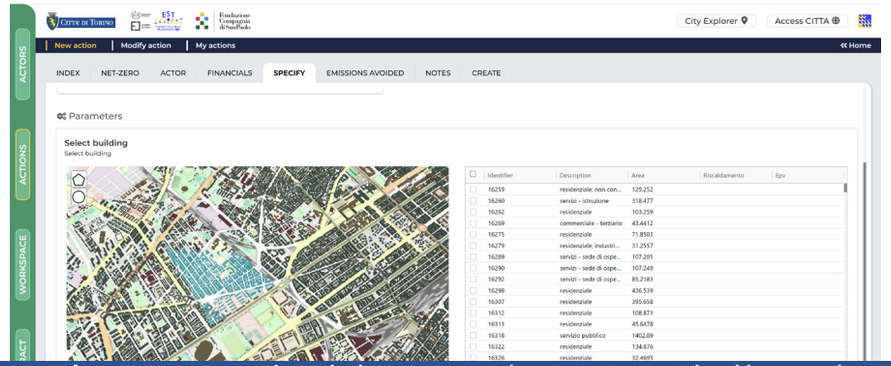
Dashboard for **targets** and evolutionary **tracking** visualization



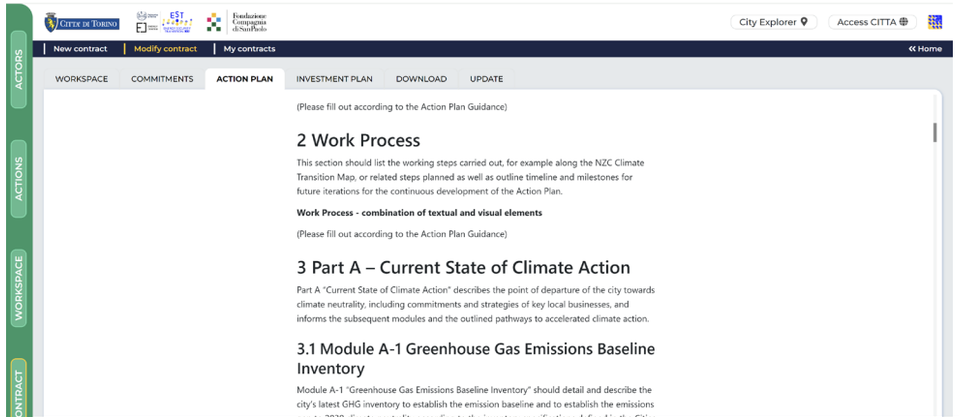
IT explorer to get familiar with the city and to design actions



List of all the actions for CO_2 reduction/compensation in the city and creation of pathways with computation of **emissions reduction/compensation** and related cost



Open environment to easily include existing and new actions with ad hoc mathematical models coded in **Python/Julia** language (no simple .xlsx files)



Automatic filling of the CCC documents (Commitments, Action Plan, Investment Plan)

Fig. 2.3 - Functioning of the CLICC IT Platform

3. PART A

The starting point for Torino:
current state of emissions and climate actions

3.1 Module A-1 :
Greenhouse Gas Emissions Baseline Inventory

As mentioned in Section 2, the division of the Baseline into Scopes, Macro-areas and sectors follows the guidelines developed by the Global Protocol for Community-Scale Greenhouse Gas Inventories. The categorization into Scope 1, Scope 2 and Scope 3 refers to the geographical location of energy consumption and emissions, using the administrative boundaries of the city as a reference. Scope 1 accounts for direct consumption and emissions related to fuels and other energy sources within the city boundaries; Scope 2 accounts for indirect consumption and emissions related to electricity and heating supply within the city boundaries; finally, Scope 3 accounts for energy consumption and emissions that occur outside the city boundaries as a result of activities within the administrative boundaries.

In particular, the following macro-areas and subsectors have been considered (see Figure 3.1.1):

① Stationary energy (sectors: residential buildings, tertiary buildings, industrial buildings and municipal buildings, industrial processes, waste-to-energy plant and public lighting)[23]

② Transport (sectors: municipal vehicles, private transport and public transport)

③ Waste (sectors: landfill, waste and wastewater treatment systems)

④ Industrial Processes and Product Use (IPPU)

⑤ Agriculture, Forestry and Other Land Use (AFOLU)

23 Henceforth, in the text, we will refer to the different sectors for brevity without repeating the word "buildings".

24 See https://www.gruppoiren.it/it/i-nostri-servizi/produzione-energia/impianti-di-cogenerazione.html

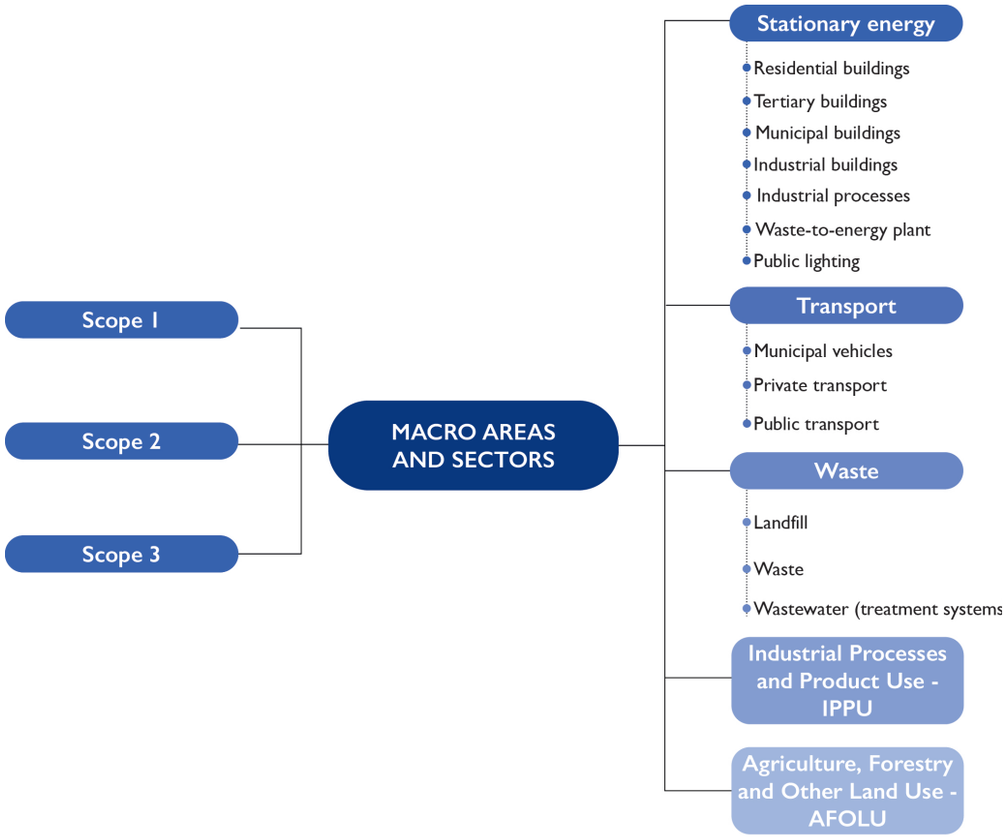


Figure 3.1.1 - Division in Macro-areas and Sectors

In the definition of the Baseline some assumptions have been adopted, for some specific subsectors, in computing the CO_2 emissions:

A1) Electricity generation and Waste-to-Energy (WtE) Power Plant: In the Città di Torino, the power station "Centrale Torino Nord" [24](which is an ETS plant), operated by the multi-utility company Iren and connected to the urban district heating network, is the prevailing source of GHG emissions related to the electricity and thermal energy generation within the city's boundaries. In any case, according to the *EU Mission Info Kit for Cities and the Global Protocol for Community-Scale Greenhouse Gas Inventories V.1.1* all the emissions related to the consumption of electricity and heat for district heating are accounted under the Scope 2.

Consistent with the *Global Protocol for Community-Scale Greenhouse Gas Inventories V.1.1*,[25] the emissions from waste-to-energy were accounted for in the Stationary Energy macro-area. The emission data of the waste-to-energy plant were obtained through the data indicated in 2022 Environmental Statement of the Torino Gerbido Waste-to-energy Plant[26], reduced in order to consider an average percentage of biogenic carbon of 60%.[27,28] This emission factor was applied to the data of urban waste flows of 2019 provided by ISPRA (Istituto Superiore per la Sostenibilità Ambientale - Institute for Environmental Sustainability),[29] AMIAT (Azienda Multiservizi Igiene Ambientale Torino - Multiservice Company Environmental Hygiene Torino),[30] Città Metropolitana di Torino and ATOR (Associazione d'Ambito Torinese per il Governo dei Rifiuti - TorinoArea Association for Waste Management).[31]

A2) Industrial Sector: The emissions and consumption of the industrial sector have been included in the macro-area "Stationary Energy". This is also in coherence with Deliverable 2.5 "Identified climate impact indicators based on existing indicators review" of the NetZeroCities project, which reports within the definition of "Stationary Energy", the entry "Energy industries: All emissions from energy production and energy use in energy industries".

According to the European Commission, contributions from industrial sectors that fall under the ETS are not considered; only those from non-ETS industries are relevant in the balance. The energy consumption and the emission of the industrial sector have been calculated according the procedure described in Section 2 (see pp. 27-28 of this Action Plan).

25 World Resources Institute, C40 Cities Climate Leadership Group and ICLEI – Local Governments for Sustainability (2016) Global Protocol for Community-Scale Greenhouse Gas Inventories. An Accounting and Reporting Standard for Cities V.1.1.https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

26 Torino Gerbido Waste-to-Energy Plant (2022) Environmental Statement.

27 JRC (2019) Best Available Techniques (BAT) Reference Document for Waste Incineration. https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

28 IFEU, Tool for calculating Greenhouse Gases (GHG) in Solid Waste Management (SWM). See https://www.ifeu.de/en/project/tool-for-calculating-greenhouse-gases-ghg-in-solid-waste-management-swm

29 See https://www.catasto-rifiuti.isprambiente.it/index.rino&cerca=cerca&&p=1

30 AMIAT S.p.a. is a company controlled by the Iren Group that manages soil hygiene, waste collection and disposal services. See https://www.amiat.it/

A3) Waste macro-area: The waste sector is not included in the PAESC and TAPE reports, but is required when defining the Baseline. For the calculation of the Baseline, emissions related to the Basse di Stura landfill were therefore considered. [32]

The Basse di Stura controlled burial landfill plant covers an area of nearly one million square meters, with a total volume of nearly 20 m^3; It is "the first Italian landfill equipped with an environmental management system with UNI EN ISO 14001:2004 certification, considered among the most advanced in Italy and Europe for the treatment and disposal of undifferentiated waste". [33]

The Basse di Stura landfill is divided into two parts: the Old Landfill, whose contribution began in 1947 and continued until 1981, and the New Landfill, which was authorized in December 1979 and ceased in 2010; in 2010, the "post-mortem" management of the site began, which led to the total environmental recovery of the area through both the planting of the vegetation cover (turf) of the site and the creation of tree barriers around the perimeter of the site to mitigate the visual impact of the plant, and the "securing of the old landfill, already converted into a green area (Marmorina Park), which had been in operation from the post-war period until the 1980s and was only partially waterproofed".[34]

Today, the unsorted waste collected by AMIAT (the company that provides integrated management of soil hygiene, waste collection and disposal services in the Città di Torino) within the perimeter of the Città di Torino is directed to the metropolitan waste-to-energy plant.

Referring to the waste treatment, the quantity of sorted waste produced by the Città di Torino in 2019 was identified in accordance with AMIAT's guidelines.[35]Thanks to the "Waste Management Status Report",[36] it was possible to identify the waste processed within the city limits (included in Scope 1) and outside of it (included in Scope 3). The emission factors applied are in line with IFEU's recommendations.[37]

The emissions associated with wastewater were instead calculated by applying a proportion based on the population of Torino, using the values reported in SMAT's 2020 Sustainability Report. [38,39,40] As the city's wastewater is treated outside its municipal boundaries, these emissions have been categorized within Scope 3.

A4) IPPU and AFOLU: Emissions associated with the IPPU and AFOLU macro-areas have been considered negligible, in the framework of the Baseline calculation.

The IPPU macro-area only includes the uses of commodities not related to energy. It has to report "Emissions from GHGs used in, or as a by-product of industrial processes and products (if present / significant)",[41]while the AFOLU macro-area should report "Changes in GHG emissions from any changes in land use giving rise to (sources) or sequestering (sinks) emissions (if significant)".

The consumptions and emissions values related to the IPPU macro-area originally released in the Expression of Interest were a preliminary assessment of the whole industrial sector for the third monitoring report of the Turin Action Plan for Energy (TAPE), issued in 2022. In particular, all the emissions related to the industrial energy consumption were attributed to the IPPU macro-area, not complying with the indications provided by the *NetZeroCities 2030 Climate Neutrality Action Plan Guidance and Explanation* (see p.8, pp.31-32): they were referred to the overall industrial sector including both ETS industry (for which only the consumption of natural gas was considered) and Non-ETS industry (for which both natural gas and electricity consumptions were taken into account).

For the definition of the baseline emission inventory of the Climate City Contract, instead, a complete review of this assessment has been made, taking into account that emissions from energy use in manufacturing and industrial facilities, construction activities and energy industries fall under the stationary energy macro-area, and not under the IPPU one. Consequently, the emissions associated to the IPPU macro-area have been considered negligible due to the fact that within the boundary of the city there are no major industries that chemically or physically transform materials releasing significant amount of GHGs.

Regarding emissions from the AFOLU macro-area, which are predominantly non-CO_2 gases (especially N_2O and CH_4 [42]), they have been considered negligible due to the limited area that is devoted to crop production and livestock activities within the city of Turin. In fact, the crop surface within the urban boundary is limited to 2 km^2,[43] corresponding to 2% of the total green area. Moreover, it has been shown ,[44,45] that urban food production actually plays a positive role in reducing greenhouse gas emissions compared with the conventional food system because of its potential to produce food with lower intensity of transportation, energy use, and packaging, and greater carbon sequestration

31 Osservatorio Metropolitano Rifiuti, ATO-Rifiuti Torinese (2020) Rapporto sullo stato del sistema di gestione rifiuti, Novembre 2020.http://www.cittametropolitana.torino.it/cms/risorse/ambiente/dwd/rifiuti/Osservatorio_rifiuti/Rapporto_rifiuti_2020/RapportoRifiuti2020.pdf

32 AMIAT (2022) Impianto ad interramento controllato "Basse di Stura". Stato d'avanzamento attività discarica e attività di gestione del Biogas. Anno 2022. https://www.amiat.it/ See https://www.amiat.it/ciclo-integrato-dei-rifiuti/destino-frazioni-raccolte/impianti/interramento-controllato-basse-di-stura

33 See https://www.amiat.it/ciclo-integrato-dei-rifiuti/destino-frazioni-raccolte/impianti/interramento-controllato-basse-di-stura

34 See https://www.amiat.it/ciclo-integrato-dei-rifiuti/destino-frazioni-raccolte/impianti/interramento-controllato-basse-di-stura

35AMIAT – Azienda Multiservizi Igiene Ambientale Torino (2019) Risultati di Raccolta Differenziata a Torino al 31 Dicembre 2019 https://www.amiat.it/ documents 4016/2019-anno-risultati-RD-Torino/16f6dda6-947c-41ad-9d23-c949d8089b0f

36 Osservatorio Metropolitano Rifiuti, ATO-Rifiuti Torinese (2020) Rapporto sullo stato del sistema di gestione rifiuti, Novembre 2020. http://www.cittametropolitana.torino.it/cms/risorse/ambiente/dwd/rifiuti/Osservatorio_rifiuti/Rapporto_rifiuti_2020/RapportoRifiuti2020.pdf

37 IFEU, Tool for calculating Greenhouse Gases (GHG) in Solid Waste Management (SWM). See https://www.ifeu.de/en/project/tool-for-calculating-greenhouse-gases-ghg-in-solid-waste-management-swm

38 SMAT (2020) Bilancio di sostenibilità. Responsabilità economica, sociale e ambientale. https://www.smatorino.it/wp-content/uploads/2021/07/Sostenibilita_Completo.pdf

39 ISTAT (2019) Censimenti Permanenti Popolazione e Abitazioni. Capoluoghi delle Città Metropolitane: Torino. https://www.istat.it/it/files//2021/11/TORINO-infografica.pdf

40 SMAT, La depurazione delle acque reflue urbane. https://www.smatorino.it/wp-content/uploads/2018/09/quaderno_depurazione.pdf

when the proper crop is selected[46] and the garden is managed individually.

Finally, in the AFOLU framework, the impact of maintenance activities is minimal, further justifying the negligible consideration of AFOLU emissions in the urban context. Urban green-related emissions are ascribable to construction works (excavation, transportation and forestry production) and maintenance activities (the use of lawnmowers, trimmers, leaf blowers, trees pruning and transportation of personnel and equipment). Additionally, the production and transport of fertilizers and other maintenance materials can contribute to CO_2 emissions. The total CO_2 emissions associated with urban green have been estimated around 5% of the amount of CO_2 absorbed[47] which is within the uncertainty band of the estimated CO_2 capture. Due to this reason, this value has not been accounted for in the present version of the Climate City Contract.

The AFOLU macro-area, although negligible in terms of emissions, is nevertheless particularly important with regard to CO_2 sinks (associated with urban forestation and greenery), as it is in this sector that these negative contributions should be accounted for.

Emissions associated with biomass consumption have always been assumed to be zero – i.e., assuming that all biomass used is certified.

The following **Table A-1.1** shows the energy consumption by commodity (expressed in MWh/year) calculated for Scopes, Macro-areas, Sectors and Sub-sectors.

41 EU Mission Info Kit for Cities, p. 22.

42 IPCC (2022), Sixth Assessment Report, WG III, FAQ 7.1 | Why is the Agriculture, Forestry and Other Land Uses (AFOLU) sector unique when considering GHG mitigation?

43 Città di Torino, Orti urbani, http://www.comune.torino.it/verdepubblico/orti-urbani/

44 David A. Cleveland et al. (2017): The potential for urban household vegetable gardens to reduce greenhouse gas emissions, Landscape and Urban Planning, Vol. 157,2017, pp. 365-374. Available at https://www.sciencedirect.com/science/article/pii/S0169204616301323

45 M. Kulak et al. (2013): Reducing greenhouse gas emissions with urban agriculture: A Life Cycle Assessment perspective, Landscape and Urban Planning, Volume 111, 2013, pp. 68-78, Available at https://www.sciencedirect.com/science/article/pii/S0169204612003209

46 Hawes, J.K., Goldstein, B.P., Newell, J.P. et al. Comparing the carbon footprints of urban and conventional agriculture. Nat Cities 1, 164–173 (2024). Available at https://doi.org/10.1038/s44284-023-00023-3

47 Michael W. Strohbach et al (2012): The carbon footprint of urban green space—A life cycle approach, Landscape and Urban Planning, Volume 104, Issue 2, 2012, pp. 220-229, Available at https://www.sciencedirect.com/science/article/pii/S016920461100301X

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Table A-1.1 Final energy use by source sector

Macro-area	Sector	Sub-sector	Energy Consumption [MWh/year] SCOPE 1 Natural gas	GPL	Fuel Oil	Diesel	Gasoline	Biomass	Solar Thermal	Municipal Solid Waste	SCOPE 2 Electricity	Heat for district heating	SCOPE 3 Municipal Solid Waste	"Total Energy Consumption [MWh/y]"
STATIONARY ENERGY	Municipal	Minicipal buildings	89,807	-	-	-	-				55,592	140,062		285,461
		Public lighting	-	-	-	-	-				59,200	-		59,200
	Residential	-	1,424,218	13,636	19,201	-	-	22,702	2,466		856,616	1,279,118		3,617,957
	Tertiary	-	942,040	-	-	-	-	806	667		1,126,551	361,745		2,431,809
	Industrial	Non-ETS	1,344,411	-	-	-	-				237,310	-		1,581,721
	Waste-to-Energy	-	-	-	-	-	-				-	-		-
TRANSPORT	Municipal vehicles	Moped	-	-	-	-	7				-	-		7
		Motorcycles	-	-	-	-	66				-	-		66
		Passenger motor vehicles	461	125	-	680	1,319				9	-		2,594
		Trucks GVW < 3500 kg	43	-	-	213	93				18	-		367
		Trucks 3500 kg < GVW < 12000 kg	-	-	-	11	-				-	-		11
		Trucks GVW > 12000 kg	-	-	-	4	-				-	-		4
	Private transport	Passenger cars	34,265	150,949	-	492,399	859,809				276	-		1,537,698
		Motorcycles	-	-	-	-	92,574				4	-		92,578
		Industrial vehicles	18,784	12,477	-	564,214	24,226				567	-		620,268
		Buses (excluding GTT city buses)	-	-	-	31,859	580				-	-		32,439
	Public transport	Tramway	-	-	-	-	-				26,107	-		26,107
		GTT rail network	-	-	-	-	-				1,380	-		1,380
		Trenitalia rail network	-	-	-	-	-				4,139	-		4,139
		Metro	-	-	-	-	-				16,471	-		16,471
		Urban vehicles	61,805	-	-	107,273	-				-	-		169,078
TOTAL			3,915,833	177,187	19,201	1,196,653	978,674	23,508	3,133	-	2,384,240	1,780,925	-	10,479,355

Part A – The starting point for Torino: current state of emissions and climate actions

Summary of energy consumption by Scopes and Sectors. With regard to Scopes 1 and 2, the most relevant energy consumption belongs to the Stationary Energy macro-area and involves the residential sector (3,617,957 MWh/y, i.e., 34.5% of the total), followed by the tertiary sector (2,431,809 MWh/y, 23.2% of the total) and the non-ETS industrial sector (1,581,721 MWh/y, 15.1% of the total). The whole Stationary Energy macro-area accounts for 76.1% of the total final energy consumption of Torino in 2019.

Another macro-sector that significantly affects the overall energy consumption is private transport (21.8% of the total), mainly due to passenger cars (1,537,698 MWh/y) and industrial vehicles (620,268 MWh/y); as far as public transport is concerned, urban vehicles (169,078 MWh/y) have the greatest impact. The whole public transport, however, is responsible for just 1.8% of the overall energy consumption of the city.

The energy commodities utilized in wastewater treatment, waste treatment, and waste-to-energy processes are excluded from this table. This omission is due to their inclusion in the emission factors used to assess emissions within the waste sector. Specifically, the adopted methodology integrates emissions associated with energy commodity consumption (such as diesel and electricity) into the treatment processes for various types of waste. This approach aims to prevent double counting; hence energy commodity consumption is not separately listed here.

Moreover, the energy consumption in the IPPU and AFOLU macro-areas are not accounted for in the calculation. In fact, as previously mentioned, there are no relevant industries that chemically or physically transform materials releasing GHGs nor agricultural activities within the urban perimeter; only the absorption of emissions from urban green areas - including parks, trees, green areas and hilly green areas - is taken into account, but this does not affect the energy consumption.

Summary of consumption by commodity. In the residential sector, consumption related to heat for district heating (1,279,118 MWh/y, i.e., 35.4% of the total energy consumption of the sector) and natural gas (1,424,218 MWh/y, 39.4% of the sectorial total) are the most important ones, followed by electricity (856,616 MWh/y, 23.7% of the sectorial total). For the tertiary sector, the most relevant commodities are electricity (1,126,551 MWh/y, 46.3% of the sectorial total) and natural gas (942,040 MWh/y, 38.7% of the sectorial total). For the non-ETS industrial sector, a major role is played by natural gas (1,344,411 MWh/y, 85% of the sectorial total).

In the private transport sector, as expected, the commodities with the greatest impact in terms of consumption are gasoline for passenger cars (859,809 MWh/y, 55.9% of the sectorial total) and diesel from industrial vehicles (492,399 MWh/y, 91.0% of the sectorial total). In 2019 the electrification of private transport was still negligible.

Overall consumption balance. The largest consumption results from the use of natural gas (3,915,833 MWh/y, 37.4% of the total), electricity (2,384,240 MWh/y, 22.8% of the total), heat for district heating network (1,780,925 MWh/y) and refined petroleum products (2,371,715 MWh/y, 22.6% of the total).

The energy consumption in 2019 by scope, macro-area and sector is graphically represented in the following Figures 3.1.2 and 3.1.3.

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Part A – The starting point for Torino: current state of emissions and climate actions

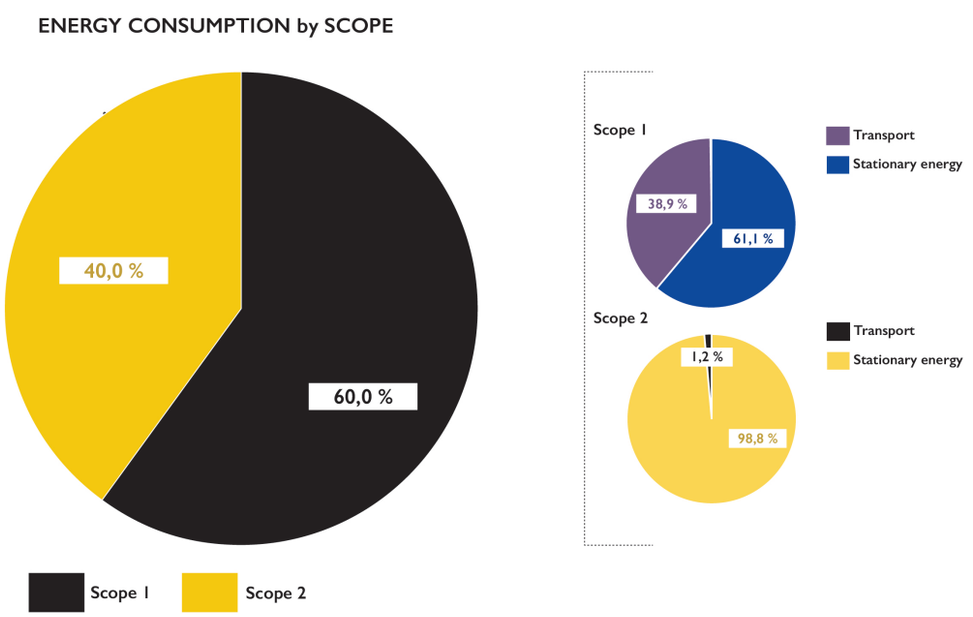

Figure 3.1.2 – Energy consumption by scope and macro-area

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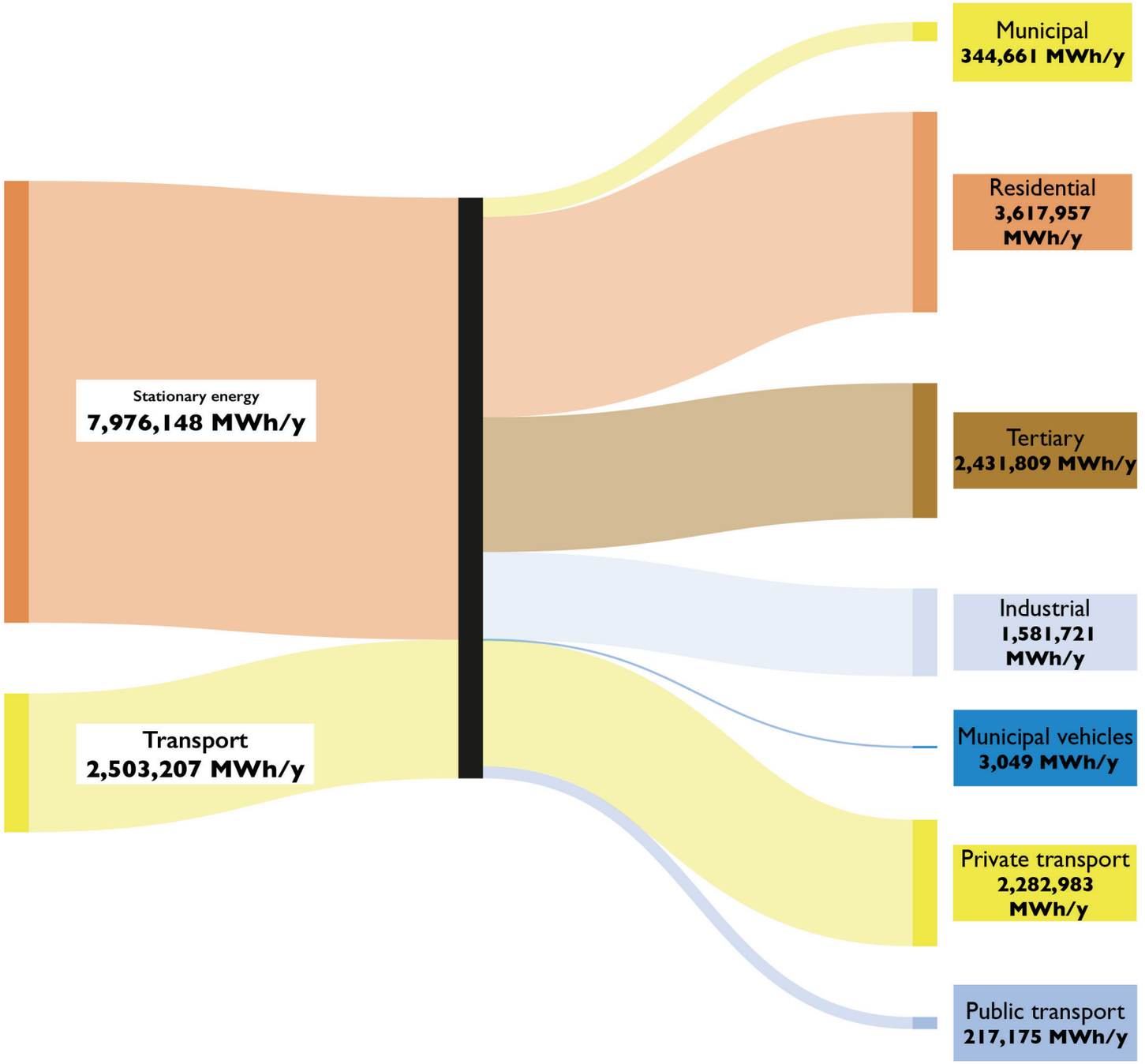

Figure 3.1.3 – Energy consumption by sectors and sub-sectors (MWh/y)

Table A-1.2 shows the Emission Factors used to define the Baseline of CO_2 emissions. In adherence to what is reported in the PAESC, in order to calculate the municipal emissions balance, the determination of the Emission Factors considered different sources: the 2006 IPCC – Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories[48]were integrated with the data provided by ISPRA and Iren Energia (in the reworking provided by the PAESC).

Table A-1.2 – Emission factors by commodity

	Emission Factor	Unit of Measure	Sources
Electricity	0,245	tCO_2/MWh	ISPRA, re-elaboration of PAESC
District Heating	0,161	tCO_2/MWh	Iren, re-elaboration of PAESC
Natural Gas	0,202	tCO_2/MWh	IPCC 2006
GPL	0,231	tCO_2/MWh	IPCC 2006
Fuel oil	0,279	tCO_2/MWh	IPCC 2006
Diesel	0,267	tCO_2/MWh	IPCC 2006
Gasoline	0,249	tCO_2/MWh	IPCC 2006
Renewable sources	0	tCO_2/MWh	IPCC 2006
Paper treatment	0.180	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Glass treatment	0.020	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Aluminum treatment	0.850	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Plastic treatment	0.550	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Green waste composting	0.192	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Organic waste anaerobic digestion	0.033	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Metals treatment	0.022	tCO_2 eq/twaste	IFEU, SWM-GHG Calculator
Waste-to-energy plant	0.434	tCO_2 eq/twaste	TRM Torino Plant, Environmental Declaration
Wastewater treatment	0.131	$kgCO_2$ eq/m^3	SMAT,Bilancio di sostenibilità 2020

The analysis of the activity sectors included in the emissions inventory (with the exception of the IPPU and AFOLU macro-areas) and the associated GHG emissions has maintained an approach based mainly on the calculation of CO_2 alone, with the exception of the Waste macro-area, because the significance of the other main GHGs (CH_4 and N_2O) in the sectors considered is not relevant and no specific measures for their reduction

are planned. In the Waste macro-area, instead, CO_2 equivalent emissions have been considered, as waste treatment processes involve significant greenhouse gas emissions other than CO_2, such as methane and nitrous oxide; considering, for example, anaerobic digestion and composting, the emissions of CH_4 (methane) and N_2O (nitrous oxide) are relevant, especially by taking into account their Global Warming Potential[49]per 100 years of 27.2 and 273 respectively (2006 IPCC Guidelines).

For what concerns the waste sector, the emissions related to the sorted waste (paper, glass, aluminum, plastic, green waste, organic waste, metals) treated in Torino, which in 2019 overall amounted to 208,736 t/y[50] and the emissions related to the treatment of wastewater (accounting to 120.25 Mm^3/y).

Moreover, the emission data of the waste-to-energy plant were obtained through the data indicated in 2022 Environmental Statement of the Torino Gerbido Waste-to-energy Plant[51], reduced in order to consider a mean percentage of biogenic carbon of 60% [52,53] . This emission factor was applied to the urban unsorted waste flow of 2019 equal to 229,020 t/y, provided by ISPRA, AMIAT, Città Metropolitana di Torino and ATOR.[54,55,56]

With regard to electricity consumption and district heating, a local emission factor was defined, calculated according to the methodology defined in the PAESC Guidelines.

The local emission factor associated with the heat distributed by the city's district heating network was calculated from the data reported in the environmental declarations of the relevant power stations (IREN Torino Nord power station and IREN Moncalieri power station).

With regard to the FENEE factor (national emission factor for electricity), in line with what is indicated by the Covenant of Mayors guidelines, the national one proposed by the Istituto superiore per la protezione e la ricerca ambientale (ISPRA - Superior Institute for Environmental Protection and Re-search) was used instead of the IPCC one.

Assumption on the emissions calculation

Table A-1.3 shows the Baseline CO_2 emissions (in terms of tonnes of CO_2 per year) calculated for Scopes, Macro-areas, Sectors and Subsectors; emissions of the remaining GHG were considered negligible, as their impact on the total balance is limited. A quantitative assessment of their contribution will be performed in

48 IPCC National Greenhouse Gas Inventories Programme (2006) 2006 IPCC Guidelines for National Greenhouse Gas Inventories. https://www.ipcc-nggip.iges.or.jp/public/2006gl/

49 The Global Warming Potential is a measure of how much energy the emissions of 1 t of a gas will absorb over a given period of time, relative to the emissions of 1 t of CO_2

50 See https://www.catasto-rifiuti.isprambiente.it/index.

51 Torino Gerbido Waste-to-Energy Plant (2022) Environmental Statement.

52 JRC (2019) Best Available Techniques (BAT) Reference Document for Waste Incineration. https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

53 IFEU, Tool for calculating Greenhouse Gases (GHG) in Solid Waste Management (SWM). See https://www.ifeu.de/en/project/tool-for-calculating-greenhouse-gases-ghg-in-solid-waste-management-swm

54 See https://www.catasto-rifiuti.isprambiente.it/

subsequent releases of the CCC. For all macro-areas and sectors, a re-evaluation of the consumption and emissions values was carried out compared to the estimates reported in the PAESC and third TAPE monitoring report.

Emissions associated with the consumption of biomass have been assumed to be zero, i.e., assuming that all biomass used is certified (according to the criteria set out in the "Info Kit" of the "EU Mission: Climate Neutral and Smart Cities" it would be necessary to know whether the biomass considered in the energy balance is certified, and therefore does not contribute to GHG emissions).

55 AMIAT – Azienda Multiservizi Igiene Ambientale Torino (2019) Risultati di Raccolta Differenziata a Torino al 31 Dicembre 2019 https://www.amiat.it/d/597091/624016/2019-anno-risultati-RD-Torino/16f6dda6-947c-41ad-9d23-c949d8089b0f

56 Osservatorio Metropolitano Rifiuti, ATO-Rifiuti Torinese (2020) Rapporto sullo stato del sistema di gestione rifiuti, Novembre 2020. http://www.cittametropolitana.torino.it/cms/risorse/ambiente/dwd/rifiuti/Osservatorio_rifiuti/Rapporto_rifiuti_2020/RapportoRifiuti2020.pdf

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Table A-1.3: GHG emissions by source sectors

Macro-area	Sector	Sub-sector	Emissions per commodity [t/y]											CO_2 Emissions [t/y]
			SCOPE 1								SCOPE 2		SCOPE 3	
			Natural gas	GPL	Fuel Oil	Diesel	Gasoline	Biomass	Solar Thermal	Municipal Solid Waste	Electricity	Heat for district heating	Municipal Solid Waste	
STATIONARY ENERGY	Municipal	Minicipal buildings	18,141.00								13,620.00	22,550.00		54,311.00
		Public lighting									14,504.00			14,504.00
	Residential	-	287,692.00	3,150.00	5,357.00			-	-		209,871.00	205,938.00		712,008.00
	Tertiary	-	190,292.00					-	-		276,005.00	58,241.00		524,538.00
	Industrial	Non-ETS	271,571.00								58,141.00			329,712.00
	Waste-to-Energy	-								99,351.00				99,351.00
TRANSPORT	Municipal vehicles	Moped					1.74							1.74
		Motorcycles					16.43							16.43
		Passenger motor vehicles	93.12	28.88		181.56	328.43				2.21			634.19
		Trucks GVW < 3500 kg	8.69			56.87	23.16				4.41			93.12
		Trucks 3500 kg < GVW < 12000 kg				2.94								2.94
		Trucks GVW > 12000 kg				1.07								1.07
	Private transport	Passenger cars	6,921.53	34,869.22		131,470.53	214,092.44				67.62			387,421.34
		Motorcycles					23,050.93				0.98			23,051.91
		Industrial vehicles	3,794.37	2,882.19		150,645.14	6,032.27				138.82			163,492.78
		Buses (excluding GTT city buses)				8,506.35	144.42							8,650.77
	Public transport	Tramway									6,396.22			6,396.22
		GTT rail network									338.10			338.10
		Trenitalia rail network									1,014.06			1,014.06
		Metro									4,035.40			4,035.40
		Urban vehicles	12,484.61			28,641.89								41,126.50
WASTE	Separate waste treatment	-								4,873.00			18,959.00	23,832.00
	Waste water treatment	-											15,730.00	15,730.00
	Landfill	-								21,761.00				21,761.00
IPPU	-	-												-
AFOLU	-	Absorption by urban green												-35,117.00
TOTAL			**790,998.32**	**40,930.28**	**5,357.00**	**319,506.35**	**243,689.83**	**-**	**-**	**125,985.00**	**584,138.80**	**286,729.00**	**34,689.00**	**2,396,906.57**

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Stationary Energy

Stationary Energy includes the following sectors and sub-sectors: municipal buildings; public lighting; residential buildings; tertiary buildings; waste-to-energy plant (according to the Global Protocol for Community-Scale Greenhouse Gas Inventories V.1.1[57]); non-ETS industry (for which the emissions related to the consumption of energy commodities have been accounted for coherently with what described in Section 2, pp. 27-28 of this Action Plan).

Emissions associated to the consumption of fossil commodities (predominantly natural gas) have been included into Scope 1, while emissions related to the consumption of electricity and heat for district heating have been included in Scope 2.

Transport

Transport includes municipal vehicles, private transport and public transport, further subdivided according to different types of vehicles (e.g., passenger cars, motorcycles, industrial vehicles and buses for what concerns private transport; tramway, rail, metro, urban vehicles for what concerns public transport; motorcycles, passenger vehicles and trucks for municipal vehicles).

Emissions associated to the consumption of fossil commodities (especially refined oil products) have been included into Scope 1, while emissions related to the consumption of electricity have been included in Scope 2.

Waste

According to the CCC guidelines, emissions from waste generated and managed within the city have been accounted for in Scope 1, while Scope 3 includes emissions from waste generated within the city but managed externally.

Scope 1:

- residual emissions from the Basse di Stura landfill[58]
- emissions from the waste-to-energy plant (share related to waste from the Città di Torino)
- emissions from sorted waste management within the Città di Torino

Scope 3:

- emissions from the management of sorted waste produced by the Città di Torino and treated outside the city boundaries

57 World Resources Institute, C40 Cities Climate Leadership Group and ICLEI – Local Governments for Sustainability (2016) Global Protocol for Community-Scale Greenhouse Gas Inventories. An Accounting and Reporting Standard for Cities V.1.1. https://ghgprotocol.org/sites/default/files/standards/GPC_Full_MASTER_RW_v7.pdf

58 In the emissions related to the Basse di Stura landfill, CH4 figure is negligible (therefore not counted), while CO2 figure is reported. See AMIAT (2022) Impianto ad interramento controllato "Basse di Stura". Stato d'avanzamento attività discarica e attività di gestione del Biogas. Anno 2022. https://www.amiat.it/s/597091/624022/2022_relaz_ANNUALE_Biogas.pdf/3d1d527e-2b05-4b13-ab4d-64d5202bef23

59 JRC (2019) Best Available Techniques (BAT) Reference Document for Waste Incineration. https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

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- emissions from wastewater treatment

As stated in the JRC guidelines[59], the only percentage of carbon to be considered for the calculation of emissions is carbon of fossil origin, which for municipal waste is around 40% of the total. The emission factor of the waste-to-energy plant (measured in the stack) is then multiplied by this percentage, resulting in 2019 emissions of 99,351 tCO_2/y.

In the Waste macro-area, wastewater emissions were also added, calculated on the basis of the emissions declared by SMAT and considering only the amount of wastewater from the Città di Torino. Emissions have been accounted in Scope 3, due to the fact that the treatment plant is located in Castiglione Torinese, outside the boundaries of the city.

IPPU and AFOLU

As previously stated, the IPPU and AFOLU macro-areas have not been accounted for in terms of emissions. For what concerns the AFOLU macro-area, the absorption of CO2 by existing green areas has been considered.

Summary of emissions by Scope and Sectors. As far as Scope 1 and 2 are concerned, the largest emissions concern the Stationary Energy macro-area and involve the residential sector (712,008 t/y, i.e. 29.7% of the total CO_2 emissions of the city), followed by the tertiary sector (524,538 t/y, 21.9% of the total) and the non-ETS industrial sector (329,712 t/y 13.8% of the total).

Another sector widely affecting emissions is private transport, especially with reference to by passenger cars (387,421 t/y 16.2% of the total), industrial vehicles (163,493 t/y, 6.8% of the total); as far as public transport is concerned, urban vehicles account for only 1.7% of the total urban emissions (41,127 t/y).

Regarding the AFOLU macro-area, the existing green areas are able to absorb 35,117 t/y of CO2, corresponding to 1.5% of the total.

Summary of CO_2 emissions by commodity and by sector (t/y). In the residential sector, emissions related to natural gas (287,692 t/y, 40.4% of the total emissions of the sector), electricity (209,871 t/y, 29.5% of the sectorial total) and heat for district heating (205,938 t/y, 28.9% of the sectorial total) have the greatest impact. For the tertiary sector, the commodities

59 JRC (2019) Best Available Techniques (BAT) Reference Document for Waste Incineration. https://eippcb.jrc.ec.europa.eu/sites/default/files/2020-01/JRC118637_WI_Bref_2019_published_0.pdf

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with the greatest incidence are mainly electricity (276,005 t/y, 52.6% of the sectorial total) and natural gas (190,292 t/y, 36.3% of the sectorial total). For the non-ETS industrial sector, the consumption of natural gas is responsible of the largest part of the sectorial emissions (271,571 t/y, 82.4% of the sectorial total) is the most important commodity.

In the private transport sector, the majority of CO_2 emissions arises from gasoline consumption of passenger cars (214,092 t/y, 55.3% of the sectorial total) and diesel consumption of industrial vehicles (150,645 t/y, 92.1% of the sectorial total).

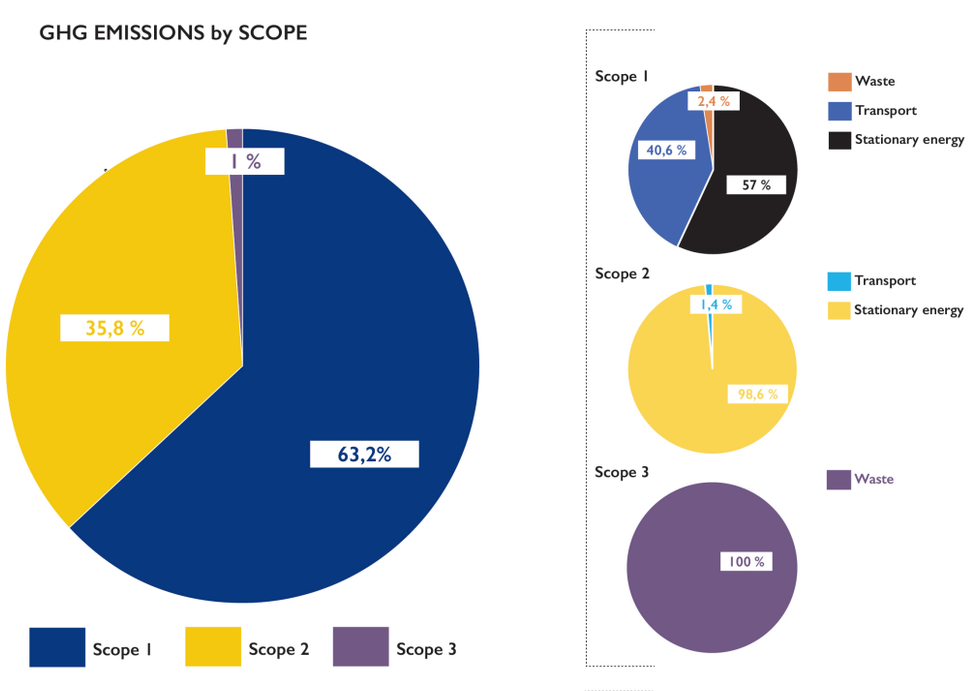
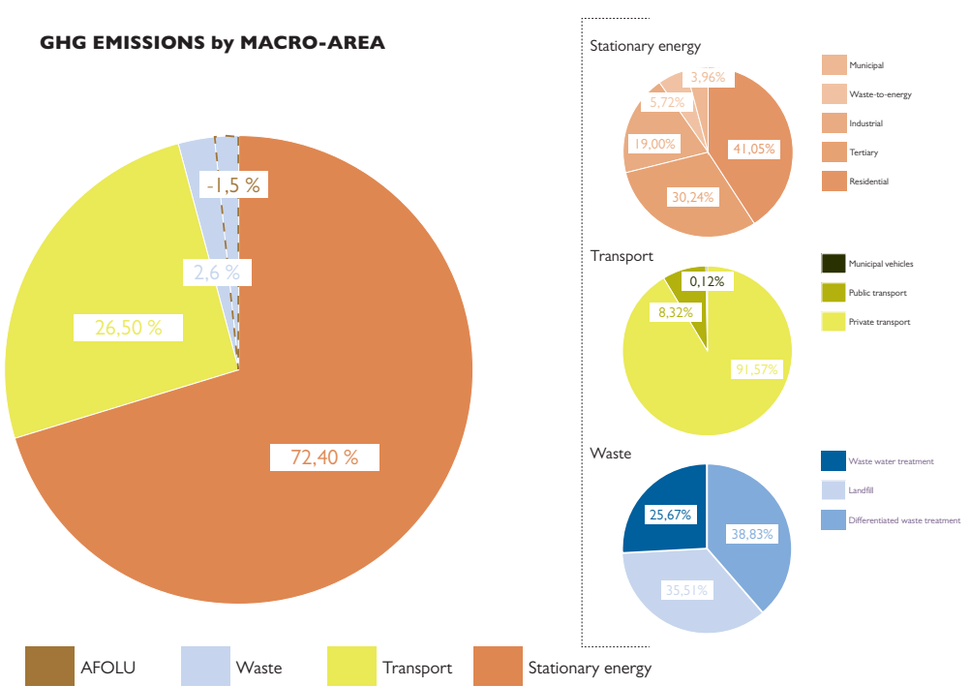


Fig. 3.1.4 – Emissions by scopes and macro-areas

Overall emissions balance. The baseline of the Torino CCC, as of 2019, has been quantified at 2,396,907 tCO_2/y. The largest emissions come from the use of natural gas (790,998 t/y, 33.0% of the total), electricity (584,139 t/y, 24.4% of the total) and refined petroleum products (609,483 t/y, 25.4% of the total).

The emissions in 2019 by scope, macro-area and sector are graphically represented in the following Figures 3.1.4 and 3.1.5.



