



Landeshauptstadt  
München



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# Climate City Contract

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Action Plan

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CITIES



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## Abbreviations and acronyms

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

Abbreviations and acronyms	Definition
<b>LHM</b>	<b>Landeshauptstadt München:</b> The official name of the city of Munich and its administrative organs.
<b>MCM</b>	<b>Munich Climate Mission:</b> The overall program that implements the European Climate-neutral and Smart Cities Mission in the city of Munich, led by the dedicated Unit (ger.: <i>Stabstelle Mission Klimaneutralität</i> ) in Munich's Climate- and Environmental Protection Department.
<b>MIM</b>	<b>Munich Impact Model (Münchener Wirkungsmodell):</b> Munich's customised, quantifiable system mapping framework for climate action and impact measurement, modelling, and evaluation. Serves as coherent streamlining methodology for mapping, modelling, planning, evaluating, digitalising, and visualising quantitative and qualitative data for Munich's climate governance.



# 1 Introduction

Munich, the capital of Bavaria, is Germany's third-largest city, with a population of 1.6 million residents in 2024. Known for its cultural heritage, innovative academic institutions, proximity to attractive natural recreation areas and its thriving economy, Munich attracts many tourists, students, and business professionals every year. It is the most densely populated and one of the fastest growing cities in Germany.

Located in southern Germany, Munich lies on the elevated plains of the Alpine foothills, offering a moderate continental climate. The city experiences warm summers with temperatures averaging around 24°C and cold winters, often dipping below freezing with occasional snowfall. The Isar and Würm are the main rivers flowing through Munich, connecting the alpine region with the Danube to the north of the city. The city is also known for its well-maintained parks and green spaces, with major areas such as the English Garden (375ha), Schlosspark Nymphenburg (229ha) or Riemer Park (133ha).

Munich has a diverse and robust economy, serving as a major centre for finance, technology, and innovation. It is home to the headquarters of global companies like Allianz, BMW, Munich Re, MTU, Siemens, Siemens Energy, and the Munich Stock Exchange. Munich's economy benefits from a thriving startup ecosystem and international trade fairs, such as the Munich International Trade Fair and the Electronica Trade Fair. The city is also home to prestigious research and educational institutions, including the Ludwig Maximilian University (LMU) and the Technical University of Munich (TUM), the Munich University of Applied Sciences and the Helmholtz Zentrum München.

Munich offers a rich cultural scene with museums like the Deutsche Museum, Alte Pinakothek, Neue Pinakothek, Pinakothek der Moderne and the Lenbachhaus. The city is known for its annual Oktoberfest, the world's largest beer festival. The Bavarian State Opera, the Munich Philharmonic, and the Residenz Theatre are key parts of the performing arts scene. Residents enjoy a high quality of life with excellent public services, healthcare, and education systems.

## What is Munich? – Different Territorial Scopes

**Landeshauptstadt München (LHM)** refers to the city of Munich itself, which is the capital of Bavaria. It is both the name of the municipal government organisation with its 15 departments (*Referate*) and municipal assets but also the name of the space defining "Munich city proper". In territorial boundary terms, it covers an area of approximately 310 square kilometres and is the most densely populated urban area in the region. Carbon emission accounting in Munich uses this area to define the scope of its territorial GHG-emission inventory. The city borders the Landkreis München on three sides.

The **Landkreis München** surrounds the city of Munich on the north, east, and south. It is a separate administrative district that includes 29 municipalities, covering an area of about 664 square kilometres. This district is characterised by suburban and rural communities that benefit from their proximity to the city, forming a significant part of Munich's metropolitan area.

Planungsregion 14, also known as the **Munich Planning Region**, encompasses the Landeshauptstadt München and the surrounding districts, including Landkreis München. This region is designed for coordinated spatial planning and development, ensuring balanced growth and infrastructure development across the urban and suburban areas. It covers a larger area than the Landkreis München, integrating multiple administrative districts to manage regional development effectively.



The **Metropolregion München** is the largest territorial unit, extending beyond the immediate vicinity of Munich to include a vast area of southern Bavaria. It covers approximately 26,000 square kilometres and includes 27 districts and 6 independent cities, such as Augsburg, Ingolstadt, and Rosenheim. This region is a major economic hub in Europe, known for its high quality of life, robust infrastructure, and significant cultural and scientific contributions.

*Most commonly throughout the CCC, the term “LHM” is used to indicate the municipal government structure as a collective actor system, including all its assets and direct responsibilities. Terms like “Munich” and “the city” mostly refer to the entire city society, including all stakeholder groups inside the 310 km<sup>2</sup> territory of Munich city proper.*

## Global, EU and federal level climate neutrality targets

The Federal Republic of Germany ratified the Paris Agreement and legally committed to keep global warming well below 2 degrees Celsius compared to pre-industrial levels and to no more than 1.5 degrees Celsius if possible. The nationally determined contribution (NDC) for Germany at UN level is embedded in the European Climate Law, setting a target for all of Europe to reach climate neutrality by 2050, and the intermediary goal to reduce all European GHG-emissions by 55% by 2030. Within this framework, supra-national target setting determines Germany’s contribution to the European climate goals under the EU’s Effort Sharing Decision (ESD) and sets [Germany’s target as of 2023](#) to 50% reduction by 2030 compared to 2005 levels, which would be 493 million tons of carbon dioxide equivalent (m t CO<sub>2</sub>e) of total emissions.

Germany’s own reduction target defined by the **Federal Climate Protection Act** (*Bundes-Klimaschutzgesetz, KSG*), as per its most recent amendment ratified on 15. July 2024, exceed international commitments and sets Germany’s nation-wide climate protection target.<sup>1</sup> These can also be transposed to a 2018 baseline year for all of Germany, to better compare Germany’s national targets with the EU Cities Mission and the Munich Climate Mission:

**Table 1: National Climate Neutrality Targets in Germany as of 2023, according to 1990 baseline and as transposition to the 2018 baseline year of the Cities Mission**

Target year	Residual CO <sub>2</sub> e	KSG 1990 baseline target (1251 m t CO <sub>2</sub> e):	Cities Mission 2018 baseline transposition (852 m t CO <sub>2</sub> e):
By 2030	438 m t	65% reduction	49% reduction
By 2035	288 m t	77% reduction	66% reduction
By 2040	150 m t	88% reduction	82% reduction
By 2045	n/a	climate neutrality	climate neutrality

## Munich’s climate neutrality targets for 2030 and 2035

In an earlier target from September 2017, the Munich city council adopted a GHG-emission reduction target for 2050 to cut emissions to 0.3 t of CO<sub>2</sub>e per capita, which became Munich’s definition of climate neutrality in line with the Paris Agreement. In December 2019, after an active year of demonstrations, civil society activity and public demand for rapid and ambitious climate action – followed by intense political debate – the city council declared a state of **climate emergency** and brought Munich’s climate neutrality target for the entire city across all stakeholders forward to 2035,

<sup>1</sup> <https://www.umweltbundesamt.de/daten/umweltindikatoren/indikator-emission-von-treibhausgasen#die-wichtigsten-fakten>



which would translate into a maximum total of 524 kilo tons of CO<sub>2</sub>e for the entire city, based on an estimated number of 1,748,000 inhabitants forecast for 2035.

The foundation for this climate neutrality target of Munich can be found in its first Decision of Principle from December 2019 (Bayerisches Versöhnungsgesetz II / Grundsatzbeschluss zur „Klimaneutralen Stadtverwaltung 2030 und weitere Maßnahmen zur Erreichung der „Klimaneutralität München 2050“ (Sitzungsvorlage Nr. 14-20 / V 16525)) with the following key aspects:

- Declaration of a climate emergency in the city
- Climate neutrality target for municipal government operations by 2030
- Climate neutrality target for the entire city by 2035
- Development of a Climate Action Plan (Maßnahmenplan) to reach climate neutrality by 2035 by including all city departments and relevant actors from civil society and public utilities
- Application to take part in the EU Cities Mission<sup>2</sup>
- Making the monitoring of the progress on Munich's climate target publicly accessible in an understandable manner

At the onset of the new election period from 2020 to 2026, the council decided to create a dedicated new Department for Climate and Environmental Protection, and to issue an Expert Survey on Munich's 2035 Climate neutrality target ([“Fachgutachten Klimaneutralität München 2035”](#) based on Decision 20-26 / V 00561). With the new department in place, two further Decision of Principles were taken by the city which now provide the framework for Munich's achievement of climate neutrality by 2035.

Decision of Principle I (Sitzungsvorlage 20-26 / V 03533) is part of a “climate package” of council decisions from July 2021, together with the establishment of a Climate Protection Audit (“Klimaschutzprüfung”) (Sitzungsvorlage 20-26 / V 03535) for all further climate-relevant council decisions, and the definition of financing framework for climate protection (Sitzungsvorlage 20-26 / V 03534)). With this set of the decisions, the Department of Climate Protection and Environmental Affairs created the structural framework for climate protection and adaptation in Munich.

- Decision of Principle I defines the scope of action for the city of Munich in climate protection and adaptation and formulates principles for a climate strategy.
- The city sets a municipal climate statute (*‘Satzung zur Umsetzung der Münchner Klimaziele auf dem Gebiet der Landeshauptstadt München (KlimaS)’*) which legally regulates the roles and responsibilities of various institutions in implementing the climate neutrality target. This statute was the first of its kind in Germany and created a binding framework for the city's climate strategy and targets.
- A Climate Council is established, via a separate statute (*Satzung zur Einführung eines Klimarates der Landeshauptstadt München (KlimaratS)*), to involve all stakeholders in Munich's climate protection efforts.
- The decision on the financing framework set up a dedicated climate budget for the city of 180 million Euros per year and led to the city's issuance of Green Bonds (“Zukunftsaktien”)

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<sup>2</sup> Bayerisches Versöhnungsgesetz II / Grundsatzbeschluss zur „Klimaneutralen Stadtverwaltung 2030“ und weitere Maßnahmen zur Erreichung der „Klimaneutralität München 2050“ (Sitzungsvorlage Nr. 14-20 / V 16525), 5. Paragraph 15 “Die Stadt München bewirbt sich auf EU-Fördermittel des Programmes „Klima-neutrale“ Stadt“. This point references the city of Munich's early knowledge of the Mission before its inception at EU-level, via Munich's participation of the cities consultation group of Eurocities to the Mission Board in 2019.



Decision of Principle II (Sitzungsvorlage 20-26 / V 05040) draws on the results of the Expert Survey for Munich's Climate Neutrality Target and describes a set of target scenarios as well as a long list of actions to be able to realise these scenarios. In essence, the expert study puts forth a target scenario for climate neutrality along the entire administrative territory by 2035, reducing per capita emissions from 6,21 t of CO<sub>2</sub>e to 1,75 t of CO<sub>2</sub>e per year. The study explains that this is most ambitious target possible based on its assumptions<sup>3</sup> and already includes the 2030 climate neutrality target for municipal operations, i.e. assets under direct control of the administration.

An additional scenario for the year "204X" is developed to account for external factors for climate neutrality, namely the transition of infrastructure and technology needed as a precondition for. Some major reasons for splitting up these target scenarios between 2035 and 204X, are the infrastructure needed to decarbonise district heating by shifting to geothermal power, which is already being implemented but can only be completed by 2040<sup>4</sup>, or the decarbonisation of the German power mix supplied via the national grid, which is the responsibility of national and *Länder* level actors as well as the power generation market, and lies outside the control of the City of Munich and all its local actors.

Other factors include demographic considerations such as a rapid population growth of a projected 13% by 2035, which would come with an increase in absolute emissions under business-as-usual assumptions. Methodological factors in emission accounting also play a role, such the utilisation of German emission factors for GHG calculation<sup>5</sup> — these typically go beyond the Mission requirements for emission accounting and already include Scope-3 emissions for the energy sector, which accounted for about 13% of power generation emissions in 2023.<sup>6</sup> It is crucial to acknowledge these complexities, path dependencies, systemic externalities and physical reality of Munich's energy system that act as guardrails for both the success or failure of the Munich Climate Mission.

Despite acknowledging the assumptions and findings of the expert study, Munich remains committed to its official 2035 climate neutrality target. The ambition of the Munich Climate Mission (MCM) remains to do all that is necessary to achieve the 2035 climate neutrality target in Munich, while also going beyond the target where possible or reducing global CO<sub>2</sub> emissions outside Munich's GHG-monitoring. This includes, for example, the target of Munich's utility company Stadtwerke München (SWM) to generate the equivalent of Munich's entire electricity demand in renewable energy by 2025. To provide a holistic and transparent understanding on MCM, it is beneficial to review the city's alignment and deviation from the requirements of the European Cities Mission across different aspects.

**Table 2: Mission Alignment of Munich's Climate Neutrality Targets**

Mission Alignment	< Cities Mission	= Cities Mission	> Cities Mission
<b>Target Timeline</b>	• Territorial Climate Neutrality in 2035	• Municipal Climate Neutrality in 2030	
<b>Reduction Target</b>			• 94% compared to baseline for 2035 territorial target
<b>Scope-3 Emissions</b>		• Inclusion of Waste Sector Scope-3 emissions	• Inclusion of Energy Sector Scope-3 emissions

<sup>3</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“.

<sup>4</sup> Stadtwerke München, „Geothermieanlage Michaelibad“.

<sup>5</sup> Timpe u.a., „Klimaneutralität München 2035“, 30.

<sup>6</sup> Icha und Lauf, „Entwicklung der spezifischen Treibhausgas-Emissionen des deutschen Strommix in den Jahren 1990 - 2022“, 19.



<b>Renewable Energy</b>			•RE power generation at 100% city demand in 2025
<b>Population Growth</b>			•Climate neutrality target includes +13% population
<b>Residual Emissions</b>		•Includes compensation plan for residual emissions	

Munich also established a more ambitious target for the administration (Landeshauptstadt München, LHM) and its municipal operations across city-owned assets to 2030.<sup>7</sup> While the administration across municipal assets is only responsible for about 3% of Munich's overall territorial emissions, the 2030 target is seen as a make-or-break milestone for the city's climate neutrality journey. To engage and collaborate with all stakeholders across different domains such as business, research, and civil society, it is seen as imperative that the administration and all municipal companies and subsidiaries of the city lead by example.

- **Directorate** (*Direktorium*; abbr. DIR) The Directorate oversees the strategic planning and coordination of all municipal departments. It ensures the implementation of city policies and serves as the central administrative body.
- **Department of Labor and Economic Development** (*Referat für Arbeit und Wirtschaft*; abbr. RAW) This department is responsible for promoting economic growth, supporting local businesses, and fostering job creation. It also focuses on vocational training and employment services to ensure a thriving labour market in Munich.
- **Department of Education and Sports** (*Referat für Bildung und Sport*; abbr. RBS) The department oversees the city's educational institutions, ranging from kindergartens to high schools, and promotes sports and physical education. It ensures that all residents have access to quality education and recreational facilities.
- **Department of Construction** (*Baureferat*; abbr. BAU) This department is in charge construction and maintenance of public buildings, public spaces, and infrastructure. It ensures sustainable development and the preservation of Munich's architectural heritage.
- **Department of Culture** (*Kulturreferat*; abbr. KULT) The department manages cultural institutions such as theatres, museums, and libraries. It promotes cultural events and activities, supporting the city's vibrant arts scene and preserving its cultural heritage.
- **Department of Health** (*Gesundheitsreferat*; abbr. GSR) This department is responsible for public health services, including healthcare planning, disease prevention, and health promotion. It ensures the well-being of residents through various health programs and services.
- **Department of Climate and Environmental Protection** (*Referat für Klima- und Umweltschutz*; abbr. RKU) This department focuses on environmental protection, sustainability initiatives, and climate action. It also enhances the city's resilience to climate change, protects biodiversity and promotes circular economy and eco-friendly practices.
- **Department of Human Resources and Civil Service** (*Personal- und Organisationsreferat*; abbr. POR) The department manages the city's human resources, including recruitment, training, and employee relations. It is also responsible for organisational development and ensuring efficient public administration.
- **Department of Information and Communication Technology** (*IT-Referat*; abbr. RIT) This department oversees the city's IT infrastructure, ensuring the security and efficiency of digital services. It also promotes the digitalisation of municipal services to enhance accessibility for residents.

<sup>7</sup> Sitzungsvorlage Nr. 14-20 / V 16525, <https://risi.muenchen.de/risi/dokument/v/5822571>, item 2, 10 and 12



- **Department of Public Order** (*Kreisverwaltungsreferat*; abbr. KVR) The department is responsible for maintaining public order, safety, and security. It oversees services such as registration, permits, and public safety regulations, ensuring a well-organised urban environment.
- **Department of Social Services** (*Sozialreferat*; abbr. SOZ) This department provides social welfare services, including support for families, children, refugees and the elderly. It ensures social inclusion and assistance for vulnerable populations in Munich.
- **Department of Urban Planning and Building Regulation** (*Referat für Stadtplanung und Bauordnung*; abbr. PLAN) The department oversees urban development, zoning, and building regulations. It ensures sustainable and orderly development, balancing environmental and community needs.
- **Treasury** (*Stadtkämmerei*; abbr. SKA) This department manages the city's budget, financial planning, and accounting. It ensures the efficient allocation of resources and financial stability for municipal operations and services.
- **Department of Mobility** (*Mobilitätsreferat*; abbr. MOR) The Department of Mobility oversees Munich's transportation systems, including public transit, cycling infrastructure, and pedestrian pathways. It focuses on sustainable and efficient mobility solutions to reduce traffic congestion and environmental impact. The department aims to enhance the accessibility and connectivity of the city's transportation network, ensuring safe and eco-friendly travel options for all residents and visitors.
- **Department of Municipal Services** (*Kommunalreferat*; abbr. KOM) This department oversees public services such as waste management. It ensures the efficient delivery of essential services to maintain a clean and functional city environment.

In accordance with their respective responsibilities, these 15 departments also manage all subsidiary and municipal companies and entities affiliated with the administration. While the number and names of municipal enterprises (*Eigenbetriebe*) and major-stake subsidiaries (*Beteiligungsgesellschaften*) of the City of Munich (*Landeshauptstadt München*) is subject to frequent change, the 2023 financial report on municipal entities<sup>8</sup> listed over 250 subsidiaries and municipal companies at the time. Some of these entities are more relevant for the decarbonisation of municipal operations than others. Some belong to a major parent group or holding and could be seen as individual or collective actors with their own subsidiaries, depending on perspective and interpretation. Therefore, a non-exhaustive list of examples of major relevant entities in Munich may include:

- Abfallwirtschaftsbetrieb München (AWM) - Munich Waste Management Company
- Stadtwerke München (SWM) - Munich City Utilities
- Münchner Stadtentwässerung (MSE) - Munich City Drainage
- Münchner Verkehrsgesellschaft (MVG) - Munich Transport Company
- Münchner Städtische Kliniken (München Klinik) - Munich Municipal Hospitals
- Flughafen München - Munich Airport Company
- Olympiapark München - Munich Olympic Park Company
- Münchner Gesellschaft für Stadterneuerung mbH (MGS) - Munich Society for Urban Renewal
- Münchner Wohnen (MW) - Municipal Housing Company Munich
- Messe München - Munich Trade Fair Company
- München Klinik - Municipal Hospital Company
- Stadtgüter München – Munich Asset Management Company
- Stadtparkasse München – Munich's publicly owned bank

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<sup>8</sup> LHM, „Finanzdaten- und Beteiligungsbericht 2023 Finanzsituation der städtischen Eigenbetriebe und Beteiligungsgesellschaften 2019 bis 2023“.



As per Munich's Climate Statue from 2021, climate protection is a crosscutting task for all municipal entities and across all their operations. Central monitoring of progress of the decarbonisation is organised via a centralised **Carbon Footprint Monitoring** (See Decision 20-26 / V 11336). In addition, the **Climate Protection Audit** (See Decision 20-26 / V 12248) reviews all climate relevant council decisions in regard to their climate impact. This includes (but is not limited to) all decisions that affect the municipal operations of the LHM. From the perspective of the Cities Mission, however, all municipal operations combined are only responsible for about 3% of the total emissions of Munich's city territory. While it is crucial for the success of the Mission that all public entities lead by example and spearhead the transition towards climate neutrality, the more significant challenge lies in climate action to reduce GHG-emissions across the city territory. The Munich Climate Mission therefore focuses on adding value via actions and activity shifts at the territorial scale and by including all relevant stakeholders outside the administration, rather than on the corporate carbon footprint of municipal operations, which are dealt with elsewhere in Munich's climate governance architecture.

**Demography:** In terms of population, Munich has been in a growth phase since 1999, statistically interrupted only by register corrections. Following the stronger population growth in recent years up to 2019, the temporary slowdown due to the pandemic in 2020 and 2021, and the migration gain in 2022 due to refugee migration, further population increases are expected for the City of Munich in the future. The reasons for migration to Munich are diverse and consist of various migration streams with different motivations. The main drivers for migration to Munich are education and employment. While job-related migration is closely linked to economic development, it is the educational institutions and universities that annually motivate young adults to move to Munich.

Population data are a major factor in Munich's GHG emission accounting and target setting.

Key demographic figures referred with high relevance for the Cities Mission include:

- Population of Baseline Year, 31.12.2018: 1,542,211<sup>9</sup>
- Expected Population 2035: 1,748,000<sup>10</sup>
- Number of Households 2018: 825.847<sup>11</sup>
- Number of Households 2035: 903.498<sup>12</sup>
- Number of Households 2050: 942.902<sup>13</sup>

**Overall Economic Structure in Munich:**<sup>14</sup> The economy of Munich is particularly service-oriented compared to other major German cities. Highly GHG-emitting basic industries are not present. Most of the DAX-listed companies located there, which are also part of the "Climate Pact," have large administrative sites in Munich, some even their headquarters. Currently, only the BMW Group, MAN, and MTU Aerospace (as well as the city owned SWM) have high energy consumption in production facilities, whose generation is also considered in the European Emissions Trading System. Beyond this, the industry in Munich has little manufacturing that involves high-temperature processes, thereby achieving a low overall energy level while maintaining high value creation. There is no basic industry such as steel production or cement production with very high temperature requirements for process heat. As a result, the challenge of decarbonisation through electrification is significantly lower than in comparable German cities with similar industrial sector value creation. Due to the disproportionate share of administrative functions of large industrial companies in Munich (a high proportion of

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<sup>9</sup> LHM, Referat für Stadtplanung und Bauordnung, „LHM Demografiebericht“.

<sup>10</sup> LHM, Referat für Stadtplanung und Bauordnung.

<sup>11</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“, 21.

<sup>12</sup> Timpe u.a., 21.

<sup>13</sup> Timpe u.a., 21.

<sup>14</sup> LHM, „Munich Annual Economic Report 2024 – summary – Landeshauptstadt München – Referat für Arbeit und Wirtschaft“.



headquarters in large companies), it is not practical to rely on average data for the relevant industrial sectors at the federal level which makes accurate emission evaluation for Munich difficult.

In the commercial sector, the high number of small businesses is also relevant, which is estimated in ranges between 70,000-90,000 businesses, depending on the data source.<sup>15</sup> Munich's economy is driven by the tertiary sector, which includes services such as finance, insurance, real estate, consulting, and various business services. This sector contributes the largest share to the city's GDP and employs most of its workforce. The secondary sector, which encompasses manufacturing and construction, also plays a significant role, particularly in high-tech industries and automotive manufacturing. The primary sector, including agriculture and forestry, is small in both GDP contribution and employment. The number of companies is highest in the tertiary sector, reflecting the diverse range of services offered in Munich.

From a GHG emissions perspective, the dominance of the tertiary sector results in lower direct emissions compared to economies heavily reliant on manufacturing or primary industries. A challenge for Munich's service economy is also addressing the downstream and upstream (Scope-3) emissions of Munich's economy. Large businesses, which may have headquarters and offices within the city boundaries, but production facilities in other parts of the country or the world, may have the greatest potential for impact outside the city. On the consumption side, the overall affluent population of Munich also has a larger material impact in terms of Scope-3 emissions compared to other cities.

However, the existing secondary sector's activities, especially in production processes in more local, small, and medium sized enterprises, still contribute significantly to Munich's overall emissions. Economic growth still represents a major factor for growing Scope-1 and Scope-2 emission projections for Munich, with an estimated GDP Growth rate 1.5% per year for the next decades.<sup>16</sup> Efforts to reduce GHG emissions in Munich focus on increasing energy efficiency, transitioning to renewable energy sources, and implementing sustainable practices across all sectors, but spread across many **small and medium-sized enterprises (SMEs) as the most relevant stakeholder** group. Initiatives supporting larger cohorts SMEs in addressing their GHG-emissions may prove more impactful for climate neutrality targets in a city like Munich than engaging a few major industrial actors.

**Table 3: Employees per Sector**

Sector	Employees 2023	Change from 2022
Agriculture and Forestry	593	0.2%
Manufacturing	102,894	2.5%
Construction, Energy and Water Supply, Energy Industry	39,979	2.7%
Trade, Hospitality, Transport	161,670	2.2%
Information and Communication, Media	112,747	4.5%
Financial and Insurance Services	59,790	1.3%
Real Estate, Consulting, Business Services	241,767	1.9%
Public Administration	45,112	0.5%
Education and Teaching	36,499	2.2%
Health and Social Services	112,115	1.3%
Other Public and Private Services	47,168	2.4%
<b>Total</b>	<b>960,354</b>	<b>2.2%</b>

<sup>15</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“, 38.

<sup>16</sup> Timpe u.a., 21.



**Green Economy Sector Munich:** As defined by the Munich Green Economy Report from 2023,<sup>17</sup> the green economy is a cross-sectoral industry and includes all products and services that contribute to climate, environmental or resource protection. It covers six sectors defined as

- Energy efficiency and energy savings,
- Circular Economy and Circular Processes
- Mitigation and Protection Technologies
- Environmentally Friendly energy conversion, transport, and storage
- Environmentally friendly mobility
- Water management

Munich's Green Economy achieved a gross value added (GVA) of € 5.9 billion in 2022. With an increase of 7% p.a. since 2010, the green economy grew significantly faster than the overall economy in the region (4.3% p.a.) and counts about 7,800 active companies with 61,879 employees in 2022. A challenge remains both the overall lack of qualified talent - *Fachkräftemangel* – across all economic sectors in Munich (around 60% of positions take 2 months or longer to be filled), and a particularly high gender gap specifically in the green economy: Only 3.5% of women work for the green economy sectors, compared to 9% of Munich's male workforce. The difference is even more pronounced when looking at trainees.

**Table 4: Emission System Boundaries - Climate Neutrality Target by 2035**

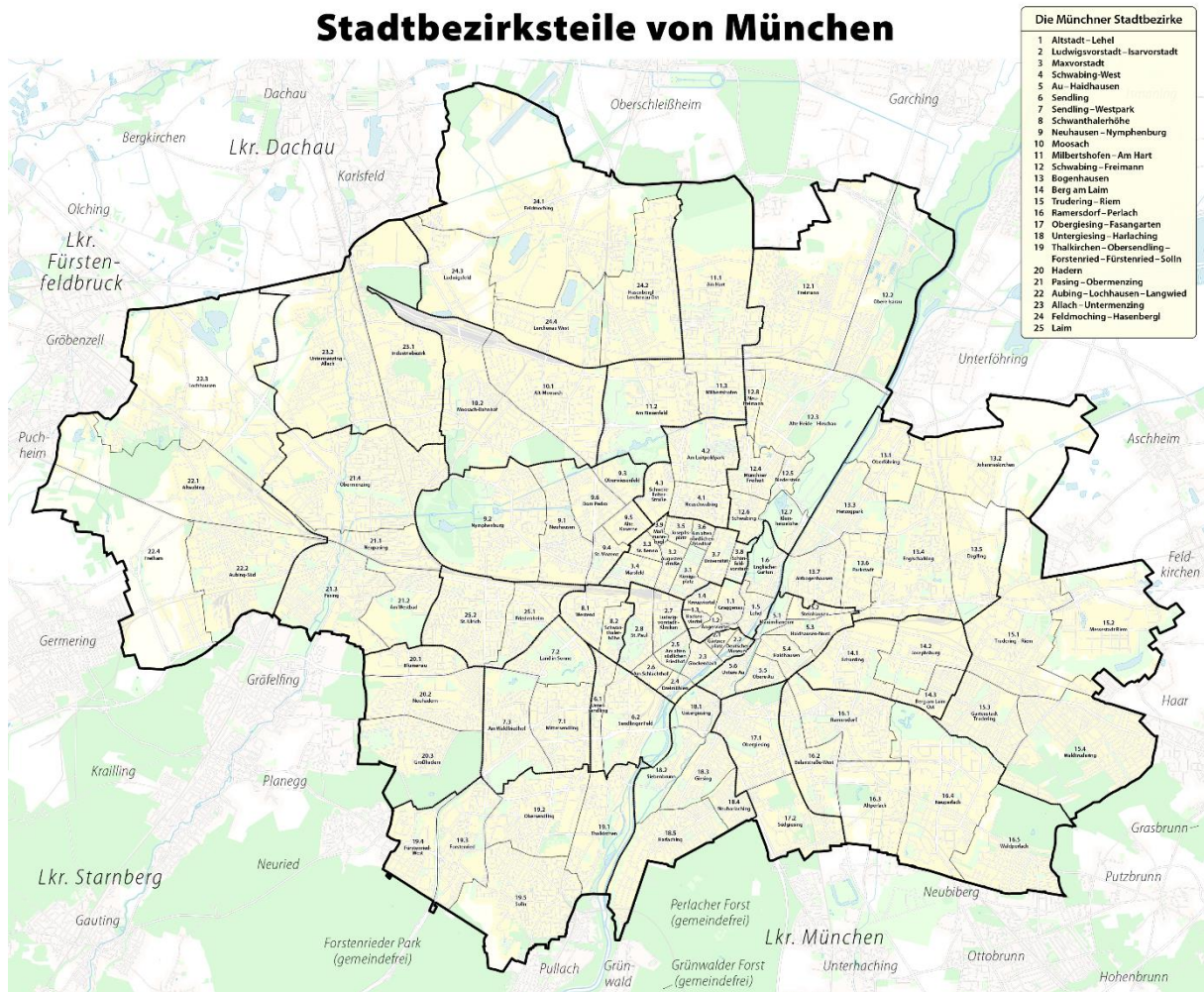
Sectors	Scope 1	Scope 2	Scope 3
<b>Stationary energy</b>	Included	Included	Included
	No Exclusions	No exclusions	(Included in Scope-1 and 2, based on inventory calculation method)
<b>Transport</b>	Included	Included	Excluded
	No exclusions	No exclusions	Excluded
<b>Waste/wastewater</b>	Included	Not applicable	Included
	No exclusions	Not applicable	No exclusions
<b>IPPU</b>	Excluded	Excluded	Excluded
	Excluded	Not applicable	Excluded
<b>AFOLU</b>	Excluded	Not applicable	Excluded

<sup>17</sup> LHM, „Umweltwirtschaft in der Region München – Strukturmerkmale, Innovations- und Gründungsgeschehen (2023) – Landeshauptstadt München – Referat für Arbeit und Wirtschaft“.



	Excluded	Not applicable	Excluded
<b>Other</b>	Not applicable	Not applicable	Not applicable
<b>Geographical boundary</b>	<b>Same as city administrative boundary</b>	<b>Smaller than city administrative boundary</b>	<b>Larger than city administrative boundary</b>
	<b>X</b>		

Figure 1: Map of Munich's Administrative Boundaries





## 2 Part A – Current State of Climate Action

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

### 2.1 Module A-1 Greenhouse Gas Emissions Baseline Inventory

#### GHG Emissions Baseline inventory

As an official baseline, the emissions inventory from 2018 is used as a point for relative comparison. In 2018, the CO<sub>2</sub> equivalent of calculated emissions per resident was 5.34 tons. The number of inhabitants in 2018 was 1,542,211. The total GHG-emissions calculated for Munich in 2018 therefore reached 8,235 kilo tons of CO<sub>2</sub> equivalent. This means Munich aims to achieve a reduction of GHG-emissions of over 94% by 2035, compared to the 2018 baseline. This value serves as the baseline for Munich’s contribution to the cities mission, as indicated during the Expression of Interest (EOI) to join the cities mission. Munich’s 2018 baseline inventory includes CO<sub>2</sub> emissions from the sectors stationary energy, transport, and waste / wastewater management. The sectors IPPU and AFOLU are excluded from the inventory.

In line with the Cities Mission requirements, this covers the entire city territory and all districts, includes Scope-1 and Scope-2 emissions for stationary energy and transport domains. To additionally cover Scope-1 and Scope-3 emissions for the waste and wastewater domain, an additional 237.5 kilo tons of CO<sub>2</sub> equivalent must be added to the official baseline total GHG-emissions inventory.

Emissions are reported in CO<sub>2</sub> equivalents and include CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O. The Global Warming Potential (GWP) of the gases follows the IPCC methodology with a GWP of 1 for CO<sub>2</sub>, a GWP of 25 for CH<sub>4</sub> and a GWP of 298 for N<sub>2</sub>O. All other GHGs (HFCs, PFCs, SF<sub>6</sub> and NF<sub>3</sub>) are excluded. The excluded GHGs only account for 1.6% of the total greenhouse gas emissions in Germany. Due to their low relevance and especially because of the difficulties in measuring them at the municipal level (these gases are emitted during product applications such as car air conditioning systems, commercial and industrial refrigeration, road asphaltting, and aluminium production), these GHGs were neglected.

In line with the Cities Mission requirements, this covers the entire city territory and all districts, includes Scope-1 and Scope-2 emissions for stationary energy and transport domains. To additionally cover Scope-1 and Scope-3 emissions for the waste and wastewater domain, an additional 237.5 kilo tons of CO<sub>2</sub> equivalent must be added to the official baseline total GHG-emissions inventory.

**Climate Neutrality Expert Survey:** To aggregate and provide the necessary data and information basis needed, Munich decided<sup>18</sup> to compile a **Climate Neutrality Expert Survey** (ger. “[Fachgutachten Klimaneutralität München 2035](#)”). The report was finished in 2022, and provides three scenarios for Munich based on the baseline inventory year 2018:

- For 2018, the total number of emissions calculated in the Climate Neutrality Expert Survey was 9,134 kilo tons of CO<sub>2</sub>e with 6.21 tons of CO<sub>2</sub>e per capita<sup>19</sup>. Those numbers differ significantly from the official baseline inventory mentioned above. A fundamental difference is that in this study all weather-dependent data are presented adjusted for temperature. In addition, the modelling of the heating sector in the scenarios is based on a different study in

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<sup>18</sup> Beschluss der Vollversammlung vom 22.07.2020 (Sitzungsvorlage Nr. 20-26 / V 00561)

<sup>19</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“.



which the basic data comes from 2017. This leads, among other things, to higher values for natural gas consumption. The heating oil consumption was also determined to be higher in the heat study than in the LHM's GHG monitoring. Further methodological differences relate to the emission factors used for electricity and district heating. This does not represent the official baseline of Munich or the MCM.

- A trend scenario for 2035 describes the developments expected by this reference year if there are no significant changes to the current foreseeable developments at the EU, federal, and state levels, and if the Munich does not implement any further intensified climate protection ambitions. This trend scenario works with underlying assumptions such as developments in emission factors or the impacts of projected population growth on Munich.
- A “target scenario” for 2035 describes the developments deemed possible by the defined target year for climate neutrality in Munich under the assumption that all measures are taken in a timely manner, but only achieve full and synergetic effect after 2035.
- A second “target scenario” with full climate neutrality around 0,38t of CO<sub>2</sub>e per capita for a fictional year “204X”, which describes potential time lags between actions taken and finally observing their full impact on GHG-emissions, including long-lasting infrastructures like buildings, energy networks, and transport routes will not be completed by 2035. This scenario deliberately does not specify a concrete year, as the exact final year of the full effect on climate neutrality depends on a variety of unforeseeable variables to interact.

**Maintaining Ambition in the face of methodological uncertainty:** The Climate Neutrality Expert Survey from 2022 serves as an important knowledge and information source for the MCM, but does not dictate its course of action or methodological considerations for Monitoring, Evaluation and Learning (MEL). The MCM refers to the political target of climate neutrality for 2035 and utilises the official 2018 inventory as a baseline, to maintain consistency and comparability to available data, rather than referring to the calculations of the Climate Neutrality Expert Survey. Scenarios under the Expert Survey are considered alongside other studies, reports, and information sources. New information and perspectives are also considered for the MCM as they become available (such as the 2024 final report on the improvement of data and information basis for Munich's heat plan<sup>20</sup>). This allows the MCM to remain agile and ambitious in the search for solutions to barriers that seem hard to overcome. Therefore, the 204X target scenario of the expert survey and its assumptions that the 2035 target may be hard to achieve, serves as an important piece of information MCM, but should not lead to inaction or to giving up on climate neutrality in 2035 which remains the MCM target as set by the city council.

**Methodological considerations for Munich's Baseline Inventory:** The GHG-Emission baseline data used for Munich's Climate City Contract is based on Munich's 2018 climate inventory, which was created with the Klimaschutzplaner tool according to the German BSKO standard and already used as a baseline for the Expression of Interest application of Munich to the Cities Mission. To ensure all data and information in the CCC refer to the same year and to avoid a mismatch between the inventory and the target scenario, 2018 was chosen as a common baseline year for the CCC as well (rather than mixing data points from different year). Future iterations of the CCC may update the baseline both in terms of reference year and methodology.

To follow the [Cities Mission Info Kit](#) and the [GPC](#), the available data and information have been partly recalculated and rearranged from the original BSKO methodology to match the sectoral composition of both frameworks. In some cases, this meant that new rounding error margins were created in the

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<sup>20</sup> FfE, „Abschlussbericht zum Projekt: Wärmestrategie München Verbesserung der Daten- und Analysegrundlage für die kommunale Wärmeplanung“, 105.



process. However, the values depicted here are already describing large scale scenarios and statistical data, which are not to be confused with directly measured values. To interpret the data depicted here in the CCC, it is important to recognise the high-level and modelled nature of these scenarios and values. They give an indication of the general directions and focus points of Munich's climate emissions, not an exact metric of reality.

Under acknowledgement of this disclaimer, Munich's CCC baseline data fulfil the Cities Mission's Info Kit requirements and the GPC BASIC reporting level, while already exceeding those requirements in that the Scope-3 Emissions on stationary energy are included indirectly in Scope-1 and Scope-2 by means of the emission factors used. The main data points missing for a full requirements coverage according to the next more ambitious reporting standard level, GPC BASIC+, are as follows:

- Data on Industrial Processes and Product Use (IPPU) other than energy-related emissions, which are already included in the Stationary Energy Sector
- Data on the effects of Agriculture, Forestry, and other Land Use (AFOLU), other than energy related emissions, which are already included in the Stationary Energy Sector
- Reliable estimates of Scope-3 Emissions on Transport (especially Flights) as well as Scope-3 Emissions based on product use, consumption, and grey energy.

The impact of missing data points on IPPU and AFOLU can be seen as negligible from the perspective of the Mission Info Kit's definition of minor emission sources and are not included in defining impact pathways and fostering climate action in Munich. Firstly, Munich's economic structure can be described as a service economy, with a smaller footprint of industrial processes and the associated non-energy related GHGs as described in the GPC. Most GHG-emissions resulting from economic activities result from energy use (both in terms of conventional heating, cooling and electricity use for buildings, as well as process energy use) and are therefore already included in the stationary energy sector. Secondly, the AFOLU sector is practically non-existent within Munich's territorial boundary and resulting emissions on Scope-1 and Scope-2 level are negligible compared the major emissions sources of Munich.

### Scope-3 Emissions and limitations of quantitative

**inventories:** However, Scope-1 and Scope-2 emissions are merely the measurable, reportable, and verifiable (MRV) "tip of the iceberg" regarding Munich's actual carbon footprint. The biggest challenge in terms of impact metrics comes from the territorial nature of Munich's climate inventory, which by and large excludes consumption-based emissions (note: except for **Scope-3**

**Emissions** of fossil fuel use, which are included in Munich's Scope-1 emissions of energy based on the applied emission factors). With a purchasing power of € 34,423 per inhabitant in 2023 and a per capita GDP of € 86,756 in 2021, Munich is one of the most affluent cities in Germany and Europe and has a high material footprint. According to one estimate by CircleEconomy as per the Circularity Gap Report for Munich from 2023, "2019, Munich consumed 47 million tonnes of virgin materials, meaning that the average Munich resident consumed 32 tonnes of virgin materials and was responsible for 23 tonnes of CO<sub>2</sub> equivalent (CO<sub>2</sub>e) that year. These figures are well above national, EU and global averages. Most importantly, Munich's material footprint is four times higher than what is estimated to be





'sustainable' level of consumption (8 tonnes per capita), while the carbon footprint is ten times higher than the global target set for 2030 to limit global warming to 1.5-degrees."<sup>21</sup> These estimates are significant and – even assuming a large error margin – demonstrate the key role of out-of-boundary, consumption-based emissions in Munich's carbon footprint. It is important to notice that these estimates cannot be considered in Munich's measurable, reportable, and verifiable (MRV) target setting under the CCC for two reasons:

- **Data Scope:** The available data around Scope-3 emissions are rough, macroscopic estimates that do not allow for quantitative climate action impact measurement and planning. In other words, the data can show how important the material footprint of Munich is in its journey to become climate neutral. But it does not support the monitoring or measuring of impact of individual climate actions.
- **Data Compatibility:** Currently, the methodologies used for estimating carbon emissions within the city boundary and outside the city boundary are not compatible or harmonised. National and international reporting efforts under the Cities Mission and beyond require strict avoidance of double counting of emissions to work. Counting Scope-3 emissions inevitably leads to double counting of most major emission data as per the current GHG-Inventory methodology and emission factors used, which already include an estimation model for Scope-3 emissions for primary energy consumption within the stationary energy sector.

### **Limitations of the Baseline Inventory and 2025 Action Plan Methodology for Impact**

**Quantification:** To ensure accurate monitoring of Munich's future climate action activities, it is important to measure the effects along with reasonable impact pathways. So far and in this document, the emission reductions calculated for the city administration's climate action measures must be seen as rough estimations which can't be linked to any existing impact pathways (Module B-2). The Munich Impact Model (MIM, Module B-1) with its focus on activity shifts aims to solve the existing hurdles regarding the monitoring of emission reduction impacts of measures as a basis for the iterative mission process to commence after January 2025. Especially for indirect or enabling measures, where impacts can rarely be calculated for individual measures as a direct causal link to emission reductions, the focus on activity shifts moves the spotlight from the impact assessment of single measures to a more broad and comprehensive depiction of portfolios of measures working together to shift from higher to lower carbon intensive activities and achieve a joint, quantifiable impact.

As the climate action portfolio (Module B-2) under the first submission of the Action Plan in 2025 consists exclusively of measures of the city administration and does not yet include non-administrative actor projects, the estimated emission reductions (Module A-2, Table 12, column 5) do not cover the identified emission gaps to reach Munich's climate neutrality target. Three major methodological considerations need to be considered:

- 1) **Measures and projects taken by non-administrative stakeholders are not accounted for in 2025.** The first iteration of the Action Plan provides a macroscopic overview of emission inventories and scenarios across the entire city territory in Part A, while only mapping known public sector actions covered by the municipal budget in Part B. The Action Plan thereby sets a fundamental basis and frame for actors from other sectors to report and contextualize their projects and measures towards in the future. However, all such measures from other actors already underway are not yet accounted for in the first iteration of the Action Plan.

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<sup>21</sup> Conde u.a., „The Circularity Gap Report Munich“, 6.



- 2) **Unaccounted Emission Reductions may require co-creation of additional measures:** To reach the goal of climate neutrality, more climate action measures may need to be identified and implemented with city stakeholders, e.g. through the work of MCM's Transition Team.
- 3) **Low reliability of accounted emissions reduction estimates:** In the 2025 version of the Action Plan, the underlying assumptions of emission reduction measures listed in Part B have been adopted from data sources without methodological documentation available to the MCM Unit Team. They can therefore not be seen as scientifically reliable. For future iterations of Action Plan, more detailed impact planning and measurement according to the MIM will be necessary to replace, confirm or disconfirm these estimated values, while also providing detailed measurement of future measures of the action plan according to the same methodology.

**Action beyond Data:** Focusing on emission sources included in the sectors of stationary energy, transport and waste, some climate action related measures won't have an impact on the city's emission inventory. As explained above, this relates mostly to Scope 3 measures in the field of circular economy, climate adaptation or value chain decarbonisation. This won't be an excluding criterion for Scope 3 measure development, as they still are able to contribute to climate protection and have a potential positive effect to an activity shift. Therefore, a qualitative approach to action planning and activity shifts is as important as a quantitative one. Following the principle of *Machen statt Messen* (engl. "Act, don't measure"), meaning that Munich and the MCM also embraces climate action measures derived from a qualitative rationale, even in the absence of adequate data to prove their impact.

**Reporting:** Munich reported its emission data inventory to the MyCovenant platform once for 2019. The baseline inventory of 2018 was not uploaded to the platform. Starting 2025, reporting will be implemented via CDP-ICLEI in accordance with GPC, covering all reporting requirements under the Covenant of Mayors and the Cities Mission.



## Energy consumption, activity data, emission factors used and total emissions per sector for Munich's inventory baseline

Following tables show the data used to calculate Munich's emission baseline inventory 2018.

**Table 5: Final energy use by source sectors**

Base year	2018 (Population: 1.542.211)		
Unit	MWh per capita; GWh		
	Scope 1	Scope 2	Scope 3
<b>Stationary Energy</b>	<b>4.7 MWh per capita; 7,462 GWh</b>	<b>6.8 MWh per capita; 11.050 GWh</b>	(included in Scope 1&2)
Natural Gas	4.0 MWh per capita; 6,230 GWh	n/a	(included in Scope 1)
District Heat	n/a	2.5 MWh per capita; 4,237 GWh	(included in Scope 2)
Local Heat	n/a	0.1 MWh per capita; 154 GWh	(included in Scope 1)
Environmental Heat	n/a	0.1 MWh per capita; 154 GWh	n/a
Fuel oil	0.7 MWh per capita; 1,077 GWh	n/a	(included in Scope 1)
Power	n/a	4.1 MWh per capita; 6,505 GWh	(included in Scope 2)
<b>Transport</b>	<b>3.4 MWh per capita; 5,214.4 GWh</b>	<b>0.2 MWh per capita 357 GWh</b>	Excluded
Petrol (fossil)	1.3 MWh per capita 2,337 GWh	n/a	Excluded
Petrol (bio)	0.1 MWh per capita 105 GWh	n/a	Excluded
CNG (fossil)	0.0 MWh per capita 8.3 GWh	n/a	Excluded
CNG (bio)	0.0 MWh per capita 2.4 GWh	n/a	Excluded
Diesel (fossil)	1.9 MWh per capita 2,937 GWh	n/a	Excluded
Diesel (bio)	0.1 MWh per capita 155 GWh	n/a	Excluded
Kerosene	0.0 MWh per capita 0 GWh	n/a	Excluded
LPG	0.0 MWh per capita 51.1 GWh	n/a	Excluded
Electricity	n/a	0.2 MWh per Capita 357 GWh	Excluded



Table 6: Activity by source sectors

Base year 2018		Population: 1.542.211	
Stationary Energy	Scope 1	Scope 2	Scope 3
		see Table A-1.1	see Table A-1.1
Transport	Scope 1	Scope 2	Scope 3
	Vehicle Kilometres (Vkm)		
Electric cars	0	8,248,585,323	0
Diesel busses	58,385,506	0	0
Diesel cars	2,830,549,326	0	0
Electric busses	0	46,565	0
Electric motorbikes	0	802,666	0
Natural gas cars	9,012,240	0	0
LPG cars	50,317,506	0	0
Fuel motorbikes	105,985,237	0	0
Fuel cars	2,775,927,324	0	0
Trams and light rail	0	53,989,548	0
Ton Kilometres (Tkm)			
Heavy trucks (electric)	0	518,068	0
Heavy trucks (diesel)	2,325,906,267	0	0
Heavy trucks (gas)	1,203,857	0	0
Rail freight (diesel)	586,867,331	0	00
Rail freight (electric)	0	1,019,316,208	0
Person Kilometres (Pkm)			
Rail passenger transport (diesel)	101,936,659		0
Rail passenger transport (electric)		723,547,224	0
Waste	Scope 1	Scope 2	Scope 3
	Metric tons		
Solid Waste Landfill	0	0	5,512
Solid Waste Incineration	0	0	371,984
Compostable Waste	30,640	0	26,881
Digestible waste	17,473	0	0
Recycling	177,879	0	0
Waste water	Scope 1	Scope 2	Scope 3
	Cubic metres (m <sup>3</sup> )		
Waste Water	108,542,800	0	59,591,151



Table 7: Applied emission factors

Stationary	Scope 1	Scope 2	Scope 3	Year	Data Source
	t CO2e per MWh				
Natural Gas	0,247	0	0	2018	Klimaschutz-Planer
District Heat	0	0,215	0	2018	Klimaschutz-Planer
Local Heat	0	0,116	0	2018	Klimaschutz-Planer
Environmental Heat	0	0,17	0	2018	Klimaschutz-Planer
Fuel Oil	0,318	0	0	2018	Klimaschutz-Planer
Electricity	0	0,544	0	2018	IFEU
Transport	Scope 1	Scope 2	Scope 3	Year	Data Source
	t CO2e per MWh				
Petrol (fossil)	0,3216	0	0	2018	IFEU
Petrol (bio)	0,1123	0	0	2018	IFEU - Biodiesel
CNG (fossil)	0,2485	0	0	2018	IFEU
CNG (bio)	0,0344	0	0	2018	IFEU - Biogas
Diesel (fossil)	0,3264	0	0	2018	IFEU
Diesel (bio)	0,1123	0	0	2018	IFEU
Kerosene	0,3222	0	0	2018	IFEU
LPG	0,2904	0	0	2018	IFEU
Electricity	0	0,544	0	2018	IFEU
Waste	Scope 1	Scope 2	Scope 3	Year	Data Source
	g CO2e per metric ton				
Solid Waste Landfill	644	0	644	2006	IFEU
Solid Waste Incineration	455	0	455	2006	IFEU
Compostable Waste	179.5	0	179.5	2006	IPCC
Digestible waste	22.8	0	22.8	2021	UK NAEI
Recycling	0	0	0	-	-
Waste water	Scope 1	Scope 2	Scope 3	Year	Data Source
	g CO2e per m <sup>3</sup>				
Waste water	320	0	320	2021	UK NAEI



Table 8: GHG emissions by source sectors

Basic Data	Base year: 2018			Population: 1.542.211		
Unit	kt CO2e			kt CO2e per Capita		
	Scope 1	Scope 2	Scope 3	Scope 1	Scope 2	Scope 3
<b>Stationary Energy</b>	<b>1.913,5</b>	<b>4.493.7</b>	<b>0,0</b>	<b>1,2</b>	<b>2,8</b>	<b>0,0</b>
Natural Gas	1538,9	0.0	0.0	1,00	0.0	0.0
District Heat	0.0	869,6	0.0	0.0	0,56	0.0
Local Heat	0.0	17.9	0.0	0,02	0.0	0.0
Environmental Heat	0.0	26.2	0.0	0.0	0.0	0.0
Fuel Oil	342.5	0.0	0.0	0,22	0.0	0.0
Electricity	0.0	3,528.7	0.0	0.0	2,22	0.0
<b>Transport</b>	<b>1,634.3</b>	<b>194.2</b>	<b>0.0</b>	<b>1.1</b>	<b>0.1</b>	<b>0.0</b>
Petrol (fossil)	632.6	0.0	0.0	0.4	0.0	0.0
Petrol (bio)	11.6	0.0	0.0	0.0	0.0	0.0
CNG (fossil)	1.7	0.0	0.0	0.0	0.0	0.0
CNG (bio)	0.1	0.0	0.0	0.0	0.0	0.0
Diesel (fossil)	958.6	0.0	0.0	0.6	0.0	0.0
Diesl (bio)	17.4	0.0	0.0	0.0	0.0	0.0
Kerosene	0.0	0.0	0.0	0.0	0.0	0.0
LPG	12.5	0.0	0.0	0.0	0.0	0.0
Electricity	0.0	194.2	0.0	0.0	0.1	0.0
<b>Waste</b>	<b>40.7</b>	<b>0.0</b>	<b>196.7</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>
Solid Waste Landfill	0.0	0.0	3.6	0.0	0.0	0.0
Solid Waste Incineration	0.0	0.0	169.3	0.0	0.0	0.0
Compostable Waste	5.5	0.0	4.8	0.0	0.0	0.0
Digestible waste	0.4	0.0	0.0	0.0	0.0	0.0
Recycling	0.0	0.0	0.0	0.0	0.0	0.0
Waste water	34.8	0.0	19.1	0.0	0.0	0.01
<b>Total</b>	<b>3,588.4</b>	<b>4,687.9</b>	<b>196.7</b>	<b>2.3</b>	<b>2.9</b>	<b>0.01</b>



## Addressing residual emissions



To take responsibility for residual emissions in the target year 2035 Munich will consider implementing measures inside or outside its city boundary (e.g. natural carbon sinks) and the compensation of remaining emissions through carbon credits (in that order). The Climate Neutrality Expert Survey highlighted some potential measures for Munich:

- **Renewable Energy Expansion Offensive (since 2008):** City utilities SWM generate as much electricity from renewable sources in its own facilities by the year 2025 as the total electricity consumption of the city of Munich. This pertains to a purely accounting-based consideration of generated and consumed electricity quantities. At the end of 2020, the City Council decided to continue and adapt the Renewable Energy Expansion Offensive beyond 2025. Due to the expected significant increase in electricity demand in the coming years, this goal is being adjusted accordingly. The rising electricity demand is driven by the growing population and an increasing need for electricity due to the rising number of heat pumps and the gradual shift towards e-mobility, including the electrification of the city utilities' bus fleet.
- **CO<sub>2</sub> sequestration by purchasing forested areas and reforestation:** To achieve the goal of climate neutrality by 2035, the city of Munich plans to sequester carbon from the atmosphere into biomass through the purchase of forested areas and the reforestation of agricultural and grassland. Studies estimated the CO<sub>2</sub> reduction effects from the purchase of 10 hectares of forest per year at nearly 120,000 tons of CO<sub>2</sub> over a period of 10 years. Through the reforestation of a total of 5 hectares of arable or grassland each year, approximately 7,700 tons of CO<sub>2</sub> are expected to be sequestered in biomass over a 10-year period. After 80 years, the CO<sub>2</sub> sequestration is projected to increase to about 290,000 tons of CO<sub>2</sub>. The CO<sub>2</sub> reduction effects of both measures presented in the reports have been estimated to be very high.
- **Boglands as a climate protection measure:** The City of Munich is identifying specific bogland areas in the surrounding region that are suitable for rewetting. Given that there are relatively few reference projects, these areas have the potential to serve as model projects with significant radiating value.
- **CO<sub>2</sub> compensation:** The City of Munich is considering the calculative offset of remaining emissions through the purchase of compensation credits from projects with high standards.
- **Withdrawal of emission rights from the EU emissions trading market:** In the EU Emissions Trading System (EU ETS) for industrial installations, a maximum allowable number of emissions is defined and reduced over time. This creates the opportunity to withdraw emission rights from the trading system as part of a compensation measure, without these rights being used for actual emissions. In this way, participating actors in the system are incentivised to reduce their emissions more significantly than would be permitted by the total amount of available emission rights. To achieve this effect, the city can commission an entity to purchase emission rights to the required extent and withdraw them from the market, ensuring that they cannot be utilised for emissions from installations covered by the trading system.