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EMISSIONS by MACRO-AREA

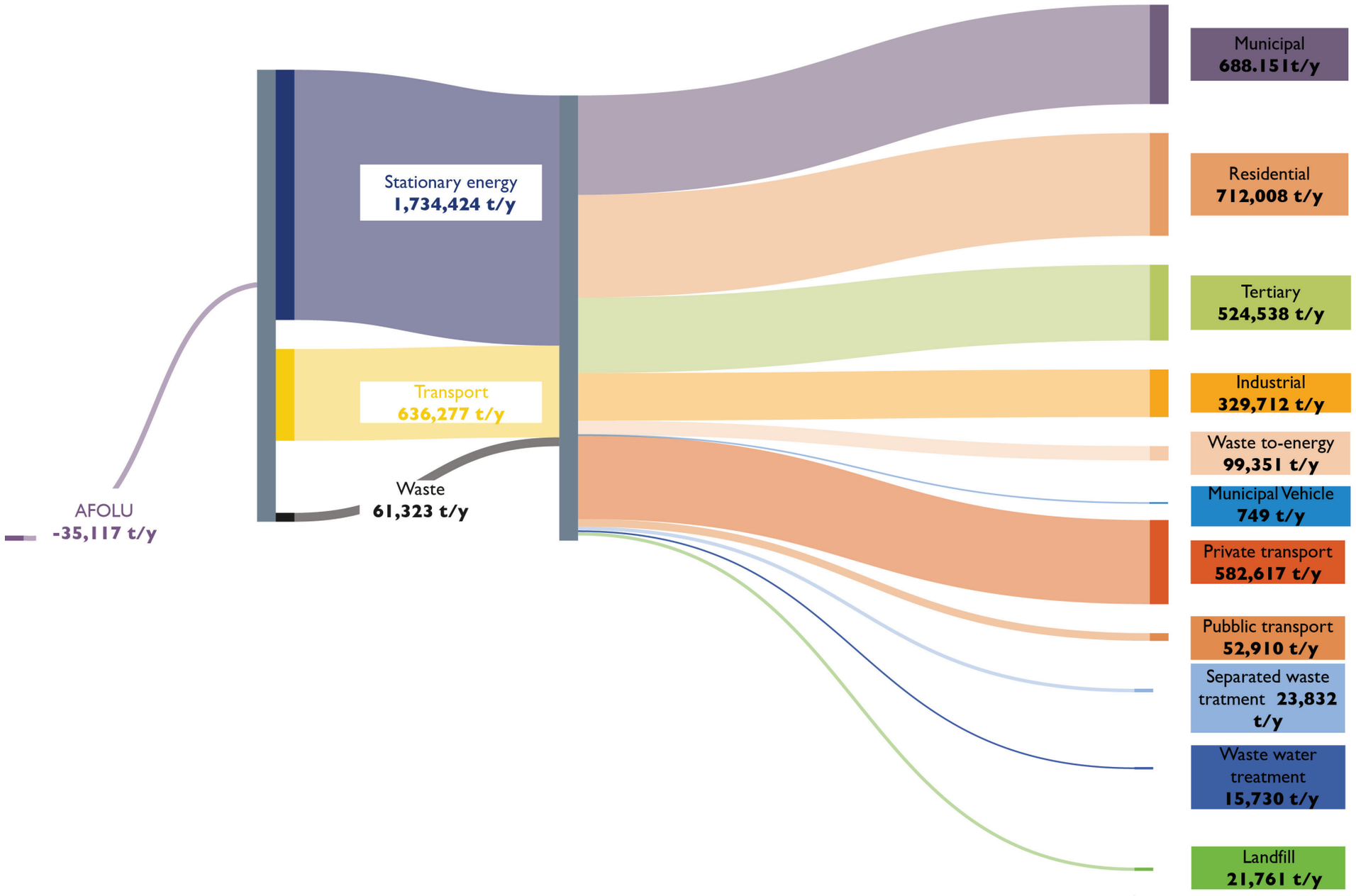

Fig. 3.1.5 – Emissions by macro-areas, sectors and sub-sectors

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Table A-1.4 summarizes the activities considered for each macro-area and sector and divided in Scope 1, Scope 2 and Scope 3, assuming 2019 as the Base year.

Table A-1.4: Activity by source sectors in 2019

Base Year: 2019

Macro area	Sector	Sub-sector	SCOPE 1	SCOPE 2	SCOPE 3
STATIONARY ENERGY	Municipal	Municipal buildings	X	X	
		Public lighting		X	
	Residential	-	X	X	
	Tertiary	-	X	X	
	Industrial	Non-ETS	X	X	
	Waste-to-energy	-	X		
TRANSPORT	Municipal vehicles	Mopeds	X		
		Motorcycles	X		
		Personal transport vehicles	X	X	
		Trucks GVW < 3500 kg	X	X	
		Trucks 3500 kg < GVW < 12000 kg			
		Trucks GVW > 12000 kg	X		
	Private transport	Cars	X	X	
		Motorcycles	X	X	
		Industrial vehicles	X	X	
		Buses (excluding GTT urban buses)	X		
	Public transport	Tram network		X	
		GTT railway network		X	
		Trenitalia rail network		X	
		Subway		X	
		Urban vehicles	X		
WASTE	Separate Waste Treatment	-	X		X
		-			X
	Wastewater treatment Landfill	-	X		
IPPU	-	-	-	-	-
AFOLU	-	Absorption from urban green	X		

Stationary Energy macro-area (Municipal and Private Buildings)

Municipal and private buildings' emissions appertain to both Scope 1 and Scope 2. The calculation of GHG emissions for this sub-sector for the reference base year 2019, was elaborated on the basis of the ISTAT (Istituto Nazionale di Statistica - National Institute of Statistics) data concerning the stock of buildings in Torino, as referred to in the PAESC.

In order to determine the stock of buildings, the data from the ISTAT census issued in 2011 was taken as a reference – showing a stock of 63,764 buildings, 411,264 properties with at least 1 resident, and 36,158 residential buildings.

In addition to the number of buildings and properties, the heated surface area was also taken into account as a proxy to determine GHG emissions. The average heated surface area of the buildings for each intended use was determined by skimming and statistically processing the 329,655 energy performance certificates available today for the Città di Torino, from which the total air-conditioned surface area of the buildings considered was derived (amounting to 52 million m^2, of which 35 million m^2 related to the residential sector – consistent with the figures given in the PAESC) and their breakdown by energy class according to their related use and energy class.

Sources for the evaluation of the Stationary Energy Sector (Municipal and Private Buildings)

- Piano d'Azione per l'Energia Sostenibile e per il Clima (PAESC)
- Istituto Nazionale di Statistica (ISTAT)[60]
- Torino Action Plan for Energy (TAPE)

Stationary Energy macro-area (Non-ETS Industry)

The Non-ETS Industry Sub-sector encompasses Scope 1 and Scope 2 emissions. For the evaluation of electricity consumption in the industrial sector, a process was initially conducted to extract the consumption of companies, aggregated according to the ATECUE code.[61] Data on consumption were provided by the Regione Piemonte database – notably with the source identified as IRETI SpA. [62] Only the ATECUE codes falling within the industrial sector were considered.

60 See http://dati-censimentopopolazione.istat.it/index.aspx?queryid=3456

Regarding natural gas, relevant data were retrieved from the Regione Piemonte database, with sources from the companies SNAM and Italgas.[63]The aggregation of these data is less specific than data on electricity, due to their classification based solely on use. In this context, only the industrial component was taken into account; the consumption of the ETS industry was subtracted from this component, which was obtained through a direct request to the entities belonging to it.

In addition, a detailed cataloguing of all industries located within the boundaries of the municipality of Torino was carried out. Each industry was characterized by its ATECO code and subdivided into registered office and local units. At the moment, this cataloguing was not used for the calculation of the baseline, but could be useful for the more accurate development of future interventions.

For the non-ETS Industry sector, a complete re-evaluation of the consumption and emissions values was carried out compared to the estimates reported in the PAESC and in the third TAPE monitoring report, and included to the Stationary Energy macro-area according to the NetZeroCities 2030 Climate Neutrality Action Plan Guidance and Explanation (see p. 8, pp. 31-32).

Sources for the evaluation of the Stationary Energy macro-area (Municipal and Private Buildings)

- Regione Piemonte database – IRETI SpA
- Regione Piemonte database – SNAM and Italgas

Transport macro-area

Transport emissions also appertains to both Scope 1 and Scope 2. The calculation of emissions for the Transport sector was based on a comprehensive analysis of the vehicles in the Città di Torino as of 2019. The calculation of GHG emissions has systematized the data regarding both municipal and private vehicle stocks (as of 31 December 2019), cancellations (cessations of circulation), first registrations of new vehicles and ownership transfers that occurred during 2019 in the Città di Torino. The data have been calculated on the basis of the findings on the legal status of vehicles counted in the PRA (Pubblico Registro Automobilistico - Public Register of Motor Vehicles). [64]

The research counted a stock of 698,626 public and private vehicles, divided into different types,[65] different emission categories (Euro 0 to Euro 6) and emission profiles.[66]

61 Classification of the economic activity of electric utilities.

62 IRETI S.p.A. is an Iren Group company that manages the distribution of electricity in the municipality.

63 SNAM S.p.A. is an energy infrastructure company operating nationwide, active in the transport, storage and regasification of natural gas. See https://www.snam.it/en/home.html. Italgas is an Italian company specialized in gas distribution activities operating nationwide. See https://www.italgas.it

64 The Institute recording all events related to the "legal" life of the vehicle are recorded Automobile Club Italia (2020) AUTORITRATTO 2019.https://www.aci.it/laci/studi-e-ricerche/dati-e-statistiche/autoritratto/autoritratto-2019.html

65 Buses, freight trucks, special/specific motor vehicles, passenger cars, special/specific motorcycles, special/specific motor vehicles and quadricycles, special/specific trailers and semi-trailers, freight trailers and semi-trailers, road tractors or tractor-trailers.

66 Green gasoline, electricity, Diesel, Natural gas, LPG.

In addition to the number of vehicles, the calculation of emissions took into account odometer mileage on urban routes, expressed in km.

Sources for the evaluation of the Transport macro-area

- ACI – Automobile Club Italia "Autoritratto 2019" (May 2020)[67]
- GTT – Gruppo Torinese Trasporti, "Dichiarazione non finanziaria 2021"[68]
- Vehicle Fleet Management Service of the General Services Division of the Città di Torino

Waste macro-area

The Waste Sector emissions appertains to both Scope 1 and Scope 3. For the calculation of the emissions related to the waste sector in 2019, data from the report issued by the Waste Register of ISPRA - Istituto Superiore per la Protezione e la Ricerca Ambientale [69] were taken into account.

The report records 437,805 t/y of waste produced by the Città di Torino in 2019. [70] According to the data reported by ISPRA and the company AMIAT - Azienda Multiservizi Igiene Ambientale Torino S.p.A., updated to 31 December 2019, the share of sorted waste represents 47,7% of the total (about 208,736 t/y). [71]

On the other hand, unsorted Municipal Waste represents the amount of residual waste (229,069 t/y). According to the "Report on the state of the waste management system" compiled in November 2020 by the Waste Metropolitan Observatory and ATOR - the Torino Waste Management Association, residual waste is treated almost entirely by the Gerbido [72] waste-to-energy plant (and represents about 40.7% of the total waste treated by the plant).

Sources for the evaluation of the Waste macro-area

- ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale
- AMIAT – Azienda Multiservizi Igiene Ambientale Torino S.p.A.
- "Rapporto sullo stato del sistema di gestione rifiuti" –

67 Automobile Club Italia (2020) AUTORITRATTO 2019. https://www.aci.it/laci/studi-e-ricerche/dati-e-statistiche/autoritratto/autoritratto-2019.html

68 GTT (2021) Dichiarazione non finanziaria.https://www.gtt.to.it/cms/risorse/fornitori/trasparenza/pdf/DatiUlteriori/DNF_2021.pdf

69 See https://www.isprambiente.gov.it/it

70 See https://www.catasto-rifiuti.isprambiente.it/index.

71 AMIAT – Azienda Multiservizi Igiene Ambientale Torino (2019) Risultati di Raccolta Differenziata a Torino al 31 Dicembre 2019. https://www.amiat.it/

72 The Torino waste-to-energy plant located in Gerbido manages the incineration of municipal and special non-hazardous waste and is operated by TRM S.p.A. See http://www.cittametropolitana.torino.it/cms/ambiente/rifiuti/termovalorizzatore-gerbido

73 Città Metropolitana di Torino (2023) Rapporto sullo Stato del Sistema di Gestione dei Rifiuti. Rapporto 2023 – Dati consuntivi dell'anno 2022. http://www.cittametropolitana.torino.it/cms/ambiente/rifiuti/osservatorio-rifiuti/rapporto-sistema-gestione-

Osservatorio Metropolitano Rifiuti [73]

AFOLU macro-area

The evaluation of the AFOLU Sector has taken into account the number of trees declared by the municipality of Torino (arboreal account), their CO_2 storage factors, and the distribution of species in the city as assessed by the PAESC.

The arboreal account encompasses the urban greenery within the boundaries of Torino Municipality. The total volume of CO_2 stored by the extension of urban greenery is calculated as a function of the number of forest categories in the municipality of Torino and in relation to their capacity to absorb carbon dioxide (tCO_2/tree/y). According to arboreal balance estimates, there are about 147,000 trees in the urban area of Torino – of which 48,000 represents the street trees; in addition, there are about 230,000 trees in the Municipality's hilly area.

As for the street trees, the distribution of species is known and it is therefore possible to associate the relative absorption capacity with each species. The species distribution available for street trees is used as representative for the entire municipality to a first approximation.

In order to make a comparison, an estimate of the CO_2 stored by urban greenery is also made by using the data on tree distribution over the municipality provided by the Environment Park[74] : this second evaluation slightly differs from that of the street trees reported in the tree balance.

For the 2019 baseline, the CO_2 storage capacity of greenery was calculated on a total green area (including urban green and forest green) of 53.67 million m^2.

Sources for the evaluation of the AFOLU macro-area

- "Mosaicatura PRG e varianti urbanistiche", Torino Urban Atlas
- "Pianificazione territoriale e strategica" (Tav. 3.1)
- Variables considered: Forest cover (m^2): known species
- Urban green (m^2): species not known (known only from tree balance)

74 The Environment Park is a technological private/public partnership hub focused on environmental innovation and promoting environmental sustainability as a competitivity engine. See https://www.envipark.com

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3.2 Module A-2
Current Policies and Strategies Assessment

The Città di Torino has always been committed to developing actions to protect the environment and reduce emissions and climate-changing gases – including through careful strategic energy management.

In this sense, the first **Piano Energetico Comunale (PENCO - Municipal Energy Plan)** was drafted – back in 1992 – by the offices of the Azienda Energetica Municipale (Municipal Energy Company), on behalf of the Città di Torino, in order to elaborate an urban energy balance and set out measures that could be adopted to rationalize energy consumption – mainly aimed at the Transport, Industry, Residential and Tertiary Sectors.

The document was subsequently followed, in 1993, by the so-called **Piano Energetico Urbano (Urban Energy Plan),** elaborated within the **TEST (Torino Energy Strategy)** project and developed to organise an information system capable of defining the relationship between incoming energy flows and final demand, for the different sectors.

These two initial actions were followed by the adoption of the **Piano Urbano per la Mobilità Sostenibile (PUMS - Urban Plan for Sustainable Mobility)** in 2008-2011, initially falling under the City's purview: the strategic plan builds on existing planning tools and takes due account of the principles of integration, participation and evaluation to meet the mobility needs of people and goods, with the aim of improving the quality of life in and around cities.

In 2009, the Città di Torino joined the **Covenant of Mayors**, which committed cities to prepare and implement a Sustainable Energy Action Plan, with the goal of reducing their CO_2 emissions by more than 20% by 2020 – through increased energy efficiency, increased use of renewable energy sources, and appropriate promotion and communication actions.

The City Council Resolution of 13 September 2010 also approved the **Torino Action Plan for Energy (TAPE)** – thus reinforcing its commitment to significantly reduce CO_2 emissions by 2020. TAPE's priority areas of implementation are public and private buildings, mobility and transport, in which major structural investments have been launched.

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The 2009 Covenant was subsequently updated with the adoption of the **Mayors Adapt**, in 2015, initiated by the EU Commission to incentivize cities to voluntarily undertake local adaptation strategies and awareness-raising activities on climate change. Furthermore, in 2019, the **New Covenant of Mayors for Climate and Energy** was signed, whereby the City committed to reduce CO_2 (and possibly other greenhouse gas) emissions by at least 40% by 2030 through improved energy efficiency and increased use of renewable energy sources, to enhance the resilience of its territory and to share vision, results, experience and know-how with other local and regional authorities in the EU. The **Piano d'Azione per l'Energia Sostenibile e il Clima (PAESC - Sustainable Energy and Climate Action Plan)** was elaborated in 2023 as an output of the Covenant of Mayors for Climate and Energy.

Other recently activated actions include: the **Piano della Mobilità Ciclistica (BICIPLAN - Bicycle Mobility Plan)**, approved in 2013 and aimed at increasing (to at least 15%) bicycle travel within the next 10 years (from about 15,000 to 75,000 people); the **Allegato Energetico - Ambientale al Regolamento Edilizio della Città di Torino (Energy-Environmental Annex to the Building Regulations of the Città di Torino),** aimed at identifying a series of requirements, some mandatory and others voluntary, with a view to the energy and environmental qualification of building processes and products; the **Piano di Resilienza Climatica (Climate Resilience Plan),** adopted in 2020 and drawn up in synergy with various institutional subjects, including ARPA, the Regione Piemonte, Torino Universities and the Società Metropolitana Acque Torino (SMAT - Torino Metropolitan Water Company), in order to identify the territory's main vulnerabilities and identify short- and long-term adaptation measures, defining a series of nearly 80 actions to reduce the impacts caused mainly by heat waves and flooding.

The actions adopted by the Città di Torino have found tight synergy with the Plans and Strategies contextually activated at the provincial/metropolitan and regional level.

In particular, it should be noted that, as early as 1999, the Province of Torino (later Città Metropolitana), in its own **Piano territoriale di coordinamento provinciale (Provincial territorial coordination plan)** – a development planning tool that systematizes the territories and proposes the best possible territorial arrangement – indicated fair access to resources (combating territorial and

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population marginality and socio-economic development), health, safety, mobility, culture, and the "beauty and harmony" of places as among the shared "values" and "rights".

More recently, following the introduction of the guidelines for the drafting of PUMS, contained in Ministerial Decree 397/2017, which introduced the responsibility of Metropolitan Cities to draft a single PUMS for all municipalities within their territorial scope, also the Città Metropolitana has adopted its own **Piano Urbano della Mobilità Sostenibile (PUMS - Urban Plan for Sustainable Mobility)**. This updated plan envisages a set of actions and interventions with a ten-year time horizon (from 2020 to 2030), to develop a vision of a more accessible, safer and less polluting mobility and transport system, oriented to improve people's quality of life. Also, in September 2022, work started on the approval of the **Piano della Mobilità Ciclistica (BICIPLAN - Bicycle Mobility Plan)** of the Città Metropolitana di Torino: the Città Metropolitana is drawing up an initial knowledge framework, from which a proposal for metropolitan cycle corridors and bike-to-rail nodes will be derived.

Moreover, in 2022-2023, the Città Metropolitana issued the **Agenda per lo sviluppo sostenibile della Città metropolitana di Torino e del suo territorio (AMSvS - Agenda for the sustainable development of the Metropolitan Città di Torino and its territory) 2023**, which consists of work processes involving a plurality of subjects and territories, giving rise to useful tools for collective action and documents – products of shared work paths – that will be fed and updated over time.

Finally, the Regione Piemonte is particularly committed to the development of actions to protect the environment and reduce the production of climate-changing gases, also with a view to redeveloping and enhancing the mountain and semi-mountainous areas of which it is mainly composed.

Among the main actions developed by the Regione Piemonte, it is worth to mention:

- the **Relazione Programmatica sull'Energia - Programmatic Report on Energy (2009)**, containing the objectives and directions of the regional energy policy, preparatory to the proposal for the new Piano Energetico Ambientale Regionale (PEAR - Regional Environmental Energy Plan);
- the **Piano Paesaggistico Regionale (PPR - Regional landscape plan)**, adopted in 2017 as an instrument for the protection and promotion of the local landscape, aimed at regulating its transformations and supporting its strategic role in the sustainable development of the territory;
- the **Piano Regionale di Qualità dell'Aria (PRQA - Regional Air Quality Plan)**, approved in 2019 to illustrate the state of air quality and the identification of the areas that have the greatest influence on it (Agriculture, Energy, Transport, Industry) and which was implemented by the amendments introduced by L.R. (Regional Law) no. 2/2021 to the text of L.R. no. 43/2000 - Disposizioni per la tutela dell'ambiente in materia di inquinamento atmosferico (Provisions for the protection of the environment with regard to air pollution);
- the **Piano Tutela delle Acque (PTA - Water Conservation Plan)**, issued in 2021 for the protection and enhancement of surface and groundwater in the territory with a view to the sustainable development of the community and the full achievement of the environmental objectives set out in the Water Framework Directive 2000/60/EC;
- the **Strategia Regionale per lo Sviluppo Sostenibile del Piemonte (SRSvS - Regional Strategy for Sustainable Development of Piedmont)** of 2022, which outlines the areas and objectives that the Regione Piemonte intends to pursue within the framework defined by the United Nations 2030 Agenda and in coherence with and implementation of the Strategia Nazionale per lo Sviluppo Sostenibile;
- the **Piano Energetico Ambientale Regionale (PEAR - Regional Environmental Energy Plan)**, which aims to align regional policies with those of the Climate and Energy Package and the Piano Nazionale Integrato per l'Energia e il Clima (National Integrated Energy and Climate Plan), and to support and promote an entire industrial and research chain in this sector.

In order to provide a more organic view of the actions taken at a local, regional and national level for the abatement of climate-changing emissions, it has been decided to collect those of a more normative and general nature in **Table A-2.1**, reporting instead the individual Projects undertaken by the Città di Torino and the Regione Piemonte in the following **Table A-2.1b.**

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Table A-2.1:
Relevant policies, strategies and regulations in the period 1991-2023

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

MUNICIPAL LEVEL		
PLAN	Piano d'Azione per l'Energia Sostenibile della Città (TAPE – Torino Action Plan for Energy) 2010	It formalizes the City's commitment to significantly reduce its CO_2 emissions by 2020. In the TAPE, 1991 was defined as the base year for calculating the CO_2 emission reduction target, this target was initially set at a 40% reduction, later scaled down to 30%. Priority areas for TAPE implementation are public and private buildings, mobility and transport, where major structural investments have been initiated, with short and medium-term effects. A gradual reduction in CO_2 emissions was expected, estimated to exceed 40% by 2020, compared to the 1991 level. Three Plan monitoring reports were developed, which periodically verified the consistency of the reduction trend with the 2020 target. Specifically, the third monitoring report found a 46 percent reduction in CO_2 emissions in 2019 compared to the base year.
PLAN	Piano Regolatore di Illuminazione Pubblica Comunale (PRIC - Municipal Public Lighting Master Plan) 2012	Plan to ensure the fulfilment, alongside the typical needs for safety and security through public lighting, of the new requirements of environmental, monumental and landscape enhancement, towards balancing the need for good lighting with energy saving.
PLAN	Piano della mobilità ciclabile (BICIPLAN -Bicycle Mobility Plan) 2013	Plan aimed at reaffirming the importance of soft mobility in the general framework of urban mobility, given the high levels of atmospheric pollution and urban congestion that compromise the quality of life in the city, and at encouraging the use of bicycles not only for leisure but especially for home-school and home-work trips. The objective of the Biciplan is to increase (reaching at least 15% of the mobility share) cycling trips within the next 10 years (from about 15,000 to 75,000 persons). The planning process was shared with districts and associations.
STRATEGY	Nuovo Patto dei Sindaci per il Clima e l'Energia (PAESC - New Covenant of Mayors for Climate and Energy) 2019	By joining the Covenant of Mayors for Climate and Energy, the City has committed itself to: • reduce CO_2 (and possibly other greenhouse gas) emissions in its territory by at least 40% by 2030, in particular through improved energy efficiency and increased use of renewable energy sources; • increase the resilience of their territory by adapting to the effects of climate change; • share vision, results, experience and know-how with other local and regional authorities in the EU and beyond through direct cooperation and peer-to-peer exchange, in particular within the Global Covenant of Mayors.

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

REGULATION	Allegato Energetico - Ambientale al Regolamento Edilizio della Città di Torino (Energy-Environmental Annex to the Building Regulations of the Città di Torino) 2018	The Energy-Environmental Annex to the Building Regulations identifies a series of requirements, some mandatory and others voluntary, with a view to the energy and environmental qualification of building processes and products. Within the voluntary requirements (defined to incentivize the realization of building interventions that are, from an energy-environmental point of view, superior to the minimum standards required by the regulations in force) in relation to the higher construction costs linked to a higher quality of the product used, a score is recognized for the various interventions, which translates into a "discount" on urbanization charges up to a maximum value of 50%, as provided for by the "Regulation for the determination of the contribution for concessions charges".
PLAN	Piano di Resilienza Climatica (Climate Resilience Plan) 2020	The City's Resilience Plan, prepared by representatives of 15 City departments and offices and numerous other subjects, including ARPA, the Regione Piemonte, Torino Universities and SMAT, identifies the territory's main vulnerabilities and identifies a series of short and long term adaptation measures, defining a series of actions (about 80 in total) aimed at reducing the impacts caused mainly by heat waves and flooding, which represent the main risks related to climate change to which the city is exposed.
PLAN	Piano Strategico dell'Infrastruttura Verde (Green Infrastructure Strategic Plan) 2022	An analysis and planning tool to direct investments and management policies for Torino's public urban green system in the coming decades, supplementing urban planning instruments. The Plan analyses in depth Torino's urban green system defining medium-long term strategies for its enhancement and development. It is a planning document to direct investments in new works and maintenance interventions, define management priorities of the urban green infrastructure system, starting from an overall analysis of the public green system, identifying strengths and weaknesses, assessing opportunities and defining strategies, objectives and actions. It is largely based on two analytical approaches: 1) the first, the so-called "greenprint", is both a quantitative and qualitative analysis of the entire public green system.2) The second is the quantitative and economic analysis of the ecosystem services generated by the city's entire green infrastructure system as a basis for future planning of its functions.
PLAN	Piano Strategico e Piano d'Azione sul tema della gestione sostenibile delle acque in ambito urbano (Strategic Plan and Action Plan on the topic of sustainable urban water management)	The Strategic Plan (SP) defines the 'fundamental' objectives, any lower-ranking objectives (operational objectives) and identifies the main lines of action to achieve them. For each objective, it sets a medium-term horizon of 2030 and a long-term horizon of 2050. Particular emphasis is placed on the measures falling within the competence of the FUA (Functional Urban Areas) and the Municipalities forming the Città Metropolitana, concerning the urban territory and the Integrated Water Service. The Action Plan (AP), which identifies the priority actions to be implemented within a short time horizon (4 years), is made up of individual action sheets described in detail to allow their implementation in the short term. The AP is renewed every 4 years, so that through the implementation of the first two APs the mid-term objectives of the SP (2030) are expected to be achieved.

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

METROPOLITAN LEVEL		
PLAN	Piano Urbano della Mobilità Sostenibile (PUMS – Urban Plan for Sustainable Mobility) 2023	The PUMS is a set of actions and interventions on the territory of the Città Metropolitana with a time horizon of ten years (from 2020 to 2030), developing a vision of a more accessible, safer and less polluting mobility and transport system, oriented towards improving people's quality of life. Through a balanced development of all modes of transport with preference given to the most sustainable ones, and thanks to a transparent and participatory approach, the PUMS proposes to improve the effectiveness and efficiency of the mobility system for people and goods, and to achieve environmental, economic and social sustainability objectives.
STRATEGY	Agenda per lo sviluppo sostenibile della Città metropolitana di Torino e del suo territorio (AMSvS - Agenda for the Sustainable Development of the Metropolitan Città di Torino and its territory) 2023	It takes the form of work processes involving a plurality of actors and territories, giving rise to useful tools for collective action and a plurality of documents - products of shared work paths - that will be fed and updated over time.
STRATEGY	Linee di indirizzo per il processo di definizione del Piano Strategico Metropolitano (PSM - Guidelines for the metropolitan strategic plan definition process) 2024-2026 2023	The new 2024-2026 MSP (Metropolitan Strategic Plan), the drafting of which will engage the authority in the second half of 2023, will relaunch the development vision proposed by the 2021-2023 Plan, entitled "Torino Metropoli Aumentata" (Torino Augmented Metropolis). As envisaged by the Guidelines approved by the Metropolitan Council in its session of 10 May 2023, the drafting of the new Strategic Plan will take place through a structured participatory planning process, which will take place between July and December 2023.
PLAN	Piano della Mobilità Ciclistica (BICIPLAN - Bicycle Mobility Plan) of the Città Metropolitana (Part of the PUMS) 2022	Following the first kick-off meeting held on 30 September 2022, the Città Metropolitana is drawing up an initial cognitive framework, which it will complete following meetings with the territory in March 2023. This will result in a proposal for metropolitan cycle corridors and bike-to-rail nodes.
PLAN	Piano dell'accessibilità e dell'intermodalità (Accessibility and intermodality plan) (Part of the PUMS) 2022	The Plan[75] will govern the development of the Metropolitan Railway Service, a substantial expansion of the metro network (with the construction of line 2 and the extension of line 1), and several extensions of the tram network, which must be accompanied by an overall redesign of the car network, both urban/suburban and suburban.

75 http://www.cittametropolitana.torino.it/cms/trasporti-mobilita-sostenibile/pums/pums-piano-approvato-2022/piano-accessibilita-intermodalita

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

REGIONAL LEVEL		
STRATEGY	Disposizioni per la predisposizione e la realizzazione della Strategia Regionale sui Cambiamenti Climatici quale attuazione della Strategia Nazionale di Sviluppo Sostenibile (Provisions for the preparation and implementation of the Regional Climate Change Strategy as an implementation of the National Sustainable Development Strategy) 2015	The strategy defines the political and administrative initiative of the Regione Piemonte to contain global warming and counteract the negative effects of climate change. The Regional Strategy on Climate Change (SRCC) will be the reference tool that will orient the administrative action in this sense, starting from the technical-scientific evidence up to the measures that will have to be taken in the regional planning and programming in the different sectors, with attention to the processes of governance, horizontal and vertical institutional coordination and public participation.
REGULATION	Regolamento attuativo al Piano Paesaggistico Regionale PPR (Implementation regulations to the Regional Landscape Plan) 2019	Regional Landscape Plan (PPR) approved by the Regional Council Resolution No. 233-35836 of October 3, 2017. The Plan is an instrument for the protection and promotion of the Piemonte landscape, aimed at regulating its transformations and supporting its strategic role in the sustainable development of the territory. With the Implementing Regulations to the PPR The Region has detailed how to ensure the adaptation and coherence of the different planning tools.
PLAN	Piano Regionale di Qualità dell'Aria (PRQA - Regional Air Quality Plan) 2019	The PRQA documentation illustrates: (i) the state of air quality and the identification of the ambits that have the greatest influence on air quality (Agriculture, Energy, Transport, Industry); (ii) technical in-depth studies that validate the contents of the PRQA from a scientific point of view (Modelling and Analytical Source Apportionment, Analysis of energy consumption and achievable emission reductions, Assessment of the environmental effects of the PRQA with reference to Climate Change, Summary Statement of the SEA pathway) (iii) the measures pertaining to each area and relative quantification in terms of emission reductions; (iv) the results of the modelling simulations regarding the implementation of air quality measures, which indicate 2030 as the year of return to the air quality limits defined in Directive 2008/50/EC.
PLAN	Piano di Tutela delle Acque (PTA - Water Conservation Plan) 2021 (update)	The Water Protection Plan (WPP) pursues the protection and enhancement of our territory's surface and groundwater with a view to the sustainable development of the community and to the full achievement of the environmental objectives of the Water Framework Directive 2000/60/EC. It is also a fundamental tool to strengthen the resilience of aquatic environments and related ecosystems and to address the effects of ongoing climate change.

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

STRATEGY	Strategia Regionale per lo Sviluppo Sostenibile del Piemonte (SRSvS - Regional Strategy for Sustainable Development of Piedmont) 2022	It outlines the areas and objectives that the Regione Piemonte intends to pursue within the framework defined by the United Nations 2030 Agenda and in coherence with and implementation of the National Strategy for Sustainable Development.
PLAN	Piano Energetico Ambientale Regionale (PEAR - Regional Environmental Energy Plan) 2022	The PEAR fulfils, among others, two fundamental objectives: on the one hand, to orient regional policies towards those of the Climate Energy Package and the National Integrated Energy and Climate Plan and, on the other hand, to support and promote an entire industrial and research sector that has great opportunities for growth.
STRATEGY	Primo stralcio della Strategia Regionale sul Cambiamento Climatico (Regional Strategy on Climate Change)	The Regional Strategy on Climate Change (SRCC) will be the reference tool that will guide the administrative action in this sense, starting from the technical-scientific evidence up to the measures that will have to be taken in the regional planning and programming in the different sectors, with attention to the processes of governance, horizontal and vertical institutional coordination and public participation.
	NATIONAL LEVEL	
PLAN	Piano Nazionale di adattamento ai cambiamenti climatici – (PNACC - National Climate Change Adaptation Plan)	The aim of the Plan is to contain the vulnerability of natural, social and economic systems to the impacts of climate change and to increase resilience. It represents the implementation tool of the 2015 National Climate Change Adaptation Strategy for national planning to support the institutions that will be called upon to develop the contents of the plan on their own scale of government, taking into account the specificities of different contexts.
PLAN	Piano Nazionale Strategia Energetica Nazionale (SEN - National Energy Strategy National Plan) 2017	A Ministerial Decree of the Ministry of Economic Development and the Ministry of the Environment and Land and Sea Protection adopted the 2017 National Energy Strategy, the Italian government's 10-year plan to anticipate and manage change in the energy system. The Strategy aims to make the national energy system more • competitive: improve the country's competitiveness by continuing to reduce the energy price and cost gap with Europe, in a context of rising international prices • sustainable: to sustainably achieve the environmental and de-carbonisation targets set at the European level, in line with the future targets set at COP21; • secure: continue to improve the security of supply and flexibility of energy systems and infrastructure, strengthening Italy's energy independence.

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

PLAN	Piano Nazionale Integrato per l'Energia e il Clima (PNIEC - National Integrated Energy and Climate Plan) 2020	The text of the Integrated National Energy and Climate Plan (PNIEC) was prepared in 2020 by the Ministries of Economic Development, the Environment and Infrastructure and Transport and incorporates the innovations contained in the Decree Law on Climate as well as those on investments for the Green New Deal provided for in the Budget Law 2020. The PNIEC was sent to the European Commission in implementation of Regulation (EU) 2018/1999, thus completing the path started in December 2018. With the Plan, national targets to 2030 on energy efficiency, renewables and CO2 emissions reduction are set, as well as targets on energy security, interconnections, single energy market and competitiveness, development and sustainable mobility, outlining for each of them the measures that will be implemented to ensure their achievement. The proposal of revision of the plan has been published in 2023.
PLAN	Piano Nazionale di Ripresa e Resilienza (PNRR - National Recovery and Resilience Plan) 2021	The National Recovery and Resilience Plan (NRP) is part of the Next Generation EU (NGEU) programme, the EUR 750 billion package, roughly half of which consists of grants, agreed by the European Union in response to the pandemic crisis. The main component of the NGEU programme is the Recovery and Resilience Facility (RRF), which has a duration of six years, from 2021 to 2026, and a total size of EUR 672.5 billion (312.5 grants, the remaining 360 billion low-interest loans). Italia Domani, the Recovery and Resilience Plan presented by Italy, envisages investments and a coherent package of reforms, to which resources amounting to EUR 191.5 billion are allocated, financed through the Recovery and Resilience Facility and EUR 30.6 billion through the Supplementary Fund established by Decree-Law No. 59 of 6 May 2021, based on the multi-year budget variance approved in the Council of Ministers on 15 April. The total of the planned funds amounts to EUR 222.1 billion. In addition, a further EUR 26 billion has been earmarked for the realisation of specific works and for replenishing the resources of the Development and Cohesion Fund by 2032. In total, some EUR 248 billion will thus be available. In addition to these resources, there are also those made available by the REACT-EU programme, which are to be spent in the years 2021-2023, as provided for by EU regulations. These funds amount to a further 13 billion. The Plan is developed around three strategic axes shared at European level: digitalisation and innovation, ecological transition, and social inclusion. It is an intervention that intends to repair the economic and social damage of the pandemic crisis, help resolve the structural weaknesses of the Italian economy, and accompany the country on a path of ecological and environmental transition. The NRP will contribute substantially to reducing territorial, generational and gender gaps.

A-2.1: List of relevant policies, strategies & regulations (1991 – 2023)

PLAN	Piano nazionale di contenimento dei consumi di gas (National gas consumption containment plan) 2022	The so-called 'National Plan for the Containment of Natural Gas Consumption' is a document containing a set of rules provided by the Ministry of Ecological Transition (MiTE) with the aim of limiting the effects of rising energy prices (especially in the wake of the conflict between Russia and Ukraine), by immediately launching a savings campaign to prepare for possible interruptions in gas supplies from Russia, the main supplier of this energy source until recently. The MiTE adopted the Plan in order to save gas and avoid as much as possible an excessive depletion of national storages also in view of the following 2023/2024 season. This measure, in line with the indications defined in Regulation (EU) 2022/1369 of 5 August 2022, implements - through Ministerial Decree 383 of 6 October 2022 - the indications of the European Commission.

Table A-2.1b lists the major projects initiated by the Città di Torino and the Regione Piemonte, considered relevant for their positive environmental impacts on the territory:

Table A-2.1b: Projects and interventions developed by the Città di Torino

	LOCAL LEVEL	
PROJECT	Torino Climate Lab	The Città di Torino, as part of the process aimed at drawing up the Climate Resilience Plan, developed an activity of comparison with cities, both Italian and non-Italian, that already had an adaptation strategy or plan. In particular, thanks to the technical and economic support of the German Marshall Fund of the United States, during 2017 a collaboration was established with the American cities of Portland (Oregon), Oakland (California) and New Orleans (Louisiana), which made it possible to observe positive models of participatory processes and to verify the impact of adaptation measures already implemented, albeit in territorial contexts different from that of Torino. Specifically, there were several moments of in-depth discussion with the City of Portland in which representatives of the two cities fruitfully confronted each other, both in the territory of Torino and in the city of Portland, deepening the strategy and the strengths and weaknesses of the American process and thus constituting an important model for the development of the Resilience Plan of Torino. Instead, the subject of the comparison with New Orleans was the co-creation model of the adaptation strategy that the American city is developing, which envisages the active participation of citizens in the planning and construction of the plan. This approach favours the acceptance of the solutions identified and the co-responsibility of citizens, who are not third parties but active participants in the choices made by the administration."
PROJECT	Mille alberi per Torino (A Thousand Trees for Torino)	Over the last few decades, qualitatively and numerically significant volunteer experiences have developed, i.e. of citizens asking or accepting to collaborate, voluntarily and absolutely free of charge, with their administration in projects aimed at improving the quality of life in their city, without the intermediation of an association. The project envisaged the shared planting of new trees in all the districts by city technicians and groups of citizens: a participatory care of the area in which all citizens are invited to participate by sharing a day of work to plant the trees, of which they will then also be custodians and guardians as they grow.
	REGIONAL LEVEL	
PROJECT	LABORATORIO PER LO SVILUPPO SOSTENIBILE DEL PIEMONTE (Laboratory For Sustainable Development Of Piedmont)	The Region has started work on the collaborative construction of the Piemonte Sustainability Laboratory, one of the main implementation tools of the Regional Strategy for Sustainable Development. The project, coordinated by the Regione Piemonte and IRES Piemonte (Istituto di Ricerche Economico Sociali del Piemonte), sees the active participation of managers and officials of the two bodies and the contact persons of the main regional thematic observatories, as well as regional and national experts from the knowledge and monitoring system. The general aim of the Laboratory is to support political and technical decision-makers with the necessary knowledge for integrated multi-level and multi-dimensional planning and programming, in order to promote policies that are consistent with sustainability objectives and to design flexible strategies that can be adapted to changing circumstances and events, adopting a long-term vision, also thanks to the development of new forecasting and reprogramming skills.

The following **Tables A-2.2** and **A-2.3** present the overall vision for the decarbonization, in terms of reaching at least 80% of reduction (i.e. at least 1.92 Mt/y) of CO_2 with respect to the Baseline.

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Table A-2.2: Emission gap

	(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 emissions (ideally not older than 2018) - referring to the inventory used for target setting	The emissions reduction target for 2030 ideally achieves a minimum 80% reduction from the baseline, as reported in Section 2 of the Commitments document of the CCC. The overall target should be absolute or net-zero (i.e. including the compensation of any residual emissions).	These are the emissions reductions that would be achieved through existing policies, and plans, outlined in Section A-2.1. Those actions are by definition not part of the action portfolio in section B. If they are fully or partially incorporated in module B-2, their associated reduction potential should be referenced in column (5) and not be included here. WARNING if the baseline is a BAU scenario: If the BAU modelling includes any of these existing measures, please also do not include the associated emissions reduction in this column as otherwise it would be double counted.	(4) = (2) – (3)	This column is used to present the already quantified emission reduction associated with the action portfolios outlined in module B-2. Ideally, this equals the gap. If the there is a difference between the reduction potential of the actions specified in module B-2 (for instance because their reduction potential has not been fully estimated or because additional measures will be identified in future iterations), the CCC AP should be explicit about this difference and explain how the difference will be closed. In principle, as long as the difference has not been addressed, it would be considered as part of the residual emissions.	(6) = (1) – (2)
	(absolute; Mt/y)	(absolute; Mt/y)	(%)	(absolute; Mt/y)	(%)	(absolute; Mt/y)	(%)	(absolute; Mt/y)	(%)	(absolute; Mt/y)	(%)
Stationary Energy	1,734,424	665,055	41.6	289,071	38.6	375,984	44.2	375,984	44.2	1,069,369	134.0
Transport	636,277	381,089	23.8	142,751	19.1	238,338	28.0	238,338	28.0	255,187	32.0
Waste	61,323	72,471	4.5	12,265	1.6	60,207	7.1	60,207	7.1	-11,148	-1.4
Agricultural, Forestry and Other Land Use (AFOLU)	-35,117	-	-	-	-	-	-	-	-	-35,117	-4.4
Industrial Process and Product Use (IPPU)	-	-	-	-	-	-	-	-	-	-	-
Energy Systems	-	480,530	30.0	303,918	40.6	176,612	20.8	176,612	20.8	-480,530	-60.2
Total	**2,396,907**	**1,599,146**	**100.0**	**748,005**	**100.0**	**851,141**	**100.0**	**851,141**	**100.0**	**797,761**	**100.0**

Part A – The starting point for Torino: current state of emissions and climate actions

In **Table A.2.3**, The blue columns provide the baseline for the emissions – divided by macro-areas and sectors – in t/y ("Absolute Value") and the weight in percentage of each sector on the total emissions in the baseline ("Share on the Total Baseline").

The first block of green columns lists the proposed macro-actions for the city, for which specific mathematical models, implemented in the CLICC SW Platform, have been designed in order to compute the expected CO_2 reductions associated to them; the third column reports the value in t/y. The second and third blocks of green columns provide a subdivision of the effects of the macro-actions between the ongoing actions and the ones foreseen by the Climate City Contract (CCC).

The orange block of columns provides the residual emissions of CO_2 in t/y.

In each block of columns, there is a column (pu – per unit, %/100) that must be read by row and allows for tracking the reduction the residual emissions for each macro-area. For example, assuming the overall emissions for transport sector equal to 1 in the baseline, the whole set of macro-actions in the macro-area would reduce the emission to 0.40 (reduction of 0.60 pu, equal to 60%). Of this reduction, the actions already in place reduce the value in the baseline by 0.224 pu (22.4%) and the ones designed for the CCC reduce the value in the baseline by 0.375 pu (37.5%). Altogether, the expected effect of the reduction is 0.224+0.375 = 0.599 pu ~0.60 pu (60%). The residual emission for the macro-area is 1-0.224-0.375 = 0.401 pu ~ 0.40 pu, which corresponds to 40% of the baseline emissions (reduction of 60%).

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Table A-2.3:
Emission reduction due to existing and future actions and residual emissions by 2030

Macro-Area	Sector	Baseline Emissions (Base Year: 2019)			Sectorial Macro-Actions			Emission Reduction due to Existing Action Plans			Emissions Reduction due to Future Actions			Residual Emissions (Reference Year: 2030)	
		Absolute Value (t/y)	Share on the Total Baseline (%)	Per Unit Value (p.u.)	Code	Description	Overall Emissions Reduction (t/y)	Absolute Value (t/y)	Share on the Total Existing Actions (%)	Per Unit Emissions w.r.t BY (p.u.)	Absolute Value (t/y)	Share on the Total Future Actions (%)	Per Unit Emissions w.r.t BY (p.u.)	Absolute Value (t/y)	Per Unit Emissions w.r.t BY (p.u.)
Stationary Energy	Buildings (Municipal, Residential, Tertiary, Industrial) + Industrial Processes	1,620,569	67.6		FS1	District Heating: 70% coverage of TRL network in built volume without new power plants	-73,237	-289,071	38.6		-375,984	44.2		1,069,369	
					FS2	Thermal Insulation of Buildings: Improvement of thermal insulation in F and G class buildings; further improvements for other classes	-144,893								
					FS3	Data Centers: Recovery of 55% of waste heat from data centers (Hypothesis: 9% annual increase in data centers)	0								
					FS4	Heat Pumps: Different heat pumps according to energy class, only for buildings using natural gas (50% of buildings in class E and D). Photovoltaic Systems: PV systems to cover the electrical needs of heat pumps	-224,872								
					FS5	Electricity Storage: Storage systems to increase self-consumption of locally produced electricity from PV installations	-29,152								
					FS6	Electrical Equipment: Improvement in energy efficiency class	-38,694								
					FS7	CCS Installation on Iren generation plants for District Heating	0								
					FS8	Policies for the development of energy communities	-16,713								
					FS9	Policies for the development of positive energy districts	-707								
					FS10	Energy retrofitting of 800 municipal buildings with Iren (EfficienTO)	-12,134								
					FS11	Industrial process efficiency improvement (25% more efficiency)	-82,428								
	Waste-to-energy plant	99,351	4.1		FS12a	Implementation of Line 4 of the plant and application of CCS	-27,721								
	Public lighting	14,504	0.6		FS13	Public LED lighting	-14,504								
	Total Stationary Energy	**1,734,424**	**72.4**	**1.00**			**-665,055**	**-289,071**	**38.6**	**-0.17**	**-375,984**	**44.2**	**-0.22**	**1,069,369**	**0.62**
Transport	Municipal vehicles	749	0.0		FT1	Replacement of ICE vehicles with electric ones	-688	-142,751	19.1		-238,338	28.0		255,187	
	Private transport	582,617	24.3		FT2	Limitations on private traffic	-101,936								
					FT3	Replacement of private cars with electric vehicles	-77,813								
					FT4	Promotion of alternative means of transport: building cycle paths	-17,017								
					FT5	Development of policies of carsharing with Non-ICE vehicles	-25,066								
					FT6	Development of policies of car pooling	-50,366								
	Public transport	52,910	2.2		FT7	Renewal of the local public transport fleet	-36,363								
					FT8	Construction of metro line 2	-71,840								
	Total Transport	**636,277**	**26.5**	**1.00**			**-381,089**	**-142,751**	**19.1**	**-0.22**	**-238,338**	**28.0**	**-0.37**	**255,187**	**0.40**
Waste	Landfill - residual emissions	21,761	0.9		FW1	Elimination of residual emissions from landfills	-21,761	-12,265	1.6		-60,207	7.1		-11,148	
	Wastewater treatment	15,730	0.7		FW2	Process efficiency improvement (15% more efficient)	-2,590								
	Waste Reduction and increase of sorted waste	23,832	1.0		FW3	Reduction of waste generation, reduction of waste sent to waste-to-energy plant by the city of Turin and increase in sorted waste collection	-48,121								
	Total Waste	**61,323**	**2.6**	**1.00**			**-72,471**	**-12,265**	**1.6**	**-0.20**	**-60,207**	**7.1**	**-0.98**	**-11,148**	**-0.18**
AFOLU	-	-35,117	-1.5		-	-	-	0	0.0		0	0.0		-35,117	
	Total AFOLU	**-35,117**	**-1.5**	**1.00**			**0**	**0**	**0.0**	**0.00**	**0**	**0.0**	**0.00**	**-35,117**	**1.00**
IPPU	-	-	-		-	-	-	-	-		-	-		-	
Energy Systems	PV Share Increase	-	-		FE1	Increase in the share of PV in the electricity generation system	0	-303,918	40.6		-176,612	20.8		-480,530	
	Green Certified Electricity				FE2	Increase in the share of purchase of certified "Zero Emissions" electricity	0								
	Emission Factors				FE3	Variation of the carbon content of Electricity/Gas/District Heating on the energy consumption	-480,530								
	Total Energy Systems	**-**	**-**	**-**			**-480,530**	**-303,918**	**40.6**	**-**	**-176,612**	**20.8**	**-**	**-480,530**	**-**
TOTAL		**2,396,907**	**100.0**	**1.00**			**-1,599,146**	**-748,005**	**100.0**	**-0.31**	**-851,141**	**100.0**	**-0.36**	**797,761**	**0.33**

Part A – The starting point for Torino: current state of emissions and climate actions

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

The Climate City Contract is a strategic document with relevant social and political implications. It involves a wide and dense network of social, political and economic stakeholders – raising questions and potential barriers on the way to its implementation.

Within this framework, different types of systemic barriers – organized in separate, yet closely intertwined categories (Governance, Politics, Funding, Engagement, Infrastructure/ Technologies) have been identified in order to frame better climate action and a stronger collaboration with the city's ecosystem.

These barriers do not exclusively represent contingent criticalities to be 'solved' in the definition and implementation of the Climate City Contract; rather, they have a strategic and proactive character. Future strategies stem from systemic barriers, outlining opportunities for the definition of a new pact between the city, stakeholders and citizens.

In particular, the tables inserted downstream from the description of the Governance and Engagement barriers/actions clarify the link between the barriers detected and the actions that the City identifies to break them down by exploiting existing and strengthenable assets, resources, relationships and competences. Enabling actions are reported and described in detail in Section 5 of this Action Plan.

Table A-3.1: Opportunities and systemic barriers to climate neutrality by 2030

Description of urban systems, systemic barriers, and opportunities		
Governance	Horizontal internal governance (Opportunity)	A greater push for an inter-sectoral overcome of the municipality's vertical organizational structure is an indispensable element for (i) face the challenge of climate neutrality in a structural and responsible manner; (ii) systemize policies/strategic choices to use the available funds by effectively orienting programs, plans, projects and interventions; (iii) contribute to the strengthening of multi-level institutional governance and, more generally, make collaboration with the actors of the city ecosystem efficient; (iv) link activation initiatives and dialogue with the community by implementing skills in participatory process design.
Governance	Multilevel external vertical governance (Opportunity)	A strengthening of relations on the level of multi-level institutional governance and, in particular, with the Region and the Città Metropolitana appears useful to generate coordinated, synergic action capable of territorializing supra-local strategies. The Città di Torino, which is very active in projects financed with European funds, is present in various international and national networks active in environmental and climate change issues. The experience gained over the years through the exchange with many actors in the different fields of action of the CCC represents an asset and an opportunity for: (i) improve the efficiency/effectiveness of multilevel institutional governance (local/regional/national/community); (ii) strengthen the relationship with (non-governmental) stakeholders of the local ecosystem; (iii) refine engagement models of partners relevant to the energy transition; (iv) give greater impetus to the co-creation of partnership actions with significant impacts on the abatement of climate-changing emissions.
Governance	Digital infrastructure enabling multi-level governance (Opportunity)	The systematization of knowledge to underpin the interaction with the ecosystem of actors is, without a doubt, an indispensable factor to support the collective understanding of the challenge, facilitate dialogue, foster alliances and partnerships on projects/initiatives with relevant direct and indirect impacts, and guarantee constant monitoring and corrections to be introduced during the implementation and deployment of the Action Plan. The City, taking advantage of consolidated relations with the academic and scientific world, provides itself with a digital platform useful to detect the incisiveness of the abatement of climate-altering emissions of multilevel interventions financed with multiple funds (EU, national, regional, local). This platform is instrumental in the construction and monitoring of the CCC but, by targeting the integration of data on the Digital Twin, it represents a useful tool for governing multi-actor decision-making processes by coordinating climate partnership action.

Description of urban systems, systemic barriers, and opportunities

Engagement	Barrier to the participation of fragile groups in society	It is an obstacle related to social inequalities in terms of the ability to engage and co-empower marginalized, vulnerable and intergenerational targets (people in energy poverty, young people and foreigners). It includes issues related to climate justice and intergenerational equity. In particular, youth participation is not always truly integrated into a systemic view of the different dimensions of governance to foster deeper structural changes. In order to overcome this barrier, the Città di Torino has initiated a participatory process with various stakeholders involved, including school youth and associations that support people in economic and energy poverty.
Engagement	Barrier linked to the weakening of the bond of trust between citizens and the Public Administration	They are related to the context of projects and interventions with significant environmental impacts that in recent years have led to urban conflicts that are still ongoing. This barrier may hinder the city's adoption of a truly transformative and empowerment-generating approach. Tackling complex issues such as the challenge towards climate neutrality with honesty also means acting on behavioral changes and cultural issues that need to be considered urgently and in a necessarily shared perspective capable of building new connections within the city ecosystem. The development of participatory pathways and the direct involvement of citizens in the journey toward climate neutrality may, therefore, provide a valuable opportunity to regenerate and strengthen the relationship of trust between citizens and institutions.
Administrative Policy	Barrier linked to multilevel policy frameworks	The relationship between urban/regional policies or the national and European frameworks is not always well defined, and the timing for their coherent configuration can be problematic. However, this issue can be a starting point for future alignment between frameworks
Administrative Policy	Barrier linked to multilevel policy frameworks	The lack of specific regulatory references accompanying the community and stakeholders towards decarbonization may prove to be an opportunity to reconfigure part of the Città di Torino's building and urban regulations to the energy transition – providing them with targeted norms. In any case, these regulations depend also on European and national standards, and have to be aligned with them.
Administrative/ Policy	Barrier linked to political cycles	The political discontinuity resulting from the changes of administration after local elections, coupled with the priority given to different political strategies in each political cycle, is a potential barrier to the continuity/ stability necessary for the realization of a medium- to long-term project such as the Climate City Contract. However, the transversality of intentions of the Climate Contract makes it an opportunity to overcome political contingency and establish a common path beyond political representation. This is linked to problems related to long term planning.

Description of urban systems, systemic barriers, and opportunities

Technical barriers	Barrier linked to the competences of the Municipality	Given the multifaceted nature of the Climate City Contract, as most actions require the direct participation of the stakeholders involved (companies, citizens), techno-infrastructural limits emerge involving local government in terms of limits of competences and limits of available human resources. Awareness of these organizational limitations and the desire to accelerate the path to climate neutrality, however, can help the City continue to invest in the creation of a cross-cutting group of human resources, with professional and high-level expertise on relevant issues of the project.
Technical barriers	Barrier linked to the limitations in specialized manpower	The highly technical and specialized nature of the actions to be carried out to upgrade the existing building stock and equipment currently in use in the urban area (e.g., vehicles and electricity) and the implementation of the foreseen actions poses limitations regarding the procurement of specialized labor and companies with consolidated expertise and know-how. This limitation, however, can become an opportunity to foster the creation of new jobs and the emergence of new businesses related to the energy transition and environmental protection, as well as to encourage the development of vocational training pathways for schools and the reintegration of figures currently struggling to find spaces.
Technical barriers	Barrier linked to the constant technological evolution	The long-term perspective of the Climate City Contract implies the deployment of constantly updated energy balance monitoring technologies towards the decarbonization. Even this requirement, which could prove critical from the point of view of economic resources to invest, can be an incentive for the development of start-ups and newco's in the field of digitization and home automation related to the energy transition.
Financial barriers	Barrier linked to the coordination of investment by multiple actors	The Climate City contract envisages major changes affecting the urban building fabric. Its full implementation implies substantial economic investments by both municipalities and private individuals and concerns the management of procurement and the implementation of many parallel actions. However, interventions on public and private buildings will ensure economic improvement in terms of savings on utility bills (and, consequently, help for families and situations of energy and economic poverty); greater attention to future urban development; improved livability of urban areas; and the possibility of intercepting the resources allocated, nationally and at the European level, in the building sector – directing them toward compliance with the principles of environmental sustainability.
Financial barriers	Barrier linked to financial instruments	Major financial issues concern the procurement of funds in view of the diversity of actors implementing the actions, their interconnection and the need for their timely availability. At the same time, it is anticipated that many actions will require innovative financial solutions not yet fully in place.

Table A-3.2: Mapping of systems and stakeholders

Systems & stakeholders mapping

System description	Stakeholders involved	Description	Influence	Interest
Public Institutions Local territorial authorities	Regione Piemonte (Regione Piemonte)	The Region can play an instrumental role in raising funds from European and national calls, as well as contrasting climate change by exercising regulatory power and involving the public and businesses in dedicated projects. The region is developing pathways to encourage efficiency in private buildings. The abatement of pollutant emissions would promote higher standards of environmental protection at the regional level, as well as multiple positive spillovers in various sectors – including tourism, services and the quality of life of citizens.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions Local territorial authorities	Città Metropolitana di Torino (Torino Città Metropolitana)	The Città Metropolitana can ensure uniformity of action across the entire local area, extending interventions beyond the city area and involving sectors not otherwise reachable (e.g., farmers, ranchers, suburban transportation, etc.). The Città Metropolitana's interest in direct participation in the project stems from its role in representing the municipal governments that gravitate around Torino – which can become promoters of change.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions Local territorial authorities Municipality of Torino	Gruppo di Lavoro interdipartimentale (Interdepartmental Working Group) "Climate Change" in support of the preparation of the adaptation plan to climate change	With the approval, in January 2018, of a resolution of the City Council proposed by 5 different Departments (Environment, Green and Civil Protection - Urban Planning - Infrastructure and Mobility - Social Policies - Innovation), the Città di Torino has created an Interdepartmental Working Group "Climate Change" to support the preparation of the Climate Change Adaptation Plan. The goal of the working group was to work in a joint way to identify short- and long-term adaptation options, examining, within the different sectors, any good practices and measures that already exist – including fostering the definition of actions and guidelines to build adaptive capacity at the local level. Today the same Working Group has also extended its activities on mitigation.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions "Consulte comunali" (body of the City Council)	Environmental "Consulta"	The "Consulta" is a body of the City Council with propositional and advisory functions on all issues/policies/ initiatives concerning the protection and enhancement of the urban environment and green spaces – established to promote citizen participation in the protection of the environment and green spaces. In its duties, the Consulta expresses mandatory non-binding opinions on the City's deliberations and may submit proposals that relate to its functions. Participation in the project is, therefore, necessitated by its very statutory mission.	Facilitating Disseminating Agent * Medium Influence	High Interest
Public Institutions "Consulte comunali" (body of the City Council)	Consulta of Mobility, Cycling and Traffic Moderation	The Consulta's functions also extend to all policies and initiatives concerning mobility-including bicycle mobility, and traffic moderation in the city. The Council exercises a key role in involving citizens and associations in the area on all issues of sustainable mobility and traffic moderation.	Facilitating Disseminating Agent * Medium Influence	High Interest

Systems & stakeholders mapping

Public Institutions Subsidiaries and affiliated companies	AMIAT – Azienda Multiservizi Igiene Ambientale Torino S.p.A (Waste collection)	AMIAT is the Company that provides soil hygiene, waste collection and disposal services for the Città di Torino. It also operates waste treatment plants and offers integrated environmental services for public and private business customers. The interest in implementing the environmental protection policies set forth in the CCC stems from the Company's statutory purposes. At the same time, AMIAT can champion important campaigns to raise public awareness of environmental issues and combat climate change.	Driving Facilitating Agent * High Influence	High Interest
Public Institutions Subsidiaries and affiliated companies	GTT – Gruppo Torinese Trasporti (Torino Transportation Group) Public Transport	GTT provides urban and suburban public transport services, as well as the SfmA Torino-Germagnano- Ceres railway line and the new automated system of the Torino subway, with about 200 million passengers per year. Its involvement is strategic both in the actions of renewing the fleet of vehicles used for LPT (Local Public Transport) and in the involvement of the population. The Company pursues, among others, the goal of offering collective transportation and related services to the Torino and regional communities, promoting the economic development of the territory while respecting the environment and social.	Driving Facilitating Disseminating Agent * High Influence	High Interest

Systems & stakeholders mapping

Public Institutions Subsidiaries and affiliated companies	SMAT – Società Metropolitana Acque Torino Water networks and systems	SMAT's role in the proper management of drinking water and wastewater makes its involvement in the CCC essential. In 2005 SMAT significantly contributed to the achievement of the Millennium Development Goals for the environmental sustainability of integrated water service management; in March 2006, in Mexico City, it collaborated in drafting the Local Authorities' Declaration on Water at the 4th World Water Forum. The interest stems from the same statutory objectives pursued by the Company, including continuous improvement and enhancement of its resources and water quality/customer service standards. On the international cooperation front, the SMAT Group participates in initiatives aimed at promoting access to water and providing specialized technical assistance for the construction of water infrastructure and facilities. SMAT is also engaged in training activities in collaboration with Hydroaid, International School of Water for Development, of which it is a supporting member.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions Subsidiaries and affiliated companies	Iren Energy	Iren launched a 10-year Business Plan in November 2021 aimed at fostering the energy transition and combating ongoing climate change. In March 2023, the Company strengthened its investments, amounting to 10.5 billion euros over the next 8 years (+200 million vs. the 2021-2030 Plan), foreseeing an acceleration in the energy transition through the development of renewable capacity thanks to photovoltaics and onshore and offshore wind, but also through the creation of widespread energy communities. Strongly integrated with sustainability, Iren's industrial strategy revolves around ecological transition, the centrality of communities/people, and is divided into five focus areas: decarbonization, circular economy, water resources, resilient cities, and people.	Driving Facilitating Disseminating Agent * High Influence	High Interest

Systems & stakeholders mapping

Public Institutions Subsidiaries and affiliated companies	5T Mobility	Since 1992, 5T Company's Mission has been to design and manage tools and services for territorial mobility, selecting the best technical solutions on the market. It manages the Mobility and Infomobility Central of the Città di Torino and the Metropolitan Città di Torino, and the Central Mobility of the Regione Piemonte. Besides planning and managing the territory's mobility, 5T's activities also include the collection, analysis, and provision of data to support the sector policies of the Member Entities. In addition, the Company promotes the development of new forms of mobility, coordinates strategic projects in Mobility as the Service and Smart Road, works for standardization in the field of transportation, and actively participates in national and European innovation projects, including collaborating and sharing new mobility ideas.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions Subsidiaries and affiliated companies	AMP – Agenzia della Mobilità Piemontese (Piedmont Mobility Agency)	AMP is a consortium of local authorities, established in 2003 with the task of improving and optimizing public transport in the Torino metropolitan area. The agency is also a member of the international association EMTA – European Metropolitan Transport Authorities, which represents European Mobility Agencies. The agency aims to improve sustainable mobility in the region by optimizing urban, suburban and rail public transport services.	Driving Facilitating Agent * Medium Influence	High Interest
Public Institutions Subsidiaries and affiliated companies	TRM – Trattamento Rifiuti Metropolitani S.p.A. (Metropolitan Waste Treatment)	TRM is the Iren Group company that designed, built and currently manages the waste-to-energy plant of the Metropolitan Città di Torino. Its involvement in the CCC is necessary in order to ensure the proper and full implementation of actions related to the waste cycle. The company must be involved in the development of active policies, in the management of the waste-to-energy plant, towards the achievement of climate neutrality, in accordance with the values pursued by the entire IREN Group.	Driving Facilitating Agent * High Influence	High Interest

Systems & stakeholders mapping

Public Institutions Functional agencies Universities, research institutes, schools	Public and private Universities	University institutions, such as the Politecnico di Torino and the Università di Torino, not only promote sustainability through academic programs, but also hold a crucial role in combating climate change by offering technical support in drafting environmental plans. In addition, through research, universities contribute to the advancement of innovative solutions to climate challenges, generating knowledge critical to guiding the transition to more sustainable practices and more efficient technologies.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Public Institutions Functional agencies Environmental agencies	ARPA – Agenzia regionale per la Protezione Ambientale Piemonte (Regional Agency for Environmental Protection)	ARPA performs, for local authorities, services with an integrated and multidisciplinary approach to environmental issues. Also relevant is the agency's commitment to participation in international projects, particularly in the EU sphere, related to environmental issues, which allow to deepen knowledge and enhance the territory. Its participation is, therefore, important for raising funds and initiating new project-related experiments. ARPA institutionally carries out control, support and technical-scientific consulting activities and other inititives useful to local authorities in carrying out the tasks assigned to them by law in the field of environmental prevention and protection.	Driving Facilitating Agent * Medium Influence	High Interest
Organized groups Trade associations	Unione Industriali Torino (Torino Industrial Union)	Unione Industriali Torino is a voluntary association of companies at the territorial. It is a member of Confindustria and, as such, can have important effects on its member Companies and the production processes related to them. Unione Industriali Torino represents local companies in various sectors. It is involved in their promotion and development, also with reference to energy transition interventions.	Facilitating Disseminating Agent * High Influence	Medium Interest

Systems & stakeholders mapping

Organized groups Trade associations	ANCE – Associazione Nazionale Costruttori Edili (National Association of Building Contractors)	ANCE is the business association representing Italian companies of any size that operate in the construction industry. Because of its representativeness in a sector closely connected to the ecological transition, ANCE can be an important channel for the involvement of construction companies. Among its membership goals ANCE also counts the development of actions to protect the environment.	Facilitating Disseminating Agent * High Influence	Medium Interest
Organized groups Trade associations	Camera di Commercio Torino (Torino Chamber of Commerce)	The Camera di Commercio Torino is made up of more than 222,000 businesses operating in the city and province. It expresses the synthesis of the area's economic interests, with a focus on civil society and the consumer world. Its involvement in the Project is considered essential for the proper implementation of the actions planned on a local scale. The Chamber has prepared a multi-year strategic plan, which defines the priority lines of action, among which stands out the necessary increase in the territory's awareness in energy and environmental issues.	Driving Facilitating Agent * High Influence	Medium Interest
Organized groups Trade associations	Professional Associations	The participation of professional associations is important for the success of the project since, by bringing together all professionals working locally in their respective sectors, they can influence their work choices and foster the development of best practices in environmental protection. Collaborations and synergies with this entities aim at fostering the development of actions on environmental protection and energy transition in the different sectors to which the professionals involved belong are conceivable.	Facilitating Disseminating Agent * High Influence	Medium Interest

Systems & stakeholders mapping

Corporate Private Companies	PMI – Piccole e Medie Imprese (Small and Medium-sized Enterprises)	The achievement of the CCC's objectives cannot be separated from a broad involvement of individual private companies, starting with PMIs and ending with multinationals present in the area and already engaged in the fight against climate change. The interest of private companies in direct involvement in the project depends on a multiplicity of factors including, in particular, employment and economic-financial dimensions, the sector they belong to, international vocation, etc.	Driving Facilitating Disseminating Agent * High Influence	Medium Interest
	Environment Park	Environment Park is the Torino Technology Park that has been active for more than 20 years on environmental innovation. It is a reference for Public Administrations and companies receiving support in their sustainability paths.	Driving Facilitating Disseminating Agent * Medium - High Influence	High Interest
Environmental associations	E.g.: Legambiente, FAI – Fondo per l'Ambiente Italiano, CAI – Club Alpino Italiano	These associations play a key role in developing and proposing actions to protect the environment and raise public awareness	Facilitating Disseminating Agent * Medium Influence	High Interest
Bank Foundations	E.g.: Fondazione Compagnia di San Paolo, Innovation Center, Banca Etica	Bank Foundations are nonprofit, private and autonomous organizations that were created in the early 1990s by the reform of the Italian credit system. They differ in size and territorial operations and intervene in different fields, from welfare to culture, from innovation to the environment, from education to research. The Foundations' mission is to accompany the cultural, social and economic development of their communities and the entire country.	Driving Facilitating Disseminating Agent * High Influence	High Interest

Systems & stakeholders mapping

Public Institutions Subsidiaries and affiliated companies	InfraTo	InfraTo[76] is one of the most important public companies at the European level. Owned by the Città di Torino as a single shareholder, it was established on October 1, 2010, following the demerger of a business unit of GTT – Gruppo Torinese Trasporti S.p.A. InfraTo's object is the ownership and management of infrastructure, as well as engineering, design, construction and development of plants, systems and infrastructure, including railways, for both public and private passenger and freight transport systems.	Driving Facilitating Disseminating Agent * High Influence	High Interest
Third Sector		The Third Sector (or nonprofit sector) is the set of those private entities that pursue, on a nonprofit basis, civic, solidarity and socially useful purposes. They promote and carry out activities of general interest through forms of voluntary and gratuitous action or mutuality, and the production/ exchange of goods and services.	Driving Facilitating Disseminating Agent * Medium - High Influence	High Interest
Public Institutions Subsidiaries and affiliated companies	Trenitalia	A wholly owned subsidiary of FS Italiane – Ferrovie dello Stato SpA, the company provides railway services throughout national and European territory.	Driving Facilitating Agent * Medium Influence	High Interest
Citizen private transportation	Citizens	Individual citizens are essential stakeholders in the development of the path to climate neutrality both economically and culturally. Therefore, they will necessarily be involved in a multiplicity of actions, including but not limited to increasing electric mobility, replacing energy-intensive appliances with more up-to-date and efficient versions, making buildings more efficient, etc.	Driving Agent * High Influence	Medium Interest

69 https://www.infrato.it/home-eng/

Systems & stakeholders mapping

Organized groups Trade associations	ABI – Associazione Bancaria Italiana (Italian Banking Association)	ABI is a voluntary non-profit entity that works to promote knowledge and awareness of social values and behavior inspired by the principles of sound and fair entrepreneurship, as well as the realization of a free and competitive market.	Disseminating Agent * High Influence	Medium Interest
Public Institutions Subsidiaries and affiliated companies	CDP – Cassa Depositi e Prestiti	Established in 1850, CDP is an institution that finances Italy's sustainable development, employing savings to foster growth and employment, supporting business innovation and competitiveness, infrastructure and the territory. It finances the infrastructure and investments of public administrations, also offering integrated support through technical consulting services for all phases of public works implementation. Since 2015 it has been a Istituto Nazionale di Promozione italiano (Italian National Promotion Institute) and offers financial consulting for the use of national and European funds.	Driving Facilitating Agent * High Influence	Medium Interest
Public Institutions Subsidiaries and affiliated companies	SAGAT – Società Azionaria Gestione Aeroporto Torino (Torino Airport Management Shareholder Company)	SAGAT is the company that has been responsible for the management and development of Torino Airport since 1956.	Driving Facilitating Agent * Medium - High Influence	Medium Interest
Network of "Case del Quartiere"[77] (Neighborhood Houses Network)		Since 2012, the Case del Quartiere have been promoting joint projects across Houses and territories to spread best practices throughout the city.	Driving Facilitating Agent * Medium Influence	Medium Interest

77 The network of "Case del Quartiere" is detailed in the Annex II to this Action Plan.

Systems & stakeholders mapping

Consortiums	CONAI	CONAI is a private, nonprofit Consortium through which producers and users of packaging ensure the achievement of the statutory recycling and recovery targets for packaging waste. CONAI involves 7 Consortia of materials: steel (Ricrea), aluminum (Cial), paper/cardboard (Comieco), wood (Rilegno), plastics (Corepla), bioplastics (Biorepack), and glass (Coreve), ensuring the necessary link between them and the Public Administration.	Driving Facilitating Agent * Medium Influence	Medium Interest
Public Institutions Subsidiaries and affiliated companies	Terna	The Terna Group owns Italy's high and extra-high voltage electricity transmission grid (NTG), and is the largest independent power transmission system operator (TSO) in Europe. It performs an indispensable public service role to secure electricity for the country and enable the operation of the entire national electricity system. The Company has been listed on the stock exchange since 2004.	Driving Facilitating Agent * Medium Influence	Medium Interest
Corporate Private Companies	Publishers	Publishers, i.e., those who publish and disseminate content through media, can play a key role in promoting climate change by educating the public and pushing for sustainable behaviors through disseminating information and promoting environmental solutions.	Driving Facilitating Agent * High Influence	Low Interest
Public and Private Agencies	Hospitals	Hospitals, as health care institutions, can contribute to climate change by reducing their greenhouse gas emissions, adopting sustainable practices and raising community awareness of environmental health.	Driving Facilitating Agent * Medium - High Influence	Low Interest
Corporate Private Companies	Shopping malls	Shopping malls, as commercial and consumer entities, can play a crucial role in promoting climate change by adopting sustainable practices, reducing emissions, and raising customers' awareness of the importance of green choices.	Driving Facilitating Agent * High Influence	Low Interest

Systems & stakeholders mapping

Organized groups Trade associations	ANACI – Associazione Nazionale Amministratori e Consulenti Immobiliari (National Association of Property Managers and Consultants)	ANACI can take action through the promotion of sustainable practices in the real estate sector aimed at energy efficiency, responsible management of resources, and raising members' awareness of eco-friendly behaviors.	Facilitating Agent * Medium Influence	Low Interest
Corporate Private Companies	Fuel distributors	Fuel distributors, if geared toward promoting low-emission fuels can play a positive role in combating climate change. However, if they remain focused on fossil fuels without transitions to more sustainable options, their impact may be negative.	Driving Facilitating Agent * Medium Influence	Low Interest
Corporate Private Companies	Gas and electricity distributors	Gas distributors (e.g.: SNAM[78]and Italgas[79]) supply natural gas to end users, including domestic consumers, businesses and industries. They operate the distribution network that transports gas from supply infrastructure to points of use, ensuring a safe and smooth flow. Electricity distributors (e.g.: IRETI[80]) manage the distribution of electricity from the transmission grid to local distribution networks. They are responsible for ensuring that electricity reaches end users reliably by maintaining and operating infrastructure and resolving any interruptions or problems in supply.	Driving Agent * High Influence	Low Interest

78 https://www.snam.it

79 https://www.italgas.it

80 https://www.ireti.it

Systems & stakeholders mapping

Corporate Private Companies	Energy-intensive enterprises	Energy-intensive enterprises are defined by their annual electricity consumption. Until 2018, this consumption had to be greater than or equal to 2.4 GWh with a ratio of actual cost of energy used to sales equal to or greater than 3 percent. Today, it must be greater than or equal to 1 GWh (1,000,000 kW/h). They are required to carry out an Energy Diagnosis every 4 years, starting Dec. 5, 2015, and send the documentation to ENEA – Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile (National Agency for New Technologies Energy and Sustainable Economic Development).	Driving Agent * High Influence	Medium Interest
Network of Mobility Managers		The corporate Mobility Manager (MM), i.e., the person in charge of corporate mobility, is responsible for making systematic staff travel more active and sustainable and optimizing it.	Driving Facilitating Disseminating Agent * High Influenc	Medium - High Interest
Organized groups ACI – Automobile Club Italiano (Automobile Club of Italy)	e.g.: ACI Global	ACI Global is an instrumental Company of the Automobile Club of Italy. It operates under the regime of "in-house providing" with the objective of creating and delivering assistance services for ACI MEMBERS through an Operational Organizational Structure capable of guaranteeing an effective flow of intervention, from the first request contact until the successful execution.	Driving Facilitating Agent * Medium Influence	Medium Interest

Systems & stakeholders mapping

Public Institutions Subsidiaries and affiliated companies	ATC – Agenzia Territoriale per la Casa (Territorial Housing Agency)	ATCs are public services, noneconomic, auxiliary bodies of the Region. Endowed with organizational, patrimonial, administrative, and accounting autonomy, they implement and manage the social housing stock with jurisdiction extended to their respective territorial ambit. The Central ATC Piemonte has its headquarters in Torino and jurisdiction in the 22 aggregates (ambits) of municipalities defined by the Regione Piemonte (Torino and more than 100 municipalities in the entire province, with a wide geographic distribution).	Driving Agent * Medium Influence	Medium Interest
Corporate Private Companies	Housing cooperatives	A housing cooperative is a Limited Liability Company. The society is joined by members for the main purpose of carrying out a construction project through the building, rehabilitation or acquisition of a property. Such property may be assigned to the members on an ownership or usufruct basis. A building cooperative may finance construction through members' savings and with the assistance of a subsidized or ordinary mortgage.	Driving Agent * Medium Influence	Medium Interest
Corporate Private Companies	Cab cooperatives	Cab cooperatives are associations of taxi drivers who work together to provide public transportation services. They can play a role in climate change by adopting low-emission vehicle fleets, promoting eco-friendly practices, and supporting the adoption of cleaner technologies in the transportation sector.	Driving Agent * Medium Influence	Medium Interest

Systems & stakeholders mapping

Consortiums	Arriva Italia	Arriva Italia[81] operates Extra-urban Local Public Transport services in the Città di Torino and its Province, as well as rental services with driver. Arriva Italia is part of the Extra.To consortium [82]– the single transport operator for the Metropolitan Città di Torino – to form a single network capable of covering routes throughout the entire province. Arriva Italia has been able to implement sustainable mobility solutions to offer an increasingly green travel experience to its passengers and reduce its environmental impact.	Driving Agent * Medium Influence	Medium Interest
Public Institutions Subsidiaries and affiliated companies	CAAT – centro Agroalimentare Torino (Torino Agri-food Center)	CAAT is among the top three Agri-food Centers in Italy. It is among the most modern facilities on the national scene and facilitates the conduct of wholesale activities of agri-food products. To concretize its commitments to sustainability, CAAT has adopted an Environmental Management System and – with the adoption of ISO 14001 certification – it promotes to increase the environmental awareness and involvement of staff, suppliers and all users in general.	Driving Disseminating Agent * Medium Influence	Medium Interest
Corporate Private Companies	Aziende operatori GDO – Grande Distribuzione Organizzata (Large-scale retail trade)	Large-scale retail trade includes supermarket chains, hypermarkets, and other retail outlets with an extensive distribution network. In the context of climate change, large-scale retail trade can positively influence the environment by implementing sustainable policies, reducing the environmental impact of supply chains, adopting waste management practices, and promoting products with low environmental im-pact.	Driving Disseminating Agent * Medium Influence	Medium Interest

81 https://arriva.it

82 https://www.extrato.it

Systems & stakeholders mapping

Local social associations	Diocesan institutes	Diocesan institutes are diocesan-run church institutions, generally under the jurisdiction of a Catholic diocese. In the context of climate change, diocesan institutes can play a positive role by promoting environmental responsibility through awareness-raising initiatives, adopting sustainable practices within church facilities and promoting actions to preserve the environment.	Driving Facilitating Disseminating Agent * Medium Influence	Medium Interest
Corporate Private Companies	Energy suppliers	Energy suppliers (e.g.: ENI[83], ENEL [84], Edison [85], etc.) purchase energy potential either directly from producers or through transactions on the energy market exchange in order to offer it to end consumers. These companies manage the commercial and administrative aspects, determining the final cost of energy and sending the related bills. They can promote sustainability through supplies from renewable sources and by offering consumers tariff plans with the inclusion of a guarantee of origin. The energy suppliers themselves represent the main suppliers of electric car charging stations and are, therefore, also of particular importance in the implementation of the CCC's sustainable mobility actions.	Driving Facilitating Agent * High Influence	Medium Interest

83 https://www.eni.com/it-IT/home.html

84 https://www.enel.com/it

85 https://www.edison.it/it

4. PART B

The target and the way to go for Torino:
Pathways towards Climate Neutrality by 2030

4.1 Module B-1

Climate Neutrality Scenarios and Impact Pathways

Table B-1.1: Impact pathways in terms of macro-actions, systemic levers and direct/indirect impacts – Emission Reduction

Impact Pathways

Fields of Actions		Actions/ Outcomes	Systemic Levers	Impacts	
Macro-areas	**Sectors**			Direct (Em. red.) CO_2 (t/y)	Indirect impacts (co-benefits)
STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	District Heating: 70% coverage of TRL network in built volume without new power plants	**FINANCE & FUNDING** Meet the costs of financing the connection of buildings to the district heating network **DEMOCRACY & PARTICIPATION** Trigger information and participation initiatives to introduce citizenship to current and future short-term change	-73,237	**ENERGY BENEFITS (B)** High overall efficiency levels **PROPERTY VALUE (D)** Simplification of plant installation and maintenance work; Enhancement of property value through improved energy classes **LABOR MARKET (E)** Increased local job opportunities along the entire value chain using waste heat **ECONOMIC BENEFITS (F, G)** Elimination of expenses for purchase, maintenance and installation/ revision of boilers and flues **ENVIRONMENTAL BENEFITS (B)** Improvement of air quality **SAFETY (I)** Absence of combustion and open flames, hazards from gas leaks, burst or fire hazards

Impact Pathways

STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Thermal Insulation of Buildings: Improvement of thermal insulation in F and G class buildings; further improvements for other classes	**FINANCE & FUNDING** Consolidate existing financial resourcesProvide financial incentives to the interventions (residential buildings; tertiary; industry) **DEMOCRACY & PARTICIPATION** Dialogate with the community/ stakeholders on the initiative's relevance (residential buildings; tertiary; industry)	-144,893	**ENERGY BENEFITS (A)** Energy savings **ECONOMIC BENEFITS (F, G)** Economic savings in energy bills **PROPERTY VALUE (D)** Enhancement of real estate by improving energy classes **WELLNESS & HEALTH (H)** Improvement of air quality; Increased comfort and efficiency
STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Data Centers: Recovery of 55% of waste heat from data centers (Hypothesis: 9% annual increase in data centers).	**LEARNING & CAPABILITIES** **SOCIAL INNOVATION** Dialogue with the community by undertaking a participatory process (residential buildings; tertiary) **GOVERNANCE & POLICY** Introduce targeted policies to make the connection between the district heating network and the data centre's owners effective (municipal buildings)	0 (*)	**ECONOMIC BENEFITS (G)** Reduced and simplified maintenance of data centers; Reduced data center operating costs (especially cooling costs) **TECHNOLOGICAL INNOVATION (K)** Creation of high-density centers. High density is advantageous for cooling system dimension, allows selection of more compact equipment, and reduces the footprint occupied in the data center white space and/ or on the outside ground

Impact Pathways

STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Heat Pumps feed by PV: Different heat pumps according to energy class; only for buildings using natural gas (50% of buildings in class E and D). Photovoltaic Systems: PV systems to cover the electrical needs of heat pumps	**LEARNING & CAPABILITIES** Soliciting targeted knowledge and expertise on technology and installation (municipal buildings) **FINANCE & FUNDING** Provide financial support for the interventions (residential buildings; tertiary; industry) **DEMOCRACY & PARTICIPATION** Dialogate with the community on the initiative's relevance	-224,872	**ENERGY BENEFITS (A)** Energy savings; Efficient integration with photovoltaic panels **PROPERTY VALUE (D)** Enhancement of property value through improvement of energy classes **ENVIRONMENTAL BENEFITS (B)** Improvement of air quality **ECONOMIC BENEFITS (F, G)** Growth of local economy **WELLNESS & HEALTH (H)** Increased comfort **LABOR MARKET (E)** Job creation
STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Electricity Storage: Storage systems to increase self-consumption of locally produced electricity from PV installations.	**TECHNOLOGY** Consolidate knowledge/ awareness of the technological choices to be used and the installation of systems, especially with regard to how to work on existing buildings **GOVERNANCE & POLICY** Promote targeted policies on fire regulations, installation permits, battery safety assessment protocols **FINANCE & FUNDING** Provide financial support to citizens for the interventions	-29,152	**ENERGY BENEFITS (A)** Increased capacity for energy storage; Increased self-consumption of energy **ECONOMIC BENEFITS (F, G)** Shift of energy purchase to low-cost periods; Reduction in electricity consumption costs **PROPERTY VALUE (D)** Enhancement of property value **LABOR MARKET (E)** Local business incentive (maintenance, business development and technological innovation); Job creation

Impact Pathways

STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Electrical Equipment: Improvement in energy efficiency class	TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used (municipal buildings) FINANCE & FUNDING Provide financial support to citizens for the interventions (residential) SOCIAL INNOVATION Communicate the initiative's relevance to the community/stakeholders (residential; tertiary)	-38,694	ENERGY BENEFITS (A) Lower energy consumption ECONOMIC BENEFITS (F,G) Economic savings in energy bills SAFETY (I) Improved safety of new-generation appliances WELLNESS & HEALTH (H) Better functioning and increased performances of the new-generation appliances GEOPOLITICAL BENEFITS (L) Increased autonomy from the national power grid
STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	CCS Installation on generation plants for District Heating(for emission reduction)	TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used FINANCE & FUNDING Consolidate the economic resources to realize the intervention GOVERNANCE & POLICY Trigger/reinforce targeted policies SOCIAL INNOVATION Dialogue with the community/stakeholders by undertaking a participatory process to enhance the awareness on the initiative	0 (*)	LABOR MARKET (E) Increased local job opportunities TECHNOLOGICAL INNOVATION (K) Incentive to technological innovation ENVIRONMENTAL BENEFITS (B) Improvement of air quality

Impact Pathways

STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Policies for the development of energy communities	GOVERNANCE & POLICY Trigger/reinforce targeted policies (municipal buildings; residential; tertiary; industry) DEMOCRACY & PARTICIPATION Dialogue with the community by undertaking a participatory process (municipal buildings; residential; tertiary; industry) SOCIAL INNOVATION Communicate the initiative's relevance to the community (municipal buildings; residential; tertiary; industry)	-16,713	ECONOMIC BENEFITS (F, G) Economic savings in energy bills; Reduction of energy poverty ENERGY BENEFITS (A) Increase share of affordable and secure energy through the exploitation of a locally available source; Increased autonomy from the national power grid; Increased self-consumption of energy LABOR MARKET (E) Increased local job opportunities
STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Policies for the development of positive energy districts		-707	ECONOMIC BENEFITS (F, G) Economic savings in energy bills; Reduction of energy poverty; Energy saving; Elimination of expenses for purchase, maintenance and installation/ revision of boilers and flues ENERGY BENEFITS (A) Increase share of affordable and secure energy through the exploitation of a locally available source; Increased autonomy from the national power grid; Increased self-consumption of energy LABOR MARKET (E) Increased local job opportunities PROPERTY VALUE (D) Enhancement of real estate by improving energy classes SAFETY (I) Absence of combustion and open flames, hazards from gas leaks, burst or fire hazards ENVIRONMENTAL BENEFITS (B) Improvement of air quality WELLNESS & HEALTH (H) Increased comfort and efficiency

Impact Pathways

STATIONARY ENERGY	**Buildings (Municipal, Residential, Tertiary, Industrial)**	Energy retrofitting of 800 municipal buildings with Iren (EfficienTO)	**GOVERNANCE & POLICY** Activate existing policies (municipal buildings)	-12,134	ENERGY BENEFITS (A) Energy savings ECONOMIC BENEFITS (F, G) Economic savings in energy bills LABOR MARKET (E) Job creation WELLNESS & HEALTH (H) Increased comfort and efficiency ENVIRONMENTAL BENEFITS (B) Improvement of air quality
	Industry	Industrial process efficiency improvement (25% more efficiency)	**TECHNOLOGY** Consolidate knowledge/ awareness of the technological choices to be used **LEARNING & CAPABILITIES** Soliciting targeted knowledge and expertise on technology and installation **FINANCE & FUNDING** Provide financial incentives for the interventions	-82,428	**ENERGY BENEFITS (A)** Energy savings **ECONOMIC BENEFITS (F, G)** Economic savings in energy bills **ENVIRONMENTAL BENEFITS (B)** Improvement of air quality

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Impact Pathways

STATIONARY ENERGY	**Waste-to-energy plant**	Implentation of Line 4 of the plant and application of CCS (***)	**GOVERNANCE & POLICY** Promote/reinforce targeted policies **DEMOCRACY & PARTICIPATION** Dialogue with the citizenship by undertaking a participatory process to understand the social dimension of the initiative **FINANCE & FUNDING** Provide financial incentives for the interventions	-27,721	**LABOR MARKET (E)** Increased local job opportunities **TECHNOLOGICAL INNOVATION (K)** Incentive to technological innovation **ENVIRONMENTAL BENEFITS (B)** Improvement of air quality
	Lighting	Public LED lighting	**GOVERNANCE & POLICY** Activate existing policies	-14,504	**ENERGY BENEFITS (A)** Energy savings; Possibility to adjust the light intensity **ECONOMIC BENEFITS (F, G)** Economic savings in energy bills **WELLNESS & HEALTH (H)** Absence of mercury vapours or dangerous substances; Light pollution prevention **TECHNOLOGICAL INNOVATION (K)** Creation of a smart street lighting system, with integration of other services (e.g., systems of sensors for air quality monitoring, smart services like public Wi-Fi, video surveillance or e-mobility services)

Impact Pathways

TRANSPORT	Municipal Vehicles	Replacement of ICE vehicles with electric ones	GOVERNANCE & POLICY Promote/reinforce targeted policies DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory process to understand the social and environmental dimension of the initiative (private transportation) SOCIAL INNOVATION Dialogue with citizenship on the initiative's relevance	-688	ENERGY BENEFITS (A) Energy savings due to higher efficiency of electric vehicles ECONOMIC BENEFITS (F, G) Savings in mobility costs; Lower maintenance requirements of vehicles TECHNOLOGICAL INNOVATION (K) Incentive to technological innovation LABOR MARKET (E) Development of "green" jobs WELLNESS & HEALTH (H) Decreased noise pollution ENVIRONEMENTAL BENEFITS (B) Improved air quality
		Limitations on private traffic		-101,936	
	Private transport	Replacement of private cars with electric vehicles	TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used FINANCE & FUNDING Provide financial incentives for the interventions SOCIAL INNOVATION Dialogue with citizenship on the initiative's relevance	-77,813	

Impact Pathways

TRANSPORT	Private transport	Promotion of alternative means of transport (bicycles, etc.): Building cycle paths	GOVERNANCE & POLICY Promote/reinforce targeted policies DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory process to understand the social and environmental dimension of the initiative SOCIAL INNOVATION Dialogue with citizenship on the initiative's relevance	-17,017
		Development of policies of carsharing with non-ICE vehicles	GOVERNANCE & POLICY Promote/reinforce targeted policies (platforms for car sharing/ carpooling), normative incentives (priority access to limited access zones) FINANCE & FUNDING Provide financial incentives for the interventions DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory process to understand the social and environmental dimension of the initiative SOCIAL INNOVATION Dialogue with citizenship on the initiative's relevance; encourage private citizens' initiative	-25,066
		Development of policies of carpooling		-50,366

Impact Pathways

	Public transport	Renewal of the local public transport fleet	FINANCE & FUNDING Provide financial incentives for the interventions TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used	-36,363	
	Public transport	Construction of metro line 2	DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory process to understand initiative's relevance	-71,840	
WASTE	Residual emissions landfill	Elimination of residual emissions from landfills	TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used	-21,761	ENVIRONMENTAL BENEFITS (B, C) Improvement of air quality; Improvement of soil quality
WASTE	Wastewater treatment	Process efficiency improvement (15% more efficient)	GOVERNANCE & POLICY Promote and inject targeted policies TECHNOLOGY Consolidate knowledge/ awareness of the technological choices to be used FINANCE & FUNDING Provide financial incentives for the interventions	-2,590	ENERGY BENEFITS (A) Energy savings due to higher efficiency of wastewater treatments ENVIRONEMENTAL BENEFITS (B, C) Improved air, water and soil quality

Impact Pathways

WASTE	Sorted waste collection	Waste reduction and increase of sorted waste	GOVERNANCE & POLICY Promote and inject targeted policies DEMOCRACY & PARTICIPATION SOCIAL INNOVATION Dialogue with the citizenship by undertaking a participatory process to understand initiative's relevance	-48,121	ECONOMIC BENEFITS (G) Promote circular economy ENVIRONEMENTAL BENEFITS (B, C) Improved air, water and soil quality

Impact Pathways

ENERGY SYSTEMS	Increase in the share of PV in the electricity generation system	**TECHNOLOGY** Consolidate knowledge/ awareness of the technological choices to be used **LEARNING & CAPABILITIES** Soliciting targeted knowledge and expertise on technology and installation **GOVERNANCE & POLICY** Promote and inject targeted policies **DEMOCRACY & PARTICIPATION** Trigger information and participation initiatives to introduce citizenship to current and future short-term change	0 (*)	**GEOPOLITICAL BENEFITS (L)** Reduction of energy dependence on other countries by lowering the contribution of fossil fuels **ENVIRONEMENTAL BENEFITS (B)** Improved air quality **ECONOMIC BENEFITS (F, G)** Growth of local economy **LABOR MARKET (E)** Job creation
	Increase in the share of purchase of certified "Zero Emissions" electricity	**GOVERNANCE & POLICY** Promote and inject targeted policies	0 (*)	**LABOR MARKET (E)** Job creation **GEOPOLITICAL BENEFITS (L)** Reduction of energy dependence on other countries by lowering the contribution of fossil fuels **ENVIRONEMENTAL BENEFITS (B)** Improved air quality
	Variation of the carbon content of Electricity/ Gas/District Heating on the energy consumption (**)	-	-480,530	**ENVIRONEMENTAL BENEFITS (B)** Improved air quality

(*): These actions have not a direct effect in terms of CO2 emissions reduction, but they allow for a reduction of the emission factor of the electricity generation mix, gas and heat generation for district heating, lowering the emissions associated to the energy consumption in all the other actions.

(**): This action quantifies the effect of emission reduction due to the change of the emission factors for electricity, gas and district heating not directly accounted by the other actions.

(***) Only the contribution of CO2 emission reduction related to the combustion of the fossil fraction of Torino waste is taken into consideration in this section as reduction measure. The contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered for the compensation of the residual emission.

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Part B – The target and the way to go for Torino: Pathways towards Climate Neutrality by 2030

B-1.2: Description of impact pathways

The proposed impact pathway summarized in Table 2.1 is composed by a set of sectorial macro-actions, aiming at significantly lowering the CO_2 emission budget of the city.

These macro-actions, on the one hand, represent the general framework with respect to which all the already defined climate actions and project and the future ones can be categorized and mapped, in order to ensure their coherence with the overall decarbonization strategy of the City. On the other hand, theypush forward and strengthen the main transition goals set in the existing plans and policy actions described in section A-2, both at urban (like the PAESC, TAPE and PUMS plans) and national (like the PNIEC plan) level.

In particular, the main pillars of the proposed macro-actions, in coherence with the principles expressed in the Commitments, are ① the electrification of the urban energy system (especially for what concerns the building and the transport sectors), ② the penetration of renewable energy sources in the electricity generation mix, ③ the increase in energy efficiency (mainly in the building and industrial sector), ④ the promotion of alternative mobility modes with respect to the private one by cars, ⑤ the introduction of innovative technological options for CO_2 capture. The overall actions cover 66.7% of the baseline CO2 emissions, with a relevant emissions reduction in Stationary Energy (-38% with respect to the 2019 emissions of the macro-area) and in Transport (-60%) macro-areas.

In the selection of these actions, not only their direct impacts in terms of emissions reduction have been considered, but also their systemic impacts (allowing for a relevant decrease of the carbon content of electricity, of gas and of heat for district heating, able to reduce the emission factors associated to the consumption of these commodities, thus obtaining a decrease by 20% of the baseline emissions) and their indirect impacts. Concerning the latter, in particular, the possible co-benefits arising from the implementation of these actions have been taken into account, focusing on the positive effects in terms of growth of local economy, creation of new job positions, and tangible improvement of life quality of citizens. The identified actions, in fact, can act not just as drivers of a change in the urban energy system, but also as levers for a socio-economic development of the City itself along its transition route towards climate neutrality.

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4.2 Module B-2
Climate Neutrality Portfolio Design

Table B-2.1: Description of action portfolio for Emission Reduction

Macro Area	Sector	Portfolio description		
		Code	Action	Description
Stationary Energy Systems Built Environment	Municipal Residential Tertiary Industrial	FS1	DST Heating	District Heating: 70% coverage of TRL network in built volume without new power plants.
		FS2	Thermal Insulation	Thermal Insulation of Buildings: Improvement of thermal insulation in F and G class buildings; further improvements for other classes.
		FS3	Data Center Heat	Data Centers: Recovery of 55% of waste heat from data centers (Hypothesis: 9% annual increase in data centers).
		FS4	Heat Pumps	Heat Pumps: Different heat pumps according to energy class; only for buildings using natural gas (50% of buildings in class E and D). Photovoltaic Systems: PV systems to cover the electrical needs of heat pumps
		FS5	Elec Storage	Electricity Storage: Storage systems to increase self-consumption of locally produced electricity from PV installations.
		FS6	Energy Class	Electrical Equipment: Improvement in energy efficiency class.
		FS7	CCS Installation on DH (for emission reduction)	CCS Installation on Iren generation plant for District Heating for emission reduction
		FS8	Energy Community	Policies for the development of energy communities
		FS9	Positive Energy Dist	Policies for the development of positive energy districts
		FS10	Municipal Buildings	Energy retrofitting of 800 municipal buildings with Iren (EfficienTO).
		FS11	Industrial Processes	Industrial process efficiency improvement (25% more efficiency)
	Waste-to-Energy Plant	FS12a (*)	Line 4 and CCS on waste-to-energy plant	Implementation of Line 4 of the plant and application of CCS
	Public Lighting	FS13	Public Lighting	Replacement of traditional lamps with new LED lamps
Transport	Municipal Transport	FT1	Municipal Vehicles	Replacement of ICE vehicles with electric ones
	Private Transport	FT2	Limitation on traffic	Limitations on private traffic
		FT3	Electrification Private Cars	Replacement of private cars with electric vehicles
		FT4	Bicycle Promotion	Promotion of alternative means of transport (bicycles, etc.): Building cycle paths
		FT5	Carsharing Promotion	Development policies of carsharing with Non-ICE vehicles
		FT6	Carpooling Promotion	Development policies of car pooling
	Public Transport	FT7	GTT Bus Renewal	Renewal of the local public transport fleet
		FT8	Metro L2	Construction of Metro Line 2
Waste	Landfill Residual Emissions	FW1	Landfill Residual	Elimination of residual emissions from landfills
	Wastewater treatment	FW2	Wastewater Treatment	Process efficiency improvement (15% more efficient)
	Waste Reduction and increase of sorted waste	FW3	Sorted Waste collection	Reduction of waste generation, reduction of waste sent to waste-to-energy plant by the Città di Torino and increase in sorted waste collection
Energy Systems	PV Share Increase	FE1	PV Share Increase	Increase in the share of PV in the electricity generation system
	Green Certified Electricity	FE2	Green Certified Electricity	Increase in the share of purchase of Zero Emissions Electricity
	Emission Factors	FE3	Emission Factors	Variation of the carbon content of Electricity/Gas/District Heating on the energy consumption

(*) Macro-action FS12a accounts only for the contribution of CO2 emission reduction related to the combustion of the fossil fraction of Torino waste. The contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste (FS12b) is considered for the compensation of the residual emission. Macro-actions FS12a and FS12b, from an implementation point of view, represent a unique macro-action, which has been split in the CCC Action Plan in order to account its different contributions to both emission reduction and residual emissions compensation. Macro-action FS12b is detailed in the Section B-2.3 of this Action Plan.