## 2.2 Module A-2 Current Policies and Strategies Assessment

Munich’s operating space to create and implement strategies, policies and measures for climate action is defined by a complex multi-level architecture of policies and regulations on regional (*Länder*), national and supra-national level. This regulatory landscape with its complex interactions and interdependencies between policies, laws and regulations across levels prevents is constantly changing and beyond comprehensive systemic analysis or mapping. Additionally, due to the transversal and systemic nature of climate change and its underlying causes, there is a plethora of policies and regulations with direct or indirect impact on climate change mitigation, which are not explicitly labelled or identifiable as “climate policies”. Any listing or mapping of climate policies therefore remains incomplete, and systemic boundaries of the multi-level climate policy architecture remain in flux. However, the list below attempts to provide reference to some key elements of this policy landscape with relevance for climate action in Munich.


**Table 9: Policies and regulations on supra-national, national, and regional level**

Name	Level	Description and Link	Addressed Sectors
<a href="#">The 2030 agenda for Sustainable Development</a>		<p>The 2030 Agenda for Sustainable Development, adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.</p>	All
<a href="#">Paris Agreement</a>		<p>To tackle climate change and its negative impacts, world leaders at the UN Climate Change Conference (COP21) in Paris reached a breakthrough on 12 December 2015: the historic Paris Agreement.</p> <p>The Agreement sets long-term goals to guide all nations to:</p> <ol style="list-style-type: none"> <li>1) substantially reduce global greenhouse gas emissions to hold global temperature increase to well below 2°C above pre-industrial levels and pursue efforts to limit it to 1.5°C above pre-industrial levels,</li> <li>2) periodically assess the collective progress towards achieving the purpose of this agreement and its long-term goals,</li> <li>3) provide financing to developing countries to mitigate climate change, strengthen resilience and enhance abilities to adapt to climate impacts.</li> </ol>	All






		The Agreement is a legally binding international treaty. It entered into force on 4 November 2016. Today, 195 Parties (194 States plus the European Union) have joined the Paris Agreement.	
<a href="#"><u>Kunming-Montreal Global Biodiversity Framework</u></a>		The Kunming-Montreal Global Biodiversity Framework (GBF) was adopted at the Convention on Biological Diversity's (CBD) 15th Conference of the Parties (COP) in December 2022. Hailed as a historic landmark for biodiversity conservation and agreed upon by 195 countries, the GBF consists of four goals setting a vision for 2050 of a world living in harmony with nature and 23 action-oriented targets aimed at halting and reversing biodiversity loss by 2030. The GBF's most prominent targets include the restoration of 30% of degraded ecosystems globally and the conservation and management of 30% of land, inland water and marine and coastal areas by 2030. It also includes provisions relating to reducing species extinction and risks from pesticides and pollution, as well as the sustainable management of wild species and of areas under agriculture, fisheries and forestry. Another important target is the reduction of the rate of introduction and establishment of invasive alien species (IAS) by at least 50% by 2030. Moreover, the targets commit to mobilising financial resources for biodiversity of at least US\$200 billion per year by 2030 from public and private sources and identifying and eliminating at least US\$500 billion of annual subsidies harmful to biodiversity. Financing flows, therefore, need to be increased from US\$120-150 billion to US\$700-1000 billion per year by 2030 to bridge the biodiversity financing gap.	
<a href="#"><u>European Green Deal</u></a>		The European Green Deal aims to transform the EU into a modern, resource-efficient and competitive economy, ensuring "no net emissions of greenhouse gases by 2050", "economic growth decoupled from resource use" and "no person and no place left behind". Key targets of the green deal are to turn Europe into the first climate-neutral continent by 2050, emitting least 55% less net greenhouse gas emissions by 2030 compared to 1990 levels and to plant 3 billion additional trees to in the EU by 2030.	All
<a href="#"><u>European Climate Law</u></a>		The European Climate Law writes into law the goal set out in the European Green Deal for Europe's economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. Climate neutrality by 2050 means achieving net	All






		<p>zero greenhouse gas emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment. The law aims to ensure that all EU policies contribute to this goal and that all sectors of the economy and society play their part.</p>	
<p><a href="#">Fit for 55</a></p>		<p>'Fit for 55' is a legislative package proposed in 2021 and implemented over the subsequent years, which is expected to reduce EU net greenhouse gas emissions by 57% by 2030. Key features include "Cutting carbon, pricing emissions, investing in people» and revising EU emissions trading system to include new sectors of the economy like transport and heating fuels, and shipping. It also includes a Social Climate Fund dedicating 65 billion euros from the EU budget, and over 86 billion euros in total to support to the most vulnerable citizens and small businesses with the green transition. A Carbon Border Adjustment Mechanism ensures that imported products will also pay a carbon price at the border in the sectors covered. In combination with the EU Emissions Trading System, it reduces the risk of 'carbon leakage', whereby companies would move their production out of Europe to countries with less strict environmental standards. Fit for 55 also includes a revised Renewable Energy Directive sets the EU's binding renewable energy target for 2030 at a minimum of 42.5%, up from the previous 32% target. In practice, this would almost double the existing share of renewable energy in the EU. It is also agreed that Europe will aim to reach 45% of renewables in the EU energy mix by 2030. On transportation, new CO2 standards regulation will ensure that all new cars and vans registered in Europe will be zero-emission by 2035. The new Regulation for the deployment of alternative fuels infrastructure (AFIR) sets mandatory deployment targets for electric recharging and hydrogen refuelling infrastructure along European roads. ReFuelEU Aviation sets out EU-wide harmonised rules for the promotion of sustainable aviation fuels (SAF), with an increasing minimum share of SAF required to be blended with kerosene by aviation fuel suppliers and supplied to EU airports. The FuelEU Maritime Regulation will promote the uptake of renewable and low-carbon fuels through the establishment of a target for gradual reductions for the annual average GHG intensity of the energy used onboard by ships.</p>	<p>All</p>






<p><a href="#"><u>EU taxonomy for sustainable activities</u></a></p>		<p>The Taxonomy Regulation establishes six climate and environmental objectives:</p> <ol style="list-style-type: none"> <li>1. Climate change mitigation</li> <li>2. Climate change adaptation</li> <li>3. The sustainable use and protection of water and marine resources</li> <li>4. The transition to a circular economy</li> <li>5. Pollution prevention and control</li> <li>6. The protection and restoration of biodiversity and ecosystems</li> </ol> <p>Different means can be required for an activity to make a substantial contribution to each objective. Under the Taxonomy Regulation, the Commission had to come up with the actual list of environmentally sustainable activities by defining technical screening criteria for each environmental objective through <a href="#"><u>delegated and implementing acts</u></a>.</p>	<p>All</p>
<p><a href="#"><u>Corporate Sustainability Reporting Directive (CSRD)</u></a></p>		<p>On 5 January 2023, the <a href="#"><u>Corporate Sustainability Reporting Directive (CSRD)</u></a> entered into force. It modernises and strengthens the rules concerning the social and environmental information that companies have to report. A broader set of large companies, as well as listed SMEs, will now be required to report on sustainability. Some non-EU companies will also have to report if they generate over EUR 150 million on the EU market.</p> <p>The new rules will ensure that investors and other stakeholders have access to the information they need to assess the impact of companies on people and the environment and for investors to assess financial risks and opportunities arising from climate change and other sustainability issues. Finally, reporting costs will be reduced for companies over the medium to long term by harmonising the information to be provided.</p> <p>The first companies will have to apply the new rules for the first time in the 2024 financial year, for reports published in 2025.</p> <p>Companies subject to the CSRD will have to report according to European Sustainability Reporting Standards (ESRS).</p>	<p>All</p>
<p><a href="#"><u>Nature Restoration Law</u></a></p>		<p>The Nature Restoration Law is the first continent-wide, comprehensive law of its kind. It is a key element of the EU Biodiversity Strategy, which sets binding targets to restore degraded ecosystems, in particular those with the most potential to capture and store carbon and to prevent and reduce the impact of natural disasters. Europe's nature is in alarming</p>	<p>/</p>






		decline, with more than 80% of habitats in poor condition. Restoring wetlands, rivers, forests, grasslands, marine ecosystems, and the species they host will help increase biodiversity, secure the things nature does for free, like cleaning our water and air, pollinating crops, and protecting us from floods, limit global warming to 1.5°C, build up Europe's resilience and strategic autonomy, preventing natural disasters and reducing risks to food security.	
<a href="#"><u>National Energy and Climate Plan 2021-2023, Germany</u></a>		Germany's integrated National Energy and Climate Plan (NECP) under the European Climate Law provides an overview of the country's energy and climate policy as well as the current status of plans in these areas. Among other targets, it declares Germany's national climate goal to reach at least -55 % GHG-emission by 2030 compared to 1990 as contribution to the European Climate Law.	All
<a href="#"><u>Federal Climate Protection Act (KSG)</u></a>		The Federal Climate Protection Act (ger. Klimaschutzgesetz, KSG) is a German federal law that aims to ensure the fulfilment of national climate protection goals and compliance with European target specifications. With the Climate Protection Act, the climate protection and sector goals established in the Climate Protection Plan 2050 were legally anchored for the first time: greenhouse gas emissions are to be reduced by at least 65% below the reference value of 1990 by 2030, by at least 88% by 2040. Net greenhouse gas neutrality is to be achieved by 2045. In addition, the law sets annual reduction targets for the period up to 2040. Maximum annual emission levels are also specified for various economic sectors until 2030.	All
<a href="#"><u>Building Code (BauGB)</u></a>		The building planning law regulated in the Building Code (ger. Baugesetzbuch, BauGB) has far-reaching significance for the construction of renewable energy facilities and their use. It primarily regulates the planning permission for these facilities, which is binding for the federal states and municipalities. It also defines the ability of local authorities to implement specific and ambitious regulatory requirements for new and existing buildings on key aspects for climate neutrality. According to the BauGB, areas can be designated where certain renewable energy facilities such as wind turbines, hydrogen plants, or photovoltaic systems can be preferentially constructed. To further accelerate and simplify expansion, as of January 1, 2023, solar systems have been included in the provision of building law privilege under certain conditions (localization in 200-meter strips along highways and	Stationary Energy






		<p>railway lines of the superior network, as well as agri-PV systems in spatially functional connection with agricultural, forestry, and horticultural operations). Limitations in the BauGB for climate neutrality in cities include that cities cannot declare resource requirements, construction material requirements or process requirements for sustainable buildings, which would be necessary for tackling Scope-3 emissions in the built environment.</p>	
<a href="#"><u>Building Energy Act (GEG)</u></a>		<p>The Building Energy Act (<i>ger. Gebäudeenergie-gesetz, GEG</i>) contains requirements for the energy efficiency of buildings, the creation and use of energy certificates, as well as the use of renewable energy in buildings. For new buildings, there is a permissible annual primary energy demand that must be no more than 55% of a reference building. Additionally, the GEG aims to promote the replacement of heating systems. Municipalities have a role model function and must also comply with certain requirements for public buildings, such as the use of renewable energy in new construction and renovations.</p>	Stationary Energy
<a href="#"><u>Federal Funding for Efficient Buildings (BEG)</u></a>		<p>The Federal Funding for Efficient Buildings (<i>ger. Bundesförderung für effiziente Gebäude, BEG</i>) combines previous funding programs for promoting energy efficiency and renewable energy in the building sector, and supports the use of new heating systems, optimization of existing heating systems, measures on the building envelope, and the use of optimized equipment technology. The funding includes three sub-programs that relate to residential buildings, non-residential buildings, and individual measures. Municipalities can receive subsidies for measures in all three sub-programs through the funding.</p>	Stationary Energy
<a href="#"><u>Renewable Energy Act (EEG)</u></a>		<p>The aim of the Renewable Energy Act (<i>ger. Erneuerbare Energien Gesetz, EEG</i>) is to implement the transition to renewable energy. The share of electricity generated from renewable energy sources is to be increased to at least 80% of gross electricity consumption in Germany by 2030. The law regulates the power feed-in by grid operators and the associated compensation. In addition, the law regulates the origin and regional proof of the electricity to create transparency. Municipalities are to be financially involved by local plant operators, although this contribution by the operators is voluntary, they can demand reimbursement from grid operators. Overall, the financial contribution can amount to up to 0.2 cents/kilowatt hour.</p>	All







		In an <a href="#">updated version of the EEG from July 29, 2022</a> , it was legally established that renewable energies are in the overriding public interest and serve public safety. This is crucial to increase the pace of expansion. In future balancing decisions, renewable energies will have priority over other interests. This means that the pace of planning and approval procedures can be significantly increased.	
<a href="#">Biomass Regulation (BiomasseV)</a>		The Biomass Regulation (ger. Biomasseverordnung, BiomasseV) regulates the use of biomass as a renewable energy source in Germany. It defines for the scope of the Renewable Energy Act, which substances are considered to be biomass, which technical processes for electricity generation from biomass fall within the scope of the Act, and which environmental requirements must be met when generating electricity from biomass. It sets standards for sustainability criteria, greenhouse gas emissions, and the use of waste materials. The aim is to promote the use of biomass for energy production while ensuring that it is produced in an environmentally and socially responsible manner. The Biomass Regulation applies to the production of electricity, heat, and biofuels from biomass.	Stationary Energy
<a href="#">Combined Heat and Power Act (KWKG)</a>		The Combined Heat and Power Act (ger. Kraft-Wärme-Kopplungsgesetz, KWKG) aims to increase the net electricity generation from combined heat and power plants to 110 terawatt hours by 2020 and 120 terawatt hours by 2025. Financed originally by a levied surcharge (ger. Umlage) and since 2022 by the federal government, the CHP Act regulates the subsidies for plants that produce both electricity and heat. The financial support consists of a time-limited supplementary payment. In addition, the federal government intends to strengthen the energy transition and climate protection with an increasing number of CHP plants, as well as to provide flexible compensation for the fluctuating energy supply from volatile renewable sources.	Stationary Energy
<a href="#">Energy Industry Act (EnWG)</a>		The purpose of the Energy Industry Act (ger. Energiewirtschaftsgesetz, EnWG) is to provide the public with a secure, cost-effective, consumer-friendly, efficient, environmentally friendly, and greenhouse gas-neutral supply of electricity, gas, and hydrogen, increasingly based on renewable energies. The regulation of electricity and gas supply networks serves the goals of ensuring effective and unbiased competition in the supply of electricity and gas, securing a long-term, efficient, and reliable operation of energy supply networks, as well as optimizing the	Stationary Energy








		overall energy supply. To achieve the goals, the regulation takes into account the forward-looking expansion, optimized use, and digitization of energy supply networks, the generation and use of electricity from renewable energies and hydrogen, the flexibility in the electricity system, including the use of energy storage, and the appropriate distribution of network costs in connection with the expansion of electricity generation from renewable energies. The law also aims to implement and enforce European Union law in the area of energy supply.	
<a href="#"><u>Network Expansion Acceleration Act (NABEG)</u></a>		<p>The Network Expansion Acceleration Act (ger. Netzausbaubeschleunigungsgesetz, NABEG) aims to accelerate the expansion of cross-border and international high-voltage power lines in accordance with the Energy Industry Act. The law is intended to provide the basis for a legally secure, transparent, efficient, and environmentally friendly expansion and upgrading of the transmission network.</p> <p>The law primarily regulates the federal planning of route corridors and the approval process. Accordingly, with the approval of the Federal Council, the Federal Network Agency can be authorized by the federal government to carry out the corresponding approval procedures, including application conferences, hearings, environmental impact assessments (EIA), and approval decisions.</p>	All
<a href="#"><u>Greenhouse Gas Emissions Trading Act (TEHG)</u></a>		<p>The Greenhouse Gas Emissions Trading Act (ger. Treibhausgas-Emissionshandelsgesetz, TEHG) forms the legal basis for national trading of allowances for greenhouse gas emissions in Germany within the EU-wide Emissions Trading System (EU ETS). It serves to implement the EU Emissions Trading Directive of October 13, 2003 (ETS Directive).</p> <p>Additional regulations within the TEHG are set by the German Emissions Trading Directive 2030 (ger. Emissionshandelsverordnung 2030, EHV 2030).</p>	All
<b>Energieverbrauchsrelevante-Produkte-Gesetz (EVPG)</b>		<p>The Energy-related Products Act (EVPG) is crucial for climate mitigation in Germany as it enforces the EU's Eco-design Directive, which sets standards for the energy efficiency and environmental impact of products. By ensuring that products meet these stringent eco-design requirements, the EVPG helps reduce energy consumption and greenhouse gas emissions across various sectors. This contributes significantly to Germany's</p>	All



		broader climate goals, including achieving greenhouse gas neutrality by 2045.	
<b>Energiesteuergesetz (EnergieStG)</b>		The Energiesteuergesetz, or Energy Duty Act, plays a significant role in climate mitigation in Germany by imposing taxes on various energy products, including fuels and electricity. This taxation incentivizes energy efficiency and the use of cleaner energy sources by making fossil fuels more expensive. The revenue generated from these taxes is often reinvested in renewable energy projects and other climate protection measures, thereby supporting Germany's goal of reducing greenhouse gas emissions and achieving climate neutrality by 2045	All
<b>Energieverbrauchskennzeichnungsgesetz (EnVKG)</b>		The Energieverbrauchskennzeichnungsgesetz (EnVKG), or Energy Consumption Labelling Act, is vital for climate mitigation in Germany as it mandates the labelling of energy consumption and other key resource usage for products, vehicles, and tires. By providing clear information on energy efficiency and CO2 emissions, the EnVKG empowers consumers to make environmentally conscious choices, thereby promoting the use of energy-efficient products. This contributes to reducing overall energy consumption and greenhouse gas emissions, aligning with Germany's climate goals	Stationary Energy
<b>Stromnetzentgeltverordnung (StromNEV)</b>		The Stromnetzentgeltverordnung (StromNEV), or Electricity Network Charges Ordinance, is important for climate mitigation in Germany as it regulates the fees for accessing electricity networks. By ensuring fair and transparent pricing, it encourages the integration of renewable energy sources into the grid. This helps to balance the costs associated with the transition to renewable energy, making it more economically viable and promoting a cleaner energy mix. Additionally, specific provisions within the StromNEV support the financial viability of renewable energy projects, further aiding Germany's climate goals	Stationary Energy
<b>Brennstoffemissionshandelsgesetz (BEHG)</b>		The Brennstoffemissionshandelsgesetz (BEHG), or Fuel Emissions Trading Act, establishes a national emissions trading system for fuel emissions not covered by the EU Emissions Trading Scheme (ETS). Implemented as part of Germany's 2030 climate package, the BEHG mandates the purchase of emission certificates for fuels like natural gas, heating oil, and gasoline. This creates a financial incentive to reduce CO2 emissions by making fossil fuels more expensive. The revenue generated is used to fund climate protection measures, contributing to Germany's goal of	Stationary Energy



		achieving greenhouse gas neutrality by 2045	
<b>Energiedienstleistungsgesetz (EDL-G)</b>		The Energiedienstleistungsgesetz (EDL-G), or Energy Services Act, mandates energy audits and the implementation of energy management systems for large enterprises in Germany. By requiring these companies to regularly assess and improve their energy efficiency, the EDL-G helps reduce greenhouse gas (GHG) emissions. The act aligns with the EU Energy Efficiency Directive and aims to lower primary energy consumption, thereby supporting Germany's climate mitigation efforts. Through systematic energy audits and management, businesses can identify and implement measures to reduce energy use and emissions, contributing to the country's goal of achieving climate neutrality by 2045	Stationary Energy
<b>Heat Planning Act (WPG)</b>		The Wärmeplanungsgesetz (WPG), or Heat Planning Act in Germany aims to facilitate the strategic planning and decarbonization of heating networks across the country. It mandates local authorities to develop comprehensive heat planning strategies that outline how to transition to renewable energy sources for heating and cooling purposes in buildings. The law emphasizes the need for a systematic approach to expand and modernize heating infrastructure, ensuring that it aligns with climate protection goals and contributes to reducing greenhouse gas emissions. By promoting the integration of sustainable energy solutions, the Heat Planning Law seeks to create a more efficient and environmentally friendly heating sector, ultimately supporting Germany's broader climate objectives.	Stationary Energy
<b>Bavarian Climate Protection Act (BayKlimaG)</b>		The Bavarian Climate Protection Act aims for Bavaria to achieve climate neutrality by 2040 and reduce greenhouse gas emissions by 65% by 2030. It sets out measures for energy efficiency, renewable energy expansion, and sustainable land use to significantly cut emissions and promote a low-carbon economy.	All
<b>Bavarian Energy Programme</b>		The Bavarian Energy Programme focuses on increasing energy efficiency and the use of renewable energy sources. It includes initiatives for energy-efficient buildings, sustainable mobility, and the promotion of renewable energy technologies, contributing to the reduction of GHG emissions and supporting the transition to a sustainable energy system.	Stationary Energy, Transportation
<b>Bavarian Climate Adaptation Strategy</b>		This strategy outlines measures to adapt to the impacts of climate change, such as increased temperatures and extreme weather events. It includes actions in areas like water management,	Other



		agriculture, forestry, and urban planning to enhance resilience and reduce vulnerability to climate change.	
<b>Bavarian Renewable Energy Act</b>		The Bavarian Renewable Energy Act promotes the expansion of renewable energy sources, such as wind, solar, and biomass. It provides incentives and support for renewable energy projects, aiming to increase the share of renewables in Bavaria's energy mix and reduce reliance on fossil fuels.	Stationary Energy, Transportation
<b>Bavarian Building Energy Act</b>		This legislation sets energy efficiency standards for new buildings and renovations. It aims to reduce energy consumption in the building sector, which is a significant source of GHG emissions, by promoting the use of energy-efficient technologies and materials	Stationary Energy

### Council decisions

Within this multi-level framework of policies and regulations, the LHM created a local architecture of council decisions to pursue its climate neutrality goals over the years. Capturing the architecture of decisions and their systemic consequences is equally complex and even more dynamic and evolving as analysing the multi-level governance architecture beyond the local level. The list below aims to provide reference to frequently cited and influential council decisions, relevant to Munich's climate neutrality efforts.





**Table 10: Council decisions related to Munich's climate neutrality targets**

Name	Level	Description	Addressed Sectors
<a href="#">Decision (08-14 / V 00973)</a>		<i>Konvent der BürgermeisterInnen (Covenant of Mayors) EUROCITIES Declaration on Climate Change</i>	All
<a href="#">Decision (14-20 / V 00127)</a>		<i>EU-Initiative zur Anpassung von Städten an den Klimawandel Verpflichtungserklärung der Bürgermeister im Rahmen des Konvents der Bürgermeister</i>  EU Initiative for City Adaptation to Climate Change Commitment Declaration of Mayors within the Covenant of Mayors	/
Decision (20-26 / V 03067)		<i>München schließt sich dem Green City Accord an</i>  Munich joins the Green City Accord	All
Decision (14-20 / V 16525)		<i>Bayerisches Versöhnungsgesetz II / Grundsatzbeschluss zur „Klimaneutralen Stadtverwaltung 2030 und weitere Maßnahmen zur Erreichung der „Klimaneutralität München 2050“</i>  Decision of Principle for a "Climate-neutral Municipality 2030 and additional measures to achieve climate neutrality Munich 2050"	All
Decision (20-26 / V 03533)		<i>Grundsatzbeschluss I Umsetzung Klimaziele München Erlass einer Klimaschutz Erlass einer Klimaratssatzung</i>  Decision of Principle I – Implementation of Munich's Climate Goals,	All



## Action Plan



		Issuance of a Climate Statute, Issuance of a Climate Council Statute	
Decision (20-26 / V 03535)		<i>Einführung einer Klimaprüfung bei Beschlussvorlagen</i>  Introduction of a Climate Protection Check for Draft Decisions	All
Decision (20-26 / V 03534)		<i>Finanzrahmen für den Klimaschutz ab 2022</i>  Financial Framework for Climate Protection from 2022	All
Decision (20-26 / V 02817)		<i>Monitoring zur Maßnahmenumsetzung des „Maßnahmenkonzept Anpassung an den Klimawandel in der Landeshauptstadt München“</i>  Monitoring the Implementation of Measures in the "Action Plan for Climate Change Adaptation in the City of Munich"	/
<a href="#">Decision (20-26 / V 03507)</a>		<i>Mobilitätsstrategie 2035 - Entwurf einer neuen Gesamtstrategie für Mobilität und Verkehr in München</i>  Mobility Strategy 2035 - Draft of a New Comprehensive Strategy for Mobility and Transportation in Munich	Transport
Decision (20-26 / V05040)		<i>Grundsatzbeschluss II Klimaneutrales München 2035 und klimaneutrale Stadtverwaltung 2030: Von der Vision zur Aktion</i>  Decision of Principle II Climate Neutral Munich 2035 and Climate Neutral City Administration 2030: From Vision to Action	All
<a href="#">Decision (20-26 / V 04479)</a>		<i>Schwerpunktsetzung im Referat für Klima- und Umweltschutz- personelle Mehrbedarfe Eckdatenbeschluss Haushalt 2022 Nrn. 2, 3, 4, und 11</i>  Focus Areas in the Department for Climate and Environmental Protection - Additional Personnel Requirements Key Data Resolution Budget 2022 Nos. 2, 3, 4, and 11	/
Decision (20-26 / V 05892)		<i>Analoge und digitale Öffentlichkeitsbeteiligung in der Landeshauptstadt München; Vorstellung des Externen-Konzepts für die systematische Weiterentwicklung</i>  Analog and Digital Public Participation in the City of Munich; Presentation of the External Concept for Systematic Further Development	/
Decision (20-26 / V 06103)		<i>Förderprogramm Klimaneutrale Gebäude</i>  Funding Program for Climate-Neutral Buildings	Stationary Energy
<b>Decision (20-26 / 06054)</b>		<i>Novellierung und Umbenennung des Förderprogrammes „München emobil“</i>	Transport