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Table B-2.2: Individual actions outline – Emission Reduction

B-2.2: Individual action outlines – Emission Reduction

FS1 - DST Heating

Action outline	Action name	DST Heating
	Action type	Technical
	Action description	District Heating: 70% coverage of TRL network in built volume without new power plants.
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever(s)	Finance & Funding Democracy & Participation
Implementation	Responsible bodies/person for implementation	IREN
	Action scale & addressed entities	Municipal scale
	Involved stakeholders	IREN, Municipality, Citizens
	Comments on implementation	Already planned and budgeted
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of natural gas
	GHG emissions reduction estimate (total) per emission source sector	73,237 t/y
	Investment costs and costs by CO_2e unit	211 M€; 2,882 €/t

FS2-Thermal Insulation

Action outline	Action name	FS2-Thermal Insulation
	Action type	Technical
	Action description	Thermal Insulation of Buildings: Improvement of thermal insulation in F and G class buildings; further improvements for other classes
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Finance & Funding Democracy & Participation

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Owners of buildings
	Action scale & addressed entities	Buildings class F & G in city, other classes
	Involved stakeholders	Municipality, Engineering and Installation companies
	Comments on implementation	Need for comprehensive planning of human and technical resources, administrative processes, and of financial instruments. The municipality will open a dedicated contact point to this end.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption
	GHG emissions reduction estimate (total) per emission source sector	144,893 t/y
	Investment costs and costs by CO_2e unit	6,042 M€; 41,699 €/t

FS3 – Data Center Heat

Action outline	Action name	Data Center Heat
	Action type	Technical
	Action description	Data Centers: Recovery of 55% of waste heat from data centers (Hypothesis: 9% annual increase in data centers)
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Governance & Policy Learning & Capabilities Social Innovation

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Owners/operators of data centers
	Action scale & addressed entities	All data centers in city
	Involved stakeholders	IREN, developers of data centers
	Comments on implementation	This action will require a close dialogue between the operators of the Data Centers and the operator of the district heating facilities (IREN). The municipality will facilitate this operation and accelerate all needed administrative steps with a dedicated contact point.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction of heat generation from other sources
	GHG emissions reduction estimate (total) per emission source sector	- (*)
	Investment costs and costs by CO2e unit	7 M€; - (*)

FS4 – Heat Pumps

Action outline	Action name	Heat Pumps feed by PV
	Action type	Technical
	Action description	Heat Pumps: Different heat pumps according to energy class; only for buildings using natural gas (50% of buildings in class E and D). Photovoltaic Systems: PV systems to cover the electrical needs of heat pumps
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Learning & Capabilities Finance & Funding Democracy & Participation

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Owners of buildings
	Action scale & addressed entities	Buildings class E & D in city
	Involved stakeholders	Municipality, Engineering and Installation companies
	Comments on implementation	Need for comprehensive planning of human and technical resources, administrative processes, and of financial instruments. The municipality will open a dedicated contact point to this end.
Impact & cost	Generated renewable energy (if applicable)	Green electricity generation
	Removed/substituted energy, volume or fuel type	Substitution of natural gas with electricity
	GHG emissions reduction estimate (total) per emission source sector	224,872 t/y
		2,253 M€; 10,018 €/t

FS5 – Electricity Storage

Action outline	Action name	Electricity Storage
	Action type	Technical
	Action description	Electricity Storage: Storage systems to increase self-consumption of locally produced electricity from PV installations
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Technology Governance & Policy Finance & Funding
Implementation	Responsible bodies/person for implementation	Owners of PV installations
	Action scale & addressed entities	All PV installations in city
	Involved stakeholders	Engineering companies
	Comments on implementation	Need for comprehensive planning of human and technical resources, administrative processes, and of financial instruments. The municipality will open a dedicated contact point to this end.

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	29,152 t/y
	Investment costs and costs by CO_2e unit	391 M€; 13,419 €/t

FS6 – Energy Class of equipment

Action outline	Action name	Energy Class
	Action type	Technical
	Action description	Electrical Equipment: Improvement in energy efficiency class.
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Technology Finance & Funding Social Innovation
Implementation	Responsible bodies/person for implementation	Citizens, companies
	Action scale & addressed entities	All city dwellings and buildings
	Involved stakeholders	Citizens, companies, suppliers of appliances
	Comments on implementation	Need for comprehensive planning of human and technical resources, administrative processes, and of financial instruments. The municipality will open a dedicated contact point to this end, mainly for citizens. For tertiary and industrial actors, the municipality will establish a joint table for co-designing the intervention.

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in electricity consumption
	GHG emissions reduction estimate (total) per emission source sector	38,694 t/y
	Investment costs and costs by CO_2e unit	2,463 M€; 63,648 €/t

FS7 – CCS Installation on DH (for emission reduction)

Action outline	Action name	CCS Installation on DH (for emission reduction)
	Action type	Technical
	Action description	CCS Installation on Iren generation plants for District Heating (for emission reduction)
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Technology Finance & Funding Governance & Policy Social Innovation
Implementation	Responsible bodies/person for implementation	IREN
	Action scale & addressed entities	Cogeneration plant Iren Torino Nord
	Involved stakeholders	Technology providers, Municipality
	Comments on implementation	As the responsible entity is the operation of the district heating system (IREN), the municipality will support and facilitate any required administrative process.

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	- (*)
	Investment costs and costs by CO_2e unit	120 M€; - (*)

FS8 – Energy Community

Action outline	Action name	Energy Community
	Action type	Policy; technical
	Action description	Policies for the development of energy communities. Reduction of CO_2 emissions for private residential buildings due to the introduction of Renewable Energy Communities (RECs) in Torino[79]
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Governance & Policy Democracy & Participation Social Innovation

79 Renewable Energy Communities are Associations of private individuals (citizens, institutions and enterprises) that implement renewable energy production and self-consumption facilities.

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	All citizens, Municipality
	Action scale & addressed entities	Municipal district
	Involved stakeholders	Citizens, municipality, technology providers
	Comments on implementation	This action will require a close integration of social, economic and technical measures. The municipality will call a joint table with the operator of the power distribution grid (IREN), other relevant technical and business actors, and representatives of civil society and social actors. The intervention will have an overall reach, but will be organised as more convenient in the various city districts.
Impact & cost	Generated renewable energy (if applicable)	Green electricity generation
	Removed/substituted energy, volume or fuel type	Self-consumption of electricity
	GHG emissions reduction estimate (total) per emission source sector	16,713 t/y
	Investment costs and costs by CO_2e unit	198 M€; 11,868 €/t

FS9 – Positive Energy Districts

Action outline	Action name	Positive Energy Districts
	Action type	Policy; technical
	Action description	Policies for the development of positive energy districts
Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Governance & Policy Democracy & Participation Social Innovation

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	All citizens, Municipality
	Action scale & addressed entities	Municipal district
	Involved stakeholders	Citizens, municipality, technology providers
	Comments on implementation	This action will require a close integration of social, economic and technical measures. The municipality will call a joint table with the operator of the power distribution grid (IREN), other relevant technical and business actors, and representatives of civil society and social actors. The intervention will begin by selecting the potential districts.
Impact & cost	Generated renewable energy (if applicable)	Green electricity generation
	Removed/substituted energy, volume or fuel type	Self-consumption of electricity; reduction in energy consumption
	GHG emissions reduction estimate (total) per emission source sector	707 t/y
	Investment costs and costs by CO_2e unit	12 M€; 17,488 €/t

FS10 – Municipal Buildings Retrofitting

Action outline	Action name	Municipal Buildings
	Action type	Technical
	Action description	Energy retrofitting of 800 municipal buildings with Iren (EfficienTO)

B-2.2: Individual action outlines – Emission Reduction

Reference to impact pathway	Field of action	Stationary Energy Systems; Built Environment (Municipal, Residential, Tertiary, Industry)
	Systemic lever	Governance & Policy
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	All buildings owned by municipality
	Involved stakeholders	Municipality, technology providers, engineering companies
	Comments on implementation	Already planned and partially budgeted
Impact & cost	Generated renewable energy (if applicable)	Green electricity generation
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption; substitution of natural gas with electricity
	GHG emissions reduction estimate (total) per emission source sector	12,134 t/y
	Investment costs and costs by CO_2e unit	110 M€; 9,065 t/y

FS11 – Industrial Processes

Action outline	Action name	Industrial Processes
	Action type	Technical
	Action description	Industrial process efficiency improvement (25% more efficiency)
Reference to impact pathway	Field of action	Stationary Energy Systems; Industrial
	Systemic lever	Technology Learning & Capabilities Finance & Funding

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Industrial companies
	Action scale & addressed entities	Industries
	Involved stakeholders	Industrial companies, technology providers, engineering companies
	Comments on implementation	As the main actors are the operators of the industrial operators, the municipality will establish a joint table for co-designing the intervention.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption
	GHG emissions reduction estimate (total) per emission source sector	82,428 t/y
	Investment costs and costs by CO_2e unit	237 M€; 2,875 €/t

FS12a – Line 4 and CCS on waste-to-energy plant

Action outline	Action name	Line 4 and CCS on waste-to-energy plant
	Action type	Technical
	Action description	Implementation of Line 4 of the plant and application of CCS. Only the contribution of CO2 emission reduction related to the combustion of the fossil fraction of Turin waste is taken into consideration in this section as reduction measure; the contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered for the compensation of the residual emission.

B-2.2: Individual action outlines – Emission Reduction

Reference to impact pathway	Field of action	Stationary Energy Systems; District Heating
	Systemic lever	Governance & Policy Democracy & Participation Finance & Funding
Implementation	Responsible bodies/person for implementation	TRM
	Action scale & addressed entities	TRM waste-to-energy plant
	Involved stakeholders	Municipality, TRM, technology providers, engineering companies
	Comments on implementation	The intervention is the responsibility of the operator of the facility (TRM). The municipality will support and facilitate any required administrative process.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	27,721 t/y
	Investment costs and costs by CO2e unit	33 M€; 1,176 €/t

FS13 – Public Lighting

Action outline	Action name	Public lighting
	Action type	Technical
	Action description	Public LED lighting
Reference to impact pathway	Field of action	Stationary Energy Systems; Lighting
	Systemic lever	Governance & Policy

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Municipal vehicle fleet
	Involved stakeholders	Municipality
	Comments on implementation	Already planned and budgeted
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	688 t/y
	Investment costs and costs by CO_2e unit	25 M€; 35,995 €/t

FT1 – Municipal Vehicles Renewal

Action outline	Action name	Municipal Vehicles Renewal
	Action type	Policy; technical
	Action description	Replacement of ICE vehicles with electric ones
Reference to impact pathway	Field of action	Transport; Municipal Vehicles
	Systemic lever	Governance & Policy Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Municipal vehicle fleet
	Involved stakeholders	Municipality
	Comments on implementation	Already planned and budgeted
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	688 t/y
	Investment costs and costs by CO2e unit	25 M€; 35,995 €/t

B-2.2: Individual action outlines – Emission Reduction

FT2 – Limitation on traffic

Action outline	Action name	Limitation on traffic
	Action type	Policy
	Action description	Limitations on private traffic
Reference to impact pathway	Field of action	Transport; Private Transport
	Systemic lever	Governance & Policy Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, citizens
	Comments on implementation	As responsible for the intervention, the municipality will launch a co-design process with relevant social actors.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption
	GHG emissions reduction estimate (total) per emission source sector	101,936 t/y
	Investment costs and costs by CO_2e unit	2 M€; 20 €/t

B-2.2: Individual action outlines – Emission Reduction

FT3 – Electrification Private Cars

Action outline	Action name	Electrification Private Cars
	Action type	Technical
	Action description	Replacement of private cars with electric vehicles
Reference to impact pathway	Field of action	Transport; Private Transport
	Systemic lever	Technology Finance & Funding Social Innovation
Implementation	Responsible bodies/person for implementation	Citizens
	Action scale & addressed entities	Private vehicles fleet
	Involved stakeholders	Citizens
	Comments on implementation	The action relies on actions by the owners of vehicles. The replacement of current vehicles based on combustion engines with electric ones will be accompanied by the municipality with information campaigns, including the potential access to financial support.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	77,813 t/y
	Investment costs and costs by CO2e unit	3,416 M€; 43,896 €/t

B-2.2: Individual action outlines – Emission Reduction

FT4 – Bicycle Promotion

Action outline	Action name	Bicycle Promotion
	Action type	Policy; technical
	Action description	Promotion of alternative means of transport: building cycle paths. Encouragement of commuters' modal shift from car trips to cycling in the Città di Torino to enhance CO2 emission reduction by improving cycling infrastructure and adaptation results in a shift from car usage to cycling in urban areas
Reference to impact pathway	Field of action	Transport; Private Transport
	Systemic lever	Governance & Policy Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, citizens
	Comments on implementation	The municipality will extend the current cycling infrastructure, including paths, lanes, tracks and parking. In addition, the municipality will accompany this with information campaigns.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	17,017 t/y
	Investment costs and costs by CO2e unit	259 M€; 15,205 €/t

B-2.2: Individual action outlines – Emission Reduction

FT5 – Carsharing Promotion

Action outline	Action name	Carsharing Promotion
	Action type	Policy; technical
	Action description	Development of policies of carsharing with Non-ICE vehicles. Encouragement of the transition from Private Car (PC) trips to Car Sharing (CS) through the implementation of the electric CS fleet to 9.6%
Reference to impact pathway	Field of action	Transport; Private Transport
	Systemic lever	Governance & Policy Finance & Funding Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality, carsharing companies
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, carsharing companies, citizens
	Comments on implementation	The municipality will call a joint table with current and potential operators of carsharing companies and social actors for co-designing the expansion of available services. In addition, the municipality will accompany this with information campaigns.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption; substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	25,066 t/y
	Investment costs and costs by CO_2e unit	544 M€; 21,683 €/t

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B-2.2: Individual action outlines – Emission Reduction

FT6 – Carpooling Promotion

Action outline	Action name	Carpooling Promotion
	Action type	Policy
	Action description	Development of carpooling policies. Encouragement of commuters' modal shift from individual car trips to carpooling
Reference to impact pathway	Field of action	Transport; Private Transport
	Systemic lever	Governance & Policy Finance & Funding Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, carpooling service companies, citizens
	Comments on implementation	The municipality will call a joint table with social actors for co-designing the expansion of relevant initiatives. In addition, the municipality will accompany this with information campaigns.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	50,366 t/y
	Investment costs and costs by CO_2e unit	1 M€; 18 €/t

FT7 – GTT Bus Renewal

Action outline	Action name	GTT Bus Renewal
	Action type	Policy; technical
	Action description	Renewal of the local public transport fleet
Reference to impact pathway	Field of action	Transport; Public Transport
	Systemic lever	Finance & Funding Technology

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Municipality, GTT company
	Action scale & addressed entities	Public bus fleet
	Involved stakeholders	Municipality, GTT company, citizens
	Comments on implementation	Already planned and partially budgeted by the operator GTT
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	36,363 t/y
	Investment costs and costs by CO_2e unit	485 M€; 13,341 €/t

FT8 – Metro Line 2

Action outline	Action name	Metro Line 2
	Action type	Policy; technical
	Action description	Construction of Metro Line 2 - Reduction of CO2 emissions due to the implementation of subway Line 2
Reference to impact pathway	Field of action	Transport; Public Transport
	Systemic lever	Democracy & Participation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, technology providers, engineering companies, citizens
	Comments on implementation	Already planned and partially budgeted

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Substitution of petroleum products with electricity
	GHG emissions reduction estimate (total) per emission source sector	71,840 t/y
	Investment costs and costs by CO_2e unit	4,926 M€; 68,573 €/t

FW1 – Landfill Residual Emissions

Action outline	Action name	Landfill Residual Emissions
	Action type	Technical
	Action description	Elimination of residual emissions from landfills. Reduction of CO2 emissions due to the exhaustion of residual emissions from the landfill in Torino
Reference to impact pathway	Field of action	Waste; Landfill Residual
	Systemic lever	Technology

B-2.2: Individual action outlines – Emission Reduction

Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Basse di Stura landfill
	Involved stakeholders	Municipality
	Comments on implementation	Current interventions are already planned and budgeted. After this, there is no further investment, only supervising the evolution of the landfill until the exhaustion of the residual emissions.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	21,761 t/y
	Investment costs and costs by CO_2e unit	-

FW2 – Wastewater Treatment

Action outline	Action name	Wastewater Treatment
	Action type	Technical
	Action description	Process efficiency improvement (15% more efficient)
Reference to impact pathway	Field of action	Waste; Wastewater Treatment
	Systemic lever	Governance & Policy Technology Finance & Funding
Implementation	Responsible bodies/person for implementation	SMAT
	Action scale & addressed entities	Treatment plant
	Involved stakeholders	Municipality, SMAT
	Comments on implementation	Responsible of the action is the operator SMAT. No major investment foreseen.

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	Reduction in energy consumption
	GHG emissions reduction estimate (total) per emission source sector	2,590 t/y
	Investment costs and costs by CO_2e unit	-

FW3 – Sorted Waste Collection

Action outline	Action name	Waste Reduction and increase of sorted waste
	Action type	Policy; technical
	Action description	Reduction of waste generation, reduction of waste sent to waste-to-energy plant by the Città di Torino and increase in sorted waste collection
Reference to impact pathway	Field of action	Waste; Waste Treatment
		Governance & Policy Democracy & Participation Social Innovation
Implementation	Responsible bodies/person for implementation	Municipality, AMIAT
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, AMIAT, citizens
	Comments on implementation	The action requires minor investments, but an overall change of behavior by all social actors for reducing the production of waste. The municipality will support this with information campaigns.

B-2.2: Individual action outlines – Emission Reduction

Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	48,121 t/y
	Investment costs and costs by CO2e unit	1 M€; 31 €/t

FE1 – PV Share Increase

Action outline	Action name	PV Share Increase
	Action type	Technical
	Action description	Increase in the share of PV in the electricity generation system
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology Learning & Capabilities Governance & Policy Democracy & Participation
Implementation	Responsible bodies/person for implementation	Municipality, citizens
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, Engineering and Installation companies, citizens
	Comments on implementation	This action will require investments in large scale PV installations. The municipality will establish a working group with the operators of the transmission and distribution grids (TERNA and IREN), and relevant business actors.
Impact & cost	Generated renewable energy (if applicable)	Green electricity generation
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	- (*)
	Investment costs and costs by CO2e unit	82 M€; - (*)

FE2 – Green Certified Electricity

B-2.2: Individual action outlines – Emission Reduction

Action outline	Action name	Green Certified Electricity
	Action type	Policy
	Action description	Increase in the share of purchase of certified "Zero Emissions" electricity
Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology Learning & Capabilities Governance & Policy Democracy & Participation
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, IREN
	Comments on implementation	The municipality will launch a dialogue with the operator IREN for establishing a strategy for the acquisition of green certified electricity for Torino.
Impact & cost	Generated renewable energy (if applicable)	Electricity certified as green
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	- (*)
	Investment costs and costs by CO2e unit	- (*)

FE3 – Emission Factors (**)

Action outline	Action name	Emission Factors
	Action type	Technical
	Action description	Variation of the carbon content of Electricity/Gas/District Heating on the energy consumption

B-2.2: Individual action outlines – Emission Reduction

Reference to impact pathway	Field of action	Energy systems
	Systemic lever	Technology Learning & Capabilities Governance & Policy Democracy & Participation
Implementation	Responsible bodies/person for implementation	-
	Action scale & addressed entities	Energy system
	Involved stakeholders	-
	Comments on implementation	This action results from the implementation of other actions and the impact on the consumption of energy. The municipality will follow the resulting value and inform the city actors.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	480,530
	Investment costs and costs by CO2e unit	-

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(*): These actions have not a direct effect in terms of CO2 emissions reduction, but they allow for a reduction of the emission factor of the electricity generation mix, gas and heat generation for district heating, lowering the emissions associated to the energy consumption in all the other actions

(**): This action quantifies the effect of emission reduction due to the change of the emission factors for electricity, gas and district heating not directly accounted by the other actions

Part B – The target and the way to go for Torino: Pathways towards Climate Neutrality by 2030

In the calculation of CO_2 emissions, the evaluation of carbon content in commodities, such as electric-ity, gas, and district heating, is crucial. This is quantified in terms of emission factors, indicating the amount of CO_2 produced per unit of energy ($kgCO_2/kWh$).

Emission factors can be determined at the national level based on existing values and future projections (e.g., 2030), or at the municipal level in a base year. When undertaking initiatives to guide a city towards carbon neutrality, changes in commodity consumption composition are made, emphasizing renewable sources or procuring "green" (carbon-free) certified products.

This alteration affects the emission factor of the commodity. For instance, the national emission factor for electricity in 2019 is 0.269 $kgCO_2/kWh$, expected to decrease to 0.0767 $kgCO_2/kWh$ by 2030, aligning with the projected increase in renewables in the national electricity mix outlined in the Na-tional Integrated Plan for Energy and Climate (PNIEC). At the municipal level, the emission factor is lower (0.245 $kgCO_2/kWh$ in 2019) due to factors like the presence of PV plants within the city and the use of Green Certified electricity.

Actions taken within the Climate City Contract, such as installing new PVs or procuring additional Green Certificated electricity, necessitate a recalculation of the local emission factor of electricity, which is then applied to the overall electricity consumption. Similarly, the introduction of biogas re-duces the emission factor of the gas commodity, and utilizing waste heat from data centers reduces the emission factor of district heat.

In the calculation of CO_2 emissions, this "summation effect" is considered, accounting for the cumula-tive impact of all actions. The projected municipal emission factors for 2030 are: electricity 0.0302 $kgCO_2/kWh$, gas 0.1798 $kgCO_2/kWh$, and district heat 0.1050 $kgCO_2/kWh$.

Besides the set of macro-actions, a portfolio of all the "micro-actions" already in progress or to be de-veloped in the City has been created, uploaded in the CLICC web platform in order to monitor their evolution over time, and reported in Annex I, mapping them with respect to the related of macro-actions domain. This portfolio includes micro-actions, under the direct responsibility of the Municipality and of the City's stakeholders, already implemented starting from 2019, currently ongoing and planned/funded to be implemented by 2030.

B-2.3: Summary strategy for residual emissions

As a result of the emission reduction actions presented in this Action Plan in Module 4.1 and Module 4.2, the City of Turin expects to achieve by 2030 a share of reduced emissions equal to 66.7% of the 2019 baseline, i.e. about 1.6 Mt/y. Following this estimate, residual emissions are expected to be 33.3% of the 2019 baseline, i.e. 797,761 t/y (Fig. 4.2.1).

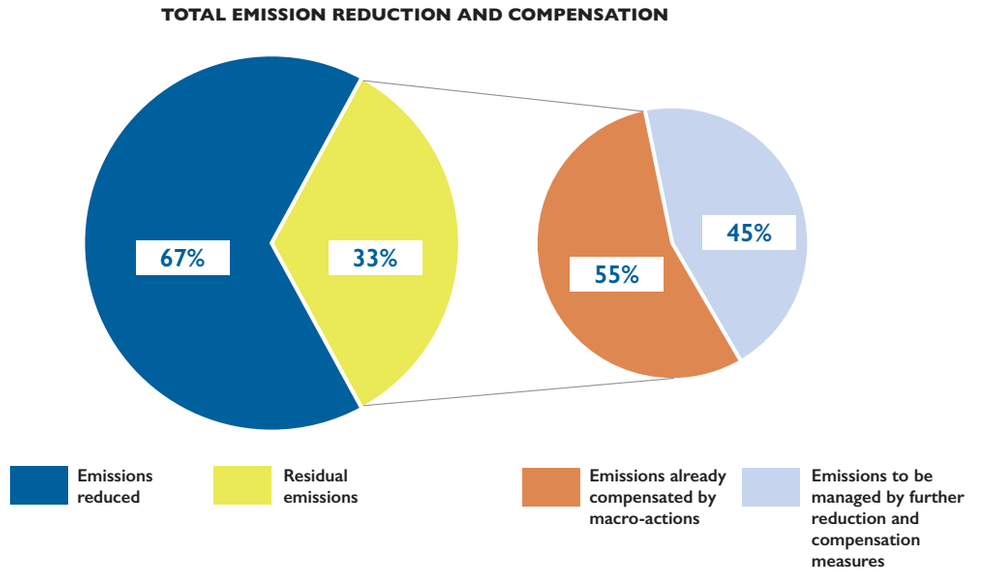

Fig. 4.2.1. Total Emission Reduction and Compensation

Considering these figures, four macro-actions have been planned to compensate 55.4% of the residual emissions, i.e., 442,318 t/y (corresponding to 18.5% of the 2019 baseline emissions) (Fig. 4.2.2).

These macro-actions include:

- the contribution of the CCS installation on the Torino's waste-to-energy plant to the removal of the CO2 emissions related to the combustion of the biogenic fraction of the wastes treated by the plant (FS12b). This macro-action, from an implementation point of view, has to be jointly considered

with the macro-action FS12a, taking into consideration the CO2 reduction effect related to the combustion of the fossil fraction of the wastes treated by the plant. Therefore, macro-actions FS12a and FS12b, from a practical perspective, represent a unique macro-action, which has been split in order to account for its different contributions to both emission reduction and residual emissions compensation;

- three macro-actions related to the CO2 removal in the AFOLU macro-area, through the increase in planted trees (FG1), the implementation of the so-called "green roofs" (FG2) and the treatment of soil to make it able to capture CO2 (FG3).

A synoptic description of these macro-actions is reported in Tab. B-2.3.1.

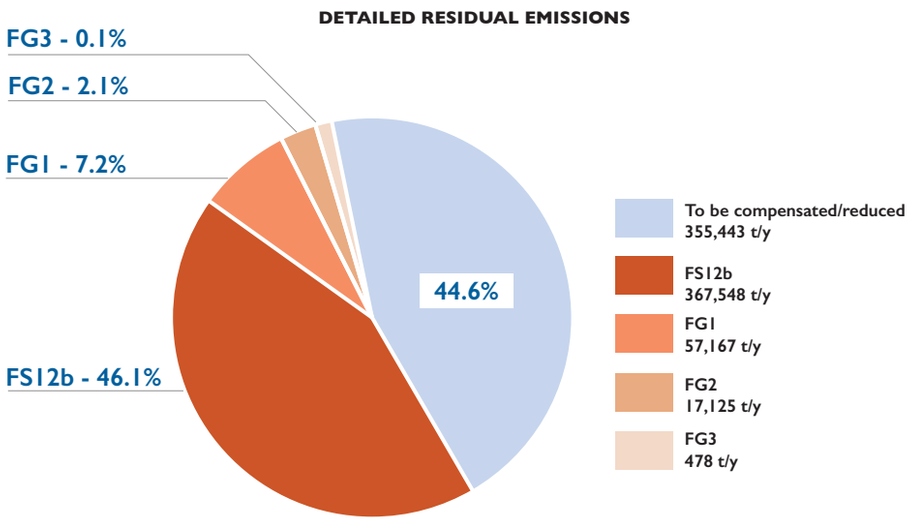

Fig. 4.2.2. Emission Compensation by macro-actions

Table B-2.3.1: Description of action portfolio for Residual Emission Compensation

Macro Area	Sector	Portfolio description		
		Code	Action	Description
Stationary Energy	Waste-to-Energy Plant	FS12b	Line 4 and CCS on waste-to-energy plant	Implementation of Line 4 of the plant and application of CCS; only the contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered in this section
AFOLU	-	FG1	Planted Trees	Increase in planted trees and green areas
		FG2	Green Roofs	Development of green areas on roofs and vertical forests
		FG3	Soil Treatments	Soil treatment to make it capable of capturing CO2

The following Tab. B-2.3.2 describes the individual action outline of the four actions that have been envisaged for residual emission compensation.

Table B-2.3.2: Individual action outlines – Residual Emission Compensation

B-2.3.2: Individual action outline – Residual Emission Compensation

FS12b – Line 4 and CCS on Waste-to-energy plant		
Action outline	Action name	Line 4 and CCS on waste-to-energy plant
	Action type	Technical
	Action description	Implementation of Line 4 of the plant and application of CCS; only the contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered in this section
Reference to impact pathway	Field of action	Stationary Energy Systems; District Heating
	Systemic lever	Governance & Policy
Implementation	Responsible bodies/person for implementation	TRM
	Action scale & addressed entities	TRM waste-to-energy plant
	Involved stakeholders	Municipality, TRM, technology providers, engineering companies
	Comments on implementation	The intervention is the responsibility of the operator of the facility (TRM). The municipality will support and facilitate any required administrative process.
Impact & cost	Generated renewable energy (if applicable)	NA
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions compensation estimate (total) per emission source sector	367,548 t/y
	Investment costs and costs by CO2e unit	432 M€; 1,176 €/t

B-2.3.2: Individual action outline – Residual Emission Compensation

FG1 – Planted Trees		
Action outline	Action name	Planted Trees
	Action type	Technical
	Action description	Increase in planted trees and green areas. Assessment of green areas expansion feasibility and CO2 absorption potential
Reference to impact pathway	Field of action	AFOLU; Planted Trees
	Systemic lever	Learning & Capabilities Governance & Policy
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban green areas
	Involved stakeholders	Municipality, private actors
	Comments on implementation	Already planned and partially budgeted. The municipality will increment the interactions with private actors for better coordination.
Impact & cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	57,167 t/y
	Investment costs and costs by CO2e unit	120 M€; 2,099 €/t
FG2 – Green Roofs		
Action outline	Action name	FG2 - Green Roofs
	Action type	Technical
	Action description	Development of green areas on roofs and vertical forests. Assessment of green roofs deployment and their potential for CO2 absorption

B-2.3.2: Individual action outline – Residual Emission Compensation

Reference to impact pathway	Field of action	AFOLU; Green Roofs
	Systemic lever	Learning & Capabilities Governance & Policy Finance & Funding Democracy & Participation
Implementation	Responsible bodies/person for implementation	Citizens
	Action scale & addressed entities	Flat roofs in urban areas
	Involved stakeholders	Citizens, installation companies
	Comments on implementation	This action will require a close integration of social, economic and technical measures. The municipality will call a joint table with the social actors and relevant technical and business actors. The intervention will begin by selecting the potential first projects, for then disseminating information and promoting similar actions.
Impact & cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	NA
	GHG emissions reduction estimate (total) per emission source sector	17,125 t/y
	Investment costs and costs by CO2e unit	4,521 M€; 264,000 €/t

B-2.3.2: Individual action outline – Residual Emission Compensation

FG3 – Soil Treatments

Action outline	Action name	Soil Treatments
	Action type	Technical
	Action description	Soil treatment to make it capable of capturing CO2. Assessment of permeabilization of impermeable areas feasibility and CO2 absorption potential
Reference to impact pathway	Field of action	AFOLU; Soil Treatments
	Systemic lever	Technology Social Innovation Governance & Policy Finance & Funding
Implementation	Responsible bodies/person for implementation	Municipality
	Action scale & addressed entities	Urban area
	Involved stakeholders	Municipality, technical companies
	Comments on implementation	This action will require a close integration of social, economic and technical measures. The municipality will call a joint table with the social actors and relevant technical and business actors. The intervention will begin by selecting the potential first projects, for then disseminating information and promoting similar actions.
Impact & cost	Generated renewable energy (if applicable)	N/A
	Removed/substituted energy, volume or fuel type	N/A
	GHG emissions reduction estimate (total) per emission source sector	478 t/y
	Investment costs and costs by CO2e unit	183 M€; 383,009 €/t

The described macro-actions for residual emission compensation can be included into an overall Impact Pathway as shown in Tab. B-2.3.3.

B-2.3.3: Impact Pathways – Residual Emission Compensation

Fields of Actions		Actions/Outcomes	Systemic Levers	Impacts	
Macro-areas	Sectors			Direct (Em. comp.) CO2 (t/y)	Indirect impacts (co-benefits)
STATIONARY ENERGY	Waste-to-energy plant	Implementation of Line 4 of the plant and application of CCS; only the contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered in this section	GOVERNANCE & POLICY Promote/reinforce targeted policies DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory FINANCE & FUNDING Provide financial incentives for the interventions	-367,548	LABOR MARKET (E) Increased local job opportunities TECHNOLOGICAL INNOVATION (K) Incentive to technological innovation ENVIRONMENTAL BENEFITS (B) Improvement of air quality
		Increase in planted trees and green areas	GOVERNANCE & POLICY Promote and inject targeted policies (what kind of arborean species, treatments, guidelines for the installation and maineinance)	-57,167	WELLNESS & HEALTH (H) Reduction in urban heat islands; Increased comfort for citizens ENVIRONEMENTAL BENEFITS (B, C) Improved air, water and soil quality

B-2.3.1: Impact Pathways – Residual Emission Compensation

AFOLU		Development of green areas on roofs and vertical forests	LEARNING & CAPABILITIES Enhance of companies' know-how on the practical feasibility of the initiative (training of companies operating in the sector) GOVERNANCE & POLICY Promote and inject targeted policies (what kind of arborean species, treatments, guidelines for the installation and maintenance of green roofs), upgrading of the existing policies FINANCE & FUNDING Provide financial incentives for the interventions DEMOCRACY & PARTICIPATION Dialogue with the citizenship by undertaking a participatory process to understand the environmental and cultural relevance of the initiative	-17,125	WELLNESS & HEALTH (H) Reduction in urban heat islands; Increased comfort for citizens PROPERTY VALUE (D) Increased economic value of the property ENVIRONEMENTAL BENEFITS (B, C) Improved air, water and soil quality ENERGY BENEFITS (A) Energy saving

B-2.3.1: Impact Pathways – Residual Emission Compensation

AFOLU		Soil treatment to make it capable of capturing CO2	TECHNOLOGY Consolidate knowledge/awareness of the technological choices to be used. Enhance of stakeholders' and companies' know-how on the existence and usage of innovative materials/ technologies SOCIAL INNOVATION Dialogue with citizenship on the environmental and cultural relevance of CO2 carbon capture materials GOVERNANCE & POLICY Promote and inject targeted policies FINANCE & FUNDING Provide financial incentives for the interventions	-478	WELLNESS & HEALTH (H) Reduction in urban heat islands; Increased comfort for citizens ENVIRONEMENTAL BENEFITS (B, C) Improved air, water and soil quality; Stormwater control

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The City of Torino commits to introduce, in future releases of the Climate City Contract, measures to deal with the share of residual emissions currently uncovered, corresponding to 355,443 t/y, i.e., 14.8% of the 2019 baseline emissions, accordingly to the overall climate neutrality goal of the "EU Mission: Climate Neutral and Smart Cities". Even if presently specific reduction/compensation measures are not precisely defined, the city intends to follow several paths for furthering the path towards climate neutrality, namely:

- Continuation of the mitigation of emissions in the building stock:
    - The effort for improving the energy performance of buildings will go on up to at least 2050, building on the ambitious pathways envisioned by the new Energy Performance of Buildings Directive (EU/2024/1275) targeting the entire building stock and the phase-out of fossil fuels in buildings. It must be taken into consideration the large stock (more than 130,000 buildings) and the age of a great majority of it. This process cannot be easily accelerated as it depends on two factors that are impossible to resolve by the Municipality on its own: specialized manpower for the execution of the work in suitable numbers for the quantity of buildings to revamp, and investments instruments fitting the financial faculties of the owners of the residential dwellings.
    - Optimize the local production of electricity from photovoltaic in buildings and urban areas, including their integration in energy communities and positive energy districts. This will require further interactions with the power utilities, in the context of the still lacking national rules for this type of interventions.
    - Complementary measures for fostering the implementation of the new rules for new and refurbished buildings and civil construction in general. One can anticipate as a key initiative the use of low-carbon or recycled building materials. Though this heavily depends on the evolution of the European and national zero-carbon-ready building standards.
- The **electrification of the vehicle stock** will carry on at a pace that although foreseen as persistent is hard to anticipate

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as it depends on the evolution of technologies and the car market. This, together with the steady extension of public transport and the adoption by the public of solutions such as transport-as-service, car-sharing and car-pooling, will minimize the remainder emissions from transport.

- Test and apply as more convenient innovative **nature-based solutions (NBS)** to reduce and remove emissions: this will include: 1) The study of biochar interventions, adding it to terrains as conven-ient; this will be linked to the conversion of sustainably obtained biomass, in balance with its use for other purposes (i.e. production of biogas, burning at the waste-to-energy plant). 2) Restoration of soils and of surfaces currently covered by cement/asphalt/abandoned industri-al or commercial areas; restoration of green and river coastal areas for improving their mitiga-tion performance. 3) Increase the reforestation and plantation of trees in appropriate zones.
- The emissions from **waste** will be minimized with enhancements in the planning and execution of waste collection and treatment, dissemination of social behavioral changes fostered by education and promotion of joint efforts with the population, and the tight linking of waste-related activi-ties to recycling and biomass applications.

As the abatement of residual emissions is central to the CCC strategy, the Municipality will intensify its initiatives, it will be important **to maintain ahigh alliance with the local ecosystem** as an active part of the necessary strategies.

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

Indicators have been organized according to Impact Pathways:

Impact Pathways for Emission Reduction (Tab. B-3.1)

- Pathway R.1 – Stationary Energy; Built Environment
- Pathway R.2 – Stationary Energy; Energy Systems
- Pathway R.3 – Transport
- Pathway R.4 – Waste

Table B-3.1: Indicators by macro-area and 2030 target values – Emission Reduction

B-3.1: Indicators by macro-area and 2030 target values – Emission Reduction

R.1 – Stationary Energy; Built Environment

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Modernizing the urban environment and making it more efficient				2030
Mitigation actions on built environment	**FS1÷FS6:** Extension of district heating network; Thermal insulation; Recovery of waste heat from data centers; Installation of heat pumps, photovoltaic, and energy storage; etc.	IR1.1	Reduction of CO_2 emissions per inhabitant	0.59 [t/ inh.]
		IR1.2	Reduction of CO_2 emissions per unit of surface	3925 [t/ km^2]
		IR1.3	Reduction of CO_2 emissions per unit of GDP	17.3 [t/ M€]

R.2 – Stationary Energy; Energy Systems

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Upgrade the energy systems of the city towards zero-emissions				2030
Mitigation actions in energy systems	**FS7÷ FS13 + FE1÷FE3:** Improvement of energy efficiency in industrial processes; development of energy communities and positive energy districts; Line 4 and CCS on waste-to-energy plant (*); etc.	IR2.1	Reduction of CO2 emissions per inhabitant	0.74 [t/ inh.]
		IR2.2	Reduction of CO2 emissions per unit of surface	4876 [t/ km2]
		IR2.3	Reduction of CO2 emissions per unit of GDP	21.5 [t/ M€]

B-3.1: Indicators by macro-area and 2030 target values – Emission Reduction

R.3 – Transport

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Upgrade the transport network to reduce emissions				2030
Mitigation actions in the transport sector	**FT1÷FT8**: Replacement of ICE vehicles, Limitation of traffic, Promotion of alternative means of transport, etc.	IR3.1	Reduction of CO_2 emissions per inhabitant	0.44 [t/ inh.]
		IR3.2	Reduction of CO_2 emissions per unit of surface	2928 [t/ km2]
		IR3.3	Reduction of CO_2 emissions per unit of GDP	12.9 [t/ M€]

R.4 - Waste

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Making the municipal waste management system more efficient				2030
Mitigation actions in the waste sector	**FW1÷FW3:** Elimination of residual emissions in landfills; Separate waste collection; etc.	IR4.1	Reduction of CO_2 emissions per inhabitant	0.08 [t/ inh.]
		IR4.2	Reduction of CO_2 emissions per unit of surface	557 [t/ km2]
		IR4.3	Reduction of CO_2 emissions per unit of GDP	2.4 [t/M€]
		IR4.4	Waste per capita	449.1 [kg/inh.]
		IR4.5	Share of sorted waste	75%

(*) Only the contribution of CO2 emission reduction related to the combustion of the fossil fraction of Torino waste is taken into consideration in this section as reduction measure. The contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered for the compensation of the residual emission.

Moreover, additional indicators have been outlined for the actions dedicated to residual emission compensation.

Impact Pathways for Residual Emission Compensation (Tab. B-3.1b)

- Pathway C.1 – Stationary Energy; Energy Systems
- Pathway C.2 – AFOLU

Table B-3.1b: Indicators by macro-area and 2030 target values – Residual Emission Compensation

B-3.1b: Indicators by macro-area and 2030 target values

C.1 – Stationary Energy; Energy Systems

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Modernizing the urban environment and making it more efficient				2030
Compensation actions in energy systems	FS12b Implementation of Line 4 of the plant and application of CCS; only the contribution of CCS to the removal of the emissions related to the biogenic fraction of treated waste is considered in this section	IC1.1	Compensation of CO2 emissions per inhabitant	0.43 [t/ inh.]
		IC1.2	Compensation of CO2 emissions per unit of surface	2824 [t/ km2]
		IC1.3	Compensation of CO2 emissions per unit of GDP	12.4 [t/ M€]

C.2 – AFOLU

Outcomes/ impacts addressed	Action/project	Indicator No.	Indicator name	Target values
Implement actions to maximize negative emissions/efficient green infrastructure				2030
Compensation actions in the AFOLU macro-area	**FG1/ FG3: Increase in planted trees and green areas**	IC2.1	Compensation of CO2 emissions per inhabitant	0.09 [t/ inh.]
		IC2.2	Compensation of CO2 emissions per unit of surface	574 [t/ km2]
		IC2.3	Compensation of CO2 emissions per unit of GDP	2.5 [t/M€]
		IC2.4	Increase in number of planted trees	565,176 [n.]
		IC2.5	Increase of green surface	9.12 [km2]

Table B-3.2: Indicators metadata

B-3.2: Indicator Metadata	
Indicator Name	Reduction of CO2 emissions per inhabitant (IR1.1, IR2.1, IR3.1, IR4.1)
Indicator Unit	Tonnes per person
Definition	Reduction of CO2 emissions after the implementation of the planned actions, per inhabitant in the city
Calculation	Ratio between the CO2 annual emissions reduction of each sector and the population of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IR1.1 Built environment, IR2.1 Stationary energy, IR3.1 Transport, IR4.1 Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways R.1, R.2, R.3, R.4
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

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B-3.2: Indicator Metadata	
Indicator Name	Reduction of CO2 emissions per unit of surface (IR1.2, IR2.2, IR3.2, IR4.2)
Indicator Unit	Tonnes per km2
Definition	Reduction of CO2 emissions after the implementation of the planned actions per unit of surface of the city
Calculation	Ratio between the CO2 annual emissions reduction of each sector and the surface of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IR1.2 Built environment, IR2.2 Stationary energy, IR3.2 Transport, IR4.2 Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways R.1, R.2, R.3, R.4
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

B-3.2: Indicator Metadata

Indicator Name	Reduction of CO2 emissions per unit of GDP (IR1.3, IR2.3, IR3.3, IR4.3)
Indicator Unit	Tonnes per million euros
Definition	Reduction of CO2 emissions after the implementation of the planned actions per unit of GDP of the city
Calculation	Ratio between the CO2 annual emissions reduction of each sector and the GDP of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IR1.3 Built environment, IR2.3 Stationary energy, IR3.3 Transport, IR4.3 Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways R.1, R.2, R.3, R.4
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

B-3.2: Indicator Metadata

Indicator Name	Reduction of per capita waste (IR4.4)
Indicator Unit	Tonnes per inhabitant
Definition	Reduction of per capita waste after the implementation of the planned actions
Calculation	Ratio between annual tonnes of total urban waste produced and urban population
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathway R.4
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

B-3.2: Indicator Metadata

Indicator Name	Share of sorted waste (IR4.5)
Indicator Unit	Percentage of sorted waste
Definition	Increase of the share of the sorted waste after the implementation of the planned actions
Calculation	Percentage ratio between the amount of annual sorted waste and the total annual urban waste
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	Waste
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathway R.4
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

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B-3.2: Indicator Metadata

Indicator Name	Compensation of CO2 emissions per inhabitant (IC1.1, IC2.1)
Indicator Unit	Tonnes per person
Definition	Compensation of CO2 emissions after the implementation of the planned actions, per inhabitant in the city
Calculation	Ratio between the CO2 annual emissions compensation of each sector and the population of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IC1.1 Stationary Energy; Energy Systems, IC2.1 AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways C.1, C.2
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

Part B – The target and the way to go for Torino: Pathways towards Climate Neutrality by 2030

B-3.2: Indicator Metadata

Indicator Name	Compensation of CO2 emissions per unit of surface (IC1.2, IC2.2)
Indicator Unit	Tonnes per km2
Definition	Compensation of CO2 emissions after the implementation of the planned actions per unit of surface of the city
Calculation	Ratio between the CO2 annual emissions compensation of each sector and the surface of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IC1.2 Stationary Energy; Energy Systems, IC2.2 AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways C.1, C.2
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

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B-3.2: Indicator Metadata

Indicator Name	Compensation of CO2 emissions per unit of GDP (IC1.3, IC2.3)
Indicator Unit	Tonnes per million euros
Definition	Reduction of CO2 emissions after the execution of actions per unit of GDP of the city
Calculation	Ratio between the CO2 annual emissions of each sector and the GDP of the city
Indicator Context	
Does the indicator measure direct impacts (reduction in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IC1.3 Stationary Energy; Energy Systems, IC2.3 AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathways C.1, C.2
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

Part B – The target and the way to go for Torino: Pathways towards Climate Neutrality by 2030

B-3.2: Indicator Metadata

Indicator Name	Increase in number of planted trees (IC2.4)
Indicator Unit	Number
Definition	Increase in number of planted trees after the implementation of the planned actions
Calculation	Number of planted trees
Indicator Context	
Does the indicator measure direct impacts (compensation in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IC2.4 AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathway C.2
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

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B-3.2: Indicator Metadata

Indicator Name	Increase of green surface (IC2.5)
Indicator Unit	km2
Definition	Increase of green surface after the implementation of the planned actions
Calculation	Green surface
Indicator Context	
Does the indicator measure direct impacts (compensation in greenhouse gas emissions?)	Yes
If yes, which emission source sectors does it measure?	IC2.5 AFOLU
Does the indicator measure indirect impacts (i.e., co- benefits)?	No
If yes, which co-benefit does it measure?	NA
Is the indicator useful for monitoring the output/impact of action(s)?	Yes
If yes, which action and impact pathway is it relevant for?	Pathway C.2
Is the indicator captured by the existing CDP/ SCIS/ Covenant of Mayors platforms?	Yes
Data requirements	
Expected data source	Projects, and ad-hoc calculations
Is the data source local or regional/national?	Local
Expected availability	Available
Suggested collection interval	Every year, and at the end of projects
References	
Deliverables describing the indicator	NA
Other indicator systems using this indicator	NA

5. PART C

The enablers for Torino's Climate Neutrality by 2030

5.1 Module C-1 :
Governance Innovation Interventions

This section explores the "P1 - Governance" and "P2 - City's actors' involvement and Transition co-design" pillars described in the Work Process (see Section 2).

The participatory governance model is organized interconnecting internal and external groups with respect to the City's Administration – both horizontally and vertically. The activities to enable Climate neutrality by 2030 are of two types: the implementation of a multi-layer governance system, and the incremental engagement of the local eco-system.

The implementation of a dedicated governance and the engagement of the local ecosystem are fundamental steps to accompanying the city on the path towards carbon neutrality. They are guided by the **three core principles**: ① **Transparency and inclusion** ② **A focus on people and interconnection for a fair transition**[87]; ③ **Shared responsibility and collaborative learning.** These principles inspire the formation of teams within the local coalition and the modalities/spaces of collaboration with actors in the local ecosystem.

87 An inclusive transition to neutrality.

88 The framework initiatives are detailed in the Annex II of this Action Plan.

A roadmap in Two Steps

The path accompanying Torino's CCC implies building a system of participatory spaces from an incremental and multi-actor perspective. The participatory path stems from – and expands – three "framework initiatives"[88] already under way, that adopt a cross-sectoral approach and create useful synergies to identify new actions to accelerate the change process:

① **Torino City Lab**, the Città di Torino's open-air laboratory for co-developing and testing solutions to urban challenges; https://www.torinocitylab.it/it/

② **CTE Next**, the House of Emerging Technologies, to transform Torino into a widespread technology transfer center in emerging sectors identified as strategic for the area; https://ctenext.it

③ **Torino Social Impact**, the territorial coordination for the promotion of the social impact economy, in collaboration

with the Torino Chamber of Commerce; https://www.torinosocialimpact.it.

The participatory governance model of the CCC also follows an operational roadmap (Fig. 5.1) that runs along two macro phases of work, interconnected by a series of cross-cutting activities. The work is organized in four main areas: path co-design, listening, action co-design and outreach (Fig. 5.2 and 5.3).

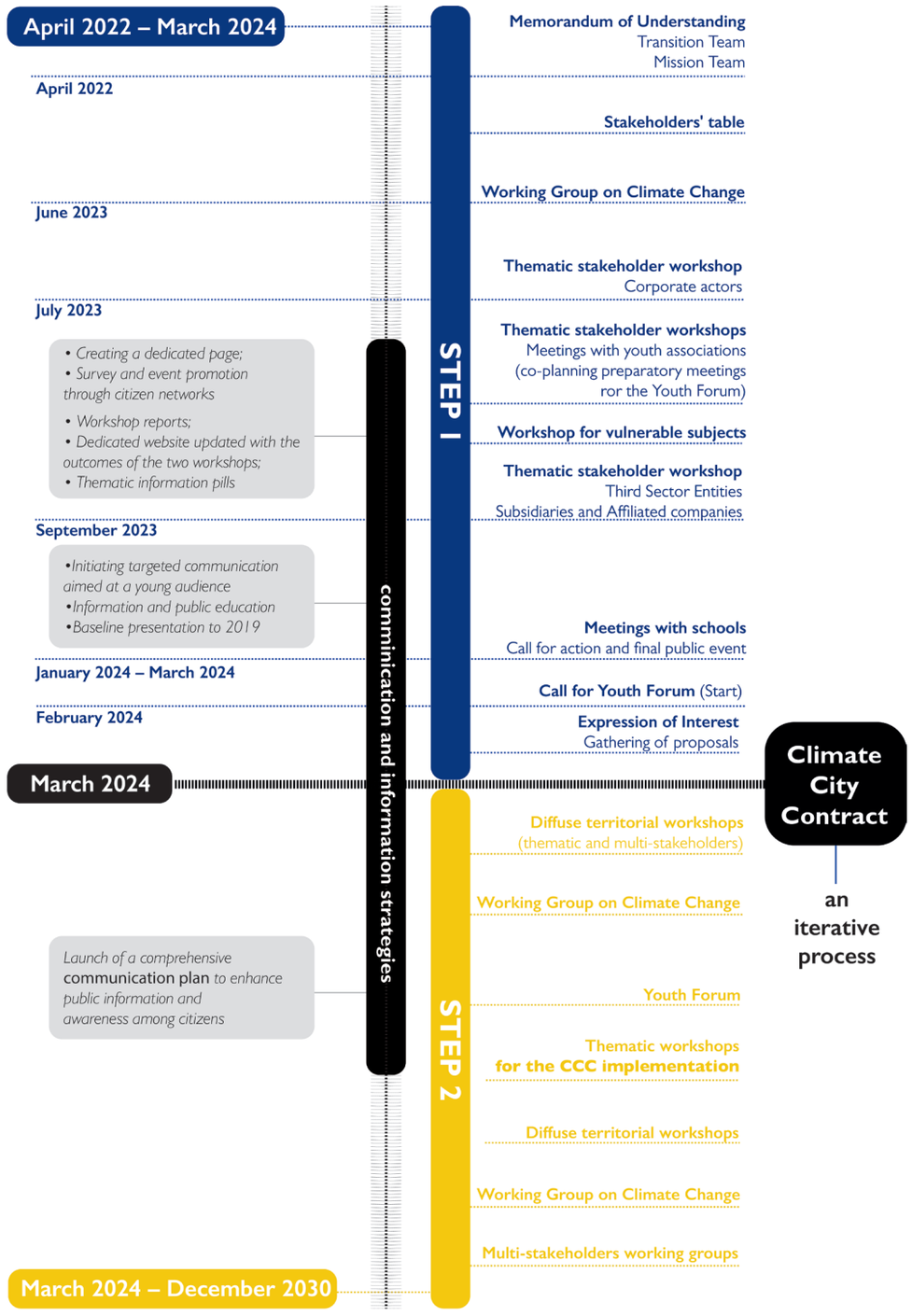

Fig.5.1 – The operational roadmap towards the CCC

The implementation of internal governance (see Table C-1.1) is accompanied by a network of initiatives aimed at fostering the local eco-system engagement. The CCC will be thus nurtured over time through the co-creation of new actions/alliances to achieve climate neutrality by 2030 – enhancing integration with other policies, coordinating the implementation of the Plan and producing social innovation for the climate challenge (see Table C-2.1).

Roadmap: Step 1[89]

Step 1 (April 2022 - March 2024) accompanied the co-creation of the CCC:

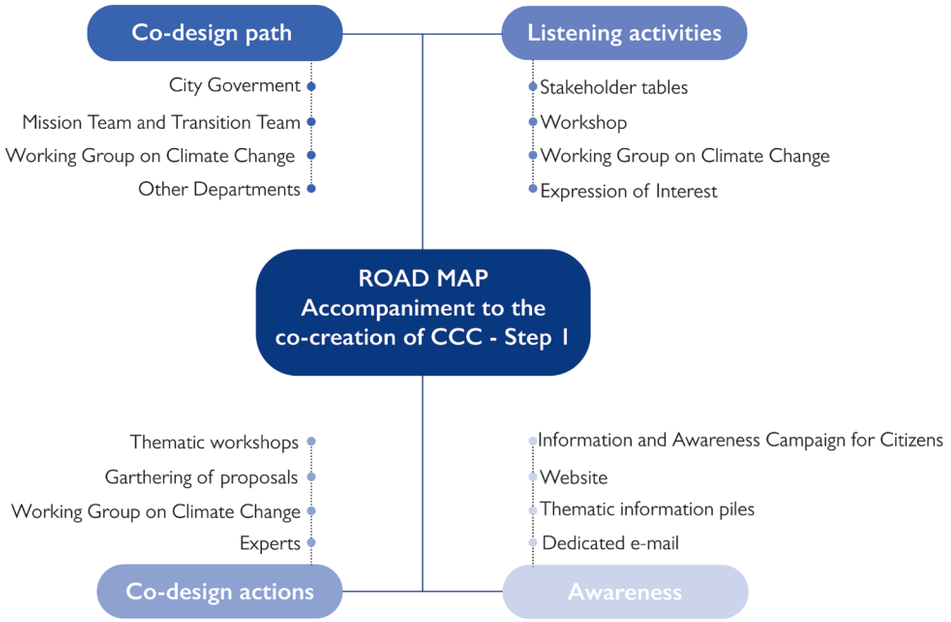

Fig. 5.2 – Scheme of Step 1

Step 1 has been implemented by means of:

① **Injection of the path with the Mission Team organization** (see Tab. C-1.2). n. 50 meetings were held involving 25 people (17 people involved by the Città di Torino; 8 people involved by the EST@energycenter of Politecnico di Torino);

② **Organization of the Climate Change Working Group (CC WG)** (see Tab. C-1.2). n. 2 meeting have been held, involving 15 sectors with a total of 33 participants;

③ **Organization of working tables** with the main actors in the area, investee companies, and representative actors from the main areas of action of the CCC (see Tab. C-2.1);

④ **Initial gathering of proposals** for climate neutrality through two surveys, one dedicated to the business community and one dedicated to Third Sector entities. Two surveys were organized, gathering a total of 60 companies and 21 organizations as stakeholders, and 43 proposals;

⑤ **Implementation of a cycle of workshops** gradually involving a growing number of thematic actors as an opportunity to inform, listen and initiate the co-design of the portfolio of actions and implementation of change initiatives (see Tab. C-2.1); [90]

⑥ **Involvement of thematic experts** in 4 fields: green infrastructure and Nature-Based Solutions (NBS), Built Environment and Energy System, Mobility and Infrastructure, and Waste and Circular Economy;

⑦ **Activities to engage vulnerable** people using the integration opportunity related to the European project SEFIT - Social Ecosystem for Fair and Inclusive Transition (see Tab C-2.1);

⑧ **"On twin Transition" workshop**, organized by Fondazione Brodolini as Lead partner – along with the Città di Torino, Rethink Ireland, and the City of Cork – has involved local actors in identifying social challenges related to climate adaptation and digital innovations. [91]

89 For a detailed overview of the initiatives undertaken through Step 1, see Annex II of this Action.

90 The outcomes of the first two workshops and the surveys that preceded them contributed to the co-creation of the City's carbon footprint knowledge framework, the identification of initial directions for a useful strategy to achieve climate neutrality by 2030 (and beyond).

91 Two workshops have been held so far: one dedicated to the world of business and start-ups (July 2023) involving 80 delegates from 40 Torino-based entities; and one dedicated to ETSs and investee companies (September 2023) with the participation of 90 actors. The workshop identified ideas and proposals useful for the drafting of a Call that will be addressed to organizations and social innovators. The Call will support projects that propose concrete contributions to climate neutrality goals and the democratization of digital innovations – also vis-à-vis disadvantaged social groups.

Roadmap: Step 2[92]

Step 2 (March 2024 – December 2030) accompanies the enhancement and monitoring of the CCC:

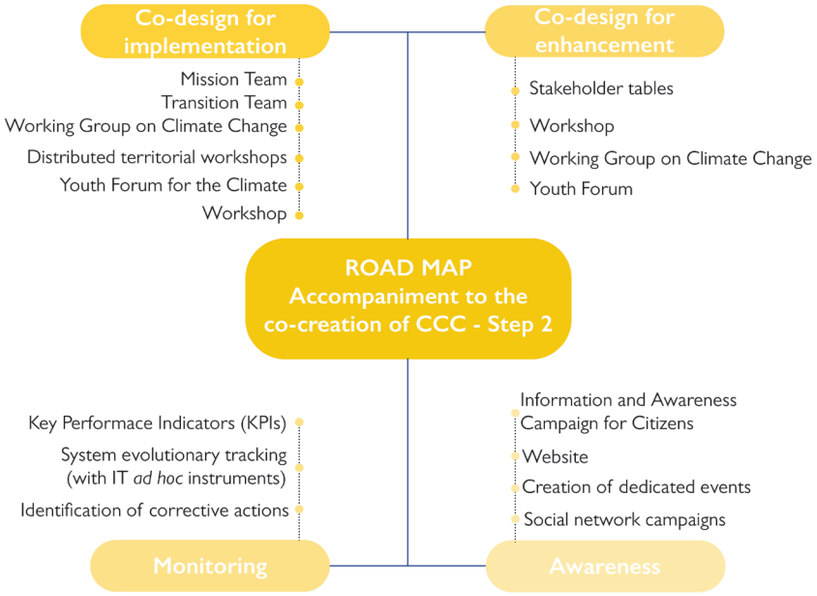

Fig. 5.3 – Scheme of Step 2

92 For a detailed overview of the initiatives undertaken through Step 2, see Annex II of this Action.

93 The Policy Lab of the Città di Torino is a laboratory for co-design and experimentation of public policies and innovative services aimed at facilitating new forms of collaboration between public decision makers, territorial actors and citizens, from an inclusive perspective in the pursuit of shared administration.

Step 2 will be enhanced through:

① **Design and empowerment of Diffuse Territorial Labs** (see Tab. C-2.2). In this framework, the Policy Lab[93] could become a stable space where to activate actors with a variable level of participation according to the needs detected during the CCC construction and monitoring phase. The Labs will create opportunities for discussion/share actions stemming from other ongoing municipal and European policies. Diffuse Territorial Labs are opportunities to discuss the most appropriate solutions on specific issues towards 2030. They can be linked to and implement, in the context of the climate neutrality challenge, the principles contained in the Torino Manifesto "New European Bauhaus: Inclusion, Sustainability and Beauty".[94] The Labs use links and capitalize on opportunities related to the Living Labs previously promoted under the FUSILLI and To Move social innovation initiatives (see Tab C-2.2).

② **Meetings to involve young people and youth associations/ Forum** (see Tab. C-2.1 and C-2.2) through information, training and interaction. [95] Territorial resources and networks already active at the city level, youth associations and groups (including informal ones) active on climate change issues will be involved in thematic workshops/Forum to broaden the map of actors, overcome generational barriers and find new ways for society to participate.

③ **Let's GOv Toolkit**[96] (see Tab. C-2.2). Toolkits represent the instruments that will be produced at the end of the co-design meetings of the 9 cities involved and will be made available to other cities to facilitate the easiest identification and implementation of pathways and actions toward climate neutrality.

④ **Search for "Climate Ambassadors" and testimonials.** Broadening the role of stakeholders by creating incentive packages and assigning labels to public and private actors who propose new actions, perspectives, connections and integrations within the CCC's main fields of action for climate neutrality.

⑤ **Monitoring Actions.** The activities of measuring, reporting, monitoring and implementing the plan are essential in order to make the CCC's collective commitment enduring, consolidate shared learning, and reshape strategies and actions to show the community, partners and actors the progress and milestones achieved. In this sense, the definition of proper Key Performance Indicators (KPIs) for quantifying the multidimensional (energy,

94 The Città di Torino - with the support of the Torino Committee of the New European Bauhaus - has written the first version of the New European Bauhaus Manifesto for Torino. The Manifesto was born as the first form of local expression of the inspiring principles of the "New European Bauhaus: Inclusion, Sustainability and Beauty"

95 These meetings/ Forum will stem from a specific co-design activity: it is conceived as a space for mutual learning, in which young people can contribute to efforts to democratize scientific production, for example, by promoting climate-focused "citizen-science" initiatives together with the City; Two propaedeutic activities have been launched, one aimed at high schools and one at youth associations and informal groups active on climate transition issues. The dialogue with high schools in Torino and province aims to raise awareness of the challenges and commitments that the Città di Torino will face in achieving Climate Neutrality to 2030, contribute to the promotion of dialogue between young people and the city administration in the construction of CCC strategies and actions

environmental, economic, social) impacts of actions, the continuous tracking of the evolutionary trajectory of the system (also through ad hoc IT tools) and the possible definition of corrective actions for realigning the trajectory with the ideal one needed for reaching the climate neutrality goal are crucial elements to be effectively implemented.

⑥ **Multi-actor workshop** dedicated to gathering proposals and discussing the main activities that have been implemented. [97]

Cross-cutting actions

Information, awareness and communication hold a strategic role in bonding the governance system and the local ecosystem in effectively accompanying the implementation of CCC, its monitoring and its deployment. Communication initiatives have an impact on the local ecosystem, making it more responsible and open to take responsibility vis-à-vis its effects on the climate.

The focus revolves around three keys:

① **Awareness and understanding** of the climate phenomenon, the collective challenge, and the systemic levers on which to act in sustainable timeframes and ways;

② **Knowledge and transparency** of the process and actual progress of the city towards climate neutrality (e.g.: through activation of in itinere civic monitoring; tracking of change; etc.);

③ **Thematic information** for climate neutrality to foster awareness, enable knowledge transfer to increase the local ecosystem's skills, and incentivize informed and responsible participation.

These aspects are aimed at expanding engagement and broadening the pool of potential climate action partners – within the framework of the CCC's multilevel and multi-actor approach.

The communication activities will involve specific information spaces on the thematic areas of the CCC – either by creating new events of diverse nature and scale at the city level, or by leaning on existing events that are already consolidated and enjoy relevant level of participation. [98] These spaces will present moments of dissemination of both the efforts deployed by the local ecosystem and obstacles and challenges to be overcome by engaging additional partners.

96 Let's GOv is a pilot project involving the Città di Torino together with 8 other Italian cities (Bergamo, Bologna, Florence, Milan, Padua, Parma, Prato, and Rome) of the European Mission "100 Climate-Neutral and Smart Cities by 2030," University of Bologna and the EST@energycenter Lab of the Politecnico di Torino (scientific partners) and AESS - Agency for Energy and Sustainable Development (technical partner). The project involves the 9 partner cities in testing a multi-level governance model for emissions reduction. The Città di Torino plans to support the creation of Renewable Energy Communities (RECs) through the mapping of municipal buildings on which to install Renewable Energy Sources (RES). The experimentation will also establish a public-private governance model to spread energy efficiency practices and renewable energy production.

The communication of the path towards climate neutrality will aim at addressing all city actors, and will necessarily have to go through the adaptation, in a dissemination key, of all the elements useful to create the right conditions for the partnership network to act properly. This informational support will have to provide all the information necessary to manage and facilitate the engagement process, making effective the collaboration of the different actors within the spaces of participation that are articulated along the roadmap accompanying the CCC.

The following activities are planned/have been implemented:

① **Activation of differentiated information/communication channels** to raise awareness among the local ecosystem (especially citizens) and support the CCC creation/implementation process;

② **Design of a communication plan** according to the different actors, barriers and levers of change –with the aim of informing and raising awareness, supporting and broadening the active involvement of the local ecosystem;

③ **Creation of an information space** on the CCC within the municipal website and through a dedicated website[99](see Tab. C-2.2); specific posters for each thematic workshop have been made, promoted through social/web channels of different active networks;

④ **Promotion of an awareness campaign** targeting citizens and small events to understand the challenge and disseminate information (see Tab. C-2.2);

⑤ **Drafting of thematic information pills** by the experts involved on the 4 fields of action of the CCC;[100]

⑥ **Design and identification of "Climate Ambassadors"** as part of engagement activities with the business community;

⑦ **Presentation moments** at relevant thematic events or other initiatives pertinent to climate neutrality topics.

97 It will be an opportunity to present the baseline to 2019 and an important milestone in order to raise awareness, act on identified levers of change, and promote collaborative approaches toward building a zero-emission city. The meeting was crucial to consolidate new alliances, coordinate public-private partnership actions, address the time dimension of the Plan and its future monitoring, and define new models to be tested in terms of co-responsibility in the implementation and co-management of change action.

98 For instance, the Cinemambiente, the Biennale Democrazia and the Biennale Tecnologia initiatives; annual events of bank foundations.

99 The dedicated website is in progress.

100 In Step 1, 4 thematic pills were produced as support for informed participation in the September 2023 workshop, and then posted on the municipal website and sent to all participants.

C-1.1:
Description and visualization of the participatory governance model for climate neutrality

There are 3 levels of internal governance, which articulately respond to the Systemic Barriers described in Table A-3.1 and are detailed in Table C-1.2.

① Consolidation of internal horizontal governance

The "Mission Team" is at the core of the governance model and is responsible for the implementation of pillar "P1 - Governance." The Mission Team is formed by two entities internal to the Città di Torino (the "Transition Team" and the "Climate Change Inter-departmental Working Group") and the partnership with the working group of the EST@energycenter Lab, established at the Energy Center of the Politecnico di Torino, which involves a multidisciplinary team embodying the operational convergence and cultural diversity of three departments of the Politecnico di Torino: DAD (Department of Architecture and Design), DENERG (Department of Energy) and DIATI (Department of Environment, Territorial and Infrastructure Engineering).

② External multi-level governance

Inter-stakeholder relationships foster the adoption of a cross-sectoral approach at the institutional level (horizontal and vertical multilevel), closer collaboration between public actors at different spatial scales, and greater capacity for different community actors to relate to each other, refining partner engagement models and strengthening the relationship with non-governmental actors in the local ecosystem.

The Mission Team intertwines the European, national, regional and local dimensions in relation to different governance objectives through the connection of networks at different territorial scales; the capitalization of experience from the local to the international level; the territorialization of supra-local strategies through the incorporation of climate action into local-scale planning instruments, regulations and projects.

③ Organizational and cooperative science-based governance

The engagement of the EST@energycenter Lab multi-disciplinary working group aims, coherently with the general vision (Section 2), at guaranteeing a science- and science-based approach from the very first steps – starting, in particular, from the definition of the knowledge framework on climate-altering emissions at baseline (year 2019) and the calculation of the direct impacts of the actions needed for reaching the climate neutrality goal.

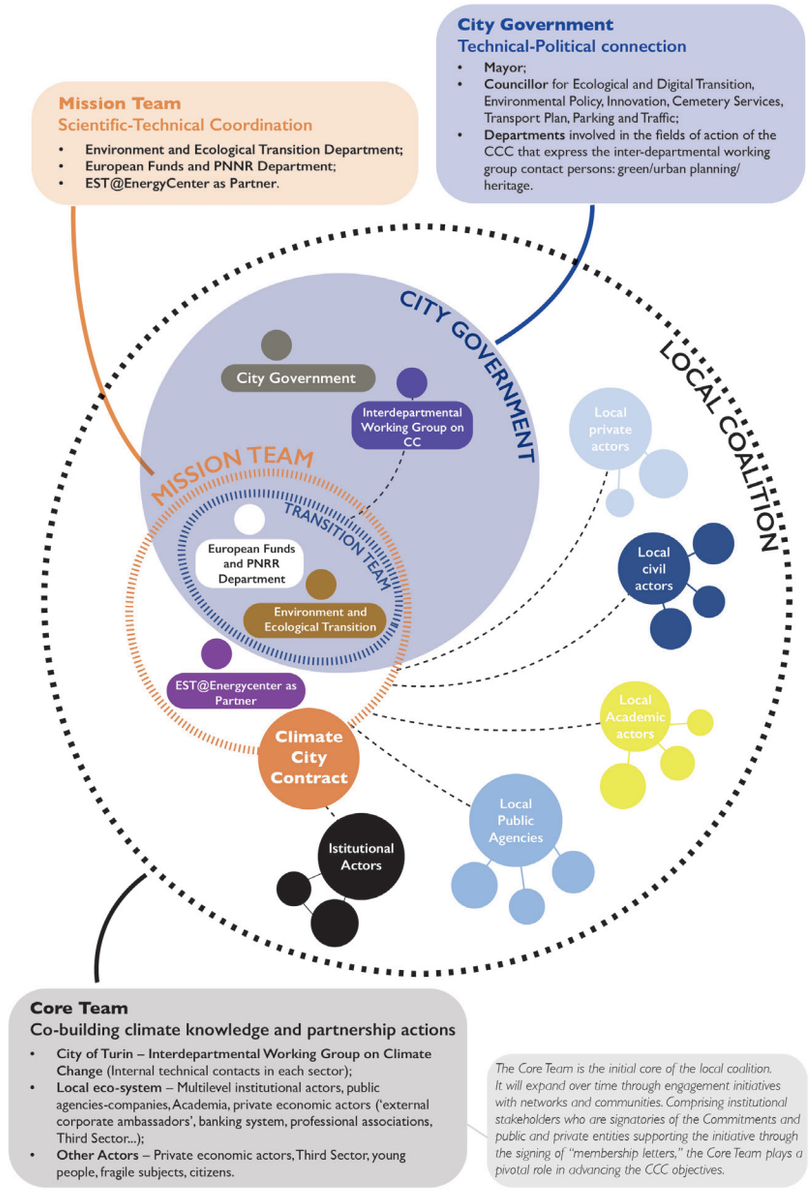

Fig.5.4 – Scheme of actors and network

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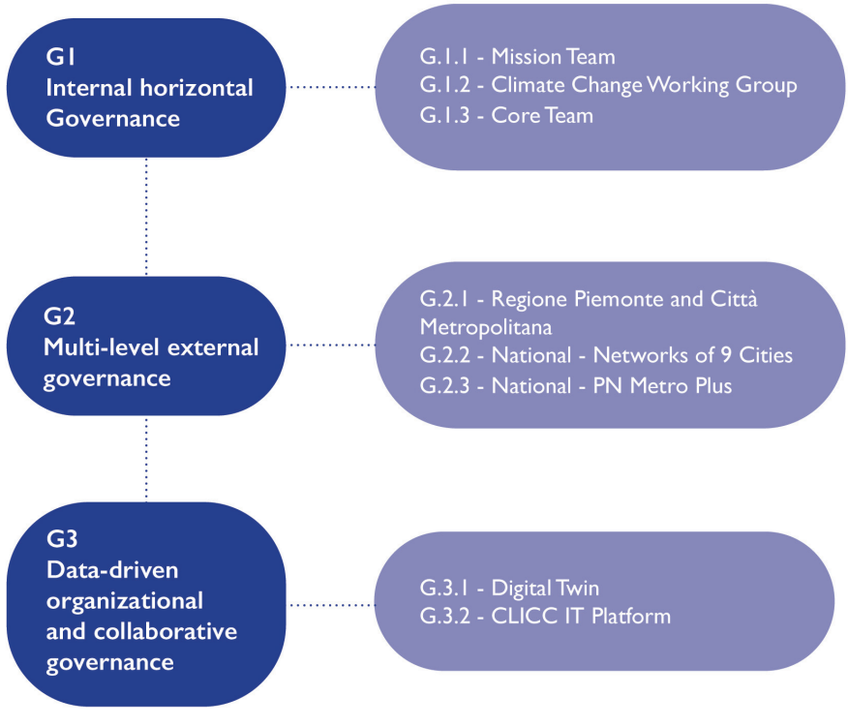

Fig.5.5 – Governance innovations

Table C-1.2:
Relations between governance innovations, systems, and impact pathways

G.1 – INTERNAL HORIZONTAL GOVERNANCE

G.1.1 - Mission team	
Description	Within the local coalition is the team dedicated to the technical and scientific coordination of climate action - as well as acting as liaison with the political side and the local ecosystem actors. The composition of the team brings together knowledge, expertise and direction actions and interventions. Among the team's activities: • Co-design of the accompanying pathway to climate neutrality; • Co-design of digital platform to support climate action management and CCC.
Systemic barriers addressed	Strengthening the relationship and knowledge exchange between: • Internal groups within the municipality with expertise on environmental issues, fund management and international projects; • Internal groups, the scientific community and research centers; • Technical and political referents in the Administration.
Leadership / Stakeholders involved	Leadership • EST@energycenter of Politecnico di Torino (Coordinator) • Department of Environment and Ecological Transition (Città di Torino) • Department for European Funds and PNNR (Città di Torino)
Enabling impact	Creation of an internal/external collaborative governance system for climate action. Levers • Governance & policy • Finance & founding • Technology/infrastructure • Democracy and participation • Learning & capabilities
Co-benefits	• Focus on reaching a climate initiative synergistic, efficacious and measurable; • Capacity building; • Strengthening the Public Administration's (PA) competencies and the partnership for climate; • Strengthening the capacities regarding engagement and inclusion of fragile and strategic actors in the climate partnership. Co-benefits • Climate resilience • Economy local and global connection • Social inclusion

G.1.2 – Intersectoral Working Group "Climate Change"	
Description	Within the local coalition, it assists the Mission Team by supporting the co-construction of climate knowledge and partnership actions. It consists of technical subjects, in the City's administration, with consolidated expertise in the CCC action areas.
Systemic barriers addressed	Overcoming the vertical Public Administration's (PA) organizational structure through: • Coordinated management and implementation of policies/ strategies/projects on environmental issues; • Activation of cross-sectoral processes across sectors relevant to CCC thematic areas; • Grafting of environmental focus into PA processes, programs, plans, projects and regulations.
Leadership / Stakeholders involved	• Città di Torino • Director-General of the city administration • Department of Environment and Ecological Transition • Air Quality and Strategic Projects Office Stakeholders • Relevant Divisions in the Municipal administration (European Funds and PNNR Department ; Energy management ; Green and Parks Division ; Civil Defense, Emergency Management and Security Division ; Infrastructure - Urbanization Division ; Infrastructure Division - Bridges and Waterways Service ; Mobility Division ; Private Construction Division ; Urban Planning and Quality of the Built Environment Division ; Social, Social, Health and Housing Services Department ; School Building Service ; Public and Social Housing Service ; Infrastructure Service for Trade and Sports ; Technical Heritage Division ; Vehicle Fleet Management Service ; Utility Management and Control Service) Participants to the Working Group: 33
Enabling impact	Integrated vision and response by the Municipality, maximizing internal knowledge and experience Levers • Governance & policy • Learning & capabilities • Technology/infrastructure • Social innovation
Co-benefits	• Countering fragmentation of responsibilities. • Coordinated action on policies with direct/indirect climate impacts. • Capacity building of PA. • Testing on co-design/use of data-driven digital infrastructure. Co-benefits • Climate resilience • Economy • Health • Biodiversity

G.1.3 – Core Team	
Description	The core team consists of engaged institutional actors, co-signatories to the Commitment, and public and private entities that support the initiative by signing "membership letters" as Main Partners and Widespread Partnership/Supporters (see partnership structuring in Section 3.2). Subscribing and Adhering Parties: • Share the principles of the Core Contract; • contribute actions to the city challenge in different roles and levels; • participate in initiatives to co-construct practical climate actions by becoming partners with the City in the Climate Neutrality Challenge; • implement and monitor interventions; • offer insights/evaluations and offer correctives on the effectiveness of interventions throughout their lifecycle; • contribute to the identification of relevant targets/actors to engage and involve.
Systemic barriers addressed	Deficient interaction and communication among the stakeholders of the city. Access to all relevant information for the production of the CCC.

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Leadership / Stakeholders involved	Leadership Città di Torino Partners 6 Main partners signatories of the CCC • Città di Torino • Regione Piemonte • Città Metropolitana • Politecnico di Torino • Università degli Studi di Torino • Camera di Commercio di Torino (Torino Chamber of Commerce) Stakeholders Political/technical reference staff in the Municipality, the Città Metropolitana and the Region. • 40 participants from private companies, • 35 participants from Third Sector entities • 20 associations for vulnerable people • 6 schools
Enabling impact	Strenghtening and improvement of the dialogue competences of all actors in the local ecosystem. Creation of the conditions for enabling a collaborative climate governance system in-cluding public and private actors. Levers • Governance & policy • Learning & capabilities • Democracy and participation
Co-benefits	Reduction of the fragmentation of initiatives and resources required for implementing the plan towards climate neutrality; Strengthening the engagement and networking capacities of the climate partnership; Coordinated actions for implementing the climate policies. Co-benefits • Climate resilience • Resource efficiency • Economy • Health • Social

G.2 – EXTERNAL MULTI-LEVEL GOVERNANCE

G.2.1 - Regione Piemonte and Città Metropolitana Torino

Description	Regione Piemonte and Città Metropolitana are members of the Core Team and co-signatories of the CCC. Joint working groups at the political and technical levels on relevant CCC topics.
Systemic barriers addressed	Fragmentation and lack of coordination of climate actions.
Leadership / Stakeholders involved	Leadership Città di Torino Stakeholders • Regione Piemonte (relevant groups working on CCC) • Città Metropolitana (relevant groups working on CCC)
Enabling impact	Reinforcing the links of the city with Regione and Città Metropolitana. Promotion of a multi-level governance system and working method. Development of joint integrated climate actions. Coordination with the measures of the Piano Strategico Metropolitano, and connections of the various programming instruments. Levers • Governance & policy • Social innovation • Democracy and participation • Learning & capabilities • Finance & Funding

Co-benefits	• Reduction of the fragmentation of initiatives and resources required for implementing the plan towards climate neutrality; • Systematic approach to knowledge and data, with sharing of models for the multilevel deci-sion making; • Coordinated actions for defining and implementing the climate policies. Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Waste/Water/Food/Land use • Biodiversity - Greater biodiversity
G.2.2 - Let's GOv	
Description	Let's GOv is the joint project of 9 Italian cities, funded by the European Commission in the context of the "Mission Cities". It consists of two-year pilot projects in each city. Torino will work on engagement as a key element for creating a better connection among actors across different decisional levels. The tasks will see the trying of models for the engagement of citi-zens, relevant public and private subjects, sharing of knowledge and information, and crea-tion of a more efficient multi-level ecosystem for the energy transition.
Systemic barriers addressed	Deficient communication among actors, leading to poor engagement.
Leadership / Stakeholders involved	Leadership Città di Torino – Environment Division Stakeholders Scientific partners • EST@energycenter, Politecnico di Torino • University of Bologna Technical partner • Agenzia per l'energia e lo sviluppo sostenibile (AESS – Agency for Energy and Sustainable Development)

Enabling impact	Improvement of efficiency in the internal and external governance for accelerating climate neutrality. Experimenting and testing of engagement and governance models based on data. Networking and joint learning among the cities. Levers • Governance & policy • Social innovation • Democracy and participation • Learning & capabilities • Technology/infrastructure • Finance & funding
Co-benefits	Overcoming the silo logic in the public administration; Strengthening of the engagement and empowerment capacities in the climate partnership; Test of innovative models for public-private collaboration and funding of projects. Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Land use
G.2.3 Network of cities - PN METRO PLUS	
Description	Torino takes part in the Italian Network of 14 Metropolitan Cities identified as intermediate Organisms for the National Program PON Metro 2014-2020, now called PN Metro Plus and Città Medie Sud 2020-2027. This new edition of the National Program is focused on the environment: each city elaborates an Operational Plan for a multi-level coordinated action for climate detailing the synergies and complementarities with the PNRR (National Recovery and Resilience Plan) and the funding from the program React EU .[101]
Systemic barriers addressed	Overcoming planning conflicts and issues in the internal and external governance in climate actions

101 Coordination: Municipality of Bologna. The network is formed by the cities of: Bergamo, Bologna, Firenze, Milano, Padova, Parma, Prato, Roma and Torino.

Leadership / Stakeholders in-volved	Leadership • Città di Torino, Department for European Funds and PNNR Stakeholders • Technical reference staff in the Municipality
Enabling impact	Improvement of efficiency in the internal and external governance for accelerating climate neutrality; Promotion of a multi-level governance system and working method; Development of joint integrated climate actions between cities at the national level. Levers • Governance & policy • Democracy and participation • Learning & capabilities • Finance & Funding
Co-benefits	Joint learning about the management of coordinated multi-level climate actions Strengthening of the engagement and empowerment capacities in the partnership Co-benefits • Climate resilience • Resource efficiency • Economy • Health • Social

G.3 – ORGANISATION AND COLLABORATIVE SCIENCE-BASED GOVERNANCE

G 3.1 - Digital twin

Description	Construction of a science-based governance system supporting the sustainable development of the territory. Creation of an Urban Digital Twin of the city (based on cloud technologies and in line with Torino's Territorial Informatic System) for supporting the governance of the city and of the climate transition processes (data interoperability: ci Lack of efficient system for the gathering and elaboration of data ty planning; civil protection; taxes and cadaster; environment and sustainability; viability and transport; commerce, etc.).
Systemic barriers addressed	Lack of efficient system for the gathering and elaboration of data
Leadership / Stakeholders involved	Leadership • Comune di Torino • EST@energycenter Lab - Politecnico di Torino Stakeholders • Utilities

Enabling impact	Strengthening of e-governance solutions in support of the systematic organization of: • shared, transparent data; • decisional processes and interaction with the climate partnership. Levers • Technology/infrastructure • Governance & policy • Democracy and participation • Learning & capabilities
Co-benefits	The use of up-to-date and monitored data on the effects of climate actions will help with the: • construction of knowledge bases useful for the partnership; • evaluation of the effectiveness of the partnership actions; • dissemination of the results of the climate transition; • Strengthening of the empowerment capacity of the partnership actors. Co-benefits • Climate resilience - Mitigation • Resource efficiency - Land use/Water • Biodiversity • Health/Environment/Well being

G 3.2 - DATABASE AND PLATFORM CLICC

Description	The digital platform CLICC is a multilevel and multi-source system for the definition, mapping and monitoring of climate actions. The CLICC platform allows to quantitatively assess the impacts of actions and pathways in terms of GHG emission reduction and the related costs, allowing the City decision makers for testing "in silico", in an interactive way, different policy options and identifying the combina-tion of them that mainly fits with their strategies for reaching the climate neutrality. CLICC will enable the mapping of the partnership actors, empowering the engagement and orienting them towards concrete results (with impact on both the ecosystem and the carbon mitigation).
Systemic barriers addressed	Lack of efficient system for the gathering and elaboration of data

Leadership / Stakeholders involved	Leadership • EST@energycenter Lab - Politecnico di Torino Stakeholders • Città di Torino • Utilities • All actors of the climate partnership
Enabling impact	Improvement of the effectives of the internal and external governance (multi-level institutions and the local ecosystem) for accelerating climate neutrality Levers • Technology/infrastructure • Governance & policy • Democracy and participation • Learning & capabilities
	• governance and collaborative management of the climate partnership and the elaboration and implementation of the CCC; • definition of actions according to their potential and direct/indirect impacts; • identification of target actors in the ecosystem with whom to interact. Capacity building strengthening of competencies in the public administration.
Co-benefits	Strengthening of the engagement and empowerment capacities of the central actors in the climate partnership. Co-benefits • Climate resilience - Mitigation • Resource efficiency - Land use/Water • Biodiversity • Health/Environment/Well being

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5.2 Module C-2 : Social Innovation Interventions

The construction and implementation of the CCC is based on the gradual involvement of the local ecosystem (thus intercepting the second pillar "P2 – City actors' involvement and Transition co-design"). The main kernel of the local coalition engaged in the construction of the CCC is the Core Team – strongly institutional-based and formed around relationships already present and established in the territory. The Core Team is made up of public subjects co-signing the Commitment and public/private subjects already involved who support the initiative by signing "membership letters". Starting with the Core Team, the Governance around the Climate City Contract aims to broaden the group of actors.

The actors of the local ecosystem – those already involved and those to be involved – are clustered in different sectors: institutional actors, private actors, participatory companies, Third Sector and civil society actors, university bodies and schools.

Part C - The enablers for Torino's Climate Neutrality by 2030

ACTORS AND NETWORKS DIAGRAM OF THE LOCAL COALITION

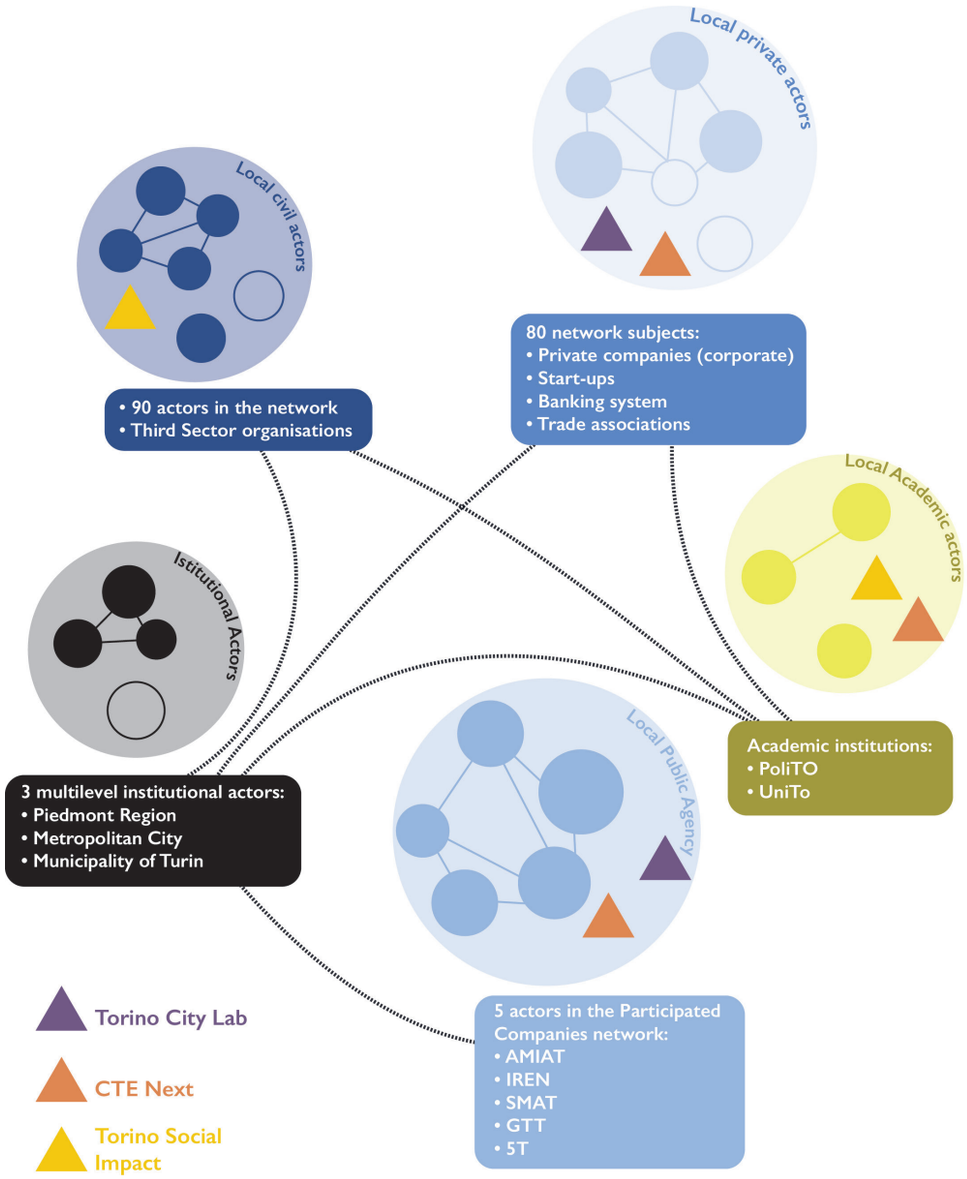

Fig.5.6 – Scheme of actors and network

Fig. 5.6 highlights, within each cluster, the networks already activated and those to be involved in the construction of the CCC. In the current system of relations between the ecosystem's different actors, the networks of the Third Sector, the business world, the banking system and the Participated Companies (utilities) represent a relevant contribution. Furthermore, a major focus is put on empowering the younger generations by involving schools, academia, and youth entrepreneurship in building the conditions for achieving climate neutrality.

In this framework, experience with highly differentiated targets makes it possible to test (and refine) effective ways and models of engagement of relevant partners in the concrete implementation of the city transition towards environmental sustainability. The work on this topic, making the most of previous experience at the local level, will also benefit from the comparison with other Italian cities engaged in the EU Mission. It will also be enriched from insights that will emerge within national and international networks of which Torino is a member, thus unleashing the potential of communities of practice on these issues.

The main social innovation actions and projects aimed at local ecosystem engagement are shown in Table C.2.1. They are to be interpreted as a response to the Systemic Barriers highlighted in Table A-2.3. They consist of three macro-categories of intervention:

① **Creation of diverse engagement spaces**, which are amplified by harnessing the engagement capacity of active networks to act collectively, responsibly and equitably, and generate lasting impacts over time;

② **Promotion of synergies and coordination with interventions envisaged by local, National and European social innovation projects** to address climate neutrality strategies by strengthening links with other public, private, Third Sector and citizen entities for the empowerment of the entire local ecosystem;

③ **Implementation of awareness and information** to strengthen the bonds between citizens and PA – broaden the involvement of vulnerable and intergenerational actors to encourage social behavior change, strengthen active local engagement.

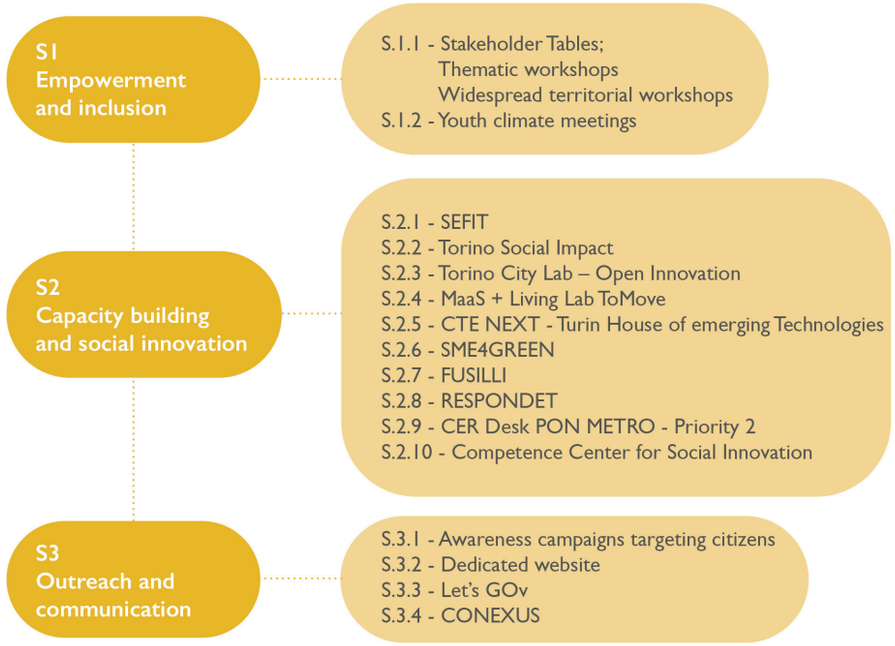

Fig.5.7 – Social innovations

Table C-2.1:
Relations between social innovations, systems, and impact pathways

S.1 - Empowerment and inclusion:

S.1.1 – (a) Tables with stakeholders (b) Thematic workshops, (c) Laboratories distributed in the territory	
	(a) Promoted by the Mission Team in line with the political leadership of the city, with targeted participants; (b) Interactive working groups organized by themes; (c) Collaborative spaces for the integration of policies. From specific territories to the city level, for taking lessons on the CCC's themes.
Systemic barriers addressed	Difficulties in the interaction among stakeholders and with the city leadership
Leadership and Stakeholders involved	Leadership • Mission Team In collaboration with • Working group CCC • Other groups in Città di Torino Stakeholders • City actors according to the subject, the topic and the objective of the discussion
Enabling impact	Empowerment of the local ecosystem for the joint understanding of the actions. Developments of interventions in an integrated and multi-level manner. Broadening of the participation and creation of new alliances among actors. Promotion of collective intelligence in the search for solutions and innovation. Levers • Democracy and participation • Governance & policy • Learning & Capabilities • Social innovation • Finance & Funding • Technology/infrastructure

Co-benefits	Strengthening of the engagement and empowerment capacities in the partnership. Coordinated actions for the implementation of policies with direct/indirect climate impact. Guarantee the long-term impact and the joint work in the partnership. Co-benefits • Climate resilience – Mitigation • Health – Environment • Health -Well being • Social – Inclusion • Social – Education • Economy – Local and global connection • Economy – Entrepreneurship and innovation • Resource efficiency – Waste/Water/Food/Land use • Biodiversity

S.1.2 – Meetings to involve young people and youth associations/Forum

Description	Participation of youth (fragile group). Activities and instruments in support of local ecosystem. Youth involvement is implemented through the engagement of secondary schools (two meetings with more than 200 students will be held in February 2024) and the establishment of a Youth Forum to facilitate discussion between youth and institutions Spaces for interaction and debate, with various levels of involvement (information, consultation, co-creation, monitoring) in relevant topics identified by the Mission Team.
Systemic barriers addressed	Difficulty in reaching the younger generations
Leadership and Stakeholders involved	Leadership • Mission Team In collaboration with • Working group CCC • Assessorato "Politiche giovanili ed educative" (Youth and educational policies) – Città di Torino Stakeholders • Youth associations • Networks of young citizens (Centers for Youth) • Informal • Schools

Enabling impact	Broadening the active participation of the younger generations. Co-construction of solutions with joint responsibility. Support to initiatives by youth groups. Levers • Democracy and participation • Governance & policy • Learning & Capabilities • Social innovation
Co-benefits	Generational equity in the actions towards climate neutrality Increase of awareness on the challenges and commitments of the Città di Torino. Guarantee the long-term impact of the climate actions Co-benefits • Climate resilience - Adaptation • Health - Environment • Health -Well being • Social inclusion • Social education

S.2 - Capacity building and social innovation

S.2.1 - SEFIT

Description	Promote the development of local social ecosystems for more equal and inclusive green and digital transitions. Two countries are involved Italy and Ireland, with lessons for the rest of Europe. The project partners will map and analyze, involving local actors and stakeholders the most pressing social challenges linked to climate adaptation and digital innovation. The goal of the project is also that of enabling the collaboration between public institutions and private actors in order to encourage innovation.
Systemic barriers addressed	Difficulties in the interaction among stakeholders and with the city leadership, and with foster-ing social innovation

Leadership and Stakeholders involved	Leadership • Città di Torino (Dipartimento Fondi Europei e PNRR) Partners • Fondazione Giacomo Brodolini (IT – head), • Rethink Ireland (IE), • Città di Torino (IT), • City of Cork (IE). Stakeholders • Persons in conditions of energy poverty • Vulnerable subjects
Enabling impact	Fight against energy poverty. Broadening the involvement of fragile and vulnerable subjects. Changes in social behavior, increase od trust and social cohesion. Promotion of energy efficiency. Raising awareness on energy issues and increase of competences. Public-private partnership for increasing social innovation. Levers • Democracy and participation • Social Innovation • Learning & Capabilities • Governance & policy • Technology
Co-benefits	Sinergy between social innovation and the green-digital transitions- Answers to urgent social challenges. Promotion of social digital innovation. Strengthening of the social innovation ecosystem. Co-benefits • Climate resilience - Adaptation • Health - Environment • Health -Well being • Social - Inclusion • Social – Education

S.2.2 - Torino Social Impact[102]	
Description	Open platform with public and private actors for dealing with ideas, experiences, projects and resources for catalyzing and attracting initiatives, taking advantage of new technologies for solving social problems with models of sustainable social entrepreneurship
Systemic barriers addressed	Social challenges with new technologies, social innovation
Leadership and Stakeholders involved	**Leadership:** • Città di Torino • Camera di Commercio di Torino (Torino Chamber of Commerce) **Stakeholders** • 280 actors (companies, institutions, financial operators, actors from Third Sector
Enabling impact	Creation of an environment enabling new instruments, co-projects and experiences and net-works for social innovation, in support of the ecological transition. Levers: • Democracy and participation • Social Innovation • Learning & Capabilities • Governance & policy • Finance & funding • Technology/infrastucture

102 See https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/react-eu_en

Co-benefits	Strengthening of the engagement and empowerment capacities of the partners. Coordinated action with direct and indirect climate impacts Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well-being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Waste/Water/Food/Land use • Biodiversity
S.2.3 – Torino City Lab	
Description	Space for fostering the ecosystem of local actors, including business, for identifying innova-tive solutions for the ecological and digital transitions of the territory and the services for citi-zens
Systemic barriers ad-dressed	Cooperation between actors for the digital and ecological transitions
Leadership and Stakeholders involved	Leadership Città di Torino Stakeholders Network of 90 public and private partners, Italian and international: • large companies; • public utilities; • other strategic stakeholders (research, development and innovation, etc.)

Enabling impact	Strengthening of the collective awareness regarding the climate challenge, collaborative gov-ernance among public and private actors, and the local ecosystem Promotion and experimentation of new working methods and techniques Levers • Democracy and participation • Social Innovation • Learning & Capabilities • Governance & policy • Finance & founding • Techonology/infrastructure
Co-benefits	Strengthening of the engagement and empowerment capacities of the partners. Partnership for innovative actions with high impact on sustainability and the climate action Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Waste/Water/Food/Land use • Biodiversity
S.2.4 - MaaS / Living Lab ToMove	
Description	Co-development and testing of innovative and sustainable mobility solutions according to the "C.A.S.E" paradigm: Connected, Autonomous, Shared and Electric. The Living Lab approach will include the involvement of the Public Administration, Research, Industry and Civil Society in shaping three large-scale demonstrators: 1) Integration of an autonomous public transport service within the MaaS application, supported by reinforced Cooperative ITS; 2) demonstration of electric and autonomous robotic platforms for last mile logistics in urban hubs; 3) deployment of digital twin solutions to plan CASE mobility scenarios.