		Revision and Renaming of the Funding Program "Munich mobil"	
<a href="#">Decision (20-26 / V 06483)</a>		<i>Satzung zur Änderung der Satzung zur Einführung eines Klimarates der Landeshauptstadt München (KlimaratS) vom 12. September 2021</i> Amendment of the Statute for the Introduction of a Climate Council of the City of Munich (Climate Council Statute) dated September 12, 2021	All
Decision (20-26 / V 07870)		<i>München auf dem Weg zur zirkulären Stadt – Ein Sachstandsbericht zur Erarbeitung einer kommunalen Circular Economy Strategie (Work in Progress Report 2022) Bekanntgabe des Gutachtens „Graue Energie und Materialkreisläufe bei Sanierung statt Abriss und Neubau“</i> Munich on the Path to Becoming a Circular City – A Status Report on the Development of a Municipal Circular Economy Strategy (Work in Progress Report 2022) Announcement of the Study "Embodied Energy and Material Cycles in Renovation Instead of Demolition and New Construction"	Other
Decision (20-26 / V 08153)		<i>Umsetzung der kommunalen Wärmeplanung in München – Zwischenbericht</i> Implementation of Municipal Heat Planning in Munich – Interim Report	Stationary Energy
Decision (20-26 / V 08291)		<i>Einführung der THG-Bilanzierung „Carbon Footprint der Stadtverwaltung“</i> Introduction of GHG Accounting "Carbon Footprint of the City Administration"	All
Decision (20-26 / V 09135)		<i>Masterplan solares München</i> Masterplan Solar Munich	Stationary Energy
Decision (20-26 / V 09608)		<i>Förderprogramm klimaneutrale Gebäude – Sachstandsbericht und Anpassungsbedarf</i> Funding Program Climate Neutral Buildings – Progress Report and Needs for Adjustment	Stationary Energy
Decision (20-26 / V 10332)		<i>Umsetzung des Öffentlichkeitsbeteiligungskonzeptes in der Landeshauptstadt München Einführung eines Einwohner*innenbudgets</i> Implementation of the Public Participation Concept in the City of Munich Introduction of a Citizen Budget	/
Decision (20-26 / V 10356)		<i>Novellierung der E-Taxiförderung in München</i> Amendment to the Munich E-Taxi Funding	Transport
<a href="#">Decision (20-26 / V 09095)</a>		<i>Grundsatzbeschluss Ernährungshaus München</i> Decision of Principle Nutrition House Munich	/
Decision (20-26 / V 09208)		<i>Grundsatzbeschluss Ernährungshaus München (nicht öffentlich)</i>	/



		Decision of Principle Nutrition House Munich (non-public)	
Decision (20-26 / V 11088)		<i>Förderprogramm Klimaneutrale Gebäude (FKG) – Einführung von Fördermaßnahmen zur Berücksichtigung von THG-Emissionen im Gebäudelebenszyklus sowie Änderungen der Richtlinien der Förderprogramme FES und FKG</i>  Funding Program for Climate-Neutral Buildings (FKG) – Introduction of Funding Measures to Account for GHG Emissions in the Building Lifecycle and Amendments to the Guidelines of the FES and FKG Funding Programs	Stationary Energy
Decision (20-26 / 10568)		<i>Grundsatzbeschluss III Fortschreibung des Klimabudgets</i>  Decision of Principle III – Update of the climate budget	All
Decision (20-26 / V 11964)		<i>Förderprogramm Klimaneutrale Gebäude (FKG) – Schadensbegrenzung für die Landeshauptstadt München durch Förderpause für Einzelmaßnahmen und Förderstopp für Sanierungsberatungen</i>  Funding Program Climate Neutral Buildings – Damage control for the State Capital of Munich via the Funding Break for single measures and the funding halt for renovation consulting	Stationary Energy
Decision (20-26 / V 11336)		<i>Corporate Carbon Footprint im erweiterten Verantwortungsbereich der Landeshauptstadt München – Berichtsjahre 2020 und 2021</i>  Corporate Carbon Footprint for the extended responsibility scope of the State Capital Munich	All
Decision (20-26 / V11279)		<i>Re:lektro Strategie der Landeshauptstadt München zur längeren Verwendung und optimierten Sammlung von Elektrokleingeräten</i>  Re:lektro Strategy of the State Capital Munich for extended use and optimized collection of small electronic devices	Other
Decision (20-26 / V 12248)		<i>Evaluierung und Weiterentwicklung der Klimaschutzprüfung</i>  Evaluation and Revision of the Climate Protection Check	All
Decision (20-26 / V 11411)		<i>Kommunale Wärmeplanung für München</i>  Municipal Heat Plan for Munich	Stationary Energy
Decision (20-26 / V 12515)		<i>Dekarbonisierung der Fernwärmeversorgung in München, Transformationsplan für die Fernwärme</i>  Decarbonisation of District Heating Supply in Munich, Transformation Plan for District Heating	Stationary Energy
Decision 20-26 / V 13093		<i>Weiterentwicklung FKG – kreislauffähiges Bauen, klimagerechte Gebäudestandards im geförderten Wohnungsbau, Finanzierung FÖMIS</i>	Stationary Energy



		Further Development of FKG – Circular Construction, Climate-Appropriate Building Standards in Subsidized Housing, Financing of FÖMIS	
Decision (20-26 / V 13383)		<i>Monitoring-Bericht zum Solarenergieausbau in München</i> Monitoring Report on the Expansion of Solar Energy in Munich	Stationary Energy
Decision (20-26 / V 13265)		<i>Förderprogramm Klimaneutrale Gebäude (FKG) – Anpassungen Fördermaßnahmen</i> Funding Program for Climate-Neutral Buildings (FKG) – Adjustments to Funding Measures	Stationary Energy

## Strategies

In addition to formal policies, regulations and council decisions, strategies (or *strategy-like* documents) play an important role in guiding Munich's transition to climate neutrality. Strategies in Munich are usually overseen by thematically responsible administrative departments and created via custom combinations of a) inclusive stakeholder / citizen engagement and governance processes (e.g. *Perspektive München*), and/or b) the generation, compilation and analysis of subject matter expertise (e.g. *Munich Heat Plan*). Strategies are often embedded and institutionalised in Munich's policy landscape via dedicated council decisions and updated regularly in multi-annual review cycles (*Fortschreibungen*). They play a key role in shaping Munich's transition to climate neutrality by providing a common ground for climate governance and action, provide an understandable access to information and an overview of key targets and goals for urban development in Munich. However, while cross-references and integration is favoured across all strategic processes, many of Munich's strategies and governance processes are either operationally, chronologically or methodologically separated due to the complex practical realities of governance systems in the city. In short, there is no single coherent climate strategy in Munich, but a **strategic governance ecosystem** of climate-relevant documents and processes, governing climate action across a wide network of actors and institutions. The below list covers some of the most relevant strategies in this regard:

### Munich Perspective

The urban development concept "Perspektive München" outlines the goals for Munich's development and the strategies to achieve them. It sets the framework for future-oriented and sustainable urban development with its strategic and specialised objectives, which are translated into numerous concepts, programs, and measures, including the new urban development plan STEP2040. This plan integrates strategic and operational levels to ensure a cohesive approach to urban growth, focusing on sustainability and the common good.

To maintain its relevance, "Perspektive München" is regularly updated to address new challenges and changing conditions. First adopted by the city council in 1998, it has since been revised multiple times. It comprises several interconnected elements: the preamble "City in Balance" emphasises the core values of Munich's urban development, the strategic guidelines outline future development directions, and the specialised guidelines derive from these strategies to detail goals across key urban development areas. The STEP2040 plan further elaborates on citywide spatial development goals and strategies, while the action area approach targets nine dynamic development zones with integrated concepts and management structures. "Perspektive München" also facilitates dialogue between the administration and the public, serving as a platform for sustainable urban development.



### **Masterplan Solar Munich (MSM)**

The Masterplan Solares München outlines strategies for expanding solar photovoltaic (PV) installations on rooftops, facades, and other suitable surfaces throughout the city. It includes measures to incentivise private and public investments in solar technology, streamline regulatory processes, and provide technical support and resources to property owners. By promoting the widespread adoption of solar energy, the Masterplan Solares München seeks to harness Munich's solar potential, reduce reliance on fossil fuels, lower greenhouse gas emissions, and contribute to a sustainable energy future for the city.

### **Mobility Strategy 2035**

The Mobility Strategy 2035 for Munich aims to ensure that by 2025, at least 80% of traffic is conducted using emission-free vehicles, public transportation, walking, and cycling, with a goal of achieving climate-neutral traffic by 2035. Key objectives include the "Vision Zero" for traffic safety, increasing public transport to 30% of all trips, and supporting shared mobility with 2,500 sharing parking spaces and 200 mobility hubs. The strategy emphasises expanding the environmental network, reallocating street space and traffic light timings, and developing innovative mobility concepts for new and existing urban areas. The city and region must collaborate to reduce car commuter traffic, integrating 19 different sub-strategies on issues such as traffic safety, public transport, pedestrian and cycling traffic, shared mobility, multimodality, and climate protection to achieve a successful mobility transition.

### **Municipal Heat Plan (MHP)**

The Municipal Heat Plan (MHP) (*Kommunale Wärmeplanung*) of Munich is a comprehensive strategy designed to transition the city's heating systems towards climate neutrality by 2035. This plan involves the systematic decarbonisation of Munich's heat supply, focusing on increasing the use of renewable energy sources such as geothermal, solar thermal, and biomass, alongside enhancing energy efficiency in buildings. It includes detailed analyses of current heat demands and infrastructure, and outlines specific measures for modernising heating networks, promoting energy-efficient building renovations, and integrating decentralised renewable energy solutions. By prioritising sustainable heating solutions and reducing reliance on fossil fuels, the Municipal Heat Plan aims to significantly cut greenhouse gas emissions, improve energy security, and support Munich's broader climate goals. Creating the Municipal Heat Plan is the mandatory implementation of the federal Heat Planning Act (WPG) in Munich. Munich created the MHP as a digital public plan available to the city's geo information portal.

### **Munich Adaptation Concept**

Munich's Climate Adaptation Concept, established in 2016 and updated in 2022, outlines the city's comprehensive approach to addressing the impacts of climate change. The concept aims to enhance the city's resilience to climate-related risks such as extreme heat, heavy rainfall, and flooding. Key objectives include improving urban infrastructure to withstand climate stresses, increasing green spaces to mitigate heat island effects, and implementing sustainable water management practices. The updated concept emphasises the importance of integrating climate adaptation measures into all areas of urban planning and development, fostering collaboration among stakeholders, and raising public awareness about climate resilience. By prioritising proactive and adaptive strategies, Munich's Climate Adaptation Concept seeks to protect both the environment and the well-being of its residents, ensuring a sustainable and resilient future for the city.

### **Munich Biodiversity Strategy**

Munich's Biodiversity Strategy aims to preserve and enhance the city's natural ecosystems, promoting a rich variety of plant and animal life within urban areas. The strategy focuses on creating and maintaining green spaces, such as parks, green roofs, and community gardens, to provide habitats for



wildlife and improve the quality of life for residents. Key initiatives include the restoration of natural habitats, the planting of native species, and the establishment of wildlife corridors to connect fragmented ecosystems. Additionally, the strategy emphasises community involvement and education to raise awareness about the importance of biodiversity. By integrating biodiversity considerations into urban planning and development, Munich's Biodiversity Strategy seeks to build a resilient and sustainable urban environment that supports both nature and people.

**Munich Transformation Plan for Sustainable District Heat**

The transformation plan for sustainable district heating aims to decarbonize Munich's heat supply by 2040, primarily using deep geothermal energy, with a substantial investment of around 9.5 billion euros. Key projects include expanding geothermal plants, integrating large heat pumps, and transitioning gas-fired plants to green hydrogen. The SWM also plans to intensify and expand the district heating network by 600 km. Additionally, the plan includes biomass power plants and thermal waste treatment facilities with CO2 capture. The transformation plan provides residents with tailored heating solutions, such as decentralized heat networks and heat pumps, ensuring a smooth transition to climate-neutral heating systems. An interactive map and advisory services help property owners make informed decisions about heating options and investment timing.

**ESD VISION 2030**

Education for Sustainable Development (ESD; *Ger. Bildung für nachhaltige Entwicklung, BNE*) refers to an educational concept that enables learners to make decisions and act responsibly in the face of global, ecological, economic, and social challenges. This aims to protect the environment, promote a sustainable economy, and foster a just society for current and future generations. The ESD VISION 2030 is a concrete action programme that aims to embed Education for Sustainable Development (ESD) in Munich. It encompasses all educational sectors of the city. The BNE VISION 2030 was adopted by the Munich City Council in 2022. Since 2023, this "master plan" for ESD has been implemented step by step.

The international framework is provided by the 17 Sustainable Development Goals (SDGs) of the United Nations. ESD forms the core values of SDG 4 and is further elaborated in Target 4.7. In 2015, UNESCO launched the Global Action Programme on ESD (GAP-ESD), to which Germany contributes through the National Action Plan on ESD (NAP-ESD) adopted in 2017. For networking ESD actors in Munich, the city was recognized as a "City of the UN Decade of ESD" by the German UNESCO Commission in 2012. For its efforts in ESD, Munich received a second award from the Federal Ministry of Education and Research (BMBF) and the German UNESCO Commission (DUK) in Berlin in 2019 as part of the UNESCO Global Action Programme. In 2023, the city received a third award from BMBF and DUK, particularly for developing the ESD VISION 2030 (National Award ESD 2023/2024). The European Union (EU) awarded the ESD VISION 2030 with the URBACT Good Practice Label.

**Six Strategic Priorities**

A recent fundamental effort to analyse and boil-down the complexity of climate neutrality based on was presented in the expert survey "[Fachgutachten Klimaneutralität München 2035](#)" with the identification of six so-called "levers", which provide the source and basis for the six strategic priorities of MCM, as listed in the Climate City Contract's Commitment Document:

**Table 11: Strategic Priorities for climate neutrality**

	<p><b>1) Refurbish Buildings:</b>  <i>Reduction of heat demand in residential and non-residential buildings.</i>  The heating sector plays a crucial role, as it is responsible for around a third of the</p>
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	city's greenhouse gas emissions. The aim is to increase the rate of energy-efficient refurbishment (KfW EH 55 standard) to 2.5 % annually.
	<b>2) Decarbonise District Heat Grid:</b> <i>Development of climate-neutral district heating energy generation.</i> The transition to climate-neutral district heating using geothermal energy is essential to reduce emissions in the heating sector. The targets focus on replacing fossil fuels with geothermal energy and centralised heat pumps. Additional preparations need to be made to include climate-neutral hydrogen as a contribution to the district heating grid's renewable energy mix after 2035.
	<b>3) Replace Fossil Heating:</b> <i>Replacing oil and gas with district heat and decentralised renewable energy.</i> The energy grid needs to be expanded and densified to achieve a climate-neutral market share of 45% by 2035 and as much as 70% by 2050. The remaining energy demand is to be covered by decentralised renewable sources like local heat, heat pumps or other renewable energy options.
	<b>4) Generate Renewable Power:</b> <i>Expansion of renewable electricity generation in the city area.</i> Renewable energy generation in the urban area aims to cover around 20 to 25 percent of total electricity demand by 2050. This means expanding photovoltaics by at least 50-megawatt peak capacity per year between 2025 and 2030.
	<b>5) Decarbonise the Economy:</b> <i>Transition to climate neutrality in the business sector.</i> About 40% of GHG-emissions in Munich results from business activity. The goal is to reduce greenhouse gas emissions in the private sector by 75% compared to 2018 levels, strengthening the support for businesses to rapidly implement transformation measures, increasing energy efficiency by using waste heat and decoupling economic productivity from fossil-fuels and GHG-emissions.
	<b>6) Transform Transportation:</b> <i>Transforming Munich's transport system towards ecomobility.</i> Climate-friendly transport relies on expanding all forms of ecomobility, particularly local public transport, walking and cycling, while reducing reliance on motorised individual vehicles and simultaneously phasing out combustion engines. One goal is the share of public transport in Munich's modal split to 30% by 2030 by expanding public transport availability with a focus on enhancing rail-based infrastructure and converting a significant proportion of vehicles to emission-free drives via incentive programs as well as the expansion of Munich's EV-charging infrastructure. The overall goal is to reach an 80% proportion of ecomobility ( <i>Umweltverbund</i> ) of Munich's modal split.

The LHM devised a range of **policies and instruments** to enable the operationalization and active pursuit of its strategic priorities, including a range of funding and subsidy programs, a mandated energy agency fulfilling the role of a [“one-stop-shop” for building renovation as envisioned by the European Commission](#) as well as a neighbourhood approach to climate neutrality transition of individual city quarters.

A) Munich's **funding programs** with relevance to climate-mitigation and adaptation serve as crucial policy instruments for transforming the city towards climate neutrality. These programs target various aspects of sustainability, driving innovation and supporting local initiatives:

- **Funding Program for Climate-Neutral Buildings (“FKG”):** This program provides financial support for renovating and constructing buildings to meet high energy efficiency standards, reducing their carbon footprint, and promoting the use of renewable energy sources.
- **Funding Program for Climate-Neutral Drives (“FKA”):** Aimed at reducing emissions from transportation, this program supports the adoption of climate-neutral propulsion systems, including electric and hydrogen-powered vehicles, to foster sustainable mobility solutions.



- **Funding Program for Charging Infrastructure for Electric Vehicles:** This program supports the expansion of charging infrastructure for electric vehicles, providing financial assistance for the installation of charging stations in public and private spaces, promoting the adoption of electric mobility.
- **Funding for Consultancy on Electric mobility:** This program offers financial support for consultancy services related to electric mobility, helping individuals and businesses understand the benefits, implementation, and integration of electric vehicles into their operations.
- **Environmental Grant for Projects and Facilities (“Umweltzuschuss”):** This grant supports environmental projects and facilities that contribute to sustainability, such as waste reduction initiatives, renewable energy installations, and community-based environmental education programs.
- **Funding Program for Biodiversity Components (“Biodiversitätsbausteine”):** This program encourages the integration of biodiversity-promoting elements in urban areas, such as green roofs, wildlife corridors, and native plantings, to enhance urban ecosystems and biodiversity.
- **Funding Program for Green in the City (“Grün in der Stadt”):** Focused on increasing urban green spaces, this program funds the creation and maintenance of parks, green corridors, and community gardens, improving the quality of life and resilience of urban areas against climate impacts.
- **E – The Energy Program (“E – das Energieprogramm”):** This initiative provides funding and support for energy efficiency measures and renewable energy projects, helping to reduce energy consumption and promote sustainable energy sources throughout the city.
- **Active Design (aktiv.gestalten):** This program encourages active participation in sustainable urban development, offering grants and resources to residents and organizations to implement innovative projects that contribute to climate neutrality and enhance community well-being.

Together, these funding programs enable Munich to support a wide range of sustainability initiatives, fostering a collaborative effort towards achieving climate neutrality and enhancing the city's environmental resilience.

B) The **"Integrated Neighbourhood Approach"** for climate-neutral, climate-resilient, and liveable existing neighbourhoods is a key component in achieving Munich's climate neutrality. The neighbourhood serves as an informal link between overarching planning and building-specific measures. This level offers the opportunity to address various urban development fields such as social neighbourhoods, electricity and heat supply, mobility, waste and water management, and green and open space provision with local stakeholders, leveraging synergies and minimizing conflicts.

- Based on the citywide analysis of the Energy Use Plan and the municipal heat planning by the Department of Climate and Environmental Protection, the strategy of the integrated neighbourhood approach is implemented in existing neighbourhoods. The goal is to achieve a climate-neutral building stock in as many neighbourhoods as possible by 2035.

The willingness of the main property owners to participate is crucial for successful neighbourhood development. The goals are set specifically for each neighbourhood, considering urban planning, architectural, climate and nature conservation, housing market, demographic, and social aspects. Funding can support the conceptual phase. A stock and potential analysis and an action plan are developed. All relevant stakeholders – residents, housing industry, private owners, tenants, and energy suppliers – are involved. After the conceptual phase, implementation is accompanied by renovation management.



### Mission Demonstrator Projects in Munich

*In the context of Horizon Europe and the Cities Mission, Munich implements two major district-level demonstrator projects, ASCEND and NEBourhoods. Both projects are ambitious innovation projects focussing on individual districts for innovation deep-dives that explore and extend the boundaries of social, governance, technical climate neutrality action. In the context of the Munich Climate Neutrality Mission, both projects serve as ground-breaking enabler initiatives under the integrated neighbourhood approach. They provide opportunities for learning and blueprints for replication and scaling up across the city.*

**ASCEND** stands for Accelerate Positive Clean Energy Districts. It involves the implementation of an energy-positive and clean neighbourhood in the Munich city area – Positive and Clean Energy Districts (PCED). The goal of the project in Munich is to transform the Harthof district in northern Munich into an energy-positive neighbourhood over the next five years. This involves focusing on citizen participation, mobility, data, and especially energy, and supplementing these areas with innovative new measures. Together with partners from science and industry, the city will test and implement more than 20 different measures to achieve a positive energy balance for the district. Additionally, further measures for a clean and liveable neighbourhood transformation, in collaboration with the local community, are central to the project. The City of Munich and its partners will receive around 5.5 million euros in funding from the EU for this initiative.

The **NEBourhoods** project in Munich aims to create sustainable and inclusive urban neighbourhoods by integrating the principles of the New European Bauhaus (NEB). This initiative focuses on transforming existing urban areas into vibrant, eco-friendly communities that prioritise human well-being and environmental sustainability. Key aspects of the project include enhancing green spaces, promoting energy-efficient buildings, and fostering community engagement. By incorporating innovative design and technology, NEBourhoods seeks to reduce carbon emissions and improve the quality of life for residents. The project also emphasises social inclusion, ensuring that all community members have access to the benefits of sustainable urban living. Through collaboration with local stakeholders, NEBourhoods in Munich serves as a model for future urban development, aligning with the city's climate neutrality goals and the broader objectives of the European Green Deal.

**Energy-Agency:** The Munich Agency for Urban Renewal (*“Münchner Gesellschaft für Stadterneuerung”*, MGS) acts as energy agency of the city. MGS is responsible for the planning and implementation of urban renewal projects, focusing on sustainable development and energy efficiency. By coordinating efforts between various stakeholders, including residents, businesses, and government entities, MGS ensures that urban renewal projects align with Munich's climate goals. The agency provides expertise, funding, and support for energy-efficient building renovations, the integration of renewable energy systems, and the development of green infrastructure. Through these efforts, MGS contributes significantly to reducing the city's carbon footprint and promoting a sustainable, liveable urban environment.

The **International Building Exhibition (IBA) Munich** is part of a long-standing tradition of IBAs in Germany, which serve as innovative platforms for urban development and architectural experimentation. Typically, IBAs operate over a decade, bringing together architects, urban planners, policymakers, and community stakeholders to develop and implement visionary projects that address pressing urban challenges. The IBA Munich operates at Munich Metropolitan Region level and focuses on innovative mobility solutions to enhance urban transport efficiency and sustainability. The process involves generating ideas, qualifying, and refining these concepts, implementing the projects, and ultimately showcasing the results through exhibitions. In the context of Munich's climate neutrality



transition, the IBA can play a pivotal role by showcasing pioneering sustainable building practices, promoting energy-efficient urban design, and fostering collaborations that drive the city's commitment to reducing carbon emissions.

## **Estimating the current trajectory, emissions gap and needs for further action under the MCM**

Bringing together the full picture of a baseline scenario, the climate neutrality target, the current trajectory, and trends of where Munich's emissions are currently heading and what this means for concrete action and measures underway or yet to be co-created is no easy feat and comes with many caveats to scientific credibility. The methodological advantages and limitations of available data for the 2025 iteration of the MCM Action Plan have been described in Module A-1. The potential impact of existing policies and strategies, particularly across all levels of government, is too complex to be credibly quantify, as described in Module A-2. In this context, the MCM Action Plan, its impact model (Module B-1) and the governance process of the MCM are to be seen as an ambitious starting point to improve data-driven planning and scientific target setting, while accelerating the implementation momentum of the transition in the absence of comprehensive data. Table 12 needs to be understood as a first result of this approach.

**Baseline Emissions (Column 1):** This column follows the official 2018 baseline with a view to provide a common and transparent starting point. It refers to the official baseline inventory of the city for 2018 and adds an additional estimate on Waste Sector Emissions according to the GPC Basic standard.

**Emission Reduction Target 2035 (Column 2):** The emission reduction target for climate neutrality across the entire city territory in 2035 is aligned with the official political target set by the city council, which (together with the administration target to become climate neutral by 2030 across public sector operations) served as a basis for the Expression of Interest of Munich to become a Mission City in 2022.

**Trend Scenario 2035 (Column 3):** The Trend Scenario 2035 refers to the trend scenario of the Climate Neutrality Expert Survey from 2022, giving an insight into the business-as-usual trajectory of the city's emissions. This considers macro-trends like population growth in Munich, the forecast development of emission factors in Germany and other key factors to estimate the remaining emissions gap to be tackled by the city.

**Emissions Gap (Column 4):** The Emissions Gap describes the remaining amount of emission reductions to be achieved by the city, considering the trend scenario and what it means for reaching the 2035 target. It is therefore highly dependent on the actual course of future developments (i.e. future annual inventories in comparison to the trend scenario calculated in 2022). In other words, Munich's emissions gap, is a moving target.

**Accounted and Unaccounted Emission Reductions (Column 5 & 6):** The Accounted and Unaccounted Emission Reductions give a first indication of the "completeness" of the action plan, based on the best available information at the time. They show the visible "tip of the iceberg" of emission reduction estimates reachable by actions listed in the action plan, while also providing an estimate of how many emission reductions either need to come from unreported actions, as effects of unquantified measures (i.e. indirect or enabling measures) beyond the MCM's overview of climate action, OR unplanned emission reductions which require further co-creation. Data availability and reliability will become more accurate over time, with the monitoring and planning of actions under the MCM and in accordance with the MIM.

**Residual Emissions (Column 7):** The remaining emissions which are estimated to persist after full implementation of reduction measures and reaching the official 2035 climate neutrality target. These emissions will be the minimum to be covered with carbon sinks and measurable, reportable and verifiable compensation methods.



## 2030 Climate Neutrality Action Plan



**Table 12: Overview of Munich's baseline emissions, reduction targets and current emission gaps**

	(1) Baseline emissions		(2) Emissions Reduction Target 2035		(3) Trend Scenario 2035		(4) Emissions Gap		(5) Accounted emissions reduction through the Action Plan to address the Gap <sup>22</sup>		(6) Unaccounted emissions reduction through the Action Plan to address the Gap		(7) Residual emissions climate neutrality target 2035	
	absolute [kt CO <sub>2</sub> e]	(%)	absolute [kt CO <sub>2</sub> e]	(%)	absolute [kt CO <sub>2</sub> e]	(%)	absolute [kt CO <sub>2</sub> e]	(%)	absolute [kt CO <sub>2</sub> e]	(%)	Absolute [kt CO <sub>2</sub> e]	(%)	absolute [kt CO <sub>2</sub> e]	(%)
	Baseline Inventory Year 2018		0,3t per capita by 2035.		<p>This column represents emission reductions related to the estimated development of emission factors for the stationary energy sector (district heating &amp; electricity). Emission development for the transport sector is based on consumption data of the baseline inventory 2018 which was extrapolated towards a higher number of inhabitants by 2035<sup>23</sup>. Emissions from the waste sector were not considered in the Trend Scenario.</p>		(4) = (2) – (3)		<p>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 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.</p>		(6) = (4) – (5)		(7) = (1) – (2)	
Stationary Energy	6,407.0	75.7%	-6,016.5	-70.9%	-2,974.8	-35.0%	3,041.7	35.9%	-835.9	-9.9%	2205.8	26.0%	402.8	4.8%
Transport	1,828.7	21.5%	-1,706.4	-20.1%	+167.5	+2.0%	1,873.9	22.1%	-738.0	-8.7%	1135.9	13.4%	121.6	1.4%
Waste <sup>24</sup>	237.5	2.8%	-237.5	-2.8%	n/a	n/a	237.5	2.8%	0.0	0.0%	237.5	2.8%	0.0	0.0%
<b>Total</b>	<b>8,473.1</b>	<b>100%</b>	<b>-7,960.4</b>	<b>-93.8%</b>	<b>-2,807.3</b>	<b>-33.0%</b>	<b>5,153.1</b>	<b>60.8%</b>	<b>-1,573.9</b>	<b>18.6%</b>	<b>3579.9</b>	<b>42.2%</b>	<b>524.4</b>	<b>6.2%</b>

<sup>22</sup> Reductions listed in this column refer to estimations referring only to municipal measures within the city's climate budget (see Module B-2).