Systemic barriers addressed	Difficulty in reaching to sustainable mobility solutions
Leadership and Stakeholders involved	Leadership Città di Torino Stakeholders • University of Torino • Politecnico di Torino • Fondazione LINKS • Fondazione Piemonte Innova • GTT
Enabling impact	The Living Lab has three strategic lines: • The development of a "Digital Twin" • The integration of an autonomous collective transport service, "demand responsive"; • The experimentation of innovative services and solutions the last-mile logistics Levers • Democracy and participation • Social Innovation • Learning & Capabilities • Governance & policy • Finance & founding • Technology/infrastructure

Co-benefits	The Living Lab To Move will define an open context for innovation centered on mobility, connected with the platform Torino City Lab and in synergy with CTE NEXT, the House for emergent technologies in Torino. Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Waste/Water/Food/Land use • Biodiversity

S.2.5 - CTE NEXT - Torino House of emerging Technologies[103]

Description	The project promotes the acceleration of startup formation and technological transfer to SMEs. Focus: smart mobility, industry 4.0, innovative urban services.
Systemic barriers addressed	Deficient support to start-ups
Leadership and Stake-holders involved	Leadership Città di Torino Stakeholders • Politecnico di Torino • Università di Torino

103See https://www.torinosocialimpact.it/

Enabling impact	Technological transfer of emergent technologies in strategic sectors **Levers** • Learning and capabilities • Governance & policy • Social innovation • Finance & founding • Technology/infrastructure
Co-benefits	CTE Next is integrated with Torino City Lab for the development of business Strengthening of the engagement and empowerment capacities of the partners. Partnership on innovative initiatives with high direct and indirect impact on climate actions. Co-benefits • Social innovation • Creation of employment opportunities • Economic growth
S.2.6 - SME4GREEN	
Description	The European project SME4GREEN aims at creating in 2024 the conditions for the cooperation between local SMEs and the public authorities – fostering the development of policies supporting the adoption of green and digital solutions by local companies. It will support at least 120 SMEs in the cities of Torino (Italia) and Ilfov (Romania) for a sustainable and inclusive transition.
Systemic barriers addressed	Cooperation between SMEs and public authorities
Leadership and Stakeholders involved	Leadership Città di Torino[104] Stakeholders • Environment Park • Camera di Commercio • UniTO • Uni Pollenzo • Mercato Circolare • PoliTO • MIAC/ Polo Agrifood • Reg. Piemonte • Torino Social Impact • UnionCamere

104 See https://ctenext.it/il-progetto/

Enabling impact	Strengthening of competences concerning the digital and green transitions Levers: • Learning and capabilities • Governance & policy • Social innovation • Finance & funding
Co-benefits	Promotion of exchanges of good practices and international cooperation. Fighting against food poverty. Promotion of the local economy and of social innovation Capacity building in the food industry The Local Green Deal of SME4GREEN will feed in the Climate City Contract Creation of a dialogue with SMEs in the food industry concerning the circular economy, in synergy with the European project FUSILLI and in line with the goal of climate neutrality by 2030 Co-benefits: • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection • Economy - Entrepreneurship and innovation • Resource efficiency - Waste/Water/Food/Land use • Biodiversity
S.2.7 - FUSILLI	
Description	Foster the transformation of the urban food system though innovative Living Labs Overcoming development barriers for the development and implementation of integrated and systemic food policies, support to the transition towards sustainable food systems in the ur-ban, peri-urban and rural areas
Systemic barriers addressed	Sustainability of the urban food system

Leadership and Stake-holders in-volved	Leadership Department for European Funds and PNNR [105] (Città di Torino) Stakeholders European Partners [106]
Enabling impact	Strengthening of the policy "Torino Città del Cibo". Improvement of the awareness regarding nutrition and health Participation of citizens in the food culture. Setting of the conditions for fostering the transition towards more sustainable food models. **Levers** • Learning and capabilities • Governance & policy • Social innovation • Democracy & participation
Co-benefits	Promotion of quality food systems Multi-sectoral governance Broadening of local participation Co-benefits • Health -Well being • Social - Education • Economy - Entrepreneurship and innovation • Resource efficiency - Waste • Resource efficiency – Food

105 Piano Nazionale di Ripresa e Resilienza (PNNR – National Recovery and Resilience Plan)

106 Grupul de Consultanta Pentru Dezvoltare DCG SRL (RO), Judetul Ilfov – Consiliul Judetean (RO) – Capofila, Asociata Magurele Science Park (RO), Parco Scientifico Tecnologico per l'Ambiente Environment Park Torino (IT)

S.2.8 - RESPONDET	
Description	Promotion of the local and regional development the social economy – for the common management of resources for sustainability and the green transition – with the objective of creating a Local Action Plan.
Systemic barriers addressed	Planning for the social economy
Leadership and Stake-holders in-volved	Leadership Città di Torino Stakeholders • European partners[107] • Environment and Ecological Transition, Energy Management Divisions (Città di Torino) • Innovation and Bids Sector • Torino Chamber of Commerce's Studies Sector
Enabling impact	Fostering capacity building of the social economy, community initiatives and the public ad-ministration for the construction of a joint vision and the management of resources Stimulate the cooperation between social economy and other organizations Levers • Learning and capabilities • Governance & policy • Social innovation • Democracy & participation • Finance & funding
Co-benefits	Promotion of public-private collaboration for innovative business models for a green, circular and digital food industry. Co-benefits • Economic growth • Job creation

107 Fundacion Cartif (ES), De Surdurulebilir Enerji Ve Insaat Sanayi Ticaret Limited Sirketi (TR), Stichting VU (NL), Oslomet – Storbyuniversitetet (NO), Izmir Demokrasi Unversitesi (TR), Steinbeis Innovation Ggmbh (DE), Acondicionamiento Tarrasense Associacion (ES), Syddansk Universitet (DK), Universidad De Valladolid (ES), Tampereen Ammattikorkeakoulu Oy (FI), V. N. Karazin Kharkiv National University (UA), Wings ICT solutions information & communication technologies ike (EL), Civiesco SRL (IT), Tecnoalimenti S.C.P.A. (IT), Fomento De San Sebastian SA (ES), Nilufer Belediye Baskanligi (TR), Oslo Kommune (NO), Kolding Kommune (DK), Comune di Torino (IT), Kharkiv City Council (UA), Differdange (LU), Tampereen Kaupunki (FI), Grad Rijeka (HR), Municipio de Castelo Branco (PT), Dimos Athinaion (EL), Roma Capitale (IT), Eroski S. COOP. (ES), Territoire Naturel Transfrontalier de la Chiers et de l'Alzette (LU), Fondazione della Comunita di Mirafiori ONLUS (IT), EcoFellows Ltd. (FI), Ahlmanin koulun säätiö (FI), Dimos Athinaion Epicheirisi Michanografisis (EL).

S.2.9 - CER Desk – National Operative Program (PON METRO - Priority 2 - Environmental Sustainability	
Description	Services for supporting the setting up of Renewable Energy Communities (CER). Production of renewable energy in public buildings or areas of the City.
Systemic barriers addressed	New business models for renewable energy
Leadership and Stakeholders involved	Leadership Città di Torino (Department of Environment and Ecological Transition) Stakeholders • GSE • Regione Piemonte • Torino Chamber of Commerce
Enabling impact	Fight against energy poverty Changes in social behavior – strengthening of local commitment, trust and social cohesion Use of renewable resources and energy efficiency Raising awareness on energy matters Construction of CER contributing to the decarbonization of the city Levers • Learning and capabilities • Governance & policy • Social innovation • Democracy & participation • Finance & Funding
Co-benefits	Promotion of the energy transition and decarbonization. Changes of behaviors in line with the ecological transition. Integration with the project Let's Gov Co-benefits • Climate resilience - Mitigation • Health - Environment • Health -Well being • Social - Inclusion • Social - Education • Economy - Local and global connection; Entrepreneurship and innovation • Resource efficiency

S.2.10 - Competence Center for Social Innovation - Policy lab	
Description	Funded in part through the 2014-2020 European Social Fund and the EU programme for Employment and Social Innovation (EaSI), the italian national competence center is set up to drive social innovation – locally, regionally, nationally and transnationally. Located in Torino and lead by the Municipality of Torino the Competence Centers intends to become a national policy lab supporting public administrations, stakeholders, citizen to collaborate in the designing and implementing of public services and policies.
Systemic barriers addressed	Lack of trust between PA and citizen, poor knowledge of methodologies and policy co-design tools
Leadership and Stakeholders involved	Leadership • Città di Torino Stakeholders • Politecnico di Torino, Politecnico di Milano, University of Bologna, Fondazione Brodolini, Euricse, National Managing Authority of ESF funds
Enabling impact	Creation of a platform to help the public administrations to dialogue with the local community on urban policy in a collaborative, productive way. Levers • Democracy and participation • Social Innovation • Learning & Capabilities • Governance & policy

6.
Outlook and next steps

Plans for next CCC and CCC Action Plan iterations

Città di Torino is determined to continue with its transition towards climate neutrality implementing the pathways detailed in this ambitious Action Plan. This Plan is in line with the policies, strategies and activities carried out in the last years, and is therefore a natural (though much more ambitious) expansion of the processes and measures already in place.

The novelties in this Action Plan concern: i) the better and deeper structuring of the governance of the climate action, looking to intensifying the links with all social actors in the awareness that without their participation this effort will be impossible to fulfil; and ii) the implementation of a solid scientific base for gathering and processing all the data needed, the models and algorithms required for the calculation of the emissions and their technical factors (energy, traffic, waste treatment, etc.), and the synthesis and presentations of the results. The latter has taken the form of a software platform, developed in partnership with the academic partners of the city, and which for its relevance can be of great value to other cities that will join the Mission Cities.

The next steps by Città di Torino will be:

① **Governance:** empowerment of Torino's Mission Team, for the immediate launching of the planning and execution of projects;

② **Actor's involvement and Transition co-design:** launching of joint working tables and groups with relevant actors for the concrete discussion of the implementation of the planned actions.

③ **Finalization of the tool for supporting the implementation of the Action Plan:** the city will further develop the science-based tool for now supporting the detailed planning and tracking of the execution of the planned actions.

7. Annex I
List of Micro-actions

Table AI-1.1 – List of Micro-actions – Emission Reduction

Table AI-1.1 – List of Micro-actions – Emission Reduction

Macro-Area	Macro-Action	Micro-Action	Year	Investment [€]
Stationary Energy	FS1 - District heating: 70% coverage of TRL network in built volume without new power plants	Refurbishment of building at corso Racconigi 25, staircase 1-3-5	2025	9,058,203
		Social housing energy redevelopment	2023	-
		Energy retrofit of barracks and police stations	2025	-
		Extension of Iren District Heating Network	2026	-
	FS2 - Thermal insulation of buildings: improvement of thermal insulation in F and G class buildings; further improvements for other classes	Energy riqualification of social housing - Strada delle Cacce 122-124-126	2024	979,517
		Energy riqualification of social housing - via Ghedini 12 sc. 19-20-21	2024	2,061,811
		Energy riqualification of social housing - via Ivrea 15-17-19-21-23-25-27	2024	15,726,000
		Energy riqualification of social housing - via Maddalene 30 sc. 9-13- via Maddalene 34 sc. 1-8- via Ghedini 12 SC. 14-18	2024	15,800,526
		Energy riqualification of social housing - via Petrella 75, via Pietracqua 19	2024	704,170
		Energy riqualification of social housing - Torino via Pietracqua 35, via Cruto 24	2024	1,071,577
		Energy riqualification of social housing - via Scialoja 28-30-32-34	2024	3,550,000
		Energy riqualification of social housing - via Verga 10-12-14	2024	1,737,465
		Energy riqualification of social housing - Corso Giulio Cesare 267-269-271	2024	3,795,522
		Energy riqualification of social housing - Corso Racconigi 25 sc. 13-15-17	2024	5,227,572
		Energy riqualification of social housing - Corso Racconigi 25 sc. 14-16-18-18bis-20-22-24	2024	10,947,421
		Energy riqualification of social housing - Corso Racconigi 25 sc. 19-21-23	2024	5,227,572
		Energy riqualification of social housing - Corso Racconigi 25 sc. 2-4-6-8-10-12	2024	14,120,341
		Energy riqualification of social housing - Strada del Cascinotto 48-50-52-54	2024	1,185,004

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy	FS2 - Thermal insulation of buildings: improvement of thermal insulation in F and G class buildings; further improvements for other classes	Energy riqualification of social housing - via Carema 2-4-6-8	2024	9,087,000
		Energy riqualification of social housing - via Cuneo 30 sc. 7-8-9-10-11-12-13, via Damiano 15 sc.1-2-3-4, Via Damiano 15 sc. 14-15-16-17-18	2024	3,892,653
		Energy riqualification of schools - Pacinotti/Boncompagni	2024	1,368,000
		Energy riqualification of schools - Via Stampini 25	2025	3,850,000
		Energy riqualification of social housing - VALLETTE	2024	676,788
		Energy riqualification of social housing - Viale dei Mughetti 20	2024	4,022,429
		Energy riqualification of "Casa Bottega" market	2024	306,928
		Energy riqualification of young community center	2026	5,132,000
		Energy riqualification of public buildings - via Frejus 21 and via Bixio 56	2026	6,571,974
		Energy riqualification of schools - via Bardonecchia 34-36	2025	1,980,000
		Energy riqualification of sports complex - Lombardia and Franzoj swimming pools	2025	1,564,636
		Energy riqualification of school building at Via Mameli 18	2024	800,000
		Advancing Social Mixité and Sustainable Urban Development through Public Housing at Piazza Repubblica 13	2026	11,681,475
		Enhancing Urban Quality and Community Identity: Construction of a High-Performance Preschool Hub at Via Pietro Giuria 43	2025	3,310,419
		Enhancing Energy Efficiency: Extraordinary Maintenance for School Building 'Nigra' at Via Bianzè 7	2023	250,000
		Comprehensive Restoration and Seismic Enhancement of Pestalozzi Elementary School: A Holistic Approach to Safety, Preservation, and Energy Efficiency	2026	5,090,400

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy	FS2 - Thermal insulation of buildings: improvement of thermal insulation in F and G class buildings; further improvements for other classes	Energy Upgrading, Space Enhancement, and Regulatory Compliance for I.I.S Copernico Luxembourg	2023	3,000,000
		Energy Upgrading of School Buildings: Promoting Green Transition and Efficiency Measures (Via Beinsasco 34, Corso Vercelli 157, Via Cecchi 16)	2021	3,450,000
		Extraordinary Maintenance for Building Energy Consumption: Promoting Green Transition and Efficiency Measures (Via A.Negri 21-23)	2023	3,084,750
		Energy upgrading, space enhancement and regulatory compliance Liceo Classico Alfieri	2023	2,000,000
		Extraordinary maintenance for building energy consumption Via San Sebastiano Po 6	2023	2,469,611
		Extraordinary maintenance for building energy consumption Via Vallauri 24	2023	2,664,900
		Extraordinary maintenance for building energy consumption Via Lussimpiccolo 36/A	2023	2,647,350
		Extraordinary maintenance for building energy consumption Via Stampini 25	2025	3,850,000
		Energy upgrading, space enhancement and regulatory compliance LICEO ARTISTICO ALDO PASSONI	2023	2,000,000
		Energy upgrading, space enhancement and regulatory compliance LICEO CLASSICO GIOBERTI	2023	2,000,000
		Energy upgrading, space enhancement and regulatory compliance L.S. CARLO CATTANEO	2026	2,500,000
		School buildings energy redevelopment	2024	3,354,710
		Energy retrofit of municipal office buildings	2022	3,495,000
		Renovation of I.I.S. Russel-Moro-Guarini: Enhancing Energy Efficiency with Window and Door Replacement, Courtyard Refurbishment, and Safety Sound System Retrofit	2030	100,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy	FS2 - Thermal insulation of buildings: improvement of thermal insulation in F and G class buildings; further improvements for other classes	Renovation of Liceo Classico M. D'Azeglio: Enhancing Energy Efficiency with Façade Retrofit, Window/ Door Replacement, and Restroom/ Laboratory Refurbishment	2030	132,000
		Renovation of Istituto Santorre di Santarosa: Enhancing Energy Efficiency with New Insulated Roof Construction	2030	2,380,000
		Renovation of Istituto A. Avogadro: Enhancing Energy Efficiency with Window and Door Replacement, Floor Isolation, and Gymnasium Roof Refurbishment	2030	1,500,000
		Renovation of Istituto Superiore Giordano Bruno: Enhancing Energy Efficiency through Classroom Window and Door Replacement	2030	500,000
		Renovation of Liceo Cottini: Enhancing Energy Efficiency through Window and Door Replacement, and Outdoor Area Retrofit	2030	400,000
		Renovation of ITTS C. Grassi: Enhancing Energy Efficiency with Electric System Adaptation and Window/Door Replacement	2030	5,500,000
		Renovation of Istituto Professionale Colombatto: Improving Energy Efficiency through Asbestos Removal, Heating Regulation, and Window Replacement	2030	5,130,000
		Renovation of Istituto Professionale Birago: Enhancing Energy Efficiency through Asbestos Removal and Glazed Façade Replacement	2030	600,000
		Renovation of Liceo A. Einstein: Improving Energy Efficiency through Facade Retrofitting and Electrical System Replacement	2030	1,000,000
		Renovation of Social Housing at Corso Lecce: Installing Elevators and Upgrading External Fixtures for Enhanced Accessibility and Efficiency	2030	900,000
		Social Housing Renovation at Via Pianezza: Retrofitting Electrical and Heating Systems	2030	900,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy	FS2 - Thermal insulation of buildings: improvement of thermal insulation in F and G class buildings; further improvements for other classes	Social Buildings at Via Rosa 13 - Alma Mater: Enhancing Energy Efficiency through Thermal Insulation and Fixture Replacement	2030	1,000,000
		Seismic Upgrading and Restoration Project for Carlo Boncompagni Primary School: Enhancing Structural Safety and Energy Efficiency	2030	7,900,000
		Renovation of Scuola Silvio Pellico's School Lunch Room: Enhancing Energy Efficiency and Thermal Comfort	2030	832,000
		Improvement of energy performance of the public building at 139 Cuorgnè Road.	2027	3,000,000
	FS6 - Electrical equipment: improvement in energy efficiency	Energy riqualification of "Teatro Nuovo" theatre	2026	71,800,000
		Energy riqualification of schools - Via Verolengo	2025	3,322,587
		Energy riqualification of "Borgo Medievale" complex	2026	6,000,000
		Energy riqualification of libraries - Luigi Carluccio	2026	5,857,660
		Energy riqualification of libraries - Italo Calvino	2026	1,167,140
		Energy riqualification of Nitti, Baltimore, Don Grioli and Sebastopoli markets	2025	2,281,500
		Energy riqualification of sport plants - Primo Nebiolo Stadium	2025	1,155,958
		Extraordinary Maintenance of Social Building: Refurbishment for Energy Efficiency Enhancement (Via Foligno 10)	2026	2,761,000
		Extraordinary Maintenance of Social Building: Refurbishment for Energy Efficiency Enhancement (Via Leoncavallo 17/27 and Via Pancini 18)	2026	4,933,500
		Refurbishment of Residential Buildings: Enhancing Energy Efficiency and Implementing Sustainable Solutions (Via Sansovino 26)	2024	2,275,000
		Enhancing Energy Efficiency of Residential Buildings: A Case Study at Via Aosta 37, City of Turin	2024	1,685,000
		New Library at Via Viterbo: Enhancing Energy Efficiency and Green Spaces	2030	- €

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy	FS8 - Policies for the development of energy communities	Energy communities funds	2027	300,000
	FS10 - Energy retrofitting of 800 municipal buildings with Iren (EfficienTO)	Energy retrofitting of 800 municipal buildings with Iren (EfficienTO)	2022	110,000,000
	FS13 - Replacement of traditional lamps with new LED lamps	LED Enhancement for Public Lighting Systems. High-Power Lamps and Underpasses Replacement of Traffic Light Lanterns	2022	14,230,160
		LED Enhancement for Public Lighting Systems. 'Historical' and Decorative Fixtures	2030	12,700,000
		Public lighting lamps replacement with LED devices	2020	- €
		Traffic lights replacement with LED lamps	2022	- €
		High energy performance building construction - Piazza Montale	2024	5,373,626
		Energy riqualification of libraries - Dietrich Bonhoeffer, Natalia Ginzburg, Cascina Marchesa	2026	7,315,040
		Energy riqualification of Guala, Pavese and Madama Cristina markets	2025	2,659,200
		Energy riqualification of Brunelleschi and Porpora markets	2025	2,489,737
		Plant riqualification of sports complex - Massari	2024	2,258,190
		Enhancing Energy Efficiency in School Buildings - South Area A34 through Extraordinary Maintenance	2026	5,626,996
		Enhancing Energy Efficiency in School Buildings - West Area A33 through Extraordinary Maintenance	2026	3,591,668
		Enhancing Energy Efficiency in School Buildings - North Area A32 through Extraordinary Maintenance	2026	6,342,732
		Enhancing Energy Efficiency in School Buildings through Extraordinary Maintenance (circostrizione 7-8)	2026	2,391,537
		Park for Environmental Education and Sport - Cluster 2: Refurbishment of Ex Galoppatoio for Sustainable Community Engagement	2026	4,000,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Stationary Energy		Extraordinary maintenance of Passo Buole and Colletta sport centre, Cecchi gym, Colletta swimming pool and Parco Ruffini athletic fields	2025	2,287,788
		Energy efficiency retrofit of libraries and buildings of historical and cultural interest	2026	10,083,000
		Information and awareness-raising of citizens and operators on incentives and energy-saving opportunities	2023	- €
		Building Iren Heat Storage and Thermal Solar System with Integrated Components in Mirafiori Nord	2030	46,000,000
Transport	FT1 - Replacement of ICE vehicles with electric ones	Green to share	2023	2,930,000
	FT3 - Replacement of private cars with electric vehicles	Expansion of Public Electric Vehicle Charging Infrastructure	2019	- €
	FT4 - Promotion of alternative means of transport: building cycle paths	Green corridors Retrofit of Lungo Dora (from Corso Principe Oddone to Parco Colletta)	2023	1,998,571
		Biciplan - Connection of cycle lane : Corso Verona	2023	800,000
		Biciplan 2 - Connection of cycle lane - Securing cycle crossings and accessibility	2023	1,300,000
		Biciplan 3 - Connection of cycle lane: park of Clessidra (from Largo Tirreno to Corso Turati)	2023	800,000
		Biciplan 4 - Connection of cycle lane: Corso Marconi	2023	1,200,000
		Biciplan 5 - Connection of cycle lanes: Piazza Robilant, Via Gorizia (from Via Filadelfia to Corso Cosenza)	2023	1,250,000
		Biciplan 6 - Connection of cycle lanes	2023	2,800,000
		Enhance public cycle lane	2026	4,113,829
		Cycle lane Robilant Peschiera	2024	520,000
		Enhancing Cycle Connections for Sustainable Mobility Corso Cincinnato	2025	1,200,000
		Enhancing Cycle Connections for Sustainable Mobility paths between Corso Ferrara and Corso Grosseto	2024	1,500,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Transport		Extension of Cycle Lanes between the city and neighboring municipalities: Promoting Active Mobility and Connectivity within the City (Part A)	2024	1,320,763
		Maintenance and Improvement of Cycle Lanes: Enhancing Bicycle Mobility and Safety	2023	1,000,000
		Cycle Counterpaths: Enhancing Bicycle Infrastructure and Safety on Corso Peschiera, Corso Regina Margherita, and Corso Potenza	2023	1,000,000
		Extension of Cycle Lanes between the city and neighboring municipalities: Promoting Active Mobility and Connectivity within the City (Part B)	2023	1,320,764
		Project Harmony	2023	127,500
		Incentivizing the purchase of travel tickets for Municipality of Turin employees	2019	3,600,000
		Enhancement cycling mobility (urban cycle lanes)	2026	4,113,829
		Upgrade of bicycle network	2019	- €
		Construction of new bicycle parking stalls	2019	- €
		Urban Mobility Enhancement Program: Expansion and Revitalization of Station-Based Bike Sharing	2023	- €
		Implementation of Sustainable Bicycle Parking Facility near Porta Nuova	2030	350,000
		Enhancing Intersection Safety and Bicycle Mobility through Dedicated Crossings and Traffic Signal Adaptations	2023	1,300,000
		Enhancing Livability and Connectivity through Green Corridors along Lungo Dora	2023	2,000,000
		Promoting Modal Shift with Interchange Parking Facility at Piazza Bengasi	2025	11,585,000
		Cycling Infrastructure Enhancement on Via Vandalino: Implementing Dedicated Bike Lanes and Safe Intersection Designs	2030	2,800,000
		Enhancing Mobility in District (Circoscrizione 4): Completing Dedicated Cycling Lanes and Improving Road Crossings	2030	2,800,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Transport		Improving Cycling Safety in District (Circoscrizione 5): Traffic Light Adaptation for Road Crossings	2030	1,300,000
		Enhanced Cycling Infrastructure in District (Circoscrizione 2): Improving Traffic Control for Cyclists	2030	- €
	FT5 - Development of policies of carsharing with non-ICE vehicles	Project MaaS / Living Lab TOMOVE	2025	7,000,000
		Promotion free-flow sharing mobility service	2019	- €
		Identification of operators for a car sharing service with vehicles with reduced environmental impact, through public notice	2019	- €
	FT7 - Renewal of the local public transport fleet	Intervention of energy efficiency in transport system	2030	10,047,000
		Replacement of urban and suburban bus fleet	2024	288,400,000
	FT8 - Constuction of metro line 2	Automatic Metro M2 Line: Connecting San Mauro to Orbassano via Turin's Central Area, with Interchange Stations and Multimodal Transportation Options	2030	
		Reorganisation traffic circulation Piazza Baldisserra and refurbishment of tramway line	2027	7,500,000
		Pedestrianization and retrofit of Via Coazze between via Almese and via Saffi	2027	232,000
		Hydrogeological Refurbishment of Hillside Parks: Stabilizing River Banks and Reconnecting Cycle-Pedestrian Paths	2024	750,000
		Implementation of 30 Zone for Enhanced Public Space and Safety (large territorial portion between corso Vittorio Emanuele II, corso Trapani, via Capriolo, corso Peschiera and corso Racconigi)	2025	1,000,000
		Refurbishment of Square in Front of TorinoEsposizioni: Transforming into a Pedestrian-Friendly Entrance and Park Connection	2026	3,000,000
		Valdocco Vivibile Lotto 2 - Requalification of Public Space and Mobility for Enhanced Livability	2025	1,500,000
		New traffic light systems and installation of devices for the blind	2023	350,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Transport		Digitization and dematerialization of parking and travel tickets	2030	8,700,000
		Special collective mobility services at events	2019	150,000
		Renewal of the Protocol of Understanding for Logistics and Rationalization of Urban Goods Distribution between the City of Turin, CCIAA and the Associations, integrating and updating its sustainability criteria	2019	- €
		Promoting Intermodality through Enhanced Utilization of Interchange Parking Facilities	2019	- €
		Extending Metro Line 1 Westward with New Stations and Tunnels	2026	271,000,000
		Enhancing Emission Reductions through Completion and Development of the Metropolitan Railway System	2023	175,000,000
		New Line 12: Enhancing Public Transit Connectivity from Northern Suburbs to City Center	2030	229,700,000
		Digitization of Citizen Taxation Services: Streamlining Processes and Minimizing In-Person Visits	2030	2,800,000
		San Secondo Street Sustainable Urban Project: Velocity limitation, Emphasizing Green and Permeable Areas	2030	- €
		Pedestrianization of Roma street	2027	12,245,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Waste	FW3 - Reduction of waste generation, reduction of waste sent to wast-to-energy plant by the city of Turin and increase sorted waste collection	Creation of recycling waste collection point	2026	1,336,800
		Circular economy funds for Smes and non profit organisations	2027	2,400,000
		Project Sme4green	2023	41,500
		Project Fusilli	2024	556,000
		Project Woodcircles	2025	175,000
		SMAT's Sustainable Innovation: Biomethane Production from Sewage Sludge	2019	4,386,000
		Sustainable Water Access: SMAT's Water ATM Initiative in Turin	2020	235,120
Energy systems	FE1 - Increase in the share of PV in the electricity generation system	Energy riqualification of social housing - Via Sansovino 26	2026	2,275,000
		Advancing Energy Efficiency and Sustainability: Refurbishment of Public Housing at Via Aosta 37	2026	1,685,000
		Urban Area 'Veglio' Refurbishment: Integrating Public Residences and Green Space with Photovoltaic Power	2026	18,150,000
		Refurbishment and Expansion of Public Residences for Elderly and Families with Photovoltaic Integration - Porta Palazzo	2026	12,291,410
		Construction of Temporary Residences for Social Inclusion: A Holistic Approach to Housing and Community Support - Via Vagnone 15	2024	6,096,262

Table AI-1.1 – List of Micro-actions – Emission Reduction

Waste		Construction of a New Childhood School Building: Meeting Energy Efficiency Standards with Photovoltaic Integration at Via Verolengo	2025	3,322,587
		Construction of a New Childhood School Building: Meeting Energy Efficiency Standards with Photovoltaic Integration at Corso Massimo d'Azeglio	2025	3,310,419
		Construction of New Schools through Building Refurbishment: Achieving Energy Efficiency Standards with Photovoltaic Integration at via Santhià	2026	2,647,350
		Extraordinary maintenance of Trecate sport centre and Gaidano swimming pool	2025	2,365,199
		Implementation of a Floating Photovoltaic Power Plant by SMAT	2026	10,000,000
		PV Power Plant at SMAT Headquarters	2024	455,000
	FE2 - Increase in the share of purchase of Zero Emission Electricity	Electrical energy purchasing from renewables	2023	- €
		SMAT's Renewable Energy Transition Initiative: Exclusive Renewable Electricity Procurement since 2020	2020	16,000,000

Table AI-1.1 – List of Micro-actions – Emission Reduction

Cross-cutting		Application of Minimum Environmental Criteria in the Strategical Environmental Assessment Procedures	2023	- €
		CCC Innovation funds for Smes	2027	7,200,000
		Empowering the administration of 9 italian cities to act effectively towards climate neutrality.	2025	- €
		ESA Agreement - 5G for l'Art and House of Emerging Tech	2027	3,000,000
		Forestation campaigns with sponsors and institutional partners	2023	- €
		ISO 50001 certification of the Municipality of Turin	2023	- €
		New European Bauhaus intervententions on public spaces	2027	21,350,000
		Project Climaborough	2026	292,500
		Project CTE Next	2025	- €
		Project Desire	2025	72,500
		Project GIPA - Gruppo Interdipartimentale sulle Politiche del Cibo	2025	- €
		Project Respondet	2025	18,900
		Project Seed	2023	100,000
		Turin House of Emerging Technologies - CTE NEXT - Funding for startups and SMEs for the deployment of 5G enabled solutions for Net Zero Cities	2027	555,000

Table AI-1.2 – List of Micro-actions – Residual Emission Compensation

Tab. AI-1.2 – List of Micro-actions – Residual Emission Compensation

Macro-Area	Macro-Action	Micro-Action	Year	Investment [€]
AFOLU	FG1 - Increase in planted trees and green areas	Energy riqualification of libraries - Francesco Cognasso	2025	4,649,040
		Greening interventions in historic buildings - Villa Amoretti, Andrea della Corte and Mausoleum of Bela Rosin	2026	3,280,480
		Greening interventions in Tesoriera and Rignon Parks.	2025	2,160,000
		Greening interventions in "Cesare Pavese" and "Passerin d'Entreves" municipal libraries and in "L'isola che non c'è" and "Centro dentro" youth centres.	2026	5,268,600
		Greening interventions	2024	900,000
		Green interventions in parks, fluvial corridors and urban boulevards	2023	3,924,228
		Refurbishment of public areas	2023	3,280,703
		Urban Forestation	2020	146,400
		Urban Forestation	2021	203,350
		Urban Forestation	2022	219,600
		Urban Forestation	2023	49,003
		Urban Forestation	2029	160,000
		Refurbishment of the area of the former military gallop "Ferruccio Dardi"	2026	7,500,000
		Environmental refurbishment of Villaretto lake and ecological corridors	2025	-
		Refurbishment of EX FIP Square for Enhanced Functionality and Urban Greenery	2024	375,000
		Participatory Forestry Campaigns	2023	1,000,000
		Planting of approximately 40,000 trees in extensive city parks and a further 20,000 trees through participation in the 'forestation' call	2022	3,050,000
		Enhancing Resilient Neighborhoods through Traffic Moderation and Pedestrian-Friendly Initiatives in San Donato and San Secondo	2023	3,000,000

Tab. AI-1.2 – List of Micro-actions – Residual Emission Compensation

AFOLU		Enhancing Urban Environment with Green Spaces, Energy-Producing Furniture, and Innovative Materials - Scuola Primari Giuseppe Allievo	2030	1,000,000
		Retrofit of Corso Belgio: Enhancing Permeability and Climate Adaptation with New Tree Species and Natural Drainage Solutions	2030	-
		Retrofit of Corso Belgio: Enhancing Permeability and Climate Adaptation with New Tree Species and Natural Drainage Solutions	2030	-
		Upgrading Public Transport Stops: Lowering Temperature with Cool Materials and Green Sedum Coverings	2030	1,000,000
		Enhancing Livability on Via Stradella: Retrofitting Parking Areas with Tree Planting, Cooler Materials, and Improved Rainwater Drainage	2030	1,000,000
		Renovation of Green Area at Verbene Street: Enhancing Security with Renewable Energy-Powered Lighting and Sustainable Park Features	2030	916,000
		Retrofitting East Entry of Vallette Park: Enhancing Accessibility and Sustainability with Bike Paths and Green Area Reorganization	2030	210,000
		Revitalization of Corso Unione Sovietica's EX-IRV: Enhancing Green Spaces and Urban Vegetable Gardens with Irrigation Infrastructure	2030	7,000,000
		Urban Library Spaces Renewal: Upgrading Road Flooring, Sidewalks, and Green Areas	2030	-
		Experimental Program of Interventions for Urban Climate Change Adaptation	2024	2,266,927
		Redevelopment of municipal areas with Nature Based Solutions	2027	1,500,000
		Renaturalization of urban areas by planting trees and shrubs	2027	100,000
		Resilient redevelopment of public space - Via Stradella	2027	925,000

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Tab. AI-1.2 – List of Micro-actions – Residual Emission Compensation

AFOLU		VALDOCCO VIVIBILE I Revitalization with Experimentation of NBS Solutions, Green Interventions, and Sustainable Mobility Measures.	2023	1,300,000
	FG2 - Development of green areas on roofs and vertical forests	Nature based solutions deployment in public buildings - Via Cumiana 15	2023	55,000
		Refurbishment of green areas	2023	6,758,502
		Social Housing at Porta Palazzo: Incorporating Green Spaces for Natural Atmosphere and Shaded Areas	2030	10,000,000
		Collaboration Pact for Climate Adaptation at Viale Michelotti 166	2030	1,000,000
		Implementation of a Low-Maintenance Green Roof with Reduced Water Needs (Irrigation with Rainwater Harvesting) - Viale Michelotti 166	2025	540,000
		Hydrogeological recovery interventions in hillside parks	2024	750,000
		Project CONEXUS	2027	175,000
		Project COFARM4CITIES	2025	175,000
		Project ProGIreg	2023	896,000
		Project NextGenWE	2025	80,000
		Extraordinary Maintenance of Racconigi Market for Improved Infrastructure and Accessibility	2025	1,515,000
		Maintenance of soil (areas between Repubblica square, via Cigna, the river Dora Riparia e corso XI Febbraio)	2025	2,000,000
		Enhancing Safety and Accessibility: School Zone Redevelopment Project	2023	3,000,000

Annex I

7. Annex II

Participatory model

1. The engagement process

The Città di Torino has embarked on the journey toward climate neutrality with a deep understanding of the complexity of the challenge ahead and the opportunities it presents to leverage knowledge, planning, and collaborative processes. At each stage of compiling the CCC, there was a deliberate examination of dynamics, relationships, data, plans, and partnerships, with a focus on elements that could provide strong support for the structure of the CCC and its accompanying processes of ideation, realization, monitoring, and implementation.

The firm commitment of the political mandate to align with the EU Mission serves as a driving force in establishing **the principles, approaches, and operational core** that will guide the city in creating increasingly structural and effective conditions and partnerships to accelerate its decarbonization efforts.

The construction and implementation of the Torino CCC are founded on the decision to bring together multiple stakeholders and progressively increase their level of participation. Beginning with robust governance within the municipal administration, engagement expands to encompass a broader nucleus involving key targets within the local ecosystem—actors and entities deeply involved in other processes with high potential for direct and/or indirect impacts on achieving climate neutrality.

As mentioned in Section 5 of the Action Plan, this inclusive approach extends to individual citizens, reflecting a commitment to inform, involve, and activate various territorial stakeholders and the community in collectively addressing the challenge of achieving climate neutrality by 2030.

1.1 The principles

The Città di Torino's engagement process is guided by the 3 key principles, in line with what is set out in the Commitments and the Action Plan:

Transparency and inclusion.

The accessibility and understanding of climate neutrality must necessarily pass through its translation into a popular key, to create the right conditions for the partnership network to act effectively, systematizing knowledge, experience and lessons learned. At the same time, a partnership that intends to be effective in climate terms must engage and activate the right alliances, in order to take a systemic approach to the vulnerabilities of the local ecosystem and seize the opportunity to set up effective policies, projects and resources to contrast the energy poverty of certain targets and marginal areas of the city.

A focus on people and interconnection, for a fair transition[1].

The approach underscores the importance of interconnection and of putting people first, with their needs and abilities, in building a positive environment in which to co-create and make decisions together.

Shared responsibility and collaborative learning.

Such a significant change calls for commitment, drive, creativity and resources from a broad range of actors, working together towards a common goal. And above all, it calls for new forms of governance and collaboration that actively engage the entire local ecosystem with different degrees of empowerment and in learning that enhances collective intelligence, resulting in a process of change that is open, continuous, rooted, monitorable and implementable over time.

These principles are recognized and embraced by the signatory parties, the main partners and the supporters who have joined the initiative by signing the Climate City Contract together with the Città di Torino and the "membership letters" enclosed with the Commitment Plan. The same principles will guide the search for future coalitions with other ecosystem actors.

1 A transition to climate neutrality that is implemented fairly and is inclusive

1.2 The intensity of the engagement process

The CCC is the result of an iterative process of consultation and co-creation led by the Città di Torino, in which various stakeholders collaborate to achieve climate neutrality by 2030.

The process involves different levels of engagement– depending on the commitment required – of the following subjects and/or clusters of actors:

- public sector (municipal administration; the various levels of city government and the institutions and agencies involved);
- private sector (large corporations, SME, startups, accelerators, incubators, etc.);
- universities, research centers, schools;
- banks and Foundations:
- third sector agencies and associations (non-profit associations, NGO, foundations, professional associations, etc.);
- city residents.

As part of the information and citizen engagement activities, special attention is dedicated to the new generations and vulnerable groups, who stand to suffer most from the climate crisis.

1.3 Mapping the stakeholders

Mapping stakeholders was the inaugural task undertaken by the Transition Team, as outlined in the Action Plan Summary. The objective was to gain a comprehensive understanding of the local ecosystem. Stakeholders were categorized into four intervention areas identified by the Città di Torino: mobility, buildings and energy systems, green infrastructures, and waste and circular economy. Additionally, two cross-cutting themes of participation and governance were incorporated. Utilizing these thematic areas facilitated the Città di Torino in delineating each actor's potential role in the process, thereby determining their level of involvement and responsibility.

The stakeholder mapping conducted at the outset of the process is not intended to be static; rather, it serves as a dynamic and continuously updated collaborative tool for the Transition Team.

This mapping forms the basis for communication actions and the structuring of the Climate Partnership. Additionally, it provides a reference for Table A-3.2 (Mapping of system and stakeholders) in Section 5 of the Action Plan.

Following stakeholder mapping, an analysis of the relative importance of the actors was initiated (Fig. AII-2).This analysis aids in clarifying the interests and influence of key stakeholders, including individuals, companies, organizations, and public bodies, in the context of actions required to effectively address climate change.

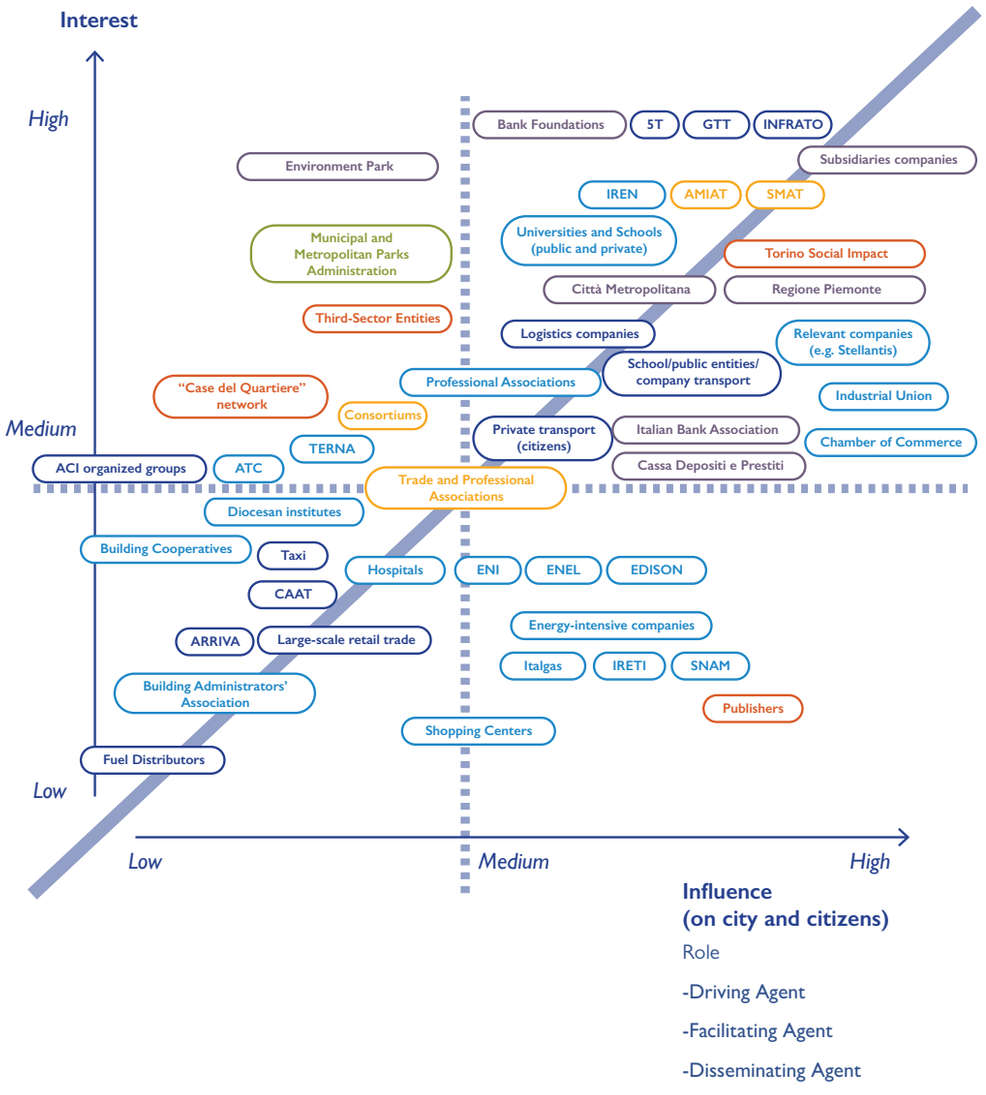

Fig AII-2: Map of stakeholders' relevance

2. Process stages

As indicated in Section 5 of the Action Plan, the process of accompanying the Città di Torino in the CCC schematized in the road map (Fig. AII-3) is divided, according to a systemic approach, in **two macro stages** (Fig. AII-4, Fig. AII-6), which precede (Step 1) and follow (Step 2) the presentation of the CCC, for the construction of a set of incremental, multi-level, multi-actor **participatory spaces** featuring moments of information, discussion and collective exchange.

Activities based on informing and raising awareness, thematic training and widespread communication are grafted onto this **architecture.**

In its effort to engage the local ecosystem, the Città di Torino took advantage of the existence of "framework initiatives", which act as municipal platforms for dialogue and collaboration in the economic and social sectors.

The **framework initiatives** are:

- **Torino City Lab (TCL)**, the open-air urban innovation lab of the Città di Torino, which from 2018 until today has attracted more than 90 partners (representing the corporate world, public utilities, backers of research, innovation and entrepreneurship, international networks and scaling partners and venture capitalists) and a community of over 100 experimental companies (mostly SME and startups). The initiative is designed to create simplified conditions for companies and other stakeholders to co-create and test their own solutions or business projects in the area. To this end, TCL offers a series of areas and workshops, simplified access to contacts and data from the Città di Torino and utilities, networking with international partners. With the aim of accelerating technological innovation with a social impact, and co-creating innovative solutions for the benefit of the territory and the city's inhabitants. Over the years, the themes prioritized and the technologies utilized have changed along with the evolution of local, national and European policies, ranging from cutting-edge technologies applied to urban mobility to the recent finalization of an ecological and digital transition towards a "zero-emissions city". Recently, Torino City Lab has been strengthened by the addition of "ToMove Living Lab", which will promote large-scale experiments on future mobility scenarios inspired by "Mobility as a service" and able to integrate cooperative, autonomous and connected driving solutions for the mobility of people and goods. TCL also promotes and transfers the open innovation model of "Living Lab" thanks to its participation in European networks such as "European Network of Living Labs - Enoll" (of which it has been a certified and active member since 2018) and its participation in European projects, with which it sets up dedicated labs, like the Circular Food Lab (associated with the EU "Fusilli" project), NBS living lab (associated with the EU ProGiReg project) and the Tech&Cultura lab (part of the former EU 5G Tours project, now Trialsnet). Website: https://www.torinocitylab.it/it/
- **CTE Next, the Torino Home of Emerging Technologies** is an open technology transfer center specializing in new technologies enabled by 5G (Artificial Intelligence, Internet of Things, Blockchain), applied to strategic areas for Torino: Smart Mobility, Advanced Urban Air Mobility, Industry 4.0 and Smart City services. Funded by the Ministry for Enterprise and Made in Italy, the CTE NEXT partners include 12 public and private entities, coordinated by the Città di Torino, with the common objective of promoting the acceleration of startups and technology transfer to SME as well as the development and adoption of innovative solutions in the aforementioned sectors. Operative since March 2021, today CTE NEXT boasts a community of about 600 companies, mostly startups and SME, not just from Torino and Piemonte, but from other parts of Italy and abroad. These companies benefit from a catalogue of over 30 services supporting business acceleration, technological development and social impact analysis, as well as field experimentation activities. Additional financing is expected to be available for development and testing activities, as well as training courses and transversal, large-scale community and networking actions (with more than 4,000 users involved in approximately 84 events). Recently, CTE NEXT has also become an instrument of promotion and change towards a model of "zero-emissions city": since 2022 there have been several training opportunities generating ideas and networking on the topic, also in collaboration with

Torino's two universities. The last two calls for companies were also focused on raising the potential of emerging technologies in areas related to the transition to climate neutrality in sectors such as mobility, energy systems, the built environment, circular economy and waste management, as well as transversal actions for the involvement and education of the public. For example, 30 early-stage startups are candidates for the Call for Acceleration 5G&Emerging Tech for Climate Neutrality, with the deadline for applications set at 29 January 2024: of these, about 8 companies and 3 informal groups will be assisted in developing a business model with social and environmental benefits and possible application in the Torino area. Website: www.ctenext.it

- **Torino Social Impact.** It is an alliance an alliance between companies and public and private institutions to make Torino an attractive place to do business and finance by intentionally and jointly pursuing objectives of economic profitability and social impact. A cluster of skills, activities and services to strengthen and promote the local ecosystem in the framework of the 2030 Agenda. Torino Social Impact is an open platform with more than 290 participants, including private companies, institutions, financial sector operators and Third Sector entities, that have underwritten a Memorandum of Understanding (MoU) aimed at pooling ideas, experiences, projects and resources to catalyze and attract forms of entrepreneurship that exploit the opportunities presented by new technologies to offer solutions to emerging social problems through economically sustainable business models. Torino Social Impact accelerates, reinforces and promotes the projects, activities and events of all the local subjects that act to find solutions to the area's social needs. The TSI platform enables the involvement and pivotal role of partners, activating and facilitating Communities of Practice on shared issues and challenges and drawing on the expertise of network partners to collaborate on emerging projects, as in the case of the establishment of the Community of Practice on the Circular Economy, which took place in July 2023 as a result of the European Respondet project. Website: www.torinosocialimpact.it

The capitalization and valorization of the existing "framework initiatives" led to the creation of a **participatory process** capable of engaging multiple actors from different sectors in a shared endeavor.

The **intensity of the engagement of local actors** within the various **participation spaces** developed increases based on the object of discussion (strategy, action, elimination of barriers, etc.) and the desired outcome. It takes on an informative, consultative nature, even providing for concrete meetings for the co-design of actions and/or policies in support of climate neutrality.

The **participatory process assisting the local ecosystem in adhering to the CCC** follows the path laid out in the operational **roadmap** shown shown in Figure AII-3. The roadmap is not to be read sequentially, but in an integrated and systemic manner. It sums up the various interconnected stages and describes the milestones and the instruments utilized, along with the information and communication action, which develops transversally throughout the entire process.

The **most suitable methodologies and tools,** which have been and will be used to engage stakeholders, are defined by the Città

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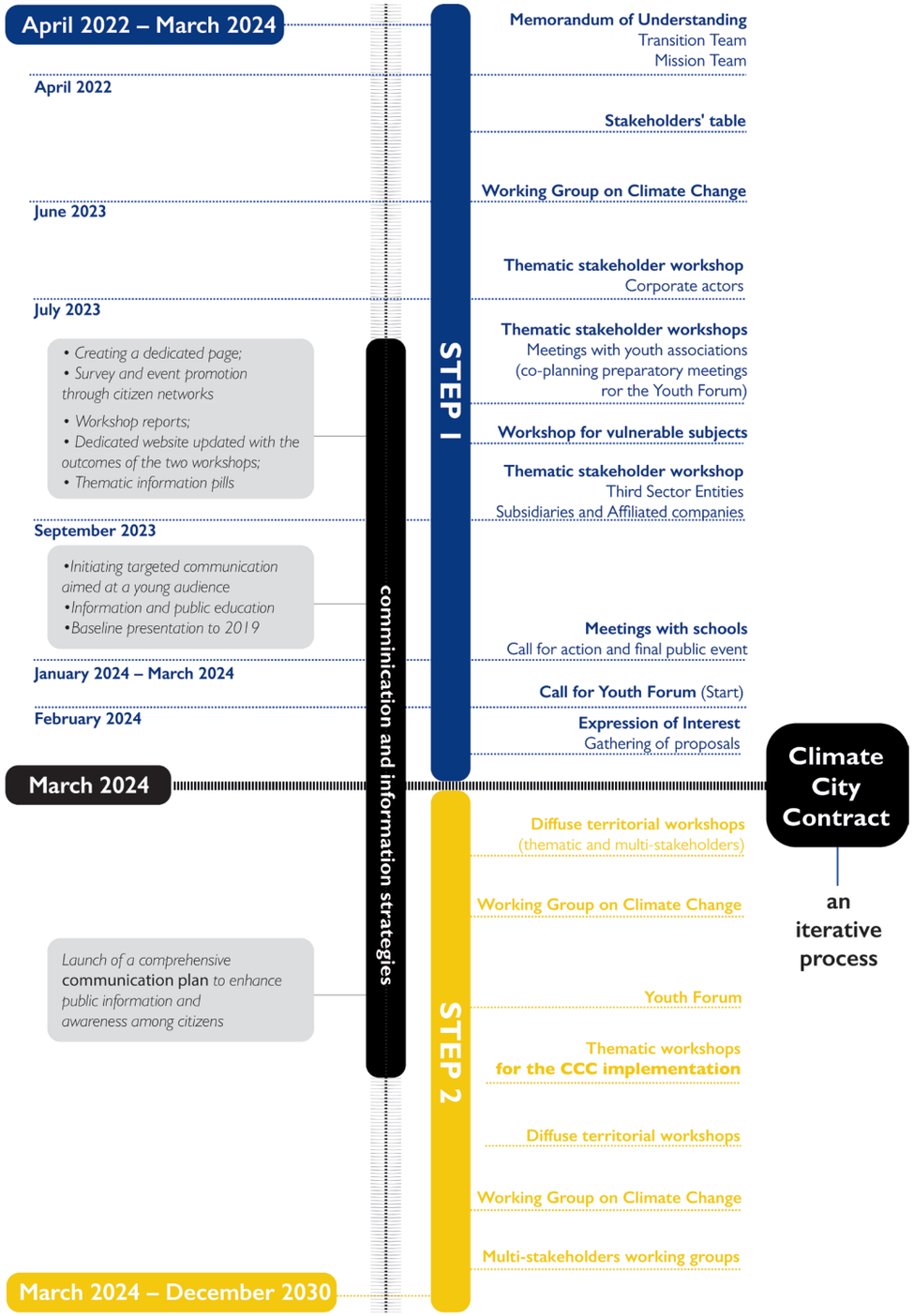

Fig AII-3 –
Roadmap summing up the process of accompaniment leading up to the CCC

di Torino based on the co-design of the process, the application context and the goals and targets identified. A description of the main instruments of information, discussion and participation used by the Città di Torino for the CCC is contained in the following table.

2.1 STEP 1 – Accompanying the co-creation of the CCC

Tab AII-1 : Information and engagement spaces

Instruments of information, discussion and participation	Composition	Function/brief description
(a) Stakeholder thematic round tables (b) Workshops (thematic/ multistakeholder)	Actors pertinent to the theme, object and objectives	• (a) Promoted by the Mission Team, together with the political body, engaging specific targets • (b) Interactive, theme-based and sometimes multi-actor projects. They are intended to come up with shared solutions on the theme and progressively open to new categories /targets (ex.: new generations) They deliver effective contributions to: (i) co-design actions for the Plan; (ii) identify innovative solutions; (iii) expand the network of actors; (iv) empower communities. They are designed and organized in different modalities, depending on the point in the process, and can be useful tools for presenting lessons learned and identifying new themes for the implementation of the CCC, with a view to promoting collective learning. They serve as points of initial contact between scientific knowledge and knowledge of the territory, leading to the design of actions for the Plan. In their form as multistakeholder workshops, they increase operational effectiveness and focus on the integration of different urban policies in the service of the common goal of climate neutrality.

Decentralized territorial labs	Relevant or interested actors from the local multilevel ecosystem (territorial or thematic).	Collaborative spaces activated with a view towards integrating policies on specific issues that require broader interaction, including the community and/or specific clusters of actors. They establish links and integrate with the Living Labs activated during the urban innovation projects promoted by the city government through Torino City Lab (ex.: the FUSILLI and ToMove projects) and may find a point of reference and coordination in the newly constituted National Competence Center for social innovation[2], which will be based in Torino.
Call to Action	Actors relevant to the work theme, object and objective.	Dedicated calls to stimulate innovative actions favoring specific target groups.
Young people for the climate forum	Representative of City schools, youth associations, active informal groups, young citizens.	An interaction and discussion space with variable engagement intensity (information, consultation, co-creation, monitoring) involving young people and focusing on relevant topics identified by the Mission Team.

Step 1 (April 2022 - March 2024) had the objective of

- building a strong governance;
- understanding the system, starting with the data and technical-scientific expertise, along with the qualitative contribution of local actors;
- exploring possible avenues and co-creating a portfolio of actions for the shared creation of the Action Plan.

The process of engagement, in its diversified structure starting from the Mission Team (introduced in the Summary of the Action Plan) and the Working Group on Climate Change (WG CC), aims to cross-pollinate, open and integrate all urban policies by making the ambition of successfully facing the climate challenge the heart of an integrated and transversal approach within the Public Administration (PA) and capable of reverberating throughout the entire local coalition.

2 The National Competence Center for social innovation, funded by the European Easi Program, is based in Torino and coordinated by the Città di Torino itself, as project leader. The mission of the Competence Center is to facilitate the promotion, mainstreaming and upscaling of social innovation, according to the specific characteristics of the context of each partner involved and based on a strong strategic alliance between the public administration, universities and research centers, intermediaries and professionals who share a common vision of social innovation as a key driver for inclusive and sustainable European development.

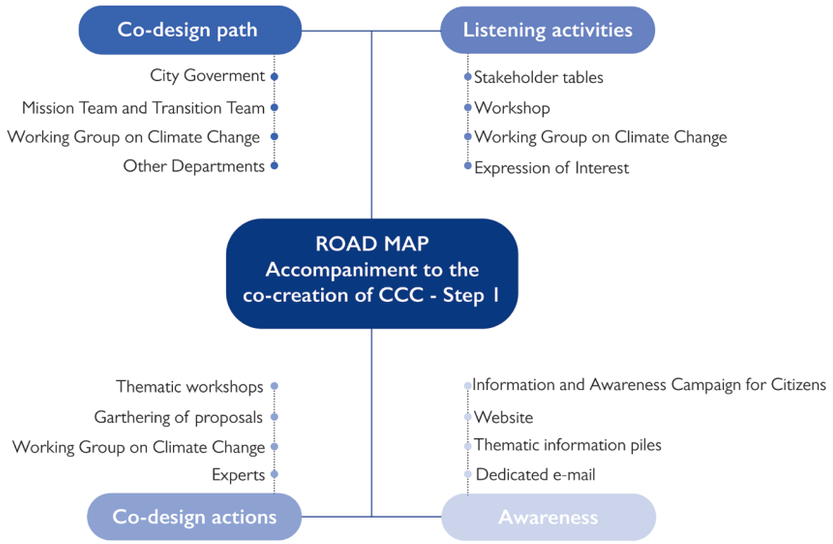

Fig. AII - 4
Step 1 (April 2022 - March 2024) accompanied the co-creation of the CCC

2.1.1 Instruments for information, discussion and participation in Step 1

Thematic stakeholder round tables

a) The round tables with the area's main actors, public-private companies and the stakeholders relevant to the theme, representing the areas of intervention of the path to the CCC were organized as bilateral meetings, with the aim of providing information on the Mission and initiating an action of engagement by promoting a vision of shared participation in actions necessary to the climatic transition.

The process began with 17 meetings for single categories of actors, which took place from March to June 2023, and saw the participation of:

- category associations;
- investee companies part-owned by the Città di Torino;
- the academic and research community;
- public institutions above the local level;
- the main banking groups;
- the city's bank foundations;

The meetings held are described described in Tab. AII-2.

3 The aim of the EfficienTO project, dedicated to improving the efficiency of school buildings in the Città di Torino, is to reduce emissions by 33% by saving energy, reducing toxic emissions, upgrading technology and connecting with sources of renewable energy.

Tab AII-2 : Schedule of meetings

Stakeholder category	Stakeholders	Theme	Meetings
Investee companies	IREN	Energy Communities	27/03/23
	IREN	Public lighting and traffic lights	11/04/23
	IREN	Remote heating	13/04/23
	IREN	EfficienTO project [3]	17/05/23
	GTT	Public transportation	13/04/23
	5T	Public and private transportation	03/05/2023 19/05/2023
	TRM	Energy: production of energy and heat for TLR from waste-to-energy plant	10/05/23
	SMAT	Energy: increased efficiency of S.I.I. managed plants	31/05/23
Universities and the research community	UniTO – University of Torino	Circular Economy and contacts with Confindustria Piemonte and Unione Industriale di Torino	05/04/23
	UniTO – University of Torino	Sustainability and International Cooperation for Development	09/05/23
Public institutions	CMT – Torino Metropolitan Area	PUMS – Sustainable Urban Mobility Plan for the Torino Metropolitan Area	15/05/23
	Regione Piemonte	Regional energy policy	25/05/23
Bank foundation	Compagnia San Paolo	Support for the process and contacts with other bodies	26/05/23
Banking sector	Unione Industriali	Role of the Small and Medium Enterprises	07/06/23
	Intesa San Paolo Unicredit	Role of the banks	22/06/20
Regional agency	ATC	Improving the energy efficiency of residential buildings	30/06/23

Meetings with representatives of supra-local public institutions were important because, in addi-tion to informing and sharing the path that Torino has undertaken, they were intended to promote the coordination of climate policies and plans between the different levels of government, in order to fa-cilitate more effective and longer lasting actions.
Also worth mentioning is the dialogue with banking foundations and financial institutions, which has made it possible to launch coordinated actions and prepare an enabling context that will lead to the identification of possible sources of financing for the actions of the Plan and at the same time over-see the implementation phase.
The commitment of Intesa San Paolo and its Innovation Center and, in general, of banking founda-tions in this area is also evidenced by the investment in attracting the International Accelerator and Techstars, which accelerates the best European startups with solutions for #Transformative Cities.

Listening and co-design activities (Step 1)
The workshop cycle

Workshop for enterprises and start-ups
July 2023

Picture: Città di Torino

Workshop for Third-Sector Entities, Subsidiaries and Affiliated Companies
September 2023

Picture: Angela Nasso

Workshop aimed at vulnerable subjects
December 2023

Picture: Angela Nasso

Programme of workshops and meetings aimed at high schools
January-March 2023

Picture: Angela Nasso

Prticipatory path aimed at citizens in the framework of the General Urban Development Plan
June-November 2023

Picture: Giuliano Berti for Urban Lab

Fig. AII - 5
The cycle of workshops

The Città di Torino has launched a series of workshops to engage stakeholders in opportunities to inform, listen and start the co-design of actions.

- Workshop: "Torino towards Climate Neutrality by 2030. An open discussion with local businesses."

On Thursday, 20 July 2023, from 9 a.m. to 1 p.m., at CSI NEXT, headquarters of the Torino House of Emerging Technologies, the meeting "Torino towards Climate Neutrality by 2030. An open discussion with local businesses" was held, with a view towards engaging the Torino business community in the process of developing the "Torino Climate City Contract". The event was attended by 80 people, representing more than 40 Torino businesses.

The workshop began with an informative introduction, which introduced the elements of the context: the 100 Climate-Neutral Cities challenge: the path undertaken by the Città di Torino towards the "Climate City Contract", the science-based approach and data collection methods used to analyze reductions in CO_2 emissions, the objectives and the initial results of the call. The second part was devoted to work sub-groups, for a total of 4 round tables, intended to collect ideas and identify areas for collaboration relevant to the main pillars of the CCC: energy systems, mobility and transportation, waste management and circular economy, green infrastructures and nature-based solutions, the built environment, digital solutions and other actions designed to increase engagement and education.

- "The Città di Torino meets the Third Sector"

The workshop dedicated to Third Sector Entities (ETS, or non-profit) and representatives of investee companies was held on 20 September 2023.

The first part of the workshop was dedicated to illustrating the policies and guidelines and to reconstructing the initial cognitive framework within which the CCC Action Plan is embedded.

The inventory of city emissions per base year (2019) and the data by thematic area of the CCC were presented. These are used to identify the systemic barriers that the actions that will be tracked with the support of local stakeholders will have to overcome to bring about a significant change.

Afterwards, participants were presented with a thematic update of an informative and educational nature by 4 experts on the thematic areas of the path towards the CCC.

This segment included the involvement of experts on 4 thematic areas: green infrastructures and NBS (Nature Based Solutions), Built Environment and Energy Systems, Mobility and Infrastructures and Waste Management and Circular Economy.

- Workshop: "Torino's schools for the Climate City Contract"

An experience dedicated to the city's high schools, which were selected with a dedicated call - "Dimmi la tua" (literally, Let's hear from you) – promoted in conjunction with the Torino Metropolitan Area.

The intervention was divided into a workshop, an intermediate stage of work by the classes within their schools and a final meeting:

* The workshop involved the organization of several segments dedicated to providing information and training and the themes of the CCC and constructive interactive activities designed to engage young people and encourage their active participation;
* For the intermediate stage, the schools, taking the outcomes of the workshop as their point of departure, drew up proposals to present to the city as their contribution to the collective effort towards climate neutrality;
* The final meeting was aimed at creating a space for exchange between the Public Administration and young people, through the public presentation of all the proposals elaborated by the various classes, with the Mayor of the Città di Torino and the Torino Metropolitan Area, Stefano Lo Russo, in attendance, along with the Deputy Mayor of the Torino Metropolitan Area, Jacopo Suppo, and the Councilwoman in charge of the ecological and digital transition, mobility, transportation and innovation for the Città di Torino, Chiara Foglietta, clearly indicating a reciprocal commitment to a collective action for the realization of policies aimed at climate neutrality.

The intervention saw the participation of 16 third, fourth and fifth-year classes from 6 high schools in Torino, for a total of 200 students and 16 faculty members.

The **first workshop,** held on 8 February from 9 a.m. to 1 p.m., was designed to increase the participants' awareness concerning

the challenges and commitments that the Città di Torino must make in order to reach climate neutrality by 2030, as well as contributing to building a dialogue between young people and the city government regarding the strategies and actions outlined in the CCC and their active participation.

The workshop was divided into 12 thematic round tables operating simultaneously: 4 tables on Green Infrastructures and NBS, 3 on Mobility and Transportation, 2 on Waste Management and Circular Economy and 2 on the Built Environment and Energy Systems (Renewable Energy Communities, CER). A 13th round table, not thematic but transversal, was composed of the 16 faculty members from the various schools.

The round table discussions were guided by questions and moderated by a support figure to ensure constructive interaction.

The final meeting took place on 4 March 2024 at the central offices of the Torino Metropolitan Area. The aim of the meeting was to report the results of the discussions and reflections of the classes involved to the political representatives of Torino for a collective commitment in the construction of the CCC.

During the meeting, the voices and considerations of the young participants in the project on the thematic areas proposed in the workshop were heard.

- Call to action - An activity designed to engage vulnerable targets

An initial activity aimed at involving vulnerable targets has been planned as part of the European project SEFIT Social Ecosystem for Fair and Inclusive Transition, whose objective is to fund projects with the ambition of promoting green and/or digital transitions, involving disadvantaged people and providing social innovation solutions to address and mitigate the current and future impacts of climate change in Torino.

The social innovations presented must be congruent with the objectives of the EU Mission for 100 climate-neutral and smart cities by 2030.

The workshop, organized on December 15, 2023, engaged local actors and stakeholders in the activity of identifying the specific challenges of the call for action:

* Financial and Consumption Education: projects empowering people through energy conservation skills and promoting behavior change as a countermeasure to the growing poverty caused by the high cost of energy;
* Green Jobs: projects focusing on the training and employment of disadvantaged individuals in the green economy;
* Sustainable mobility: projects focusing on improving the sustainability of transport and mobility in the Città di Torino
* Youth Participation: Promoting youth involvement in the framework of climate change to encourage their dialogue with the Municipality of Torino and local stakeholders on climate change issues. This initiative aims to activate a **Torino Climate Change Youth Forum,** including vulnerable targets such as NEETs (Not in Education, Employment or Training), second-generation individuals and others.

The call for action, which was issued in February 2024, is aimed at local organizations and includes grants for a total value of 200,000 euro.

- Decentralized territorial lab. An activity favoring discussion and awareness raising with city residents with regard to the revision of the GRP.

The General Regulatory Plan (GRP/Land Use Plan) is the main planning instrument for the municipal territory: an indispensable technical document, but also a strategic document of primary importance. The GRP determines the orientation of future transformations and configurations of the urban space, sets rules, establishes limits and indicates the future of already built-up areas and those to be developed or regenerated.

The GRP is entrusted with the responsibility of a synoptic look, necessary to evaluate the connections between physical spaces, social environments and economic dynamics, and to express a political vision of the city and its future.

The drafting of a new Plan is framed in an administrative and bureaucratic perspective, responding to regional regulations with timeframes, constraints and procedures defined by law. The drafting process is currently in its second phase, in fact the most important, which will lead to the drafting of the Preliminary Project. It must be tackled in a shared manner with the various parties that act, operate and live in Torino, in order to capture the territory's needs, orient the lines of government for the benefit of the entire community and define shared objectives, strategies

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and actions for the city of tomorrow.

For this reason, the Città di Torino with Urban Lab, has planned a path to discuss the guidelines being defined with institutions, organizations and citizens. A series of moments of collective work and learning where local actors can express their point of view and suggest development trajectories, share aspirations and experiences and align visions and values.

In 2023 the dialogue between the local authorities and stakeholders occurred at three main appointments: 7 and 8 June; 20,21 and 22 October; 14,15 and 16 November 2023. The events included collaborative work organized by thematic tables, which alternated with keynote lectures, public meetings, presentations by various associations in the area and round table discussions on city change.

The initiatives realized throughout 2023 actively engaged more than 1000 people (representing more than 350 organizations and institutions) in in-person participatory activities. An online survey, open to all those who live, work and study in Torino, collected more than 4600 feedbacks on the city's assets and future trajectories, while more than 1500 people followed the keynote lectures, public conferences and meetings that accompanied the process.

Regarding climate change and Torino's need for mitigation and adaptation tools, a number of key issues and topics were highlighted in the different phases of the discussion. In particular, the main principles and operational approaches were defined, along with discussions on the relationship between environment and transformation, which resulted in the early definition of the "City as an Ecosystem". Here the conversation focused on:

* regenerating abandoned areas
* making transformations sustainable by identifying new value creation mechanisms
* activating virtuous processes through temporary uses and monitored experiments
* integrating urban systems and the functionally and spatially constructed city
* differentiating and renewing the uses of urban greenery (e.g., agricultural parks, urban parks)
* coordinating specific transformations and systemic strategies, including supralocal ones
* "de-consuming" soil and making land use more mindful
* improving urban resilience with adaptation and mitigation strategies
* integrating ecosystem services into planning processes (not just as compensation)
* monitoring and encouraging improved efficiency and recovery of the building stock

Through the spring and summer of 2024, the conversation and interaction with communities and citizens will continue with a focus on quality of life in neighborhoods. The debate that took place in the previous phase will frame the forthcoming activities along the 9 most recurring themes, guiding a conversation focused on quality of physical spaces (public spaces, parks, green areas) and quality and accessibility of public and collective services at the local level:

* blending multiple identities
* repopulating Torino
* connected city
* sustainability and resiliency
* publicness
* transformations
* safe and dynamic city
* inclusiveness
* participation and cooperation

The themes summarize what has been learned about the problems and resources of the territory, and thus compose a framework that - consistently with the suggestions proposed during the public meetings and local workshops - envisions the development prospects of the city over the coming years and the challenges to be faced in order to become a climate neutral city.

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2.2 STEP 2 – Accompanying the realization, implementation and monitoring of the CCC

Step 2 (March 2024 - December 2030) has the objective of accompanying and participating in the realization, implementation and monitoring of the CCC.

The activities in Step 2 are intended to stimulate collective reflection and learning to achieve lasting change. Some of the actions will be dedicated to monitoring and consolidating the Action Plan in progress. The transversal action of communication remains.

In continuity with Step 1, the implementation of transversal and cross-cutting actions will be encouraged. These will be designed to raise awareness, inform in an accurate, accessible and transparent way and strengthen the bonds of trust between residents and the PA by creating enabling conditions, as well as to support the overcoming of the barriers on involvement and co-responsibility linked to social inequalities (vulnerable targets) and intergenerational inequalities (young people and foreigners).

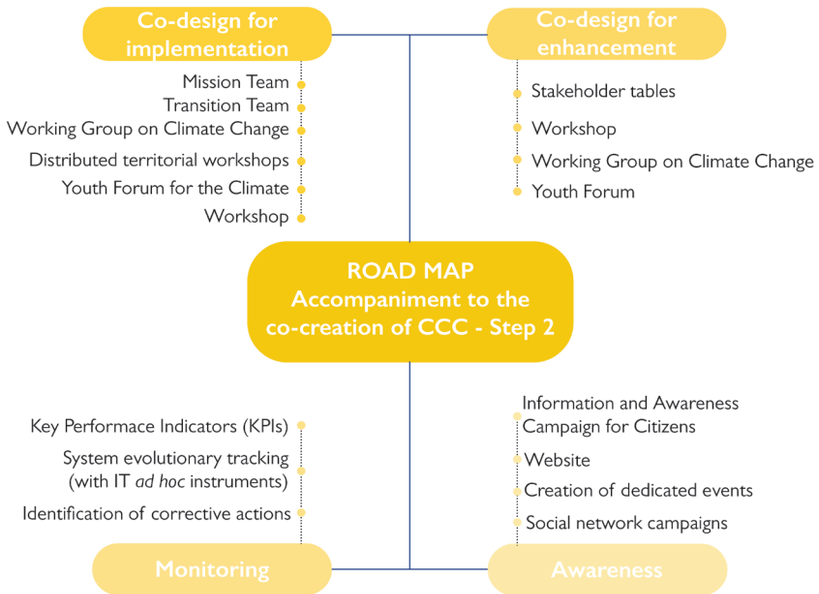

Fig. AII - 6 – Scheme of Step 2

2.2.1 Co-design activities in the realization stage

- **Multi Stakeholder thematic round tables**

These are multi-actor workshops, coordinated by the Città di Torino, dedicated to co-constructing the main activities to implement the Plan.

They are aimed at generating shared responsibility for action by guiding and coordinating all the different contributions from the local ecosystem.

- **Decentralized territorial labs**

The creation of decentralized territorial labs (the Competence Center for Social Innovation could be designated to coordinate the activity) will offer an opportunity for exchange and co-design - within which to activate subjects already involved/to be involved with a variable level of intensity of participation (information, consultation, co-design, etc.) depending on the needs identified during the construction/implementation and monitoring phase of the CCC. The labs could identify opportunities and integrate actions deriving from other policies (such as the process of drawing up the GRP and the EU projects that overlap the fields of intervention of the CCC).

The decentralized territorial labs will make use of ties and capitalize on opportunities associated with the Living Labs, promoted in the framework of urban innovation projects such as, for example, FUSILLI[4], TIP4PED, CTE NEXT and Torino City Lab with TO MOVE[5].

With this as the point of departure, new actions will be tested by implementing an integrated approach based on the portfolio of actions that derive from multiple projects in the common direction of the fight against climate change, with the aim of involving more stakeholders and stimulating collective learning. In this way, we try to break down the silos of the public administration, by working in a transversal and inter-departmental way on different projects and experimenting with new organizational methods that generate results that can be implemented and scaled more effectively.

- **Other initiatives aimed at young people for the ecological transition**

The open innovation initiatives launched by the Città di Torino - Torino City Lab (with ToMove) and CTE NEXT NET – call for several listening, animation and co-development activities aimed

4 FUSILLI Project - Foster the transformation of the urban food system through the implementation of innovative Living Labs. The Municipality of Torino is responsible, together with its third parties (UNITO, UNISG, ORTI GENERALI) and in collaboration with the Mirafiori Community Foundation, for the creation of the "Food Innovation Living Lab". https://www.torinocitylab.it/

5 TO MOVE Project is a Living Lab distributed in various locations throughout the Città di Torino, focused on the development of new smart and sustainable urban mobility scenarios that use innovative cooperative, connected and autonomous mobility solutions, integrating them into the "Mobility as a Service" paradigm.

at the younger generations. For example:

* Torino City Lab includes a laboratory dedicated to technological innovation for education called Edu.Lab: embedded in a middle school, it hosts testing activities with companies and researchers on new educational models and content. One of the focuses is precisely on the ecological transition, applied to school buildings as well as the promotion of sustainable lifestyles based on circularity, with dedicated workshops.
* Similarly, starting in 2023, CTE NEXT launched a training catalogue with over 22 free courses aimed at boys and girls from Torino schools from primary school onwards - part of the "Growing Up in the City" educational services initiative - focused on the theme of ecological and digital transition, entrepreneurial capacity and how to become "agents of change".

- **The search for ambassadors and testimonials ready to act collectively for the Climate**.

The City will issue a call for "Climate Ambassadors", starting from the involvement of the companies and groups that have signed the statements of support. The aim is to expand their active roles during Step 2, by creating incentive packages and assigning "labels" to public and private entities that propose new actions, ideate and build links, connections and integrations to act within the main fields of action of the CCC for climate neutrality.

2.3 A transversal action (information, awareness raising and communication)

This transversal action follows the entire process (Step 1 + Step 2) of participation in the CCC.

Information and communication play a strategic role in the activation of the local ecosystem and in increasing the efficacy of the process of supporting the realization, monitoring and implementation of the Action Plan of the CCC.

The external information activities will have the task of acting on the change of the ecosystem, making it more responsible and predisposed to assume responsibility for the impacts of its actions on the climate. They will concentrate on three key aspects:

1. **raising awareness and increasing understanding of the climate phenomenon**, the collective challenge and the systemic levers to act on, with sustainable methods and times;
2. **knowledge and transparency of the process** of the city's progress in achieving climate neutrality;
3. **thematic information on climate neutrality,** to foster greater and more widespread awareness, allow a transfer of knowledge to increase the competences of the local ecosystem, systematize and pool knowledge for a more informed and responsible participation.

As indicated in Section 5 of the Action Plan, the information activity will be structured to propose specific moments of in-depth study on the thematic areas proposed in the course, or will link events that already possess an organizational structure and enjoy a high level of participation (for example: Cinemambiente; Biennale Democrazia; the annual events hosted by bank foundations, etc.). At the neighborhood level, meetings with local residents will be set up thanks to the direct and widespread awareness raising ability of the Network[6] of the 8 Neighborhood Houses of Torino[7] and, depending on the various targets to be reached, of other active local civic groups (for example: the Youth Centers).

To expand its reach to various targets, the Città di Torino can rely on a diversified range of communication tools.

Online communication:

- Activation of social channels through the creation of graphics and content related to the various stages launched and planned;
- Website to:
  * Share the key moments of the process of achieving the CCC with stakeholders
  * Information on the stages of engagement, single moments of participation and sharing the outcomes and the relative documentation in order to make the process transparent
  * Reinforce key messages with new formats and engaging storytelling
  * Sharing of inspirational and informative videos and interviews realized during the entire process
  * Creation of graphics and images to summarize and update on the activities undertaken

6 The Network is a local organization comprising the 8 Neighborhood Houses of Torino, whose mission is to disseminate good practices in the areas of social innovation and urban regeneration, prioritizing local needs and making the city's residents protagonists of the community's social and cultural life.

7 The Neighborhood Houses are regenerated public spaces, open to residents of all ages. They are designed to respond to a variety of needs and propose a wide range of different initiatives; cultural events, personal services, consulting, catering services and much more.

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* Possibility of receiving feedback on the process and/or request information through a dedicated email address

- Podcast: featuring the experts, who explain the state of the art of the process that the Città di Torino has undertaken, with theme-based, in-depth close-ups, aimed at young people and using a more up to date and accessible lexicon. A monthly appointment broadcast on the Città di Torino's YouTube channel.

Offline communication:

- Creation of posters and flyers for posting in the area, in strategic points of greatest visibility for the process, to make the challenge visible and recognizable
- Creation of postcards, flyers and brochures for widespread distribution in schools,the Neighborhood Houses and other civic networks, such as the info points of the Città di Torino;

2.3.1 What has been achieved in Step 1

Step 1 has seen the creation of an **information space on the CCC on the website of the Città di Torino.**

In addition, the following were produced:

* invitation cards and brochures specific to each thematic workshop, which were posted and promoted on all the social and web channels of the various active networks, such as TSI, TCL and CTE NEXT;
* two videostories and interviews during the workshops;
* 8 presentations in thematic info short format by the experts involved in the 4 action areas of the CCC. Step 1 saw the realization of:
* 4 thematic shorts serving as support for informed participation in the workshop held in September 2023 and dedicated to Third Sector Entities, which were then posted on the Città di Torino's website and sent to all participants;
* 4 thematic shorts as information and learning activities during the workshop held in February 2024, dedicated to secondary schools, which were then posted and sent to all the participating classes. Schools are also an exceptional vehicle for disseminating information from the students to their families;
* press releases and articles in local dailies.

Several presentations **have been organized** in the area on the occasion of thematic events or other initiatives related to the City's EU projects, such as SME4GREEN[8] or Climaborough[9] as part of which a program of three online meetings entitled "Climawebinars" has been organized and is currently underway.

Torino's path to Climate Neutrality was presented in the context of the Nitto ATP Finals and in particular at the Nitto[10] innovation Summit on 9/11/2023.

On 26 March, as part of the event "Innovation on the move. Maas4Italy for the mobility of the future", one of the key themes of the CCC will be addressed: mobility seen from the perspective of innovation and sustainability.

8 SME4GREEN is a project funded by the COSME-LGD (Local Green Deals) program that provides support to at least 120 SME to drive the twin green and digital transitions through the implementation of actions aimed at steering the local economy of Torino (Italy) and Ilfov (Romania) on a sustainable and inclusive path.

9 CLIMABOROUGH - Local engagement of citizens in the co-creation of societal transformational change for climate resilience is a project of the Città di Torino with 20 partners, funded by the European Union's Horizon Europe program. The aim of the project is to bridge the gap between the design and implementation of urban innovations, especially in the face of the climate emergency and the consequent mitigation and adaptation needs that cities must meet to protect their citizens.

10 In April 2019, Torino was chosen as the venue for the Nitto ATP Finals from 2021 to 2025.

CCC Presentation Moments
Presentations of the Climate City Contract within other city projects and initiatives

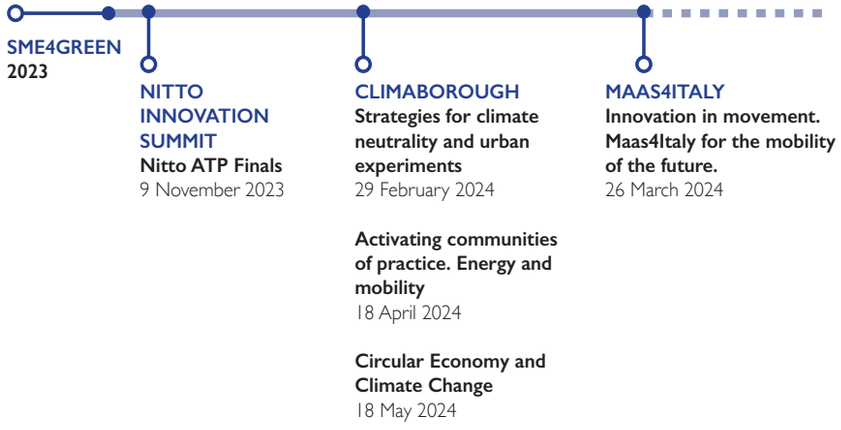

Fig. AII - 7
The moments of presentation of the Città di Torino's commitment to the CCC

3. Building the Climate Partnership

The Città di Torino has identified three levels of involvement in the construction of the partnership:

- Signatories
- Main partners
- Supporters

Signatories

The first level of involvement is represented by the public actors involved in the construction phase of the CCC and who sign the CCC commitments. The signatories include public entities such as the Regione Piemonte and the Città Metropolitana di Torino, the Università di Torino, the Politecnico di Torino and the Chamber of Commerce.

Main partners

This is a group of stakeholders (listed in Table AII- 3) that includes all the Utilities of the Città di Torino, the city's banking foundations, Italian financial institutions and other relevant public entities.

All these actors can make a significant contribution, on the one hand, to overcoming the barriers identified and creating favorable conditions for collective change, and on the other, to accelerating the transition towards climate neutrality.

Tab. AII - 3 – Description of Main Partners

Main Partners – Signatory entities:

Stakeholder category	Stakeholders	Description
Investee companies	IREN Group	An Italian joint-stock company, operating as a multi-service provider, in particular in the production and distribution of electricity, district heating services, the management of integrated water services, environmental and technological services.
	SMAT	Leader in the field of integrated water services, where it operates through the design, construction and management of diversified sources of water supply, technologically advanced drinking water treatment plants, urban wastewater purification and reuse plants, collection, purification and reuse networks and cogeneration and energy recovery plants.
	ITALGAS	Italgas is an Italian company specialized in gas distribution. Founded in 1837 as the Gas Lighting Company for the Città di Torino. Alongside its core business as a gas distributor, Italgas is also active in the energy efficiency sector and aims at strengthening its presence in the water sector.
	Infra.To	Owned by the Città di Torino, its mandate includes the ownership and management of infrastructures, as well as engineering, design, construction and development of plants, systems and infrastructures, including railways, for public and private transport of people and goods.
	5T	An in-house company with total public participation, it operates on behalf of its shareholders: the Città di Torino, the Piedmont Region and the Torino Metropolitan Area. It designs, manufactures and manages mobility systems and services in Torino and Piedmont.
	GTT	Gruppo Torinese Trasporti - The company provides urban, suburban and suburban public transport services, and manages the new automated system of the Torino underground.

Public agencies	CSI Piemonte	CSI-Piemonte is a consortium of public bodies operating in the area of information and communication technologies.
	ARPA Piemonte	ARPA - Regional Agency for Environmental Protection of Piedmont - is a public body under the supervision of the President of the Regional Council, to ensure the implementation of the guidelines set by the Piedmont Region in the field of environmental forecasting, prevention and protection.
	ATC Torino	ATC –Territorial Housing Agency - a non-economic, auxiliary public service arm of the Piedmont Region and manages public, low-income housing.
	Cassa Depositi e Prestiti S.p.A.	CDP is the Italian National Promotional Institution. It fosters sustainable development in Italy, using savings responsibly to support growth and boost employment, supporting innovation, business competitiveness, infrastructure and local development.CDP finances the infrastructure and investments of public administrations, supports policies to improve the real estate assets of local authorities for urban regeneration, invests in social infrastructure, sustainable mobility and new forms of housing.
Bank foundations	Fondazione Compagnia di San Paolo	Bank foundation with philanthropic purposes, promoting cultural, civil and economic development, thanks to the fruits of its endowment.
	Fondazione CRT	Fondazione CRT is a private non-profit organisation founded in 1991 that works for the development of Piemonte and Valle d'Aosta since 30 years. Its projects and resources are engaged in building artistic and cultural heritage, scientific research, youth education, social entrepreneurship and care, and protecting the environment and people.
Private companies	SAGAT	Company that handles the management and development of the Torino Airport.
	REALE GROUP	International group operating in Italy, Spain and Chile through the Parent Company – Società Reale Mutua di Assicurazioni, the largest Italian insurance company in the form of a mutual insurance company and its subsidiaries.
	UNICREDIT	UniCredit is a pan-European Commercial Bank with a unique service offering in Italy, Germany, Central and Eastern Europe. It serves over 15 million customers worldwide. UniCredit is organized in four core regions and two product factories, Corporate and Individual Solutions.
	Intesa Sanpaolo	Intesa Sanpaolo is one of the top banking groups in Europe (53.7 billion euro of market capitalisation), with a significant ESG commitment, a world-class position in Social Impact and strong focus on climate. The Group offers its services, in Italy, to 13.6 million customers through a network of over 3,300 branches well distributed throughout the country with market shares no lower than 12% in most Italian regions.

Secondary partners/supporters

This group of stakeholders belongs mainly to the economic, cultural, social, environmental world (shown in Table 4), and acts to promote a change that is widespread and lasting.

Tab AII - 4 : Description of Supporters

Secondary partners/Supporters – Signatory groups:

Stakeholder category	Stakeholders	Description
Trade and professional associations	Unione Industriali Torino	Voluntary association of local companies belonging to Confindustria, for the representation, protection, promotion and development of private companies and their interests.
	CONFCOOPERATIVE PIEMONTE NORD	Association representing the co-operative movement
	Legacoop Piemonte	National Association of Cooperative Enterprises that promotes the development of cooperation, mutuality and the dissemination of cooperative values
Universities, schools, the research and training community	Fondazione Collegio Universitario di Torino Renato Einaudi	Collegio Einaudi is a private foundation that manages five residences and offers living spaces and training courses to over 850 deserving university students.
	Environment Park SpA	The Torino Technological Park has been active in the field of environmental innovation for more than 20 years
	Fondazione Piemonte Innova	A public-private partnership operating for the promotion and development of innovation
	Fondazione LINKS	The Foundation was born from the desire of the Compagnia di San Paolo Foundation and the Polytechnic of Torino to equip themselves with an institution capable of operating in applied research, innovation and technology transfer.
City Council committees	Consulta della Mobilità Ciclistica e Moderazione del Traffico	The Consulta committees are an arm of the City Council, with consultative and propositional powers.
	Consulta per l'Ambiente e il Verde	
Third sector entities	Pro Natura Torino APS	Environmental association
	LEGAMBIENTE PIEMONTE E VALLE D'AOSTA APS	Environmental association
	Associazione Al Cicapui ASD e APS	Sports and cultural association (top quality artisanship)

Third sector entities	Donne per la difesa della società civile APS	Cultural association
	ATT srl Impresa Sociale	A social enterprise that deals with the integration or reintegration of disadvantaged and disabled workers into the labor market.
	Biova srl - società benefit	Biova operates in the field of waste management and circular economy.
	CA' MARIUCCIA SSA	Company active in the areas of organic farming and social welfare
	Il Tuo Parco APS	Environmental association
	Cooperativa Sociale P.G. Frassati scs onlus	The Frassati cooperative designs and manages social and welfare services aimed mainly at people with fragilities
	Giustizia Climatica Ora! APS	Environmental association
	APS Fiab Torino Bici & Dintorni	Cycling association
	Green Growth Generation	Green Growth Generation aims to educate a sustainable generation and promote sustainable lifestyles and consumption and respect for the environment.
	Rifiuti Zero Piemonte	Environmental association
	Associazione Hiroshima Mon Amour ETS	Cultural association
	Associazione culturale Club Silencio	Cultural association
	KAIROS CONSORZIO DI	
	COOPERATIVE SOCIALI	Consortium of social co-ops
	LaQUP APS	Cultural association
	Ama Factory ETS	Innovative cultural company
	PartecipaTO	Cultural association
	Urban Lab Torino	An independent association created to tell the story of the transformation processes of Torino and the metropolitan area. It serves as a center for documentation, dissemination and debate on the city.
	Arcobaleno Cooperativa Sociale	Social cooperative
	Triciclo - Società Cooperativa Sociale	Social cooperative that deals with the recovery and reuse of materials and the sorting and treatment of waste
	Associazione Manzoni People OdV	Volunteer group
Private companies, SME. Startups	Marazzato Azzurra Srl	Company of the Marazzato Group that handles the final treatment of industrial waste

Private companies, SME. Startups	Mercato Itinerante Srl	Innovative startup that has developed a verticalized marketplace on sustainability issues.
	Mercato Circolare Srl	A Benefit Corporation that creates digital and cultural connections between citizens, companies, associations and institutions within the circular economy ecosystem
	Orti Generali Srl	Orti Generali was created with the aim of building a social enterprise model for the transformation and management of residual urban agricultural areas
	Siborg Srl	Business consulting firm specializing in the field of energy and energy efficiency.
	Sunspeker Srl	Startup active in the development of aesthetically integrated photovoltaic solutions
	Capetti Elettronica Srl	A company with experience in technological innovation, it designs, industrializes and manufactures systems and devices with high added value.
	CLEAN AIR Srl – Società Benefit	This company provides services and solutions with high technological value and innovation in the field of ambient air purification and environmental protection
	COESA Srl	Photovoltaic consulting company
	Planet Idea Srl	A competence center with more than 200 professionals to scout the main solutions in the digital field and social innovation, to be integrated into real estate projects.
	PCM Srl	Technology Consulting firm
	Fratelli Basile Srl	Organization engaged in projects aimed at reducing energy impact, supporting mobility through the use of electric cars and reducing environmental impact
	Geosolving Srl	Geological and engineering consulting firm
	Globalchimica Srl	This company develops and manufactures chemical products that are marketed and distributed worldwide.
	ReLearn Srl	Consulting firm that monitors waste production using artificial intelligence and gamification
	Data Reply	A company that offers top quality services for extracting value from data through Advanced Analytics and AI solutions.
	BLUE Engineering Srl	A company that provides specific services in sectors of excellence, such as automotive, railways, aerospace
	Cube Italia ltd	Innovative startup operating in the AgriTech sector
	Enerbrain Srl	Startups whose mission is to monitor air quality in buildings and intervening with targeted strategies to reduce emissions
	EOT Srl	Energy of Things is the digital platform specialized in the management and optimization of energy consumption, developed to return to the customer the real costs and revenues from the various users.

Private companies, SME. Startups	I.C.R.E. Automazione s.s.	A company that develops automation solutions by applying the most modern technologies available in the electrical, mechanical, hydraulic and pneumatic sectors.
	Modelway Srl	A company that deals with technology transfer from academic research to industry.
	Ghiggia Srl	A company that focuses its activity on hydroelectric plants, restructuring its own and third-party plants, including design and automated systems with various partner companies
	IGPDecaux S.p.A	A company specializing in Out Of Home communication
	CarpeCarbon Srl	Startup that aims to develop technologies for the safe and permanent capture of CO_2 from the atmosphere and its storage underground.
	Gruppo Lavazza	A coffee company whose mission is to create sustainable value for shareholders, employees, consumers and the communities in which it operates, combining competitiveness with social and environmental responsibility
	IVECO Group	Multinational automotive company active in commercial and special vehicles, powertrain systems and related financial services
	Stellantis	Multinational holding company based in the Netherlands, manufacturer of motor vehicles. Formed from the merger of the Fiat Chrysler Automobiles and PSA groups

3.1 The statement of interest

With a view to formalizing participation in the initiative, the Città di Torino has promoted a statement of interest, aimed at all the local subjects (private companies, non-profits, consulting committees, etc.). The call for action for the collection of statements of interest was also designed to formally bring together the voluntary actions that the subjects involved intend to undertake to complement the action of the Città di Torino, as their contribution to the achievement of the common objectives.

Following an information campaign that promoted the statement of interest and reached about 800 subjects, 60 letters of support were received (and are enclosed with the Commitments). A brief summary of the actions proposed by these subjects is shown in the tables below.

By adhering to the CCC, the partners will benefit from the following:

- **Visibility** - Increase their visibility by participating in networking activities on a national and international scale.
- **Labeling** - Launch of a labeling process that will testify to the organization's participation in the City's project, which can be used in its marketing and communication actions.
- **Possible co-financing** – Possibility of joint access to projects co-financed with European, national and regional funds, aimed at the implementation of the Mission.

3.2 Actions of main partners and supporters

Main Partners – Organizations and thematic actions

The actions of the organizations providing support as Main Partners are described in the single letters enclosed with the Commitments, to which the reader should refer for a more complete picture.

Table AII-5 : Summary of thematic actions

Secondary partners/Supporters – Organizations and summary of thematic actions

Company/ Entity name	Proposed actions			
	Building & Energy	Mobility	Waste & circular economy	Green & NBS
Associazione Al Cicapui ASD e APS	-	A new green shuttle for children's mobility	Social garden with reused equipment	Sustainable garden management
Donne per la difesa della società civile APS		Pedestrianization of a large avenue in the quartier		Monitoring of the condition of green areas in the quartier
ATT srl Impresa Sociale		Adoption of cargo bike fleet for food delivery	Adoption of regenerated kitchen equipment instead of new ones	
Biova Srl - società benefit			Collection and use of unsold bread in city to make soft drinks and pastries	
CA' MARIUCCIA SSA	Installation of PV panels on farm buildings		Reuse of food wastes for feed	
Capetti Elettronica Srl	Innovative solutions for energy saving in buildings			
CLEAN AIR Srl. – Società Benefit	Innovative solutions for air pollution abatement in cities			
COESA Srl	Information to citizens on Energy efficiency funding and solutions		A marketplace for recovery of end-of-life PV panel materials	
Fondazione Collegio Universitario di Torino Renato Einaudi	Energy revamping of own buildings			
Data Reply	• Development of algorithms that analyze satellite data to identify the optimal locations for renewable energy plants like solar parks and wind farms • to evaluate the risk of catastrophes and make resiliency plans.			Use of artificial intelligence and satellite data to support urban planning for sustainable development.
Consulta della Mobilità Ciclistica e Moderazione del Traffico		Proposals for new city bike path		
Consulta per l'Ambiente e il Verde	Actions designed to encourage local residents to assume a proactive, synergistic and collaborative role in increasing awareness.	Support for "soft" mobility systems and awareness on the need for a cultural change aimed at the reduction of energy consumption and CO_2 emissions	Energy Budget, the integrated waste collection system, the study and proposals for the at least partial abatement of the causes of an increase in phenomena related to climate change	Interventions to stimulate the City Council to study issues such as the protection and development of green areas in greater depth.
Cooperativa Sociale P.G. Frassati scs onlus	Energy revamping of own buildings	Adoption of EV for mobility and food delivery	Collection and recycling of food wastes	Support to "Treedom" counter-deforestation project
Ghiggia Srl	Commissioning of PV plants			
Environment Park Srl	Zero CO2 emissions of own building by 2030	Sustainable mobility support program for employees		
Globalchimica Srl			Open innovation program for sustainable chemical solutions	Use of nature-based solutions in own industrial processes

Green Growth Generation			Organization of community "Clean-up" days	"Urban living labs" for adoption of nature-based solutions
Associazione Hiroshima Mon Amour ETS	Installation of photovoltaic panels to reduce energy consumption by 39%		Interventions to reduce the production of plastic waste by 90%. Destruction of meal tickets and actions to reduce CO2 related to transport for café supplies.	
Marazzato Azzurra Srl	Energy revamping of own buildings	Revamping of own fleet vehicles	Adoption of innovative solution for waste treatment	Tree planting for emissions compensation in urban areas
Mercato Itinerante Srl		Adoption of a cargo bike fleet for delivery	Reuse of 30% of packaging used in food delivery	
Orti Generali Srl				Social urban green gardening activities and promotion
Fondazione Piemonte Innova	DC4ET, collaborative energy management program for industries	Living Lab ToMove – Innovative collaborative mobility solutions	Innovative digital circular solution for industries	Adoption of NBS in own office furniture and equipment
Pro Natura Torino APS		Promotion and advocacy on public transport and sustainable mobility		
ReLearn Srl			An AI-based solution for monitoring circular processes	
Rifiuti Zero Piemonte			Promotion and advocacy on waste sustainable management	
Siborg Srl	Energy saving in office activities	Adoption of low emission fuel vehicles	Zero Paper office activity program	Tree planting for emissions compensation
Sunspeker Srl	Innovative solutions for PV in urban areas			

LEGAMBIENTE PIEMONTE E VALLE D'AOSTA APS	Information to citizens on Energy efficiency funding and solutions	Promotion and advocacy on public transport and sustainable mobility	Promotion and support of green public procurement	Launch of "Urban's green deal" and a participative forum on green area management
Arcobaleno Cooperativa Sociale	Design and management of a "Zero Energy" sport center	A training program for the company's 350 employees on sustainable mobility solutions		
Il Tuo Parco APS	Creation of an Energy Community in Torino	Promotion and advocacy on public transport and sustainable mobility		Participative design of recovery of Michelotti Park in Torino
BLUE Engineering Srl		Promotion and advocacy on public transport and sustainable mobility		Designing and experimenting with the application of a green wall to purify the air inside own office buildings
Associazione culturale Club Silencio			Awarding of ISO 20121 Sustainable Event Management certification	
CONFCO-OPERATIVE PIEMONTE NORD	Support to member companies in refurbishment of their own buildings.	Mobility Managers training courses for associated companies		
Cube Italia ltd				Promotion of "urban farming" technologies and solutions
Enerbrain Srl	Promotion and testing of innovative AI Energy Management solutions			
EOT Srl	An IoT "Smart Energy" Welfare community platform		IoT solutions for integration of EV into Energy community platforms	

APS Fiab Torino Bici & Dintorni		Promotion and advocacy on public transport and sustainable bike mobility		
Fratelli Basile Srl	Installation of photovoltaic panels on the entire structure (100 kW) to reduce electricity consumption by about 70%. Monitor the reduction of C02 emissions. Installation of a wallbox, with two sockets of 22 kw each, for charging electric vehicles.	Project for the total electrification of old RVs in order to give them a new life, trying to respect the environment as much as possible and reduce waste.		
Geosolving Srl	Solution for building energy refurbishment using geothermal energy			
Giustizia Climatica Ora! APS	Launch of an Energy Community in the Vanchiglietta district	Purchase of e-bikes and E-cargo bikes for shared mobility	Promotion of "local shopping" for reduction of packaging wastes	
I.C.R.E. Automazione s.s.		Processing of exhausted lubes for re-use in industries		
KAIROS CONSORZIO DI COOPERATIVE SOCIALI	Energy recovery of community centers "Bagni pubblici " and "Cascina Falchera"			Demonstration project "Agro – Forest Urban Ecosystem" to participate in green management

Triciclo - società cooperativa sociale			The organization is committed to waste reduction activities through both the reuse and promotion of emission-free mobility by encouraging the use and repair of used bicycles.	
LaQUP APS		Information and training on "sustainable mobility and transport solutions"		Information and training on "participative urban green areas management"
Legacoop Piemonte	Support to affiliated companies on green energy purchasing		Creation of a "reuse center" offering citizens the possibility to recycle their used goods	
Fondazione LINKS	Creation of a Positive Energy District (PED) in Torino	Sustainable mobility support program for employees	Training and workshops on regeneration of technological tools, workshops on sustainable cooking and packaging reduction	Pilot actions on integrated climate adaptation solutions based on ecosystem services
Associazione Manzoni People OdV	Setting up laboratories on energy saving in schools	Road safety training for kids to obtain a "bicycle riding license"		Reviving an educational garden on school grounds.
Mercato Circolare Srl			"Circular & systemic tool" for impact assessment of food value chain in Torino	
Modelway Srl	Virtual sensing software solutions for energy management	AI-based app solution for booking charging stations for BEVs		

PartecipaTO	Study of the application of the heat pump to the heating of the church and premises as a demonstration of the feasibility of achieving zero consumption for heating.			
PCM Srl				Turning its usual charitable donation for corporate Christmas gifts into the purchase of trees for the municipality.
Planet Idea Srl	Smart Energy platform for automated collection of consumption data, active management of building energy use			
Ama Factory ETS				Urban Garden, rehabilitation and re-purposing of the green areas of the former San Pietro in Vincoli cemetery.