<sup>23</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“. See also A-1 on methodological implications and the perspective of the expert survey on impact timing.

<sup>24</sup> Emissions from the waste sector were not included in the city's official emission baseline inventory (1) as well as in the reduction target (2) and BAU scenario (3). The emissions were calculated later to fulfil the requirements of the GPC standard and the Mission Info Kit.



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

Systemic barriers and opportunities to climate mitigation exist on different levels of detail, from large structural issues down to the individual climate action level. Additionally, they are often interconnected and interdependent, reinforce each other, or cancel each other out. Therefore, a full system analysis of all systemic opportunities and barriers is impractical and goes beyond the scope of this Action Plan. Instead, larger, noteworthy systemic barriers and opportunities are described below, roughly representative of three different categories:

- **Physical and Infrastructure Barriers and Opportunities:** Major geospatial, built environment, physical or technological features and characteristics of urban infrastructure related and their effect on the cities' ability to reduce emissions. Barriers tend to include geo-environmental circumstances lock-in effects and structural path dependencies, local dependency on regional or national infrastructure, or transformation latency in regards to the unavoidable implementation time of large-scale infrastructure measures.
- **Regulatory and Multi-level Governance Barriers and Opportunities:** Major regulatory and systemic features of the legal and policy framework the city operates within. This may include national and regional aspects and responsibilities for climate mitigation that affect the city, climate-positive or harmful subsidies, budgeting, and financing of climate action.
- **Social, Economic and Local Governance Barriers and Opportunities:** Economic aspects and cost of climate mitigation actions, social justice, inclusion, and equitability of the climate neutrality transition, and includes trade-offs and conflicts (barriers) or positive synergies of climate action with other urban development goals (opportunities).

### Physical and Infrastructure barriers and Opportunities

#### **Dependency on national energy mix and out-of-boundary supply side emission management:**

With network-bound stationary electricity being dependent on the decarbonization of the German energy mix based on the calculation methodology for Munich's emission baseline (See Module A-1), Munich's decarbonization efforts depend on a variety of national developments and challenges. A key barrier to the adoption of renewable energies in Germany is the failed expansion and upgrade of Germany's energy grid over the last decades, preventing the effective transmission of electricity from large coastal wind farms and renewables in the north of Germany to the demand-heavy south, where Munich is located. Re-routing energy transmission via neighbouring European countries is both costly due to higher transmission fees and also limited compared to the potential of a fully developed in-boundary grid. Being dependent on a national electricity mix that suffers from structural deficiencies is a key limiting factor for Munich to control its own Scope-2 emissions by decarbonizing the supply side in the electricity sector.

However, going beyond the boundaries of territorial carbon inventory methodologies, Munich's public utility SWM (Stadtwerke München) has undertaken highly ambitious efforts to decarbonize the equivalent of Munich's energy consumption in the European electricity market as a whole. The «**Expansion Offensive for Renewable Energies**» aims to generate as much renewable electricity by 2025 as the total consumption of the city. Established in 2008, this initiative focuses on purely on an accounting perspective, meaning the generated renewable energy does not have to be physically supplied to the city. The expansion contributes to reducing greenhouse gas emissions from electricity production and supports climate protection efforts. By 2020, an external evaluation reported a production increase to approximately 6 TWh/a, with significant investments made outside of Munich to meet targets quickly. The report recommends activating local renewable potentials while continuing to invest regionally and across Europe. In December 2020, the Munich City Council reaffirmed the 2025



target at 7 TWh/a and set a new goal for 2035, aiming for renewable electricity generation between 7.7 and 8.4 TWh. 90% of this target has already been reached in 2022 and is on track for 2025. This success story goes to show how traditionally local utilities can play a leading role in supply side management of carbon emissions across Europe, despite emission accounting limitations.

**Solar Potential:** The total potential for photovoltaic systems on roofs, facades, and traffic areas in Munich exceeds a feasible PV capacity of 4 GWp even with today's typical module efficiencies. With steadily increasing module efficiencies, the capacity can be further increased, or the same capacity can be achieved on less area. With an average specific annual yield of around 750 kWh/kWp, the feasible area potential in Munich allows for a solar power yield of more than 4 TWh. A share of 25% of inner-city PV self-generated electricity in the total electricity consumption is possible.<sup>25</sup> However, the full leverage of Munich's theoretical solar potential is unlikely to be achieved before 2050, due to a variety of expansion issues described in the **Masterplan Solar Munich (Masterplan Solares München)**, which estimates a Solar PV capacity of 0.8 TWh to be realistically achievable by 2035<sup>26</sup> requires additional measures such as demand-side management as well as expansion of energy storage (BESS) under consideration of economic viability and lifecycle sustainability trade-offs. From an accounting perspective, Solar PV is only accounted for within the boundaries of Munich if the generated energy is used directly. Grid-feed generation is calculated as part of the national energy mix and does not impact Munich's emissions inventory directly.

**Geothermal energy:** Munich holds significant potential for geothermal energy, thanks to its vast underground reservoirs. At depths ranging from 2,000 (northern border) to over 3,000 meters (southern border) within the city's territory, Munich has access to water-bearing rock layers with water temperatures between 80 and 100 degrees Celsius. This geothermal resource can be harnessed particularly to decarbonize Munich's district heating system. Geothermal energy in combination with other renewable heat sources including large-scale heat pumps and different sources of waste heat, have a combined potential to reduce the emissions factor of district heat by 80% by 2035<sup>27</sup>, as described in more detail in **Munich's Transformation plan**<sup>28</sup>.

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<sup>25</sup> LHM, „Masterplan solares Muenchen“, 19.

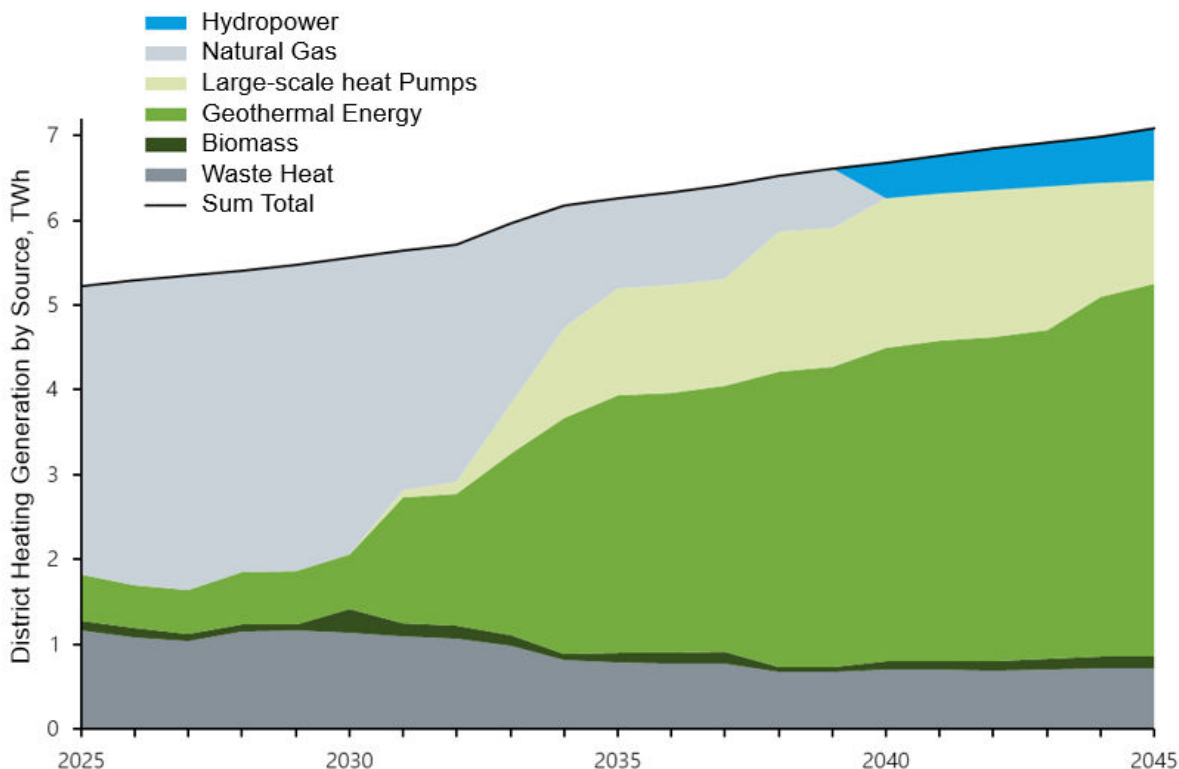
<sup>26</sup> LHM, „Masterplan solares Muenchen“, 4.

<sup>27</sup> Timpe u.a., „Szenarien für ein klimaneutrales München bis 2035“, 14.

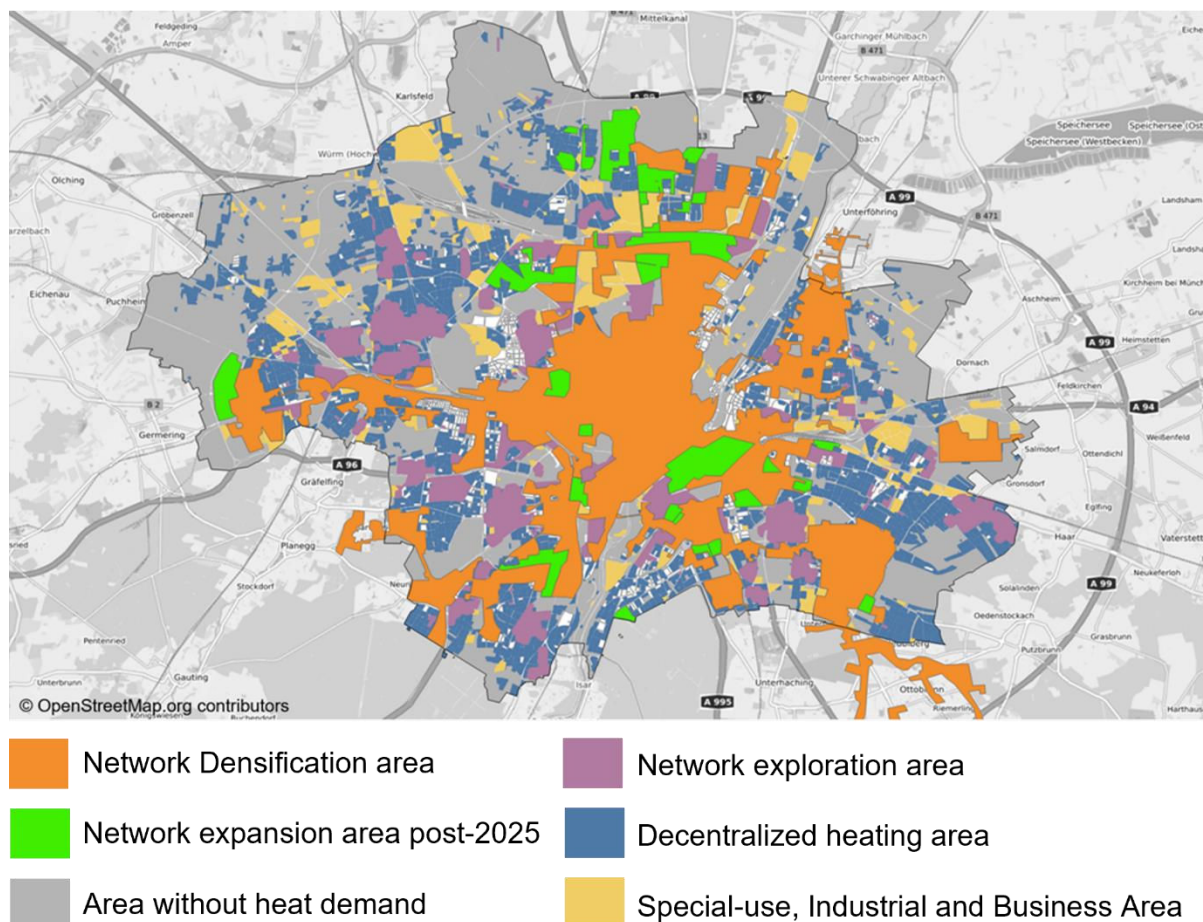
<sup>28</sup> Bieberbach, Thelen, und Braun, „Wärmewende München - Transformationsplan Fernwärme und kommunale Wärmeplanung“.



Figure 2: District Heating Generation by Source



**Expansion of District Heat, Local Heat and Heat Pumps:** As the first major city in Germany, Munich completed a comprehensive heat plan in line with the national Heat Planning Act, to provide a detailed, fully fledged roadmap on how to expand, densify and complement the city’s climate-neutral heating infrastructure. To decarbonize building heat in Munich, a combination of measures is needed, including the densification of the district heating network the expansion of the network to new districts, the inclusion of industrial and business areas into the heating network (e.g. for feeding-in excess process heat, or for process heat supply via the municipal heat network). For areas with heat demand where an expansion of the heat network is not feasible or too resource intensive, alternative solutions need to be found either via local heat networks or individual non-fossil solutions like heat pumps. Munich’s heat plan provides a publicly available, detailed view of the entire city territory on the combination and development of these solutions for each part of the city.

**Figure 3: District heating network expansion areas**

**Building energy efficiency and refurbishment:** Decarbonizing heating in Munich also requires demand side management, particularly via increasing the energy efficiency of buildings via renovation. As specified in minute detail in the scenario analysis of the final report for the Municipal Heat Plan<sup>29</sup>, About 50% of Munich's building stock would require some degree of refurbishment to reduce the original heating demand of over 11,000 GWh to under 10,000 GWh – with a large percentage of deep renovations according to the KfW EH 55 standards. Challenges in fostering this transition range from multiple pricing factors (energy pricing, carbon pricing, subsidy programs to cover renovation CAPEX) to bureaucratic hurdles such as slow permitting, split incentive structures based on building ownership – but the single most important barrier to increasing the renovation rate and accomplishing Munich's energy efficiency targets in the building sector is a **fundamental labour shortage**<sup>30</sup> in Germany and Munich from skilled manual labour to specialized, highly trained experts<sup>31</sup>. The target scenario 204X in the expert study Climate Neutral Munich 2035 optimistically assumes a renovation rate increase to 2% per year in 2030 and a further increase after that, which would amount to a total of 25% of Munich's

<sup>29</sup> „Abschlussbericht zum Projekt: Wärmestrategie München Verbesserung der Daten- und Analysegrundlage für die kommunale Wärmeplanung“, 265.

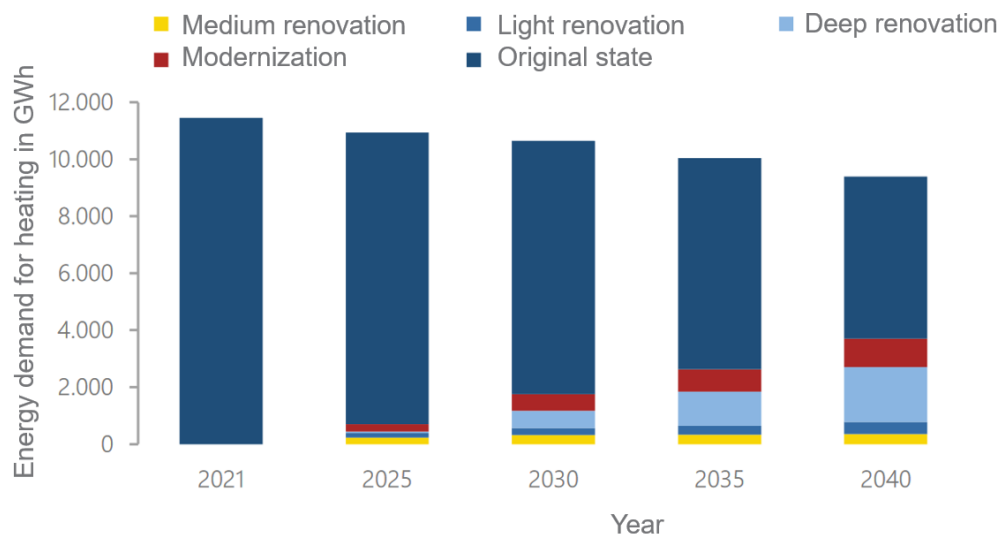
<sup>30</sup> Timpe u. a., „Szenarien für ein klimaneutrales München bis 2035“, 23.

<sup>31</sup> „Abschlussbericht zum Projekt: Wärmestrategie München Verbesserung der Daten- und Analysegrundlage für die kommunale Wärmeplanung“, 268–89.



building stock to be renovated by 2035 (on average reaching the KfW EH 70 standards across all building types)<sup>32</sup>

**Figure 4: Distribution of building renovation depths based on final energy demand energy demand in the target scenario**



## Regulatory and Multi-level Governance Barriers and Opportunities

**Climate protection as voluntary task for cities:** To date, climate protection and climate adaptation have been voluntary responsibilities for cities, municipalities, and districts in Germany, as opposed to mandatory responsibilities such as the construction of municipal roads, the provision of new development areas, the construction and maintenance of schools, libraries, swimming pools, parks, skate parks, youth centers, senior homes, kindergartens, and cemeteries. As voluntary tasks, climate protection and adaptation must compete with mandatory duties for the limited human and financial resources available to local authorities. While federal and state subsidies have provided crucial support in the past, they have not facilitated the comprehensive and long-term integration of climate change mitigation and adaptation into municipal operations. By making climate protection and adaptation mandatory municipal responsibilities, it would ensure basic funding for these efforts independent of subsidies, improve staffing, and prioritize climate initiatives over other competing municipal tasks. This would lead to better resource allocation and a more systematic approach to addressing climate challenges at the local level. In 2021, the Bundesverfassungsgericht (Federal Constitutional Court) ruled that the Federal Climate Protection Act was partially unconstitutional because it did not sufficiently protect future generations from the impacts of climate change. The court emphasized that climate protection is a fundamental right under the German Basic Law, requiring the state to take proactive measures to safeguard life and health against climate risks. For municipalities in Germany, this decision means they must integrate more stringent climate action plans and policies to contribute to achieving greenhouse gas neutrality by 2045. However, many municipalities are unable to adequately fulfil this obligation due to insufficient financial and personnel resources. A suitable mandate for municipalities would allow for better cooperation between the federal and state governments, making joint financing of these tasks legally permissible.

<sup>32</sup> Timpe u. a., „Szenarien für ein klimaneutrales München bis 2035“, 23.



**Climate-damaging Subsidies:** A 2021 report by the Federal Environmental Agency found that “environmentally harmful subsidies in Germany amounted to approximately 65.4 billion EUR”<sup>33</sup> on the national level alone, not counting EU (e.g. Common Agriculture Policy) or regional level subsidies. Looking at the distribution of the analysed environmentally harmful subsidies across individual sectors, in 2018, the transportation sector (30.8 billion EUR) and the energy sector (25.4 billion EUR) were at the top, accounting for 47% and 39% of the total environmentally harmful subsidies, respectively. There is substantial potential for alleviating public budgets by phasing out environmentally harmful subsidies. This is particularly important given the significant rise in new debt and various financial obligations, granting the state essential flexibility for climate protection, resource conservation, sustainable infrastructure development, and enhancements in education and healthcare. It is crucial to recognize that the reported subsidy amounts do not directly equate to the anticipated fiscal impacts of reducing these subsidies. Typically, reducing environmentally harmful tax benefits results in behaviour changes among businesses and households that decrease tax revenue. However, there are also beneficial fiscal effects, such as reduced future expenses for environmental damage remediation and lower health costs associated with environmental issues. Additionally, supporting measures are often necessary to prevent social hardships or to aid businesses in transitioning to climate-friendly and resource-efficient production, which sensibly allocates part of the savings. Some environmentally harmful subsidies, like the kerosene tax exemption, cannot be eliminated at the national level and require action at the EU or international level. Therefore, it is vital for the federal government to support initiatives such as the planned revision of the EU Energy Tax Directive to fully achieve the benefits for environmental protection, resource conservation, and public budgets. From the perspective of cities, these subsidies need to be seen as enabling or hindering factors for climate-neutral business models, setting the market framework for returns on investment. Creating bankable and finance-ready climate action projects requires a structural revision of the EU and national subsidy infrastructure from the perspective of creating and enabling business models and opportunities in line with GHG-emission reduction.

**Multi-level Budget Crisis:** The Bavarian State and the city of Munich are facing a double challenge of low tax revenue and high demand for infrastructure investment across all areas of responsibility in cities. Annual negotiations on how much money the state of Bavaria transfers to municipalities decided to slightly increase municipal budgets and the ratio of tax revenue distributed to local government in 2025. However, these small redistributions of funding are not enough to make up for the alarmingly high growth rate of interest and repayments for investments in mandatory tasks, including building construction, which is relevant for schools and daycare centres, social expenditures, clinics, and infrastructure like local public transport. On both municipal and state level, there are limitations to public revenue, based on overall economic performance. The constitutional debt brake (*Schuldenbremse*) prevents debt-based financing, which thereby indirectly affects municipalities, as it limits the ability of the Bavarian state to cover their own state-level spending, including support to local governments. Even for a traditionally affluent municipality like Munich, this means a need for radical spending cuts to focus on mandatory tasks, decreasing quality standards and deprioritizing already budgeted actions. Without macro-economic growth of GDP and tax revenue at federal, state and municipal level, climate action will be in jeopardy, wherever public funding or investment are needed for implementation.

**Systemic barriers and side-effects of regulatory silos:** When it comes to implementing climate action at local level, the devil is in the detail. Specific climate action is crucially dependent on EU, national and state-level regulations, far beyond climate-specific legislative acts. These are often designed for a non-climate related purpose, but in ways that negatively impact or hinder effective climate action in cities. These challenges are often structural and stem from decades of legislative paradigms (e.g. the car-centric nature of the German Road Traffic Act) or linear (non-circular)

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<sup>33</sup> „Umweltschädliche Subventionen in Deutschland: Aktualisierte Ausgabe 2021“, 98.



economic models permeating most material-intensive sectors such as construction. In other cases, policy conflicts can be found between individual legislations such as procurement laws designed to safeguard economic competition, while preventing effective public project bundling needed for the MCM portfolio approach. And lastly, bureaucratic processes for large and small climate action process often prevent rapid adoption and implementation.



### Examples for different Types of regulatory Barriers

*Legal and regulatory barriers in practice often come from single paragraphs in laws and regulations with seemingly no direct connection to climate mitigation. These barriers are highly circumstantial and can include needs for more specific regulation, exceptions to regulation under specific circumstances or a deregulation to decrease bureaucracy. The following three examples are by no means exhaustive but aim to indicate the granularity of a discussion needed.*

**Limits of development planning for circularity:** According to §9 of the federal Building Act (BauGB), which lists the exact content local governments can decide on in their development plans for city districts and areas, local governments cannot regulate the types of building materials or construction methods (e.g., timber construction) or the reusability of building materials and in development plans. Also, no process steps to support the circular economy in the construction sector, such as “selective deconstruction” with mandatory component inspection, can be established. Such regulations would however be crucial to lay the ground for a local secondary material market in construction and enabling a circular economy.

**Legal definition of Waste:** The definition of when building materials legally receive waste status is set too early in the deconstruction process and prevents further use or reuse, as the waste status of materials changes ownership or specific obligations for further handling of the material (disposal; material unsuitability for new construction; ownership rights, etc.). This would need to change for owners to have sufficient time to make decisions about the further use of the used building materials and components.

**Procurement Law and Serial Renovation:** Munich’s municipal housing company subject to public procurement law, must comply with the § 5, Section 2 of Directive 2014/24/EU (VOB/A – EU). It prescribes the awarding of tenders in partial and specialized lots, effectively dividing the total contract volume by trades. This prevents serial renovation with prefabricated facade modules, for which it would be essential to award a total contract contrary to this requirement. Given the needs for rapid energy efficient refurbishment of buildings, tenders would need to be maximally bundled and a large part of the planning would need to be placed in the hands of a main executing company.

**Permitting Speed for Geothermal Energy:** The speed at which geothermal expansion is taking place in Germany is still insufficient. By February 2022, fewer than 50 deep geothermal projects with a thermal capacity of just under 350 megawatts had been realized. In the key points paper for a geothermal campaign dated November 11, 2022, the Federal Ministry for Economic Affairs and Climate Action advocated for at least 100 new deep geothermal projects by 2030. Furthermore, in 2023, only around 23,000 decentralized brine and water heat pumps (geothermal heat pumps) out of a total of 356,000 heat pumps were installed. A major underlying factor is the lack of a law to accelerate the approval procedures for geothermal plants, heat pumps, and heat storage – similar to existing regulations for other renewable energy sources such as wind and solar.

### Socio-Economic and Local Governance Barriers and Opportunities

**Availability and accessibility of data and objective information on climate mitigation:** A major challenge for climate governance in Munich is ensure that information, facts and data on climate change, climate neutrality and all the MCM-related, complex subject matters are readily available and understandable for everyone. Inclusive climate governance must be based on common and objective understanding of facts, to lead to effective climate action while ensuring a just and equitable



transformation of the city towards climate neutrality. The complex structure of policies, council decisions, strategies and scientific documents like the Expert Survey or other reports are lengthy and complex, sometimes contradictory, and hard to understand - even for local climate experts and decision makers. Making objective climate data accessible, comprehensible, and compelling therefore is a major task within the MCM, grounding public debate, decision making and project co-creation. Visualization such as Munich's digital twin efforts are a major opportunity, therefore, to overcome the knowledge barrier and democratise access to knowledge and expertise.

**Cross-sector and multi-actor partnerships as opportunity:** While climate mitigation is a city-wide task that requires collaboration across all stakeholder domains in general, opportunities and support processes for different actors to collaborate still hold a large potential to overcome the limitations of individual actors from administration, private sector, academia, and civil society. For example, to refurbish repairable items and devices from Munich's bulky waste, Munich's waste management utility *AWM* collaborates with several Munich-based social enterprises. In their in-house repair and recycling workshops, people with disabilities and long-term unemployed people work to restore furniture, televisions, hi-fi systems, and other devices, which are then sold as second-hand goods. Another example is the Munich Urban Colab, the result of a collaboration between the LHM and the *UnternehmerTUM*, Europe's largest centre for innovation and business creation, to create a co-creation space for start-ups, researchers, administration, citizens, and major companies to create smart city solutions. Examples such as these serve as beacons how much is possible when actors join forces and leverage synergies based on shared and common ideas. This is in line with the Mission Economy approach of the MCM. In order to leverage this opportunity, processes and support mechanisms need to be created for such partnerships to take shape. Innovation finance from within and beyond Munich plays a major role in enabling new forms of collaboration.