Urban Lab	Development of the new GRP for the Città di Torino.	Development of the new GRP for the Città di Torino.	Development of the new GRPfor the Città di Torino.	Development of the new GRP for Torino. Animation and communication activities in the Valdocco neighborhood - project CONEXUS – Urban ecosystem renewal in EU and CELAC cities
IGPDecaux S.p.A	Energy efficiency activities of the IGPDecaux Logistics Hub in Torino; 2. Commitment to use 100% renewable energy; 3. Progressive replacement of the fleet with electric vehicles.	By entering into a contract with GTT for the management of the advertising spaces in the concessions of the Città di Torino, IGPDecaux is committed to financing public transport, thus contributing to the achievement of the TPL's ESG objectives.	Maximizing the recycling and recovery of the materials originating from the various activities involved.	
CarpeCarbon Srl			Design and installation on the territory of the Torino Metropolitan Area of CarpeCarbon's pilot plant for the permanent removal of 1000 tons/year of CO2	
Unione Industriali	Information and awareness-raising courses. Energy coaching.	Dissemination of knowledge for a more sustainable mobility of goods and people.	Raising awareness among member companies. ESG desk to guide circular economy strategies and policies for companies	

Gruppo Lavazza	Based on the results of the measurement and constant monitoring of environmental impacts, the Group has implemented energy efficiency projects resulting in a progressive reduction of its direct and indirect emissions from the use of electricity.		The inclusion of principles of circular economy in making business decisions allows the Group to minimize the environmental impacts of its production processes. In 2023, the "Center for Circular Economy in Coffee" was formed: a global, pre-competitive platform designed to valorize and promote the principles and the practices of Circular Economy in the coffee sector.	
IVECO Group	LED lighting with management system to reduce electricity consumption. Refurbishment of ducts, new air distribution system reducing distribution losses. Heat pump saving electricity and gas. Burner replacement. Installation of the latest generation of high-efficiency	MYshuttle, a free 'last mile' service complementary to TPL (Local Public Transport Local Public Transport), with bookable rides, with App and company code, both in advance and in real time. UP2GO is a carpooling service Electric vehicles for peri-urban logistics.	IVECO GROUP CONTAINERS MANAGEMENT programme of reusable containers for its logistics centres, including those in the Torino area, with the aim of optimising logistics and reduce environmental impact.	
Stellantis	GrEEn Campus project - Transformation of the Mirafiori site into a collaborative and zero CO2 emissions	Production of the 500e, the only BEV Car currently produced Production from 2024 at the Mirafiori plant of the new e-DCT transmission, which will equip Stellantis' MHEV and PHEV vehicles. Stellantis' low and ultra-low CO_2 emission MHEV and PHEV vehicles. Inauguration in September 2023 of the innovative Battery Technology Centre for testing and development of the battery packs that will equip future Stellantis vehicles	SUSTAINera Circular Economy Hub, with a 360° approach based on the 4R strategy applied to batteries components and entire vehicles	

CITTA' DI TORINO

CLICC
Climate City Contract

Climate City Contract
Città di Torino

2030 Climate Neutrality Commitments

Protocol
NET ZERO CITIES
EU MISSION PLATFORM | CLIMATE NEUTRAL AND SMART CITIES

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These Commitments have been adapted to incorporate the vision for striving toward climate neutrality developed by the Città di Torino and to fit with the peculiar context of the city.

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NET ZERO CITIES

Mayor's Commitment

Turin, 13 March 2024

Stefano Lo Russo

Mayor of Città di Torino

People of CLICC

Città di Torino

Prof. Stefano Lo Russo, Mayor of Torino

Dr. Eng. Chiara Foglietta, Councilor for the Ecological and Digital Transition, Innovation, Mobility and Transport

Dr. Alessandra Cimadom, General Director

Dr. Antonino Calvano (Vice General Director), Dr. Gaetano Noè (Director of the Environment and Ecological Transition Department), Dr. Gianfranco Presutti (Director of the European Funds and PNNR Department)

Eng. Mirella Iacono (Project Manager "EU Mission: Climate-Neutral and Smart Cities")

Dr. Fabrizio Barbiero, Dr. Roberta Bertero, Dr. Alessia Cerchia, Dr. Elena Ceretto, Dr. Elena Deambrogio, Eng. Luca Marasco Belcastro, Eng. Luca Sobrino (Development Team)

Arch. Bruna Cavaglià, Dr. Gianmichele Cirulli, Eng. Antonio D'Arpa, Dr. Giulia Maria Datta, Arch. Alessandra De Matteis, Dr. Marco Ferrero, Arch. Francione Marcello, Dr. Agata Grasso, Eng. Wassel Labed, Arch. Angela Nasso, Dr. Mariangela Pastorello, Dr. Giuseppe Pentasuglia, Dr. Davide Dimitri Quattrin, Arch. Isabella Quinto, Dr. Giulio Raneri, Eng. Lucia Reda, Dr. Laura Ribotta, Dr. Tiziana Tota, Dr. Antonio Vita (Support Team).

EST@energycenter, Politecnico di Torino

Prof. Ettore Bompard (coordinator), Prof. Michele Bonino, Prof. Stefano Corgnati, Prof. Francesco Laio, Dr. Marcelo Masera, Prof. Francesco Profumo (Scientific Committee)

Dr. Daniele Campobenedetto, Dr. Maria Ferrara, Dr. Daniele Grosso (coordinator), Prof. Tao Huang, Dr. Marta Tuninetti (Executive Scientific Board)

Prof. Tao Huang (scientific methodology and IT supervisor), Dr. Arch. Monica Naso (project manager)

Dr. Massimiliano Alberici, Dr. Caterina Barioglio, Arch. Irene Carrozzo, Dr. Pietro Colella, Dr. Claudia Concaro, Dr. Erminia Consiglio, Dr. Luca Ferraris, Eng. Vittorio Giordano, Dr. Mahmood Hosseini, Eng. Lorenzo Solida (Research Team)

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1. Introduction

Motivation

The Città di Torino is firmly committed to **transitioning towards a sustainable and resilient future**. This commitment is underpinned by a dedicated and coherent political agenda, which has already yielded a range of impactful actions. The programs and projects stemming from this agenda form the foundation of the Climate City Contract outlined in the accompanying Action Plan and Investment Plan documents.

The ultimate goal is to transform the city into a **more accessible, circular, and green urban environment**. This vision of a sustainable and resilient city is realized through a diverse array of activities, including emissions mitigation and climate change adaptation, among others. The dedicated webpage "Torino Vivibile"[1] serves as a permanent link with citizens and other stakeholders, providing access to Torino's "Piano di Resilienza Climatica" (Climate Resilience Plan) and updated information on all relevant thematic areas, whether directly related to climate or broader environmental issues.

The Climate City Contract (CCC) has been conceived as an ambitious program to complement and enhance the climate initiatives launched in recent years. Torino's CCC aims to guide the city towards reducing greenhouse gas emissions by at least 65% by 2030, using 2019 as a reference year, and defining a strategy for mitigating and compensating the residual emission in order to reach the net-zero emissions goal. The Action Plan outlines the areas of intervention and the actions Torino intends to continue, enhance, or initiate from scratch. The Investment Plan details Torino's approach to funding and financing all planned actions.

General background

Torino was the first capital of Italy and currently is the capital of the Regione Piemonte. Covering approximately 130 $km^{2,}$ it is located in north-western Italy, close to the Alps, and is the fourth largest Italian city by population, with about 860,000 inhabitants. Since the 1990s, the city has embarked on a radical transformation

1 See https://www.torinovivibile.it

due to the paradigm shift that has affected its urban economy, weakening the value chains linked to industrial production. During the last 30 years, the historic Italian industrial capital – and home to a significant concentration of automotive and mechanical manufacturing companies – has thus gradually renegotiated its identity as a city of innovation in education and culture, in the diversification of the economic offer and tourism, affirming itself at the national and European level.

The deindustrialization processes that have affected Torino – physiologically connected to a broader trend that has invested and transformed other Western urban areas with a formerly productive vocation – have deposited significant spatial traces on the city's fabric. Although it represents a critical issue, this economic, social, and spatial change has become an essential opportunity to redevelop large urban and industrial legacy sites, creating new spaces dedicated to services and new areas within the city.

Reusing the industrial legacy is an occasion to introduce new cultural and service spaces, reshaping the city's economy's production processes and value chains. The historic FIAT (Fabbrica Italiana Automobili Torino) factory, designed in 1921-1923 by Giacomo Mattè-Trucco and decommissioned in 1982, has been converted since 1986 by RPBW - Renzo Piano Building Workshop architecture studio into a multifunctional space including cultural, commercial and research spaces. In 2017, after a three-year recovery project, the OGR - Officine Grandi Riparazioni – a 35,000 m^2 space built between 1885 and 1895 for train maintenance – was reopened as a hub dedicated to artistic, scientific-technological, industrial, and cultural research.

The decommissioning of large industrial sites has also favored the development of large urban green areas –enhancing those already existing. Currently, Torino is one of the Italian cities with the most significant extension of public green spaces thanks to the large parks and tree-lined avenues inherited from the Napoleonic period – and the projects carried out from the 1990s to today to convert industrial sites into green sinks and recover river corridors as ecological areas. Today, green areas cover 37% of the city's surface (approximately 48 km^2, of which 25% are green urban areas, 5% cultivated land, and 7% woods), and the green area per inhabitant is 55.43 m^2.

In this sense, a flagship project is the redevelopment designed by the Latz + Partner landscape design agency between 2004 and 2012 of the 37 hectares-wide industrial area, formerly occupied by the Ferriere Piemontesi steel and sheet metal works and the Michelin tire factory, as part of a larger green urban redevelopment project. Nearby, a 20-year planning and participatory process coordinated by the Città di Torino led to the transformation of a dismissed manufacturing site of about 43,000 m^2 into the Aurelio Peccei Public Park.

Despite the crucial transformations introduced and the progresses made so far on the path towards sustainability, Torino still suffers from important environmental critical issues. Specifically, the concentration of air pollutants in Torino is notable due to anthropogenic emissions, such as those from heating and transportation, as well as the unique geo-orographic context and meteorological-climatic characteristics. The proximity of the northern Alpine arc to the urban agglomeration substantially impedes the dispersion of air pollutants, resulting in Torino being one of the Italian cities with the highest levels of air pollution.

Torino is confronted with the **effects of climate change**, including heat waves and heavy rainfall. The city's vital waterways and the hydrogeological vulnerabilities of its surrounding hilly landscape expose the urban area to the impacts of extreme weather events. Consequently, the realities of climate change can no longer be ignored. The Administration is steadfastly committed to taking tangible actions: not only to address the damage caused by past or ongoing phenomena but also – and most importantly – to safeguard human settlements from probable future events. Some of these events may be partly inevitable, even with the strictest policies aimed at reducing greenhouse gas emissions.

The Administration is acutely aware, as articulated in the programmatic guidelines for actions to be undertaken during the 2021-2026 mandate, that the climate emergency stands as one of the foremost challenges of our time. It acknowledges the significance of this emergency in both present and future social, economic, and spatial transformations, and deems it imperative to take prompt measures to mitigate its impacts. In this regard, the urban environment assumes a critical role as it accommodates a large population and serves as the primary location for the production and provision of essential community services.

Therefore, Torino has decided to participate in the Mission "100 Climate Neutral and Smart Cities by 2030" to bolster and expedite a process that has been ongoing for years. This Commitment involves various initiatives, projects, and investments aimed at combating climate change, encompassing both mitigation and adaptation policies. More broadly, it aims to create a sustainable, livable, resilient, and circular city. This participation represents an opportunity to streamline the objectives and impacts of policies affecting different areas of the city. The ultimate goal is to achieve climate neutrality by 2030, leveraging the synergy of efforts and commitments from both the Administration and the network of stakeholders involved in the process.

Being part of the 100 cities in the Mission also enables Torino to collaborate and exchange ideas with other communities dedicated to achieving the same objective. This collaboration involves sharing best practices and innovative solutions to address both the root causes and effects of climate change. It also entails discussing strategies to overcome obstacles while simultaneously developing a **"Torino model" for sustainability and climate neutrality**. This model might serve as a valuable reference point for other cities in Italy and across Europe.

Policy framework[2]

The goal of achieving climate neutrality by 2030 represents for Torino the natural evolution of the commitments made and pursued so far in terms of sustainable development, and particularly the reduction of climate-changing gas emissions.

Indeed, Torino was among the first major Italian cities to join the **Covenant of Mayors**, becoming a participant in 2009. In September 2010, the City Council approved the City's Sustainable Energy Action Plan, known as **TAPE (Torino Action Plan for Energy)**. This plan was regularly monitored to track progress on actions and ensure that the trajectory of emission reduction remained on course to meet the 2020 targets. Subsequent to the approval, three Monitoring Reports were issued, with the most recent one being released in 2021.[3] Through a comparison between the emissions inventory of 1991 and that of 2019, this report revealed an overall reduction in CO_2 emissions by 47%. This achievement notably surpassed the city's self-imposed target of 30% reduction by 2020 and approached the binding target set by the European Union for 2030, which aims for a 55% reduction from the 1990 level. This significant reduction in emissions stands as a testament to the city's dedication and commitment to combatting climate change. It underscores the implementation of substantial actions across various emission sectors, particularly in stationary energy and transportation.

The Municipal Administration recognizes that a mitigation-focused policy alone is insufficient to address climate change; adaptation to change is also crucial. Therefore, in 2019, the City joined the **New Covenant of Mayors for Climate and Energy**, embracing its commitments. This initiative not only aims to increase the percentage of greenhouse gas emissions reduction by 2030 but also entails developing a local adaptation strategy to identify more useful and effective solutions overall. To meet this new commitment, the Città di Torino approved the **PAESC (Piano d'Azione per l'Energia Sostenibile e per il Clima - Sustainable Energy and Climate Action Plan)** in February 2023. This plan implements the new emission reduction targets set by the European Commission (-55% by 2030 and climate neutrality by 2050). The PAESC defines the objective of reducing CO_2 emissions by 68% compared to 1991 through a system of local actions to be implemented by 2030.

The PAESC has been developed collaboratively with other vital local planning tools, notably the **Piano di Resilienza Climatica (Climate Resilience Plan)** issued in 2020. This plan outlines the strategy and adaptation actions necessary to prepare the territory for the impacts of climate events. Additionally, the **PUMS (Piano Urbano per la Mobilità Sostenibile - Urban Plan for Sustainable Mobility)** serves as another significant reference point. With a time horizon spanning ten years (from 2020 to 2030), the PUMS envisions a mobility and transport system that is more accessible, safer, and less polluting, ultimately aiming to enhance people's quality of life.

Opportunities

The signing of the Climate City Contract presents a significant opportunity for Torino to delineate and uphold climate commitments, reinforced by a partnership between the Administration and the local stakeholder network. Together, they will strive towards establishing a resilient city with zero emissions contributing to climate change.

The engagement of businesses and citizens, in tandem with

2 All the policies are detailed in the Action Plan, Section 3.2.

3 Città di Torino (2021) TAPE – Turin Action Plan for Energy. Terzo Rapporto di Monitoraggio. http://www.comune.torino.it/ambiente/bm~doc/report_terzo_monitoraggio_ec1.pdf

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institutional dedication, is a pivotal stride towards realizing these objectives. There is a burgeoning recognition, particularly among businesses, of their pivotal role in emissions generation and the imperative to curtail their carbon footprint. This entails adopting energy efficiency policies, investing in renewable energy sources, promoting sustainable production practices, and fostering consumer awareness.

Attaining climate neutrality aligns with the broader imperative of sustainability and ecological transition and stands as an utmost priority for Torino. It serves as a key driver to propel the city, in collaboration with municipalities within the wider Città Metropolitana,[4] towards a new phase of growth. Today, the international competition among major metropolitan cities also hinges on environmental quality; a city's attractiveness is intertwined with its sustainability across various facets of the urban landscape.

4 The Città Metropolitana di Torino (Metropolitan Città di Torino) as an administrative territorial entity has replaced the Province of Torino in 2015.

2. Goal: Climate neutrality by 2030

Aligned with the sentiments expressed in the Mission Expression of Interest (EoI), Torino aims to approach climate neutrality (Net-zero GHG emissions) across its municipal territory by 2030, leaving no area of the city or sector of the economy untouched. The objective set forth in this Contract is to achieve a minimum of an **65% reduction** in emissions relative to 2019 levels, and to define a strategy for **mitigating and compensating** the residual emission in order to reach the net-zero emissions goal.

To tackle this challenge, Torino intends to exert a positive influence on decision-making processes through the implementation of a structured approach. This approach is characterized by its integration across various levels, acknowledging the interconnectedness of different areas involved.

It relies on **scientific foundations**, utilizing measurements, mathematical models, and analytical tools to assess potential impacts of strategic choices beforehand. It is dynamic, identifying trajectories and adapting political decisions throughout their evolution. Furthermore, it adopts a **quantitative approach**, continuously quantifying and monitoring system states using tailored metrics. Finally, it emphasizes inclusivity and collaboration, fostering constant interaction with citizens and stakeholders across sectors.

Achieving such a medium-to-long-term goal requires the implementation of **multiple interconnected actions** that align with the overarching vision of climate neutrality. This endeavor is made possible through the collaborative efforts of the Administration and organizations that have committed to sharing this objective with the city. To structure this process effectively, Torino has established a **Mission team** comprising two working groups: the **Transition team** within the **City Administration**, and the **technical working group** established at the **Energy Security and Transition EST@EnergyCenterLab** of the Politecnico di Torino. This team has played a pivotal role in guiding the co-design of the CCC with various city stakeholders.

The implementation of the strategy and measures aimed at achieving this ambitious goal must consider the imperative for environmental and sustainability policies to harmoniously integrate with the growth and innovation needs of the urban area. Additionally, they must address social needs, safeguard cultural heritage, and align with urban planning efforts to ensure balanced urban development.

In pursuit of these goals, the integration of environmental and sustainability policies can yield significant co-benefits for the city. Improved air quality resulting from reduced combustion emissions, not only enhances public health but also contributes to a more livable urban environment. The implementation of green infrastructure projects and sustainable transportation systems can create employment opportunities and fostering economic growth. Prioritizing resilience measures alongside environmental initiatives can enhance the city's ability to adapt to the effects of climate change, which are more and more frequent and severe. Only by embracing a comprehensive approach that considers the interconnectedness of environmental, social, and economic factors, the city can effectively address its sustainability challenges while ensuring inclusive growth and improving the overall well-being of its residents.

3. Strategic priorities and interventions

To achieve climate neutrality by 2030, the Città di Torino has identified the following systemic strategic priorities in coordination with key stakeholders. Priorities were defined based on the baseline calculation relating to emissions (referring to 2019), which mapped the macro-areas, sectors, and sub-sectors with the most relevant impact on climate (detailed in Section A of the Action Plan). The baseline of Torino's Climate City Contract, as of 2019, has been quantified at 2,396,907 tCO_2/y. The mapping of the macro-areas, sectors, and sub-sectors has outlined the systemic priorities and the taxonomy of macro- and micro-actions. [5]

1. The first priority concerns the Stationary Energy macro-area, which accounts for **72.4% of local CO_2 emissions (1,734,424 t/y)**. The main priorities concerning this macro-area involve buildings. The actions concern the thermal insulation of residential buildings; the energy retrofitting of 800 municipal buildings; the installation of heat pumps according to energy class for a part of buildings using natural gas (coupled with the installation of photovoltaic systems to cover the electrical needs of heat pumps); the implementation of the electrification of heating systems in buildings not connected to the city's district heating network; the improvement of the energy efficiency of industrial processes.
   At the same time, the increase in energy produced from renewable sources is planned, optimizing its production and encouraging the establishment of renewable energy communities (RECs), allowing citizens, public bodies, and small and medium-sized enterprises to share the energy they produce and minimize network losses. The **overall reduction of CO_2 emissions in Stationary Energy is estimated at -665,055 t/y.**
2. Another priority is action on Energy Systems. The containment of emission factors through the variation of the carbon content of the Electricity/Gas/District Heating on the energy consumption should lead to **a reduction in CO_2 emissions of -480,530 t/y.**

5 The portfolio of macro- and micro-actions is detailed in Section B and in Appendix I of the CCC Action Plan.

3. Reducing emissions from the transport and mobility sector – which accounts for **26.5% of total emissions (636,277 t/y)** – is the third priority. In this sense, the planned actions focus on reducing travel needs (encouraging remote working methods, expanding areas with limitations on private traffic, and implementing Metro Line 2). On the other hand, the reinforcement and efficiency of public and private transport vehicles (replacement of private cars with electric vehicles; renewal of the local public transport fleet; development of carsharing and carpooling policies) and support for the development of active mobility (by expanding existing cycle paths and implementing new ones) – for an o**verall reduction in emissions of -381,089 t/y**.
4. The Città di Torino also aims to offset the residual share of unavoidable emissions by exploiting Carbon Capture and Storage (CCS) solutions for the removal of the biogenic portion of CO_2 emission from the Torino's waste-to-energy plant (estimated CO_2 removal: -365,080 t/y) and by increasing the presence of trees and green areas in urban areas also through the construction of green roofs and vertical forests (**estimated CO_2 removal: -74,770 t/y**).

Across the strategic priorities identified, the promotion of a sustainability-oriented cultural change will aim to encourage the implementation of an articulated series of measures that see citizens and private individuals as actors in the transition through a series of communication and awareness-raising activities that the City will carry out in the short to medium term.

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4. Vision and principles
for an integrated framework for (environmental) sustainability

The definition and signature of the Climate City Contract by the Municipality and by main urban stakeholders, both public and private, with a direct involvement of all the citizens (starting from young generations), represents not only an arrival point of the significant journey already undertaken in past years towards environmental sustainability, but also – and above all – a new starting point towards the achievement of the climate neutrality target, which is certainly ambitious but that can no longer be postponed.

The **transition** towards decarbonization has been clearly identified as a **key priority** for both the Città di Torino and the whole metropolitan area. It represents an important lever for a new socio-economic development phase. In this sense, the Climate City Contract can constitute a crucial element for building a common framework in which all the sustainability actions can be collocated according to a structured, integrated and coherent vision.

Moreover, the definition and implementation of the Climate City Contract is an opportunity for **building** a **systemic approach** that can be shared by other Italian and European cities, thus creating a common playground for effectively facing the challenge of the environmental sustainability, according to the goals of the "Green Deal" launched by the European Commission.

For reaching these purposes, the Città di Torino has chosen to propose **an own perspective** (consistent with the peculiarities of its socio-economic, productive and administrative system), where, in particular, the CCC is understood as the overall concept for the transition towards climate neutrality and not only as a plan for the actions required to cover the gap between the results of already planned actions and the neutrality goal. According to this, we tried to introduce into the Action Plan elements able to facilitate a strategic view of the transition, focusing not just on concrete micro-actions, but identifying a set of general macro-actions through which addressing the climate neutrality target and

providing a broad umbrella for the following detailed actions (for which ad hoc plans will detail their specific goals, objectives, tasks, budget, schedule and success criteria).

Therefore, the Climate City Contract of the Città di Torino was developed according to this perspective. This approach draws on the combination of **three** elements that constitute the **pillars** for the implementation of the vision: ① an ad hoc process **governance**, ② an effective **involvement** of the **city's actors**, and ③**science-based support** for quantitatively assessing ex-ante the costs/benefits of the single policy actions and of the overall strategies to be adopted. [6]

In particular, the proposed vision is characterized by **key attributes**. Namely, it is intended to be:

- **Integrated:** the analysis of the city's urban systems and the assessment of the impacts that different policy actions might have must be contextualized by the consideration of the integrated interrelationships of the different domains involved: environment (climate-changing emissions, air pollution, land use and impacts on the territory); economic system (development of new business models new industrial value chains and value chains related to the exploitation of renewable energy sources; need for new professional skills and competencies, and consequent creation of new job positions); social system (individual perceptions and attitudes; social acceptance and economic affordability of the transition process; human behavior and consequences on energy consumption patterns; positive impacts of the decarbonization on the citizens' life, both at individual and community level); digital system (data collection and management; data infrastructures, data sharing systems, Internet of Things (IoT) and smart metering; communication systems and protocols).
- **Multi-layer:** the city has to be modeled and analyzed as a complex, multi-layer system with different interrelated components: the energy system (in terms of energy generation, distribution infrastructures, and final uses by sector and commodity), the built environment (with the different intended uses: residential, tertiary/services, industrial), the mobility system (with the various possible mobility modes), the waste and water management and the green infrastructures.

6 The Work Process underlying this Climate City Contract is detailed in the Section 2 of the CCC Action Plan.

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- **Science-based**: the policy decision-making process should be supported by scientific approaches, models, and tools, analytically and quantitatively describing the various urban systems to evaluate the possible impacts of the strategic choices and decisions undertaken. The objective is to create skills and models to accompany the choices of the political decision-maker, developing knowledge of the possible scenarios and alternative strategic options and awareness of the consequent impacts on the different interacting domains without suggesting any scenario or option as preferential.
- **Dynamic:** in a world in transition, whose dynamics have increasingly become too expeditious to anticipate, it is impossible to think about equilibria; instead, it is necessary to do so regarding trajectories that must be followed against which to calibrate the political choices. What is commonly called "equilibrium" is a point of a given trajectory. The trajectories arise from continuous "non-linear" interactions between the different dimensions (technological, environmental, economic, financial, social) and actors (institutional, industrial, financial, and social) involved, which generate complex system dynamics and emerging integrated properties.
- **Quantitative:** political choices must be supported, as said, by a science-based approach. This approach must make it possible to quantify the main relevant variables of the climate and sustainability-related actions: emissions and costs. Pertinent other aspects to quantify are the reference configuration of the system, the possible multi-dimensional impacts deriving from different future scenarios (associated with diverse policy choices and decisions that can be taken), and the evolution of the system itself over time, thus enabling the monitoring the progress of the transition according to the implemented policies. This quantitative approach requires the availability and systematic management of the data to describe the urban systems (e.g., energy consumption and production, installed capacities, emissions, building stock and energy classes, mobility data, and macroeconomic data).
- **Inclusive and transversal:** to make the decision-making process effective and able to produce a positive impact, it is necessary to create constant interactions and a continuous dialogue with the social fabric of the city to make individual citizens, companies, and social entities aware of the cost/benefit ratio of the energy transition detailing the strategic choices according to the peculiarities of the different realities

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of the urban territory. Furthermore, it is strictly needed to carry on an intense dialogue with the city's actors and stakeholders directly involved in the transition actions (multi-utility companies operating in the area, corporate, banking system, trade associations, investors, research institutions), thus fostering a coherent vision and shared sustainability goals, and consequently orienting, in a coordinated way, political and business decisions, investment plans and corporate strategic choices. Finally, given the complexity and multidimensionality of the transition process, having a systematic approach might open concrete opportunities for the growth and development of the whole city.

Developing and implementing the vision requires identifying different functional areas, in which the key attributes can be concretely embodied and can be synthesized as follows:

- The systematized **collection and classification of data** support the extraction of useful information for decision-making. The Città di Torino implements an "open-source data intelligence" process in this framework. Data is obtained from relevant data sources managed by various city actors (municipality, utilities and energy companies, public transport companies, environmental monitoring, and protection bodies), validated and organized within innovative databases (e.g., data lakehouse and distributed databases), automatically updated through web crawlers, with a time granularity fine enough to allow detailed analysis of the current situation and mid/long-term scenario analyses. Data are needed for feeding: ① models and tools for "what if?" scenario analyses, assessing the impacts of different alternative policies, and ② monitoring systems for quantitatively tracking the evolutionary trajectories of the urban system over time.
- Constant **monitoring** of the evolution of the national and international **legislative and regulatory framework** and the general and specific targets related to the energy transition is necessary to have a constantly updated snapshot of the current possibilities and those foreseeable in the short/medium term.
- Creating continuously updated **catalogs of policy choices** already implemented in other urban contexts at the national and international scales could inspire the implementation of interventions already tested elsewhere or the definition of new policy actions. This approach is intended to encourage policies that are easily replicable and adaptable to different urban contexts (at a national and international level) to facilitate the diffusion of practical actions for decarbonizing the energy system and achieving the climate neutrality goal.
- **Modeling of the urban systems** includes stationary energy (municipal buildings, public lighting, residential, tertiary, and industrial sectors), transport (both public and private), waste (including landfill, wastes, and wastewater treatment), Industrial Processes and Product Use (IPPU) and Agriculture, Forestry and Other Land Uses (AFOLU, including the urban green infrastructure that acts as a CO_2 sink). In particular, these sectorial models should be able to quantify the impacts of different possible policy actions and strategies regarding CO_2 emissions reduction and compensation and related costs and allow for their comparison.
- A system of **formalized relations** with the various local and national stakeholders directly or indirectly involved in the transition process identifies possible convergences and shared courses of action (also through the definition of ad hoc agreements and the creation of a network of both national and international collaborations with other cities for sharing knowledge and best practices).
- **Communication with citizens and engagement** through websites, social networks, events, and printed paper allows them to constantly be aware of the strategic choices and decisions adopted, their time horizon, and actual impacts almost "in real-time." The communication process must not only be unidirectional (from the City Administration to the citizens) but, as far as possible, bidirectional, systematically collecting feedback and requests of citizens themselves, analyzing them, and possibly accepting them as corrective measures for the choices made.
- Identifying **funds and financing opportunities**, including those already foreseen in the National Recovery and Resilience Plan, possible ad hoc European and National funds, and activating dedicated financing lines by private investors (e.g., banking foundations).

Therefore, the **three pillars** can be mapped according to this **conceptual framework**. On the one hand, they are closely **intertwined with** one or more of the **critical attributes** of the vision. At the same time, on the other, they **encompass** the

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implementation of one or more functional areas (as graphically shown in Figure 1).

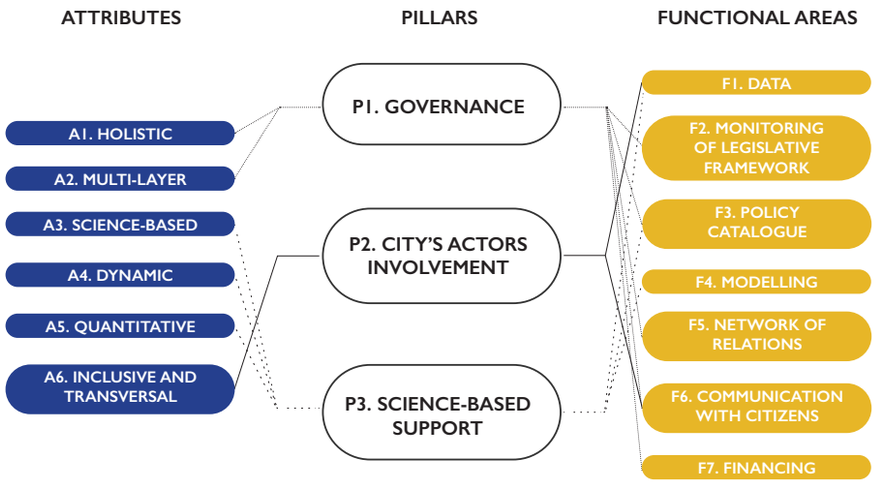

Figure 1: Conceptual framework of the CCC Vision

For each pillar, and in particular, for the governance, it is necessary to create an ad hoc integrated Mission team, able to merge different competencies, covering the various domains involved in the transition process, to properly manage the definition of the decarbonization pathways of the City, the assessment of their impacts and costs, and the monitoring of the evolutionary trajectories of the City towards the set goals. This system of competencies should range from modeling and analysis of urban systems (regarding the various sectors) at different spatial and time scales to the mapping of the urban morphology, to the evaluation of the environmental impacts of alternative policy scenarios, to the assessment of the contribution of urban green infrastructures to the absorption of CO_2, to the knowledge of the administrative and regulatory procedures for defining and implementing policies and strategic plans at the urban level.

This approach allows for a synergic cross-fertilization of expertise and know-how, consistent with the adoption of an integrated and multi-layer perspective, and requires the close involvement of two of the key City's players: the Municipality (able to provide competencies in the administrative, regulatory and policy domain) and Academia (able to deliver the required scientific competencies).

The Mission Team should be able to coordinate and accompany the City along the whole path towards climate neutrality, ensuring: ① the identification of the set of actions needed for the decarbonization of the City by 2030 and the assessment of their multidimensional impacts and costs; ② the implementation of the participatory process of involvement of the various City's actors; ③ the territorialization of supra-local strategies through the insertion of climate actions into planning tools, regulations and projects on a local scale; ④ the capitalization of experience and lessons learned from local to international levels; ⑤ the creation of connection networks with other urban realities, at both national and international level; ⑥ the management of the preparation phase of the Climate City Contract and of their future revision phases; ⑦ the monitoring of the implementation of the decarbonization actions and of their effects, the tracking of the evolutionary trajectory of the urban system and the check of the coherence with the ideal trajectory to be followed for reaching set goals; ⑧ the financial planning and the optimization of spending oriented towards climate neutrality.

Considering the second pillar, i.e., the involvement of the City's actors, a crucial aspect is the development of participatory paths with all local stakeholders, both internal and external to the municipal administration, involved in the process of co-designing the set of actions needed for the decarbonization of the City and in the subsequent process of achieving the climate neutrality target. The construction and implementation of the Climate City Contract firmly lean on incremental participation. The participatory process stems from creating a solid mandate within the municipal administration (Mission Team, Mission Group, and Climate Change Working Group). It gradually expands from a first kernel that involves defined targets of the local ecosystem (actors and subjects strongly engaged in other processes and with a high potential in terms of direct and/or indirect effects on achieving climate neutrality) to individual citizens. [7]

Such a participatory path outlines and activates diverse spaces for collaboration (information, consultation, co-creation) that gradually expand to potentially include all citizens. By adopting a

7 Detailed in the Section 5 of the Action Plan.

systemic and multi-level approach, the entire local ecosystem, made up of the different actors and subjects of the city – public and private and including citizens – is positively involved in the common challenge. The path takes place through the experimentation of forms of social innovation and governance innovation as enabling factors for effective, inclusive, and bottom-up climate neutrality transformations. In particular, according to the three **key principles** of ① **Transparency and inclusion** ② **A focus on people and interconnection for a fair transition**[8]; ③ **Shared responsibility and collaborative learning**, the local "ecosystem" to be involved should include multilevel players: institutional bodies besides the Municipality of Torino (like the Regione Piemonte and the Torino Città Metropolitana), public multi-utility companies, the private sector (corporate, banking system, trade associations), the Third Sector and non-profit organizations, the academic world and the citizens, with specific attention devoted to the younger generations (which could actively sustain and push the transition process in the following decades) and to vulnerable targets (which should not suffer from adverse effects, especially from the economic point of view, of the pathways towards climate neutrality, and for which it is crucial to ensure equity of the process). This engagement of urban actors as active participants in the City's challenge should represent the basis for **co-creating the knowledge framework on the City's carbon footprint and co-designing the portfolio of actions and their monitoring**. One of the mandates of the governance (the first pillar of the vision) is, therefore, the identification and implementation of proper stakeholders' communication and engagement approaches (e.g., meetings, working tables, workshops, thematic forums, widespread policy labs) for ensuring the effective involvement of the local "ecosystem" of actors and for promoting a common action perspective for the transition towards climate neutrality.

The third pillar, which focuses on **science-based support** for the City's policy decision-making, seeks to offer practical and effective tools. These tools are grounded in robust scientific methodologies and models and are designed to facilitate the comparative assessment of the impacts of different policy actions and strategic choices. They also enable the tracking of system evolution and verification of coherence with defined targets. This approach allows for the introduction of corrective actions, if necessary, in line with the **quantitative and dynamic** perspective described earlier. Its implementation is based on a set of key elements: ① the creation of a **database** of the whole **urban system**, allowing for collecting, validating, storing, managing and constantly updating all the data needed for the characterization of the City's urban systems and for feeding both the models and tools for "what if?" scenario analyses and the tracking system for the monitoring of the evolutionary trajectories; ② the definition of **sectorial models** for the ex-ante evaluation of the multidimensional **effects** of possible different **policy actions**; ③ the identification of a **system of Key Performance Indicators** for **tracking** the evolutionary **trajectory** of the City's transition with respect the main dimensions involved (energy, environmental, economic, social); ④ the development of IT tools directly accessible and usable by the City's policy decision-makers; in particular, these tools should be oriented, on the one hand, to the specific definition and **formalization of the CCC** (including an automatic compiling of the various sections of the contract itself) and, on the other hand, to the creation of a **Digital Twin of the City**, (under costruction). This tool will enable the follow up of the evolution of the urban systems, not just with reference to the GHG emissions but in terms of the multidimensional impacts (energy, economic, environmental, social) of the transition pathways, in a measurable and interactive (by means of a detailed geomatic representation and modelling of the City) manner.

As detailed in the Action Plan,[9] the **CLICC (CLimate City Contract) IT platform** has been developed as an instrument to define and formalize the CCC in the framework of a more general digital twin tool for the city. The platform can elaborate the simultaneous combination of different types of actions to estimate their impacts in terms of avoided GHG emissions and assess the related costs, providing a pre-compiled template for the documents (i.e., commitment, action, and investment plans of the CCC). CLICC was designed and implemented to quantitatively assess the impacts of actions and pathways in terms of GHG emission reduction and the related costs, allowing the City decision-makers to test in silico, interactively, different policy options and identifying the combination of them that mainly fits with their strategies for reaching the climate neutrality. In a broader stragic framework, the **digital twin of the city** is intended to: ① provide a comprehensive and synoptic view of the urban system ② elaborate integrated multilevel and multi-sector urban models – comprising environmental models, models of the city building

7 All the actions undertaken towards the implementation of a strong participatory environment are detailed in the Section 5 of the CCC Action Plan

8 An inclusive transition to neutrality.

9 For a detailed explanation, refer to the Section 2 of the CCC Action Plan.

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stock, transport models, models of urban energy infrastructures, models of waste treatment and circular economy and including stakeholders/social interactions and behavioral models; ③ assessing, in a multidimensional way, the impacts of the possible energy transition pathways of the city.

The proposed vision and methodological approach will result in a **"Torino Model"** for the science-based support of Cities in the climate and environmental policy decision-making field. The ultimate goal is to make the approach and the tools available to other cities. Such a framework is in line with the general purpose of the "EU Mission: Climate Neutral and Smart Cities": selecting a pool of pioneer European cities that, trying to anticipate the climate neutrality goal to 2030, could serve as a model and a forerunner for other cities aiming at reaching this crucial and ambitious target by 2050.

5. Signatories, Main Partners, Supporters

The process of building and consolidating the local ecosystem and the stakeholder engagement have identified three levels of commitment of the actors in the Climate City Contract:

1. **Signatories.** The Signatories are mainly institutional bodies that, together with the City, sign the Climate City Contract;
2. **Main Partners**. The Main Partners (e.g., investee companies, banking institutions, and foundations) are entities that support the City in the final goal through the signing of a letter of support and with the identification of concrete actions for the reduction of climate-changing emissions;
3. **Supporters** (e.g., trade associations, companies, third sector entities, and associations) endorse the City in the final goal by signing a letter of support and identifying the micro-actions and actions enabling the context of intervention for a change that is widespread and lasting.

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Signatories

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person	Name and position of the technical support
Città di Torino	LOCAL	Public Administration	Stefano Lo Russo	Mayor	Gaetano Noè – Director of Environment and Ecological Transition Department
Città Metropolitana di Torino	LOCAL	Public Administration	Stefano Lo Russo	Mayor	Claudio Coffano, Director of Environment Department and Environmental Surveillance
Regione Piemonte	REGIONAL	Public Administration	Alberto Cirio	President	Stefania Crotta - Director of Environment, Energy and Territory
Università degli Studi di Torino	NATIONAL	Public Academic Organization	Stefano Geuna	Rector	Egidio Dansero - Vice Rector for Sustainability and Development Cooperation
Politecnico di Torino	NATIONAL	Public Academic Organization	Guido Saracco	Rector	Ettore Bompard - Full Professor Energy Department (DENERG)
Camera di Commercio di Torino	LOCAL	Public Organisation	Dario Gallina	President	Guido Cerrato - Manager of the Territorial Development and Market Regulation Area

Signatories

Main Partners

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
Gruppo Torinese Trasporti	Transport Local	Public Limited Company (Plc)	Serena Lancione	Legal representative
Gruppo IREN	Multiutility National	Public Limited Company (Plc)	Luca Dal Fabbro	Legal representative
Smat	Infrastructure Local	Public Institutions Subsidiaries and affiliated companies	Paolo Romano	President
Infrato	Infrastructure Local	Public Institutions Subsidiaries and affiliated companies	Bernardino Chiaia	Legal representative
Fondazione Compagnia di San Paolo	Bank Foundation Local	Nonprofit, private and autonomous organization	Francesco Profumo	President
Fondazione CRT	Bank Foundation Local Nonprofit, private and autonomous organization	Nonprofit, private and autonomous organization	Andrea Varese	Legal representative
CSI Piemonte	Information and data Systems Local	Consortium for the Information System	Pietro Pacini	Legal representative
5T	Transport Local	Public Limited Company (Plc)	Rossella Maria Panero	Legal representative
Arpa Piemonte	Environment Dept. Local	Public Institutions Functional agencies	Secondo Barbero	Legal representative
Atc Piemonte Centrale	Social housing Regional	Public Institutions Subsidiaries and affiliated companies	Luigi Brossa	Legal representative's delegate
Intesa San Paolo	Bank National	Private Entity	Elena Flor	Head of ESG & Sustainability
Unicredit	Bank National	Private Entity	Marco Borgione,	Head of Territorial Development North West Office

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Main Partners

Cassa Depositi e prestiti	Financial Institution National	Public Institutions Subsidiaries and affiliated companies	Dario Scannapieco	Chief Executive Officer
SAGAT S.p.A.	Airport Local	Public Institutions Subsidiaries and affiliated companies	Andrea Andorno and Elisabetta Oliveri	Legal representative President
ITALGAS	Gas and electricity distributors National	Public Limited Company (Plc)	Paolo Gallo	Legal representative
REALE Group	Bank National	Private Entity	Luca Filippone	General Director of Reale group

Signatories

Supporters

Name of the institution	Sector/Area	Legal form	Name of the responsible person	Position of the responsible person
A.M.A. Factory ETS	Cultural/Local	Third sector organisation	Giuseppe Rosso	Legal representative
Arcobaleno Cooperativa Sociale	Waste/ Local	Third sector organisation	Potito Ammirati	Legal representative
Associazione Al Cicapui ASD e APS	Sport and Cultural/Local	Third sector organisation	Antonio Convertino	Legal representative
Associazione Donne per la difesa della società civile	Cultural/Local	Third sector organisation	Anna Ianniello	Legal representative
Associazione Hiroshima Mon Amour ETS	Cultural/Local	Third sector organisation	Fabrizio Aldo Gargarone	Legal representative
Associazione Il Tuo Parco	Cultural/Local	Third sector organisation	Piergiorgio Tenani	Legal representative
ATT SRL IMPRESA SOCIALE	Social/Local	Third sector organisation	Carlo Maria Tresso	Legal representative
biova srl	Circular Economy/Local	Third sector organisation	Franco Dipietro	Legal representative
BLUE Engineering s.r.l.	Design/Local	Private Entity	Moh'd Juma Eid	Legal representative
CaMariuccia	Farm/Local	Third sector organisation	Andrea Maria Pirollo	Legal representative
Capetti Elettronica	Technological/ Local	Private Entity	Anna Franca Maria Capetti	Legal representative
CarpeCarbon SRL	Environmental/ Local	Startup	Giuliano Antoniciello	Legal representative
CLEAN AIR Italia S.r.l.	Environmental/ Local	Private Entity	Pietro Calò	Legal representative
Club Silencio	Cultural/Local	Third sector organisation	Alberto Ferrari	Legal representative
Coesa Energy	Energy/Local	Private Entity	Federico Sandrone	Legal representative
Confcooperative Piemonte Nord	Representation of the cooperative movement/ Regional	Trade Association	Giovanni Gallo	Legal representative
Consorzio KAIROS	Social/Local	Third sector organisation	Daniele Caccherano	Legal representative
Consulta Ambiente e Verde	Environmental/ Local	Municipal consultation	Piergiorgio Tenani	Legal representative

Supporters

Consulta Mobilità Ciclistica e Moderazione del Traffico	Mobility/ Local	Municipal consultation	Diego Vezza	President
Cooperativa Sociale P.G. Frassati scs onlus	Social/Local	Third sector organisation	Roberto Galassi	Legal representative
Cube Italia	AgriTech	Startup	Domenico Auriemma	Legal representative
Data Reply Srl	Analytics/National	Private Entity	Luca Montinari	Legal representative
Enerbrain	Energy	Startup	Giuseppe Carlo Giordano	Legal representative
Environment Park	Environmental/ Local	Research Entity	Giacomo PORTAS	Legal representative
EOT SRL	Energy	Private Entity	Giulio Troncarelli	Legal representative
Fiab Torino Bici & Dintorni	Environmental/ Local	Third sector organisation	Massimo Tocci	Legal representative
Fondazione Collegio Einaudi	Training	Private training institution	Andrea Fabbri	Legal representative
Fondazione Links	Training/ National	Private training institution	Stefano Buscaglia	Legal representative
Fondazione Piemonte Innova	Training/ Regional	Public-private partnership	Massimiliano Cipolletta	Legal representative
Fratelli Basile Srl	Mechanics/ Local	Private Entity	Mattia Basile	Legal representative
Geosolving srl	Geological and engineering /Local	Private Entity	Santina Aiassa	Legal representative
Ghiggia srl	Plant engineering/ International	Private Entity	Giovanni Ghiggia	Legal representative
Giustizia Climatica Ora!	Environmental/ Local	Third sector organisation	Andrea John Déjanaz	Legal representative
GlobalChimica	Chemical/ International	Private Entity	Clara Besson	Legal representative
GREEN GROWTH GENERATION	Sustainable/ Local	Third sector organisation	Gabriella Esposito	Legal representative
Icre Automazione sas	Automation/ National	Private Entity	Vittorio Padovan	Legal representative
IGPDECAUX spa	Communication National	Private Entity	Fabrizio du Chène de Vère	Legal representative
Iveco Group	Transport/ International	Private Entity	Annalisa Citterio	Head of Sustainability
LaQUP APS	Cultural/Local	Third sector organisation	Silvana Ranzato	Legal representative
Lavazza	Food/International	Private Entity	Mario Cerutti	Chief Institutional Relations & Sustainability Officer

Supporters

Legacoop Piemonte	Representation of cooperative/ Regional	Trade Association	Dimitri Buzio	Legal representative
Legambiente Piemonte e Valle D'Aosta	Environmental/ Regional	Third sector organisation	Alice De Marco	Legal representative
Manzoni People	Volunteering/ Local	Third sector organisation	Laura Sciolla	President
MARAZZATO SOLUZIONI AMBIENTALI SRL	Environmental/ Local	Private Entity	Bosi Ivano	Legal representative
Mercato Circolare	Social/Local	Private Entity	Nadia Lambiase	Legal representative
Mercato Itinerante	Social/Local	Startup	Eman Saffo	Legal representative
Modelway s.r.l.	Innovation/ International	Private Entity	Francesco Pennaroli	Legal representative
Orti generali srl. impresa sociale	Social/Local	Private Entity	Stefano Olivari	Legal representative
PartecipaTO	Cultural/Local	Third sector organisation	Azzurra Beddini	Legal representative
PCM Srl	ICT/Local	Private Entity	Matteo Baldi	Legal representative
Planet Idea srl	Innovation/ International	Private Entity	Gabriele Francesco Maria Pala	Legal representative
Pro Natura Torino	Environmental/ Local	Third sector organisation	Paola Maria Campassi	Legal representative
ReLearn	Environmental/ Local	Startup	Riccardo Leonardi	Legal representative
Rifiuti Zero Piemonte	Environmental/ Local	Third sector organisation	Laura Piana	Legal representative
Siborg Srl	Environmental/ Local	Private Entity	Bruno Lanfranco	Legal representative
Stellantis	Mobility/ International	Private Entity	Daniele Chiari	Legal representative
Sunspeker	Solar technologies/ Local	Startup	Fabrizio Chiara	Legal representative
Triciclo scs	Environmental/ Local	Third sector organisation	Pier Andrea Moiso	Legal representative
Unione Industriali Torino	Business association/ Local	Trade Association	Angelo Cappetti	Legal representative
UrbanLab	Communication/ Local	Third sector organisation	Piero Boccardo	Legal representative

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