## 3 Part B – Pathways towards Climate Neutrality by 2030

The transition to climate neutrality in Munich is a complex process that requires a comprehensive understanding of the various impacts and interactions of different measures. Module B-1 outlines how the impact pathways for climate action are designed according to the Munich Impact Model (MIM), which serves as the conceptual framework for defining how specific measures contribute to achieving climate neutrality. Within the MIM, different types of measures - enabling, direct, and indirect measures, identified via the role of agency of actors and people - interact to facilitate activity shifts towards the intended transition. This means activity shifts serve as portfolios of synergetic and interdependent measures, which create quantitatively measurable impact at the portfolio level. However, there is also a need to accept that quantifying the individual impact of enabling or indirect measures is not usually possible under this model, despite their key role in fostering a shift in activities away from higher greenhouse gas (GHG) emitting practices towards lower-emission alternatives.

In short, the MIM shows how to measure impact of activity shifts (as the combined results of multiple measures and projects), not individual measures, or projects. Consequently, Module B-2 references all existing measures in relation to these Activity Shifts, regardless of their classification as direct, indirect, or enabling. Finally, Module B-3 defines the relevant indicators and parameters necessary for monitoring the implementation of these measures along the Activity Shifts, ensuring that progress towards climate neutrality is tracked and evaluated effectively.

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

**The Munich Impact Model (MIM)** is the conceptual framework by which the effect of a measure and the way it contributes to climate neutrality are defined. This is important for standardizing concepts and terminology, providing a more precise structure for future climate action development and ensuring clarity and interoperability between planning, governance, monitoring and evaluation systems and processes. Most importantly, the MIM provides a clear structural framework that allows to map, analyse, model, measure and evaluate climate actions and impact in Munich in a coherent fashion – particularly for climate action measures that have a rather indirect impact on carbon emissions.

To enable the seamless integration of climate governance, the climate city contract and digital monitoring and planning instruments developed for the MCM, the MIM is designed in alignment with the German DIN SPEC 91637 standard as well as the open-source Transition Element Framework (TEF). The TEF is a systematic approach to codify knowledge based on the IPCC, ensuring that all relevant aspects of the mitigation options defined by the IPCC can be covered, adhering to **three core principles**,

- Principle #1: The objectives of climate change mitigation are fundamentally and always about changes from high GHG-emission activities into lower emission activities (**Activity Shifts**).
- Principle #2: Separating **Implementation Measures (Maßnahmen)** (i.e. climate actions such as individual interventions or projects) from activity shifts (an objective to shift from high to low-emission activities) clarifies the *pathway to achieving quantifiable impact*.
- Principle #3: Applying the **MECE (Mutually Exclusive, Collectively Exhaustive) principle** ensures that every aspect of Climate mitigation strategy is addressed without overlap or gaps, leading to more effective and organised implementation of solutions and preventing double counting of emissions as well as ensuring additionality of climate action measures.



More specifically, MIM is an *agency-based adaptation* of DIN SPEC 91637 and consists of different **types of elements** arranged in a logical impact chain from **Enabling Measures to Actors**, (direct or indirect) **Implementation Measures to City Attributes**, via **People**, to the intended **Activity Shifts**, and finally to desired **Impacts**.

- **Enabling Measure:** Enabling Measures provide the conditions and pre-requisites to climate action in cities by enabling *Actors* to define and execute implementation measures. Enabling Measures are often projects or budgeted initiatives and may appear in action plans or similar documents together with and indistinct from *Implementation Measures*. The key definition criterion for enabling measures (separating them from *Implementation Measures*) is that they do not – neither directly nor indirectly – lead to any *Activity Shifts* or *Impacts* on their own. They simply lay the foundation or empower *Actors* to take further action.

**Examples:** *Scientific studies, institutional funding for a climate protection NGO, regulatory empowerment like a new law, city council decisions, a digital information portal, a mobility strategy, a temporary test or pilot project, or a new governance process to include stakeholders in decision making could be enabling measures, as long as they empower or enable Actors to act, but have no direct or indirect impact on the city unless also further steps are taken by these Actors.*

**Not an Enabling Condition is:** *A geothermal power plant (→ Direct Implementation Measure), fleet electrification (→ Direct Implementation Measure), a tax incentive or funding program for building refurbishment (→ Indirect Implementation Measure), a bike lane (→ Indirect Implementation Measure), an integrated public transport ticket (→ Indirect Implementation Measure).*

- **Actor:** Actors are individuals, groups or organisations who are empowered and able to take decisions and action for the city's transition to climate neutrality. They have some form of ability, decision making power, legitimization, influence or means to execute *implementation measures* for climate neutrality, either directly impacting GHG emissions or at least changing the city in a way that indirectly improves climate neutrality. Actors are distinct from other *People* in the city as they have the power to make changes to the *Attributes* city, rather than only to their own behaviour while being passively dependent on external circumstances.

**Examples:** *The mayor of a city, a city councillor, a city department, a civil society organization, the city utility, a private company that emits GHG, the CEO of a private company, an informal citizen movement, a voter during council elections, a citizen taking part in a participatory governance workshop can all be possible examples of a stakeholder, if and when they are in a position to take decisions or actions that count as change the attributes of a city in a way that has a direct or indirect influence on its climate neutrality.*

**Not an Actor is:** *The mayor of the city while driving or cycling to work (→ People), a public transport passenger (→ People), a building inhabitant without influence over the building's renovations (→ People), a business dependent on market conditions (→ People), a home owners association deciding whether or not to insulate their building based on renovation cost and energy pricing (→ People), or any citizen, resident or visitor who is (momentarily) not empowered to change more than their own behaviour (→ People).*



- **Implementation Measures:** Implementation Measures are all activities taken by *Actors* that affect or change the city in a way that directly or indirectly creates impacts for climate neutrality. Implementation measures always change the city in a way that either **directly** leads to desired *Impacts* or provides conditions and incentive structures for behavioural changes of *People* that then lead to the desired *Impacts* **indirectly**. This means that all implementation measures fall within one of two categories:

- **Direct Implementation Measures**, which change of *Attributes* that directly contribute to *Activity Shifts* that lead to emission reductions and other *Impacts* without the need of a behavioural change of people.

*Examples:* Replacing diesel busses with electric busses, decarbonization of the district heating grid, improving post-collection sorting of municipal waste for higher recycling rates, replacing fossil-fuel-based heat generation for processes with district heating.

- **Indirect Implementation Measures**, which lead to changes in the city's *Attributes* in a way that affects the incentives for *People* to contribute to an *Activity Shift* by adopting climate-friendly behaviour.

*Examples:* Expansion of cycle lanes, provision of funding programs for retrofitting of buildings or PV installations, installation of EV charging infrastructure in the city to encourage a shift to EV models for MIVs, a new or increased parking fee for the city, a subsidy program for building owners to cover energy retrofitting cost, or an education campaign to increase knowledge and awareness of sustainable consumption and climate issues, could be indirect implementation measures that incentivise *People* to adopt behaviours that support an *Activity Shift* with climate neutrality impacts.

**Not an Implementation Measure is:** The commissioning of a Solar PV potential report to inform the city council (→ *Enabling Measure*), a temporary or local pilot project to test new technology or regulation (→ *Enabling Measure*), increased cycling activity (counts as behaviour of *People*), or the act of energy retrofitting by private homeowners as a result of a subsidy program (counts as behaviour of *People*).

- **Attributes:** Attributes are tangible, observable, and objective features (i.e. qualitative or quantitative information and data describing the city) of implementation measures which lead to observable or measurable changes to the physical or socio-economic characteristics of the city. They can be measured, calculated or at least tangibly observed and described in qualitative terms, and may serve as key performance indicators (KPIs) to *Implementation Measures*. Attributes either directly contribute to an *Activity Shift* or change the ability, motivation or incentive structure for *People* to adapt their behaviour in favour of an *Activity Shift*.

*Examples:* The availability of district heating infrastructure for a building, the price of district heat, a local law against single use plastics, empty or unoccupied buildings, the frequency of bus connections, the reliability of train schedules, the availability of bicycle parking, the cost of heat pump installations, the speed of permitting for building retrofits, the publicity recognition of CO<sub>2</sub>-mitigation efforts by private businesses, the availability of recycling bins in residential buildings, vacant public land, the number of kinder gardens, the berlin wall, tunnels under the berlin wall, or the transparency of information on how recycling waste is treated, could all be examples of attributes that lead to activity shifts or incentivise people to adopt climate-friendly behaviour.



**Not an Attribute is:** *The GHG-emissions of a city (→ Impact), the mobility modal split of a city (→ Impact), the amount of heat used in commercial buildings (→ Impact), the usage of available bicycle parking.*

- **People:** People includes everyone in a city who is regularly or momentarily engaging in any activity in the city that contributes to GHG-emissions - or any carbon neutral alternative to such activities. In other words, People includes everyone that lives, works or plays in a city, uses its infrastructure, or interacts with the city's systems via their behaviour, in any way relevant to climate neutrality. People can include individual but also institutional actors such as households or businesses. The distinction between *People* and *Actors* is based on whether their level of agency, i.e. if they are (currently) in a capacity to influence the *Attributes* of a city, or if they rather impact the city via their behaviour which is confined, determined or influenced by these attributes of a city. Therefore, *People* sooner or later includes everyone, empowered and capable of changing the city in any way or not – in other words: while not *People* are *Actors* for the purpose of this framework, all *Actors* are also *People*. *People* are also key in understanding the impact logic of indirect *Implementation Measures*, as without their active change in behaviour, indirect *Implementation Measures* would not lead to an *Activity Shift* or generate any *Impact*.

**Examples:** *The Mayor while riding the underground metro, a visitor on the way to watch a football game, a company CEO while cycling to work, a resident of a private building, protesters on a public square, a family of two adults and three children, a homeless person, a local company, the employees of a hospital, a person in a wheel chair on their way to work, a city councillor while walking her dog in the park, an NGO, could all be examples of People while interacting with the city, who decide on their behaviour within the possibilities, means, features and boundaries of the city.*

**Not People are:** *Measures, Attributes, Activity Shifts or Impacts – Anything within the impact framework that does not have agency in itself is not considered people.*

- **Activity Shift:** An *Activity Shift* is a change of one GHG-emitting activity to another and therefore the defining transmission factor for all *Implementation Measures* to achieve their intended impacts. An *Activity Shift* can be the result of a single direct or indirect *Implementation Measure*, or (most often) the result of the combination of multiple direct *Implementation Measures* and indirect *Implementation Measures* involving *People*. This means that a range of different *Implementation Measures* may need to be implemented by *Actors*, combined with behaviours of *People*, in order to achieve a single desired *Activity Shift*. The outcome of an *Activity Shift* is finally a range of *Impacts*, including a reduction in GHG-emissions, but also any *co-benefits* or even *trade-offs*. By definition, an *Activity Shift* always has a reference activity (before the shift, or shifting away from) and an outcome activity (after the shift, or shifting towards).

**Examples:** *The shift from person-kilometres driven by combustion engine cars to person-kilometres travelled by electric bus; the shift from heating oil kWh of heat to fossil-free district heating kWh; can be examples of activity shifts.*

**Not an Activity Shift is:** *The installation of heat pumps in public buildings (→ Direct Implementation Measure), the increase of total kilometres of bike lanes available in the city (→ Attributes), more council decisions taken to reduce carbon emissions (→ Enabling Measure), less people driving combustion engine MIVs (without an outcome activity), more people riding bikes (without a reference activity) are not examples of Activity Shifts.*

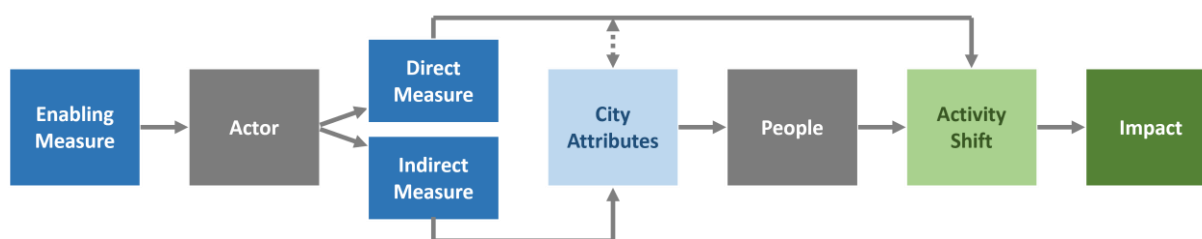
- **Impact:** The Impact of an *Activity Shift* is measured in a desirable, quantifiable, or qualitative indicator. The main indicator for the MCM are GHG-emissions, in particular in line with the city's

GHG inventory and its climate neutrality target under the mission. Other indicators may measure GHG-emissions beyond the scope of the city's climate inventory, additional desired impacts other than GHG-emissions (*co-benefits*) as well as unintended or unavoidable side effects (*trade-offs*). This means that, in all cases, the *Impact* of an activity shift should be measurable or calculatable at least in the form of a GHG-emission reduction for the purpose of this framework, with potential other indicators being into account in addition, based on other desired development targets of the city.

**Examples:** *GHG-emissions; Scope-3 Emissions; modal split; air temperature of public spaces during heat waves; air pollution; traffic congestion; number of cars in a city; the perceived quality of life; noise levels; light pollution; last-mile connectivity; or the GDP of a city can all be examples of Impacts.*

**Not an Impact is:** *The number of council decisions aligned with climate mitigation targets (→ Enabling Measures), the capacity of installed solar PV (→ Attribute), the number of energy efficient buildings (-Attribute).*

Figure 5: Impact logic of the Munich Impact Model (MIM)



Other important concepts related to this Munich Impact Model are **System Boundaries, Agency, Governance, Stakeholders, Case Dependency, and Feedback Loops**. These concepts are important to understand the MIM better, and to operationalize it in practice as a decision making and planning framework.

The **System Boundaries** of the MIM are, in a nutshell, the edges or limits of what the framework captures, to not overcomplicate the framework and make it inoperable. Firstly, there are **external system boundaries** to be aware of. For example, one system boundary is that the MIM does not consider external entities such as national or *Länder* level governmental entities as part of the system. While acknowledging the vital importance of pro-active multi-level governance and considering external circumstances such as the national and regional legal framework as vital area for improvement, the MIM focuses on what the city itself (as a local ecosystem) can and should do to reach climate neutrality. The same goes for other factors such as macroeconomic developments or force majeure events. Secondly, there are **internal system boundaries** in regard to the depth of the model, i.e. deliberate omissions of conceivable types of system elements, to focus on the essentials and keep the framework practical. Examples for omitted system element types are *factors of agency* to better describe *Actors* like funds, power, knowledge, legal mandates, which would complicate the operationalization of the framework in practice. These are covered below in the definition of Agency. The same goes for *behavioural incentives* because of attributes, such as safety, convenience, status, health or affordability as well as intrinsic motivations as consumer awareness. Lastly, there are **functional system boundaries** to the MIM in regard to the systemic relationships it considers. The MIM is deliberately designed as a simple **linear impact framework**, not considering interdependencies, feedback loops. These system boundaries do not mean that the MIM ignores such important factors and considerations, but rather that it ringfences the essential elements of the



framework to make it applicable in practice. As a result, some of the effects of this system design are to be considered via additional following concepts as described below.

**Agency** is at the centre of the MIM's distinction between People and Actors, marking the key distinction between the MIM and DIN SPEC 91637. In the MIM, it is defined the sum of all factors like the formal or informal role, identity, decision making power, influence, time, money legitimization, knowledge and so forth that allow an *Actor* to influence the *Attributes* of a city. In a nutshell, while all *People* are affected by the *Attributes* of a city, only those who have the necessary amount of *Agency* to influence a certain *Attribute* count as *Actors regarding this Attribute*. *Agency* is important when it comes to both *Enabling Measures for Actors* or *Implementation Measures by Actors*. And *Agency* is usually case depended on and specific, rather than universal: Some *People* may be key *Actors* regarding one *Attribute*, while not having any *Agency* over another. *Agency* can also be limited in time, for example when citizens can vote once every six years for a new mayor and city council, but not in between. *Agency* is central for the MIM, as it defines who is needed to be on board for the MCM when, who is underrepresented and needs to gain more *Agency* via governance processes, and where the capacity barriers and opportunities are in the city to pursuing climate neutrality. In short, *Agency* is the currency of Cities Mission implementation in the MIM.

**Governance** in turn is a process by which **Agency** is allocated, increased, decreased, or managed in a city. Given the concept of *Agency* as capacity to act, and *Actors* as a subgroup of *People* that holds *Agency* over a certain issue in the MIM, *Governance* is a way to give *People* additional, new, or different forms of *Agency* over the attributes of their city. For example, Munich's Climate Council is a relatively new and institutionalized form of governance that empowers people from across different sectors of society to consult, influence and comment of council decisions, thereby increasing their *Agency* over climate relevant issues. As the Climate Council is a representational body whose members are also mandated to speak on behalf of a societal group, this means additional (although much less direct) *Agency* is given to other *People* outside the council as well. Similar effects can be attributed to other processes as well, from formal participatory planning processes, inhabitant budgeting in Munich or even to the publishing of a digital heat plan, that provides information to *People* via a transparent online portal.

**Stakeholders** are also a key concept within the framework, even though they deliberately do not appear in the system element typology of the MIM. The reason for this is that a Stakeholder commonly is "a person such as an employee, customer, or citizen who is involved with an organization, society, etc. and therefore has responsibilities towards it and an interest in its success"<sup>34</sup> – which means that anyone affected by any changes to *Attributes*. In addition to *Actors* and *People*, Stakeholders can also be affected by *Implementation Measures* in ways not covered by the MIM at all – for example, a Geothermal power plant may not only affect *Actors* like the city utility or *People* as heat energy customers, but also other people that live near the powerplants construction site and suffer negative consequences (e.g. construction noise, visual changes to the landscape) or positive effects (e.g. new jobs created in the area). Stakeholder inclusion in governance processes is therefore important and goes beyond the linear impact dimension of the MIM.

The above-mentioned system boundaries mean that **Case Dependency** within the MIM is an important aspect when applying the framework in practice. When an individual logical chain around an intended Activity Shift, it is possible that individual system elements appear as part of one element type (e.g. Implementation Measure), while simultaneously also acting as another element type in another logical chain (e.g. enabling measure). For example, a parking fee can be an indirect Implementation Measure for an Activity Shift from car trips to bike trips, by making car parking more expensive. At the same time, the same parking fee can also be an Enabling Measure for another

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<sup>34</sup> „Stakeholder“.



Activity Shift, by generating public funds that support the city budget. The same goes for people and actors: A construction company owner may be an important *Actor* in an effort to refurbish buildings, while at the same time falling under the element type of *People* when it comes to the availability of a bus stop in front of his office. In other words, *Case Dependency* means that the correct categorization and understanding of a system element depends on the specific case or issue at hand, and there may be overlaps and differences between different cases.

Additionally, just like synergetic or other forms of interactions can happen between cases, **Feedback Loops** need to be considered between or within the same logical chains. Impacts can double as attributes, Implementation Measures can feed back into Enabling Measures, People can influence Actors. Feedback loops can both be reinforcing or balancing, meaning that they can either increase their own effect or cancel each other out. To keep the MIM operational and understandable, such feedback loops should only be considered where necessary, limiting the amount of complexity in the system model to a necessary minimum. However, they do need to be identified and considered when and where they have a significant effect.

**Table 13: Sectoral Activity Shifts towards climate neutrality aimed by the Munich Impact Model**

Sector	Activity Shift
<b>Stationary Energy</b>	<ul style="list-style-type: none"> <li>• Energy efficient new Housing</li> <li>• Energy efficient new Commercial Buildings</li> <li>• Shift to district heating in multi-family buildings</li> <li>• Shift to district heating in single-family buildings</li> <li>• Shift to district heating in commercial buildings</li> <li>• Shift to district heating in public buildings</li> <li>• Retrofitting multi-family buildings for efficient heating</li> <li>• Retrofitting single-family buildings for efficient heating</li> <li>• Retrofitting commercial buildings for efficient heating</li> <li>• Retrofitting public buildings for efficient heating</li> <li>• Shift to district heating in industrial buildings</li> <li>• Retrofitting industrial buildings for efficient heating</li> <li>• Shift to heat pumps in multi-family buildings</li> <li>• Shift to heat pumps in single-family buildings</li> <li>• Shift to heat pumps in commercial buildings</li> <li>• Shift to heat pumps in public buildings</li> <li>• Shift to heat pumps in industrial buildings</li> <li>• Energy efficient new Housing</li> <li>• Energy Efficient Lighting</li> <li>• Low carbon construction of buildings</li> <li>• Electricity from hydro reservoir</li> <li>• Electricity from solar rooftops</li> <li>• Electricity from wind onshore</li> </ul>
<b>Transport</b>	<ul style="list-style-type: none"> <li>• Shift to walking and cycling</li> <li>• Shift to electric bikes</li> <li>• Shift to Electric cars</li> <li>• Shift to travel by electric bus</li> <li>• Shift to travel by diesel bus</li> <li>• Shift to electric light trucks</li> <li>• Shift to electric heavy trucks</li> <li>• Shift to electric mobile machinery</li> </ul>
<b>Waste</b>	<ul style="list-style-type: none"> <li>• Shift to recycling of solid waste</li> </ul>
<b>Other</b>	<ul style="list-style-type: none"> <li>• Carbon Capture and Storage (CCS)</li> <li>• Carbon Sinks</li> <li>• Avoid Fugitive Emissions</li> </ul>



## 3.2 Module B-2 Climate Neutrality Portfolio Design

This section contains a description for each activity shift from the MIM planned in the CCC Action Plan.

**Table 14: Description of activity shift portfolios**

Sector	List of activity shifts	Descriptions
Stationary Energy	Energy efficient new housing Electricity from hydro reservoir Electricity from solar rooftops Electricity from wind onshore Low carbon construction of buildings Shift to district heating in buildings Energy Efficient Lighting Energy efficient new Housing Retrofitting buildings for efficient heating Shift to heat pumps	These activity shifts focus on enhancing energy efficiency and transitioning to sustainable energy sources in the built environment. Additionally, the adoption of district heating systems and heat pumps will improve heating efficiency, while energy-efficient lighting will reduce overall energy consumption.
Transport	Shift to electric bikes Shift to electric light trucks Shift to Electric cars Shift to electric mobile machinery Shift to travel by electric bus Shift to travel by diesel bus Shift to walking and cycling	In the transportation sector Munich aims to shift from individual transport to more public transport as well as to shift from fossil drives to less emission intense drives like electric cars or busses. The sector also includes logistics and commercial transportation within the city boundaries.
Waste	Shift to recycling of solid waste	As emissions from direct burning or gas from landfill of waste used as a energy source is reported under stationary energy, the waste sector focuses on shifting towards more recycling of solid wastes.
Other	Carbon Capture Storage Carbon Sinks Avoid Fugitive Emissions	Other activity shifts like CCS, avoiding fugitive emissions or carbon sinks (e.g. bogs, reforestation) will also be considered towards climate neutrality.

Beyond the following activity shifts there are more individual measures which contribute to the Munich climate neutral transformation, and which are currently not possible to match to specific activity shifts. They will be included in the other or new activity shifts going forward, as our monitoring continues to develop.

### Other (Adaptation)

1. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 5 – Mehr Grün und Mehr Biodiversität I - Untersuchung für Pflanzkonzepte auf Biodiversitäts Gründächern"
2. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 6 – Mehr Grün und Mehr Biodiversität II - Fassadenbegrünung an Betriebsgebäuden des Baureferates"
3. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 7 – Mehr Grün und Mehr Biodiversität III - Baumpflanzungen im öffentlichen Raum"
4. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 8 – Mehr Grün und Mehr Biodiversität IV - Ökologische Aufwertung Straßenbegleitgrün"
5. "Sonderprogramm Klimaschutz 2021, KOM 1 – Grunderwerb und Beschaffung von Setzlinge"
6. "Sonderprogramm Klimaschutz 2021, KOM 3 – Gebäudebegrünung"
7. "Grundsatzbeschluss II, Maßnahme 16 – Aufstockung und Erweiterung des Fördertopfes für private Begrünungsmaßnahmen sowie fachliche Prüfung und buchhalterische Abwicklung der dazugehörigen Förderanträge"



8. "Grundsatzbeschluss II, Maßnahme 18 – Pauschale D1 Gebäudebegrünung hier: Untersuchung zur Vorbereitung der Gebäudebegrünung"
9. "Grundsatzbeschluss II, Pauschale D2 Fassadenbegrünung, Maßnahme 19 – hier: Untersuchungsauftrag für Fassadenbegrünung weiterer stadt-eigener Bestandsgebäude einschl. Bildungseinrichtungen"
10. "Fortschreibung des Klimaanpassungskonzepts I – Pilotprojekt Baumstandorte & Regenwasserversickerung, Klimaanpassungskonzept I"
11. "Fortschreibung des Klimaanpassungskonzepts I – Entsiegelung und Begrünung von Schulhöfen,
12. Klimaanpassungskonzept I"
13. "Fortschreibung des Klimaanpassungskonzepts I – intensive Dachbegrünung, Klimaanpassungskonzept"
14. "Grundsatzbeschluss III, Maßnahme 08 – Beitrag zur naturnahen Pausenhofgestaltung (Entsiegelung und Begrünung von Schulhöfen"
15. "Grundsatzbeschluss III, Maßnahme 10 – Ausstattung temporäre Straßenraumgestaltung mit mobiler Bepflanzung"
16. "Grundsatzbeschluss III, Maßnahme 11 – Baumpflanzungen im Straßenraum"
17. "Grundsatzbeschluss III, Maßnahme 11 – Baumpflanzungen in öffentlichen Grünflächen"

#### **Other (Generic)**

18. "Grundsatzbeschluss II, Maßnahme 67 – KoFi-Fond (EU-Projekte)"
19. "Grundsatzbeschluss III, Maßnahme 01 – GWG München mbH (Münchner Wohnen) Stammkapitalerhöhung (SV 20-26 V 11692)"
20. "Grundsatzbeschluss III, Maßnahme 13 – Einführung eines ergänzenden und anschaulichen Klimaschutz-Monitoring-Systems"

#### **Other (Scope 3)**

21. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 3 – Verstärkung des klimafreundlichen, kreislaufgerechten Bauens I -Vorzeitige Erstellung und flächendeckender Einsatz des Ökobilanztools, Materialausweises und Bauteilkatalogs"
22. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 4 – Verstärkung des klimafreundlichen, kreislaufgerechten Bauens II –Intensivierung der Holzbauweise"
23. "Grundsatzbeschluss II, Maßnahme 1 – Nachwachsende Rohstoffe"
24. "Grundsatzbeschluss II, Maßnahme 59 – C1 Qualitätsvorgaben und -sicherung zur an die Materialien gebundene Energie ("Graue Energie"), Ökobilanzierung, Kreislaufgerechtes Bauen und Einsatz von Recyclingbaustoffen"
25. "Grundsatzbeschluss II, Maßnahme 60 – C2 Qualitätsvorgaben und -sicherung zur Intensivierung der Holzbauweise für Lernhaus und mehrgeschossige Bauten "

#### **Other (Waste)**

26. "Grundsatzbeschluss II, Maßnahme 28 – Abfallvermeidung und Kommunikation zum Thema Abfallvermeidung und Mülltrennung als Beitrag zum Klima- und Ressourcenschutz - Mehrwertzentren in den Quartieren als Erweiterung des Gebrauchtwarenkaufhauses Halle 2 "
27. "Grundsatzbeschluss III, Maßnahme 06 – Städtische Bauteilbörse"



## Individual activity shift outlines

All impact values refer to 2035 projections.

Activity shift outline	Activity shift name	Carbon sinks
	Activity shift description	Increase available areas within the city's boundaries functioning as carbon sinks
Reference to impact pathway	Sector	Other
Implementation of associated measures	Responsible bodies/person for implementation	City department of communal services
	Implementation period	2022-2023
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	/

The following measures are associated with this activity shift:

1. "Grundsatzbeschluss II, Maßnahme 63 – Moorrenaturierung Nantesbuch"

Activity shift outline	Activity shift name	Electricity from hydro reservoir
	Activity shift description	Alter the amount of electricity produced by hydro reservoir
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City department of construction
	Implementation period	2024
Impact of associated measures	Generated renewable energy (if applicable)	4,950,000 kWh
	Removed/substituted energy, volume, or fuel type	4,950,000 kWh
	GHG emissions reduction estimate (total) per emission source sector	/

The following measures are associated with this activity shift:

2. "Grundsatzbeschluss III, Maßnahme 05 – Wasserkraftturbine im Abwasserstrom auf dem Klärwerk Gut Großlappen"



Activity shift outline	Activity shift name	Electricity from solar rooftops
	Activity shift description	Alter the amount of electricity produced by solar rooftops
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction, climate, communal services and education
	Implementation period	2022 – ongoing
Impact of associated measures	Generated renewable energy (if applicable)	103,955,000 kWh
	Removed/substituted energy, volume, or fuel type	103,500,000 kWh
	GHG emissions reduction estimate (total) per emission source sector	63,748 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

3. "Grundsatzbeschluss II, Maßnahme 1 – Photovoltaik"
4. "Grundsatzbeschluss II, Maßnahme 6 – Fortschreibung und weitere Entwicklung Bauzentrum"
5. "Grundsatzbeschluss II, Maßnahme 51 – PV-Ausbau zur Erhöhung der Eigenbedarfsdeckung"
6. "Grundsatzbeschluss II, Maßnahme 57 – B1 Verstärkter Ausbau von PV-Anlagen im Gebäudebestand"
7. "Grundsatzbeschluss III, Maßnahme 09 – Nutzersensibilisierung zur regenerativen Stromerzeugung an weiterführenden Bildungseinrichtungen"

Activity shift outline	Activity shift name	Electricity from wind onshore
	Activity shift description	Alter the amount of electricity produced by wind onshore
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City department of communal services
	Implementation period	2023-2024
Impact of associated measures	Generated renewable energy (if applicable)	11,000,000 kWh
	Removed/substituted energy, volume, or fuel type	11,000,000 kWh
	GHG emissions reduction estimate (total) per emission source sector	2664 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

8. "Sonderprogramm Klimaschutz 2021, KOM 2 – SgM Windkraftanlage (Beschlussfassung in 2021 notwendig, Mittelabfluss in 2022)"

Activity shift outline	Activity shift name	Avoid Fugitive Emissions
	Activity shift description	Avoid releasing fugitive emissions from e.g. leakages or landfills into the atmosphere
Reference to impact pathway	Sector	Other (Fugitive Emissions)
Implementation of associated measures	Responsible bodies/person for implementation	City department of communal services
	Implementation period	2024-2026
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type-	/



	GHG emissions reduction estimate (total) per emission source sector	/
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The following measures are associated with this activity shift:

9. Grundsatzbeschluss III, Maßnahme 07 – Optimierung der Deponiegasfassung am Standort Großlappen

Activity shift outline	Activity shift name	Low carbon construction of buildings
	Activity shift description	Shift square meter from standard construction to low carbon construction in square meter to fulfil the need of housing
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City department of social services
	Implementation period	2021-2025
Impact of associated measures	Generated renewable energy (if applicable)	3,022,794 kWh
	Removed/substituted energy, volume, or fuel type	2,363,935 kWh
	GHG emissions reduction estimate (total) per emission source sector	554 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

10. "Sonderprogramm Klimaschutz 2021, SOZ 1/Münchenstift – BV Pflegeheim Tauernstraße; Mehrkosten EH 40 Plus incl. PV"
11. "Sonderprogramm Klimaschutz 2021, SOZ 2/Münchenstift – BV Pflegeheim Franz-Nißl-Str.; Gesamt-Mehrkosten incl Grün + PV"

Activity shift outline	Activity shift name	Shift to district heating in buildings
	Activity shift description	Shift square meter from industrial building heated with gas, oil, and direct electric heaters to industrial building heating with district heating in square meter to fulfil the need of comfortable premises
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction, and climate
	Implementation period	2022 – ongoing
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	/

The following measures are associated with this activity shift:

12. "Grundsatzbeschluss II, Maßnahme 5 – Verstärkte Nutzung dezentraler Wärme aus oberflächennaher Geothermie und Abwärme - inkl. Optimierung der thermischen Grundwassernutzung in München, Einführung und Bedienung Grundwassermanagement Tool"



13. "Grundsatzbeschluss II, Maßnahme 58 – B2 Beschleunigte Dekarbonisierung der Wärmeversorgung"

Activity shift outline	Activity shift name	Shift to electric bikes
	Activity shift description	Shift vehicle kilometre from petrol, diesel and LPG vehicles to electric bike in vehicle kilometre to fulfil the need of mobility
Reference to impact pathway	Sector	Transport
Implementation of associated measures	Responsible bodies/person for implementation	City department of construction
	Implementation period	2021-2022
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	4,700 kWh
	GHG emissions reduction estimate (total) per emission source sector	17 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

14. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 11 – Mobilität I - Beschaffung von 5 Pedelecs für das Baureferat"
15. "Sonderprogramm Klimaschutz 2021, KVR – Mobilität auf Dienstfahrten, Anschaffung von Lastenpedelecs"

Activity shift outline	Activity shift name	Shift to electric light trucks
	Activity shift description	Shift vehicle kilometre from diesel light trucks to battery electric light trucks in vehicle kilometre to fulfil the need of logistics
Reference to impact pathway	Sector	Transport
Implementation of associated measures	Responsible bodies/person for implementation	City department of climate and environment
	Implementation period	2023-2027
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	/

The following measures are associated with this activity shift:

16. "E-Logistik – Ausrichtung des Münchner Wirtschaftsverkehrs, sodass trotz steigenden gewerblichen Verkehrs, insbesondere im KEP-Bereich, die Lebens- und Mobilitätsqualität aller Bürger\*innen verbessert wird, wobei batterieelektrische Nutzfahrzeuge in Kombination mit smarten Logistikkonzepten als integrale Hebel zur Verbesserung der Luftqualität und zur effektiven Nutzung emissionsfreier Technologien dienen."



Activity shift outline	Activity shift name	Energy Efficient Lighting
	Activity shift description	Shift to the use of less energy demanding lighting like LEDs
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction and culture
	Implementation period	2022-2026
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	174,898,985 kWh
	GHG emissions reduction estimate (total) per emission source sector	53,411 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

17. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 9 – Verkehrsinfrastruktur I - Intensivierung des Energiesparprogramms zur Umstellung der Straßenbeleuchtung auf LED-Technik"
18. "Grundsatzbeschluss II, Maßnahme 46 – KULT - Kernreferat - Abt. 2, Veranstaltungstechnik I (LED-Beleuchtung)"
19. "Grundsatzbeschluss II, Maßnahme 47 – KULT - Kernreferat - Abt. 2, Veranstaltungstechnik II (LED-Beleuchtung)"
20. "Grundsatzbeschluss II, Maßnahme 48 – KULT - Kernreferat - Abt. 2, Veranstaltungstechnik III (LED-Beleuchtung Logistikzentrum Maria-Probst-Str.)"
21. "Grundsatzbeschluss II, Maßnahme 49 – Museum Villa Stuck (Austausch Beleuchtungstechnik in LED)"
22. "Grundsatzbeschluss II, Maßnahme 50 – Bildung in nachhaltigen Räumen: Umstellung des Ökologischen Bildungszentrums auf LED-Beleuchtung als Pilotprojekt. Umstellung Beleuchtung des Zugangswegs bis zum ÖBZ und zum Vorplatz auf LED als Pilotprojekt"
23. "Grundsatzbeschluss II, Maßnahme 54 – A3 Intensivierung des Sonderprogramms Stromeffizienz mit Schwerpunkt LED-Technik"

Activity shift outline	Activity shift name	Energy efficient new Housing
	Activity shift description	Shift to energy efficient new buildings
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction and climate
	Implementation period	2020 – ongoing
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	92,000,000 kWh
	GHG emissions reduction estimate (total) per emission source sector	55,393 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

24. "Grundsatzbeschluss II, Maßnahme 1 – Energiestandards im Neubau (mind. EH 40)"
25. "Grundsatzbeschluss II, Maßnahme 52 – A1 Niedrigstenergiestandard-LHM Fortschreibung der energetischen Baustandards sowie technische Prüfung der neuen KfW-Energieeffizienzklassen (Förderung); 1,0 VZÄ ab 2022 befristet bis 2024"



26. "Grundsatzbeschluss II, Maßnahme 56 – A6 Intensivierung des Technischen Monitorings für Neubaumaßnahmen und den Gebäudebestand als Instrument zur Qualitätssicherung und Betriebskosteneinsparung und CO2-Reduzierung"

Activity shift outline	Activity shift name	Retrofitting buildings for efficient heating
	Activity shift description	Reduce the amount of energy required to heat district heating, gas, oil, direct electric, heat pump, solid biofuels, coal, solar thermal and LPG buildings through retrofitting
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction and climate
	Implementation period	2021-2035
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	40,046,200 kWh
	GHG emissions reduction estimate (total) per emission source sector	1,308,053 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

27. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 1 – Steigerung der Energieeffizienz und CO2 Reduzierung mit Verstärkung des Energiemanagements I – Zusätzlicher Einbau von Komponenten zur Ausweitung des Technischen Monitorings"
28. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 2 – Steigerung der Energieeffizienz und CO2 Reduzierung mit Verstärkung des Energiemanagements II – Dekarbonisierung der Wärmeversorgung"
29. "Grundsatzbeschluss II, Maßnahme 1 – Beratungsleistungen"
30. "Grundsatzbeschluss II, Maßnahme 1 – Einzelmaßnahmen Gebäudehülle (im Rahmen eines individuellen Sanierungsplans 2035)"
31. "Grundsatzbeschluss II, Maßnahme 1 – Einzelmaßnahmen Anlagentechnik ohne Wärmepumpe (im Rahmen eines individuellen Sanierungsplans 2035)"
32. "Grundsatzbeschluss II, Maßnahme 1 – Energiestandards im Bestand (mind. EH 55)"
33. "Grundsatzbeschluss II, Maßnahme 1 – Innovationsprämie"
34. "Grundsatzbeschluss II, Maßnahme 1 – Fachplanung und Baubegleitung"
35. "Grundsatzbeschluss II, Maßnahme 1 – CO<sub>2</sub>-Bonus Fernwärmegebiet"
36. "Grundsatzbeschluss II, Maßnahme 2 – Umsetzung des novellierten Förderprogramms FES in einer Fördermittelsoftware und jährliche Updates (Aufwand geschätzt)"
37. "Grundsatzbeschluss II, Maßnahme 53 – A2 Erhöhung der Sanierungsrate mit dem individuellen Sanierungsfahrplan Klimaneutralität (ISK) und Neuausrichtung EGuH zum ISK; 4,0 VZÄ ab 2022 befristet bis 2024"
38. "Grundsatzbeschluss II, Maßnahme 55 – A5: Intensivierung des Energiesparprogramms: Überprüfung der Energieeffizienz im Gebäudebestand – Energiechecks, Maßnahmenpriorisierung und Umsetzung sowie Erfassung der Gebäudestruktur in energetischer Hinsicht (H94)"
39. "Grundsatzbeschluss III, Maßnahme 01 – Fortschreibung Förderprogramm Klimaneutrale Gebäude - FKG"



Activity shift outline	Activity shift name	Shift to Electric cars
	Activity shift description	Shift vehicle kilometre from petrol, diesel, LPG and gas vehicles to battery electric vehicles in vehicle kilometre to fulfil the need of mobility
Reference to impact pathway	Sector	Transport
Implementation of associated measures	Responsible bodies/person for implementation	City departments of climate, mobility, communal services and education
	Implementation period	2022-2028
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	289,109 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

40. "Grundsatzbeschluss II, Maßnahme 7 – Förderprogramm Elektromobilität „München emobil“ (Zuschuss)
41. Klimaneutrale Antriebe"
42. "Grundsatzbeschluss II, Maßnahme 9 – Tiefbaumaßnahmen im Umfeld von Schnellladestationen im öffentlichen Raum"
43. "Grundsatzbeschluss II, Maßnahme 10 – Pilotprojekt zum Langsamladen (Low-Power-Charging)"
44. "Grundsatzbeschluss II, Maßnahme 35 – Umstellung des städtischen Fuhrparks auf klimaneutrale Antriebstechnologien: Kraftfahrzeuge bis 2,5 t zGG (Kategorie I)"
45. "Grundsatzbeschluss II, Maßnahme 36 – Umstellung städtischer Fuhrpark auf klimaneutrale Antriebstechnologien: Kraftfahrzeuge größer 2,5 t bis 3,5 t zGG (Kategorie II)"
46. "Grundsatzbeschluss II, Maßnahme 37 – Umstellung städtischer Fuhrpark auf klimaneutrale Antriebstechnologien: Kraftfahrzeuge größer 3,5 t zGG (Kategorie III)"
47. "Grundsatzbeschluss II, Maßnahme 40 – Errichtung Ladeinfrastruktur in stadteigenen und angemieteten Gebäuden"
48. "Grundsatzbeschluss II, Maßnahme 41 – Errichtung von Ladeinfrastruktur an städtischen Schulen"
49. "Grundsatzbeschluss III, Maßnahme 02 – Finanzierung Förderprogramm E-Taxi"
50. "Grundsatzbeschluss III, Maßnahme 03 – Fortführung Bereitstellung ausreichender und geeigneter Ladeinfrastruktur für E-Mobilität: High Power Hub Olympiazentrum"
51. "Grundsatzbeschluss III, Maßnahme 04 – Bereitstellung ausreichender und geeigneter Ladeinfrastruktur für E-Mobilität, hier: Öffentlich zugängliche Ladeinfrastruktur auf Privatgrund"



Activity shift outline	Activity shift name	Shift to electric mobile machinery
	Activity shift description	Shift to the use of electric mobile machinery within the city's vehicle fleet
Reference to impact pathway	Sector	Transport
Implementation of associated measures	Responsible bodies/person for implementation	City department of communal services
	Implementation period	2022-2026
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	1,082,900 kWh
	GHG emissions reduction estimate (total) per emission source sector	10,429 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

52. "Grundsatzbeschluss II, Maßnahme 38 – Umstellung des städtischen Fuhrparks auf klimaneutrale Antriebstechnologien: Arbeitsmaschinen und mobile Maschinen (Kategorie IV)"
53. "Grundsatzbeschluss II, Maßnahme 39 – Erprobung von schweren Nutzfahrzeugen mit unterschiedlichen elektrischen Antriebskonzepten"
54. "Grundsatzbeschluss II, Maßnahme 42 – Umstellung Fuhrpark der städtischen Forstverwaltung auf alternative Antriebe: Pilotprojekt Pritschenwagen"
55. "Grundsatzbeschluss II, Maßnahme 43 – Umstellung Fuhrpark der Stadtgüter München auf alternative Antriebe: Pilotprojekt Radlader"

Activity shift outline	Activity shift name	Shift to heat pumps
	Activity shift description	Shift square meter from multi-family buildings heated with gas, oil, direct electric, coal and LPG to multi-family buildings heated with heat pumps in square meter to fulfil the need for comfortable premises
Reference to impact pathway	Sector	Energy
Implementation of associated measures	Responsible bodies/person for implementation	City department of climate
	Implementation period	ongoing
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	35,993 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

56. "Grundsatzbeschluss II, Maßnahme 1 – Einzelmaßnahmen Wärmepumpe (im Rahmen eines individuellen Sanierungsplans 2035)"

Activity shift outline	Activity shift name	Shift to travel by electric bus
	Activity shift description	Shift vehicle kilometre from petrol, diesel, LPG and gas vehicles to electric bus to fulfil the need of commuting
Reference to impact pathway	Sector	Transport



Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction and mobility
	Implementation period	2021-2035
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	474,465 t CO <sub>2</sub> e

The following measures are associated with this activity shift:

57. "Sonderprogramm Klimaschutz 2021, MOR 1 – Beschleunigung und Verbesserung des Buslinienverkehrs"
58. "Sonderprogramm Klimaschutz 2021, MOR 2 – Elektrifizierung des Buslinienverkehrs"
59. "Grundsatzbeschluss II, Maßnahme 33 – Go!Family - multimodales Mobilitätsangebot für junge Familien"

Activity shift outline	Activity shift name	Shift to walking and cycling
	Activity shift description	Shift vehicle kilometre from petrol, diesel, LPG and gas vehicles to walking cycling in person kilometre to fulfil the need of commuting
Reference to impact pathway	Sector	Transport
Implementation of associated measures	Responsible bodies/person for implementation	City departments of construction and mobility
	Implementation period	2021 – ongoing
Impact of associated measures	Generated renewable energy (if applicable)	/
	Removed/substituted energy, volume, or fuel type	/
	GHG emissions reduction estimate (total) per emission source sector	/

The following measures are associated with this activity shift:

60. "Sonderprogramm Klimaschutz 2021, BAU Maßnahme 10 – Verkehrsinfrastruktur II - Förderung der Verkehrswende durch Radwegeausbau"
61. "Grundsatzbeschluss II, Maßnahme 13 – Konzept und Modellierung der Erreichbarkeit und Erschließung zur Umsetzung autoarmer Quartiere; hier: 1,0 VZÄ ab 2022 befristet bis 2024 (E13)"
62. "Grundsatzbeschluss II, Maßnahme 44 – Stadtweite Koordination und Projektleitung LHMobil sowie Partizipationsmanagement mit Fokus Klimaschutz und Verkehrswende"



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

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

Sector	Activity Shift	Indicators	Indicator Unit	Additional Required Calculation Parameters	Parameter Unit	Direct Impacts / Outcomes	Co-Benefits	Target Value 2035
Stationary Energy	Energy efficient new Housing	<b>Energy efficiency savings factor for residential buildings</b>	%	/		Energy Efficient New Buildings, GHG Emission Reduction	Economic Savings in Heating and Cooling	n/A
	Energy efficient new Commercial Buildings	<b>Energy efficiency savings factor for non-residential buildings</b>	%	/		Energy Efficient New Buildings, GHG Emission Reduction	Economic Savings in Heating and Cooling	n/A
	Low carbon construction of buildings	<b>Growth of low carbon construction of commercial buildings</b>	<b>m<sup>2</sup> per capita</b>	Stock low carbon construction commercial buildings  Emission factor low carbon construction  Work intensity direct operations use m2	m <sup>2</sup>  g CO2e / m <sup>2</sup>  m <sup>2</sup> / m <sup>2</sup>	Energy Efficient Buildings	Economic Savings in Heating and Cooling	n/A
	Shift to district heating in single-family buildings	<b>Stock single-family houses heated with district heating</b>	m <sup>2</sup>	Emission factor district heating  Energy intensity district heating heated single-family buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	62 % share of district heating on the city's total heating energy demand



Action Plan



	Shift to district heating in multi-family buildings	<b>Stock multi-family buildings heated with district heating</b>	m <sup>2</sup>	Emission factor district heating  Energy intensity district heating heated multi-family buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
	Shift to district heating in commercial buildings	<b>Stock district heating (non-residential, commercial)</b>	m <sup>2</sup>	Emission factor district heating  Energy intensity district heating commercial	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
	District heating in public buildings	<b>Stock district heating (public)</b>	m <sup>2</sup>	Emission factor district heating  Energy intensity district heating public	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
	Shift to district heating in industrial buildings	<b>Stock district heating (non-residential, industrial)</b>	m <sup>2</sup>	Emission factor district heating  Energy intensity district heating industrial	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
	Shift to heat pumps in multi-family buildings	<b>Stock multi-family buildings heated with heat pumps</b>	m <sup>2</sup>	Emission factor heat pumps  Energy intensity heat pumps multi-family buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	



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Shift to heat pumps in single-family buildings	<b>Stock single-family buildings heated with heat pumps</b>	m <sup>2</sup>	Emission factor heat pumps  Energy intensity heat pumps single-family buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
Shift to heat pumps in commercial buildings	<b>Stock commercial buildings heated with heat pumps</b>	m <sup>2</sup>	Emission factor heat pumps  Energy intensity heat pumps commercial buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
Shift to heat pumps in public buildings	<b>Stock public buildings heated with heat pumps</b>	m <sup>2</sup>	Emission factor heat pumps  Energy intensity heat pumps public buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
Shift to heat pumps in industrial buildings	<b>Stock industrial buildings heated with heat pumps</b>	m <sup>2</sup>	Emission factor heat pumps  Energy intensity heat pumps industrial buildings	g CO2e / kWh  kWh / m <sup>2</sup>	GHG Emission Reduction	Economic Savings	
Retrofitting single-family buildings for efficient heating	<b>Annual Retrofitting factor for single-family buildings</b>	%	Retrofitting savings factor for single-family buildings	%	Increased Energy Efficiency, GHG Emission Reduction	Economic Savings, Job Creation	Annually 1.3 % until 2025  Annually 1.7 % between 2026 & 2030



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								Annually 2.1 % between 2031 & 2035  <b>Cumulative 28.1 % until 2035</b>
Retrofitting multi-family buildings for efficient heating	<b>Annual Retrofitting factor for multi-family buildings</b>	%	Retrofitting savings factor for multi-family buildings	%	Increased Energy Efficiency, GHG Emission Reduction	Economic Savings, Job Creation	Annually 1.4 % until 2025  Annually 1.8 % between 2026 & 2030	
Retrofitting commercial buildings for efficient heating	<b>Annual Retrofitting factor for commercial buildings</b>	%	Retrofitting savings factor for commercial buildings	%	Increased Energy Efficiency, GHG Emission Reduction	Economic Savings, Job Creation	Annually 2.2 % between 2031 & 2035  <b>Cumulative 29.8 % until 2035</b>	
Retrofitting public buildings for efficient heating	<b>Annual Retrofitting factor for public buildings</b>	%	Retrofitting savings factor for public buildings	%	Increased Energy Efficiency, GHG Emission Reduction	Economic Savings, Job Creation		
Retrofitting industrial buildings for efficient heating	<b>Annual Retrofitting factor for public buildings</b>	%	Retrofitting savings factor for public buildings	%	Increased Energy Efficiency, GHG Emission Reduction	Economic Savings, Job Creation		
Electricity from solar rooftops	<b>Initial operation solar rooftop</b>	kWh	Stock per work coefficient solar rooftop	kWp / kWh	Increased Renewable Energy Production,	Economic Savings, Job Creation	11 % of total electricity demand in 2035 covered by PV	



Action Plan



				Emission factor solar panel rooftop production per year	g CO2e / kWp year	GHG Emission Reduction		(0.8 TWh in total)
				Energy intensity direct resource use kWh	kWh / kWh			
Electricity from wind onshore	<b>Initial operation wind onshore</b>	<b>kWh</b>	Stock per work coefficient wind onshore	Emission factor onshore production	kWh / kWh	Increased Renewable Energy Production, GHG Emission Reduction	Economic Savings, Job Creation	n/a
				Energy intensity direct resource use kWh	g CO2e / kW			
					kWh / kWh			
Electricity from hydro reservoir	<b>Initial operation hydro reservoir</b>	<b>kWh</b>	Stock per work coefficient wind onshore	Emission factor onshore production	kWh / kWh	Increased Renewable Energy Production, GHG Emission Reduction	Economic Savings	n/a
				Energy intensity direct resource use kWh	g CO2e / kWh			
					kWh / kWh			
Energy Efficient Lighting	<b>Saved energy through efficient lightning</b>	<b>kWh</b>	Emission factor electricity grid	Energy consumption previous technology	g CO2e / kWh	GHG Emission Reduction	Economic Savings, Job Creation	n/a
					kWh			



## Action Plan



Transport	Shift to walking and cycling	<b>Growth of active travel (walking and cycling) operations</b>	<b>Pkm per Capita</b>	<p>Stock of walking and biking</p> <p>Emission factor active travel</p> <p>Energy intensity walking/biking</p> <p>Load factor car commute</p>	<p>Pkm</p> <p>g CO2e / kWh</p> <p>kWh / Pkm</p> <p>Persons</p>	GHG Emission Reduction	Less Noise, Air Quality, Economic Savings	<p>80% share expanded EcoMobility (“Erweiterter Umweltverbund”) on modal split by 2025</p> <p>30% public transport share on EcoMobility by 2030</p>
	Shift to electric bikes	<b>Growth of electric bike operations</b>	<b>Vkm per Capita</b>	<p>Stock of electric bikes</p> <p>Emission factor produced electricity current grid mix average</p> <p>Energy intensity electric bikes</p> <p>Load factor car commute</p> <p>Proportion of personal vehicles shiftable to electric bikes</p>	<p>Vkm</p> <p>g CO2e / kWh</p> <p>kWh / vkm</p> <p>Persons</p> <p>%</p>	GHG Emission Reduction	Less Noise, Air Quality	
	Shift to Electric cars	<b>Growth of personal vehicles (BEV) operation</b>	<b>Vkm per Capita</b>	<p>Stock of personal vehicles (BEV) operation</p> <p>Emission factor produced electricity current grid mix average</p>	<p>Vkm</p> <p>g CO2e / kWh</p>	GHG Emission Reduction	Less Noise, Air Quality	



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				Energy intensity personal BEV	kWh / vkm			
	Shift to travel by electric bus	<b>Growth of electric bus operations</b>	<b>Vkm per Capita</b>	Stock of electric busses	Vkm	GHG Emission Reduction	Less Noise, Air Quality	
				Emission factor produced electricity current grid mix average	g CO2e / kWh			
				Energy intensity electric bus	kWh / vkm			
				Load factor car commute	Persons per car			
				Load factor bus commute	Persons per Bus			
				Average commute length to work (round-trip)	Kilometres			
				Proportion commutes	%			
	Shift to travel by diesel bus	<b>Growth of diesel bus operations</b>	<b>Vkm per Capita</b>	Stock of diesel busses	Vkm	GHG Emission Reduction		
				Emission factor fossil diesel WTW	g CO2e / kWh			
				Load factor car commute	Persons per car			



Action Plan



				Load factor bus commute	Persons per Bus			
				Average commute length to work (round-trip)	Kilometres			
				Proportion commutes	%			
Shift to electric light trucks	<b>Growth of electric light truck operations</b>	<b>kWh per Capita</b>	Stock of electric light trucks	Vkm	GHG Emission Reduction	Less Noise, Air Quality	n/a	
			Emission factor produced electricity current grid mix average	g CO2e / kWh				
			Energy intensity electric light trucks	kWh / vkm				
Shift to electric heavy trucks	<b>Growth of electric heavy truck operations</b>	<b>kWh per Capita</b>	Stock of electric heavy trucks	Vkm	GHG Emission Reduction	Less Noise, Air Quality	n/a	
			Emission factor produced electricity current grid mix average	g CO2e / kWh				
			Energy intensity electric heavy trucks	kWh / vkm				
Shift to electric mobile machinery	<b>Growth of electric mobile machinery operations</b>	<b>kWh per Capita</b>	Stock non-road-mobile machinery (electricity)	Vkm	GHG Emission Reduction	Less Noise, Air Quality	n/a	
			Emission factor produced	g CO2e / kWh				



Action Plan



				electricity current grid mix average				
				Energy intensity machinery (electricity)	kWh / vkm			
Waste	Shift to recycling of solid waste	<b>Growth of waste recycling operations</b>	<b>Tons per Capita</b>	Stock of recycled waste	Tons	GHG Emission Reduction		n/a
				Emission factor recycling of solid waste	g CO2e / ton recycled			
				Work intensity tons recycling	ton / ton			
Other	Carbon Capture and Storage (CCS)	<b>Amount of CO2e captured and stored</b>	<b>kg CO2e</b>	/	/	GHG Emission Reduction		n/a
	Carbon Sinks	<b>Area used as carbon sinks</b>	<b>m<sup>2</sup></b>	/	/	GHG Emission Binding	Air Quality	
	Avoid Fugitive Emissions	<b>Avoided Fugitive Emissions</b>	<b>kg CO2e</b>	/	/	GHG Emission Reduction	Air Quality	n/a



## 4 Part C – Enabling Climate Neutrality by 2030

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

### 4.1 Module C-1 Governance Innovation Interventions

*This module details the city’s governance innovations for achieving city climate neutrality by 2035, describing innovations in institutional design, in leadership, and in collaborative and outreach processes, whether they are inter-organisational or internal to the key organisations responsible for the city’s climate neutrality target. It also describes expected outcomes, for example how these governance innovations enable climate actions and their co-benefits (outlined in Modules B-1 and B-2), and how they address the opportunities, gaps and barriers identified in Modules A-2 and A-3.*

**Built on a strong mandate:** The governmental and institutional structure for climate action in Munich is not a top-down decision, but the **outcome of a successful bottom-up process**, mainstreaming the common climate protection mandate across the city. Driven by a vibrant actor ecosystem from all stakeholder groups in the city, 2018 and 2019 became a watershed for Munich’s climate policy which led to the creation of a unique set of formal institutions that act as key pillars for climate governance in Munich today:

- **Common Goal:** The common climate neutrality goal for the city by 2035 based on a Climate Statute to set and enshrine a common climate neutrality mandate for the entire city
- **Coordination of municipal government institutions:** The creation of a dedicated Climate- and Environmental Protection Department to coordinate climate strategy and operational functions for a successful transition to climate neutrality, including climate budgeting and a systematic climate check for council decision proposals
- **Inclusive Governance:** The creation of a Climate Council of representatives from politics, administration, civil society, private sector and academia to foster inclusive and holistic climate governance

The main formal institution for inclusive governance is [Munich’s Climate Council \(Klimarat\)](#). The Climate Council is a fully formalized institution with its own statute<sup>35</sup>, clearly encoding its function, composition, rights, and purpose in material law according to §23 of the Bavarian Municipality Code (*Bayrische Gemeindeordnung*). Procedures for sessions and voting are set by a formal Rules of Procedure (*Geschäftsordnung*). The Climate Council was established in 2021 and includes born and appointed representatives (3-year period) of the administration, city council factions, academia and research, private sector, and civil society. As its main tasks

- “(1) The Climate Council of the City of Munich (city) comments on fundamental decisions of the city regarding climate protection and serves as a critical and constructive companion and advisor to the honorary city council and the administration of the City of Munich in the further development of the city’s climate strategy.

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<sup>35</sup> Satzung zur Einführung eines Klimarates der Landeshauptstadt München (KlimaratS).



- (2) The Climate Council also supports communication between the public, science, politics, and administration regarding the city's climate protection efforts and facilitates public and professional discussions about the goals and criteria of the city's climate protection policy within civil society.<sup>36</sup>

The Climate Council Statute has the right to provide statements for all matters of the city council regarding fundamental decisions in the area of municipal climate protection or climate adaptation measures; updating and implementing the climate strategy (see § 7 paragraph 1 of the Climate Statute of the City of Munich); and reporting on the greenhouse gases emitted by the city and its municipal companies (see § 5 paragraphs 2 and 3 of the Climate Statute of the City of Munich), as well as the overall greenhouse gas emissions within the city area and compliance with the interim targets set in the climate strategy (see § 9 paragraph 3 of the Climate Statute of the City of Munich). These statements are then included in city council decision proposals. Munich's Climate Council is a core governance innovation and unique in its form and legal status among cities in Germany, strongly in line with the Mission's requirements to build a strong mandate across stakeholders. Since its inception, the climate council has been involved in shaping Munich's climate strategy and council decisions, forming the basis for the content of the Climate City Contract and the existing strategies and policies described in Section A-2 of the Action Plan.

**Understanding the Ecosystem:** Based on the concepts and definitions of the MIM (B-1), the ecosystem of climate actors in Munich extends much further than members of the climate council on a wide spectrum of from formal networks and platforms to informal or unorganized actors, including citizens and even temporary visitors to the city (*People*). The **public sector** in Munich itself is a extends across hundreds of entities, including the 250 subsidiaries or stakeholder relationships that are connected to public finances. Independent of the purpose or mission of these entities, mainstreaming climate neutrality via the 2030 climate neutrality target for municipal operations automatically turns every one of these entities into a climate stakeholder, seamlessly cutting across conventional public and private sector divisions. Beyond the public sector, another key type of systemic structures are dedicated climate **platforms and networks**, representing or connecting groups of stakeholders, directly or indirectly supporting climate action. For example, the *Klimaherbst* Network or the *Münchner Initiative Nachhaltigkeit* are joint initiatives by and for (largely) civil society organizations to facilitate exchange and joint action. *Klimapakt* and *Ökoprofit* are exchange and collaboration network programs run by the city government for private sector actors, focusing on large corporates (*Klimapakt*) and SMEs (*Ökoprofit*) in Munich. Corporatist **associations** such as the *Internationale Handelskammer*, *Handwerkskammer* or, for example, houseowner associations also provide network and collaboration opportunities, and single civil society organizations often provide additional pluralistic opportunities for citizens to connect, collaborate and co-create climate action. **Issue specific coordination initiatives** such as Steering Groups (*e.g. Fairtrade Stadt München*), Expert Councils (*e.g. Fachbeirat für Bürgerschaftliches Engagement in München*) or Roundtables (*e.g. Runder Tisch Fachkräftemangel*) often deliberately bring together actors from across different stakeholder groups and are a key feature of Munich's governance landscape. **Project partnerships** and similar implementation-oriented arrangements are yet another kind of formal network relationship. For example, large innovation projects such as the Horizon Europe funded mission demonstrator projects ASCEND and NEBourhoods include extensive collaboration between research and academia, city government, civil society organizations and private sector entities. Beyond such visible institutions are a range of informal, organizational, or individual relationship networks that permeate all observable forms of collaboration. Lastly, it is also important to note that there is an even larger number of actors and not organized, connected, or even marginalized and excluded from the governance ecosystem. This goes to show that understanding the actor ecosystem is not about attempting to map or manage it, but about finding means and ways of supporting it holistically and organically.

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<sup>36</sup> Satzung zur Einführung eines Klimarates der Landeshauptstadt München (KlimaratS).



Based on this understanding, the MCM strengthens existing governance systems by nurturing the ecosystem, increasing agency of people in Munich and further empowering actors to implement measures for climate neutrality. To this end, the MCM maps and analyses the rich, existing ecosystem of actors, plans, strategies, measures, actions, and projects to generate a shared understanding among all stakeholders of Munich's path towards climate neutrality. It brings to light achievements, progress, shortcomings, and weaknesses of Munich's climate protection ecosystem and enables diverse actors to better engage, collaborate and contribute to the city's climate neutrality target. And it creates concrete and open support mechanisms at scale for Munich to finance transformative action portfolios, adapt and influence regulatory frameworks and create visibility and collaboration arenas for all climate neutrality actors in Munich.

**“Orchestration” Governance Approach (Horizontal Integration):** Orchestration is a governance approach that relies on non-interference and maintaining the autonomy of individual actors, while providing guidance, support, and collaboration facilitation to the overall actor ecosystem instead. Orchestrating a city-wide climate transition, therefore, requires creating a common understanding and knowledge basis across the entire city by making the climate neutrality transition, visible, understandable, and accessible to everyone. Following the Mission economy idea developed by Prof. Mariana Mazzucato, the MCM thereby engages actors from business, civil society, and research as well as the administration in a horizontally integrated governance process. As described in the MIM, governance means increasing and allocating agency efficiently to maximise impact, but also by further including and empowering stakeholders and people in the process to become actors, rather than dependents or bystanders of climate action.

**Multi-level Governance (Vertical Integration):** In addition, reaching climate neutrality in 2035 not only a local issue but requires collaboration with other actor ecosystems at Bavarian (State / *Länder*) level, German national level and European level. Key issues that can only be addressed in such a multi-level approach include funding, financing and legislation, but also macro-structural issues such as addressing Scope-3 emissions, city-region collaboration, decarbonizing the German energy mix or advancements in European policy and subsidy support to cities. The MCM acts as a transmission belt for Munich's local actor ecosystem to engage, interact and collaborate with other actors and institutions in the multi-level governance system. On the one hand, it aims to bundle and communicate the diverse and complex needs of Munich's actor ecosystem to succeed in the climate neutrality transition towards European, German and Bavarian entities willing and able to support local actors. On the other hand, it aims to identify, streamline and avail financial or in-kind support to local actors in Munich from other levels of government to local actors.

The **Climate City Contract (CCC)** is an important governance instrument and vehicle for both horizontal orchestration as well as vertical multi-level integration. It serves as a strategic agreement that outlines specific commitments, integrating various stakeholders, and creating a common basis for information on how the city as a whole can achieve climate neutrality. The CCC is the starting point AND the outcome of the MCM's iterative governance and implementation process. To plan and structure this process, the **Green Climate Cities (GCC)** methodology developed by ICLEI<sup>37</sup> and tested in over 30 cities on all continents under the European Commission funded Urban LEDS project has been adapted to fit the specific needs of the MCM and serves as **official process framework** for the MCM. The process functions as an iterative management cycle and follows a 3x3x2 logic of breaking down the multiple and complex steps of iterative planning cycles around the CCC and its implementation in manageable and actionable steps. The three main phases “Analyse”, “Act” and “Accelerate” capture the main aspects of mission implementation. The mezzanine layer of the framework provides a simplified understanding of the key elements of climate management cycles in cities. The outside layer breaks these elements down into individual steps to guide the stakeholders

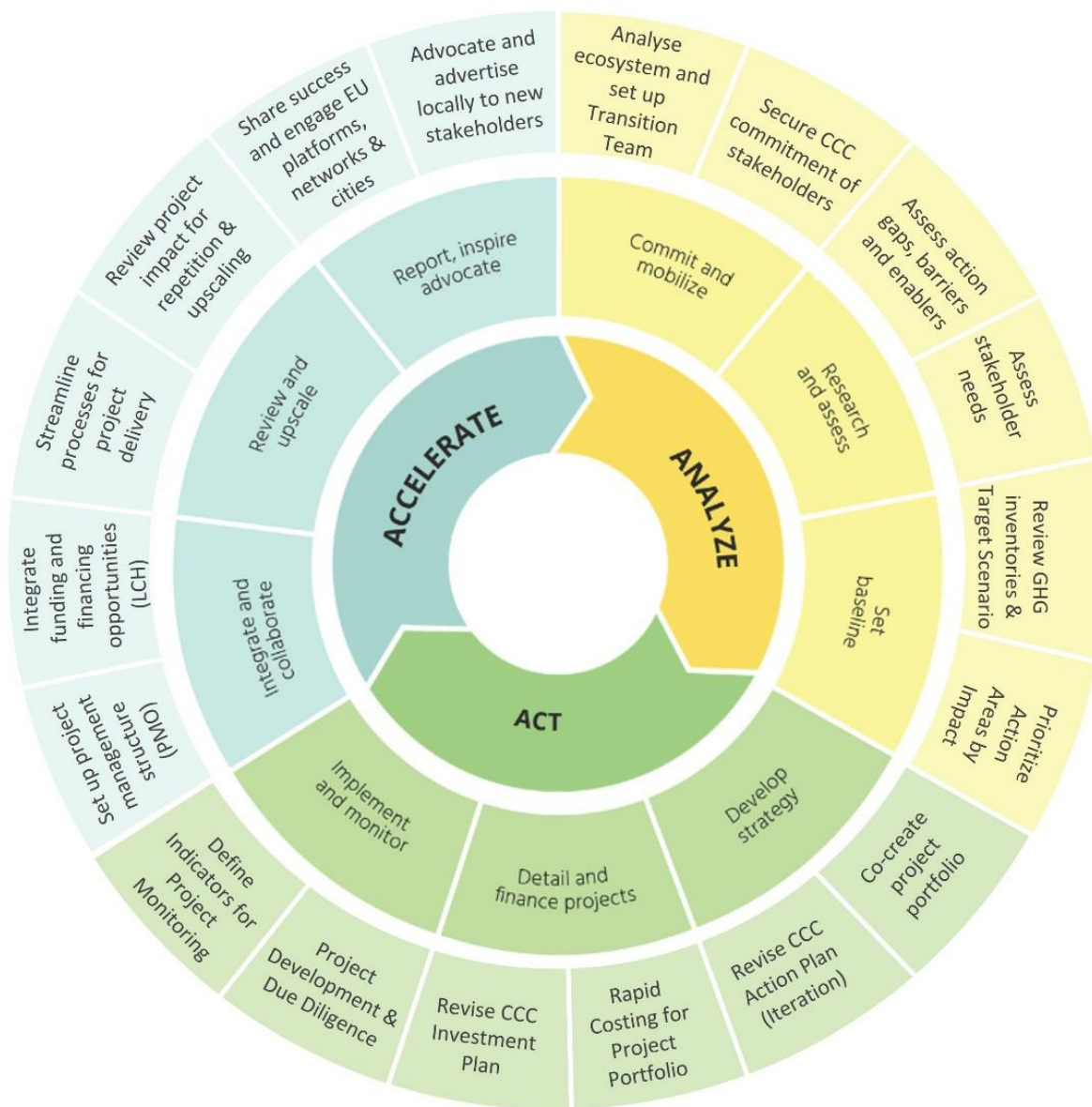
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<sup>37</sup> <https://iclei.org/greenclimatecities/>



engaged in the Mission through a clear process. The framework is neither strictly chronological in order nor prescriptive but serves as an orientation tool for the break down and planning of operational (next) steps while maintaining an overview over the entire governance process.

**Figure 6: Adaptation of Green Climate Cities (GCC) Methodology by ICLEI as official process framework for the MCM as iterative climate management cycle.**



The strategic and operational implementation and organization of this process is driven by a dedicated **Climate neutrality Mission Unit (Stabstelle Mission Klimaneutralität)** within the Department for Climate- and Environmental Protection. The unit consists of dedicated staff responsible for organizing the MCM and the implementation of all its required activities, acting as both **operational secretariat and proactive strategic management agency** of the MCM. It initiates the individual steps of the process framework, drives or supports their implementation, and ensures strategic development and continuity of the MCM throughout the entire program period until 2035. In regards to Multi-Level Governance, the Mission Unit also acts as Munich’s **coordinator and contact point** towards NetZeroCities, the European Commission, the German stronGER cities platform, national and regional





100.000 inhabitants are legally permitted to create [District Committees](#) (*Bezirksausschüsse*), which essentially function as “district parliaments” aligned with overall council election results. Munich has 25 district committees and is the only city in Bavaria which has given extensive decision rights to its district committees to directly decide over a wide range of specific local projects. Citizens can directly engage with their district committee via the respective District Committee Office, as well as by participating in the annual Citizen Assembly of each district – invitations for which are sent directly by mail to each household.

#### **Rights and Powers of District Committees (Bezirksausschüsse)**


District committees in Munich have the authority to make decisions on the design of public spaces, including streets, squares, pedestrian areas, green spaces, playgrounds, and sports fields. They identify areas lacking recreational, social, and cultural facilities and are responsible for naming streets and squares, provided no personal honours are involved. Committees also assess the establishment or redesign of weekly markets and advertising structures, and plan neighbourhood-specific pedestrian and bicycle paths. They manage cultural programs, organize festivals and events, and preserve neighbourhood history. Additionally, they decide on initial grants for local clubs and social initiatives and oversee municipal construction projects costing between 0.5 million and 2.5 million euros. Since 2007, they also have had the authority to approve grants up to 25,000 euros, permit the use of municipal properties for festivals, and make decisions on closing times and outdoor dining areas. Their scope includes special use permits for sales stands and advertising boards, setting taxi stand locations, and installing signs and parking meters. They also handle the installation of maypoles, field crosses, bike racks, and street lighting poles, and plan and expand streets and squares up to 500,000 euros.


These formal and legally legitimized institutions for direct citizen engagement are complemented by a range of social innovation interventions described in C-2, which allows for additional citizen engagement opportunities created by the LHM for people, but also strengthens and empowers self-organized, bottom-up citizen engagement opportunities driven by civil society actors and initiatives.


The MCM in general and the work of the Transition Team in particular therefore build on and integrate their processes and functions into a strong institutional governance framework in the city, relying on formally institutionalized processes such as the city council, the Climate Council, District Committees etc. while further enabling existing, bottom-up citizen engagement from within civil society. The role and understanding of the MCM is therefore to **respect, support and strengthen the well-established citizen engagement and civil society processes in Munich**, rather than creating new parallel structures for citizen engagement under the Mission.


The Transition Team implements the outputs of existing governance processes. It is composed of **actors and stakeholders** with a clear view to project ideation, development, and implementation. A comprehensive **stakeholder mapping** approach has been developed and initiated under the MCM Pilot Project Climate City Dash 2.0 (CCD 2.0) and serves as a continuous process of identifying and engaging new relevant stakeholders throughout the MCM's entire implementation period. The mapping follows a sectoral structure oriented on the strategic priorities (see Table 11) and does not aim to be complete or finalized at any point, but to continually evolve and change in line with the Transition Team's current tasks and focus. The stakeholder mapping serves as a basis for the composition of the task forces within the transition team. Rather than ranking actors in terms of influence or interest, it identifies stakeholders according to one or more potential roles they could play within a task force on a given topic. These roles serve as a rough basis for planning for diversity and organising effective collaboration structures within a task force, without prescribing or limiting a specific stakeholder as to their engagement in the task force. Role types include:





 **Challenge Owner:** *An actor that has a specific challenge to solve or could act as a project owner for climate action projects, defining a concrete challenge to be solved.*

 **Data Owner:** *An actor that possesses or can access important quantitative or qualitative data or information.*

 **Ideator:** *An actor that has relevant expertise or abilities to help with problem solving, product or solution co-creation or can facilitate processes to generate ideas.*

 **Implementer:** *An actor with the capability to implement, execute or operate projects in practice together with or on behalf of a challenge owner.*

 **Gatekeeper:** *An actor who needs to approve, ratify, or agree to projects or take actions or decisions in order for projects to proceed.*

 **Multiplier:** *An actor who speaks on behalf of or informs larger groups of stakeholders and other actors, multiplying the reach of the task force.*



**Table 15: Stakeholder Mapping\***

\*This list is neither committal nor exhaustive. It does not claim any relevance or irrelevance for actors and institutions named or not named on the list. It serves only as an illustrative example of potential stakeholders that may or may not have been contacted, or may be contacted in the future, for exploratory conversations on task force topics identified for the transition team, based on preliminary assumptions.

Stakeholder Mapping			Challenge Owner	Data Owner	Ideator	Implementor	Gatekeeper	Multiplier
System	Strategic Priorities	Example Actors (selected from preliminary CCD2.0 results)	Potential Roles					
Buildings		Münchner Wohnen	Green	Yellow	Orange	Orange	Pink	Blue
		Mieterverein				Orange	Pink	Blue
		Wohnungseigentümergeinschaften	Green		Orange	Orange		
		Münchner Gesellschaft für Stadterneuerung	Green	Yellow	Orange	Orange		Blue
Heating		Stadtwerke München	Green	Yellow	Orange	Orange	Pink	Blue
		Saubere Energie München	Green	Yellow	Orange		Pink	Blue
		Haus- und Grundbesitzervereinigung		Yellow	Orange			
		Handwerkskammer	Green	Yellow	Orange	Orange		Blue
Power Generation		ASCEND-Partner (Isarwatt, Avancis, ...)	Green	Yellow	Orange	Orange		
		Landesagentur für Energie & Klimaschutz		Yellow	Orange			Blue
		Versorgungseinrichtungen (e.g. Krankenhäuser)	Green	Yellow	Orange	Orange	Pink	
		Flughafen München	Green	Yellow	Orange	Orange	Pink	
Mobility		Service Providers (Tier, STATAUTO)	Green	Yellow	Orange	Orange	Pink	
		Münchner Verkehrsgesellschaft	Green	Yellow	Orange	Orange	Pink	Blue
		M-CUBE		Yellow	Orange	Orange		
		Bezirksausschüsse	Green	Yellow	Orange	Orange	Pink	Blue
Economy		Internationale Handelskammer	Green	Yellow	Orange			Blue
		Ökoprofit	Green	Yellow	Orange			Blue
		Arqum		Yellow	Orange	Orange		Blue
		Gewerkschaften	Green	Yellow	Orange		Pink	Blue
Cross-Cutting		LHM Referate	Green	Yellow	Orange	Orange	Pink	Blue
		Münchner Initiative für Nachhaltigkeit	Green	Yellow	Orange			Blue
		Green City e.V.	Green	Yellow	Orange			Blue
		Technische Universität München		Yellow	Orange			Blue



## 4.2 Module C-2 Social Innovation Interventions

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

**Table 15: Social Innovation Interventions as Enabling Measures for Actors in line with the MIM**

Intervention name	Description	Enablement of Actors
<b>Advisory Board for Civic Engagement (ACBE)</b>	Advisory body for citizen engagement	Empowers an active civil society to collaborate with the state, administration, and economy, bringing innovative solutions into society. Engaged citizens identify community gaps and advocate for the underrepresented, fostering an economy of time-giving over profit maximization. By connecting non-profits, city administration, businesses, and foundations, civil society contributes time, ideas, and funds, enhancing community cohesion and vibrant collaboration.
<b>Citywide Resident Budget</b>	Participatory budgeting process	Gives agency over public spending in neighbourhoods to people and empowers residents by giving them the opportunity to propose and implement community-driven projects on a budget-based approach, which ensures that highly rated proposals have a high likelihood of being implemented, as funds are pre-allocated in the municipal budget.
<b>Climate City Dash 2.0 (NZN Pilot)</b>	Digitally supported climate action governance project	Empowers Munich's actors through transparent data-driven co-creation processes for effective climate action. By leveraging interactive dashboards to provide access to data and a better understanding of climate action and impact, it enables businesses and civil society actors to implement impactful projects, transition to climate-positive practices, and request funding. This project leverages information democratization to shift from government-based to governance-based climate action.
<b>Digital Twin</b>	Digital city planning and engagement toolbox	Munich's digital twin empowers stakeholders by providing a real-time, interactive virtual model of the city. This tool enhances urban planning, infrastructure management, and climate action by visualizing data and simulating scenarios. It enables businesses, government, and civil society to make informed decisions, collaborate effectively, and implement impactful projects, driving the city's transition to climate neutrality and smart urban development.
<b>Re:Think München</b>	Citizen engagement campaign for Climate and Energy	The "Re:Think Munich" campaign by the Department of Climate and Environmental Protection aims to engage citizens in climate protection through local actions, events, and informational services. Munich's comprehensive climate package includes a municipal heat strategy to replace fossil fuels with renewable energy, funding programs for climate-neutral mobility and buildings, and initiatives for



		greening, sustainable food standards, and biodiversity. The goal is to make Munich a sustainable, resilient, and climate-neutral city.
<b>Social Lab</b>	Citizen engagement process for urban strategy co-creation	The Social Lab, introduced during the "Perspektive München" strategy process, is a methodology to empower diverse stakeholders by facilitating active citizen participation. The focus of the methodology is the representation of diversity in decision making, minimizing biases, and enabling inclusion of stakeholders from heterogeneous parts of society.
<b>Unser.München</b>	Online citizen participation platform	Facilitates transparent communication between the municipality and the public, ensuring that diverse voices are heard in the decision-making process. Through surveys, polls, and forums, unser.muenchen empowers residents to contribute to shaping their city's future, fostering a sense of community involvement and collaboration in urban planning and policymaking.

**Advisory Board for Civic Engagement (ACBE):** The [ACBE](#) is an independent advisory body for the city council. It monitors developments in civic engagement in Munich as well as nationwide and evaluates these for the municipal level. It initiates social innovation and participation processes and ensures their sustainable implementation. The mission of the ACBE is to strengthen civic engagement in its diverse forms in Munich. The board is guided by the vision of an active urban society characterised by citizen engagement and responsible co-creation of the community. The Munich City Council decided to establish the ACBE in its meeting on December 2, 2008. In 2019, the ACBE received its own [statute](#), formalising and defining its responsibilities, rights, and composition. As an independent body, it advises and supports the development process of civic engagement in Munich, aiming for future-oriented and sustainable promotion. The board presents a report to the City Council every two years. Operational responsibility for the ACBE lies with the publicly funded but operationally independent initiative "[Förderstelle für Bürgerschaftliches Engagement](#)"

**Citywide Resident Budget:** On April 27, 2022, the Munich City Council proposed the introduction of a Inhabitant Budget as part of the council decision "Analog and Digital Public Participation in Munich; Presentation of the External Concept for Systematic Further Development." This initiative allocates one million euros annually for a pilot Citizen Budget project modelled after similar initiatives in Barcelona and Paris. The proposal includes creating a dedicated office for citizen participation within the municipal administration, involving civil society organisations and district committees early in the project design, and developing youth-specific participation formats. This structured approach to the Resident Budget aims to empower residents, enhance public participation, and ensure the successful implementation of community-driven projects in Munich.

The term "Resident Budget" (Einwohner\*innenbudget) includes all residents of Munich, regardless of nationality. The concept emphasises a budget-oriented approach, ensuring that highly-rated proposals from residents have a high likelihood of being implemented, as funds are pre-allocated in the municipal budget. This approach contrasts with the proposal-based method, where suggestions are integrated into the budget without prior allocation, resulting in fewer implementations. The goal is to create an efficient process that allows for broad public dialogue and the realisation of proposals closely aligned with residents' needs, thus strengthening social cohesion and democracy.

The Resident Budget is an independent initiative, complementing existing funding structures in Munich. Residents can propose projects online through the platform [unser.muenchen.de](#), with a total



budget of one million euros per cycle. The process involves three phases: preparation, public participation, and implementation.

- Phase I: Preparation - The budget is prepared by the Public Participation Office, with online and citywide publicity efforts to mobilise residents.
- Phase II: Public Participation - Residents register and submit proposals online, which are then evaluated and voted on. The best proposals are reviewed for feasibility and budget requirements.
- Phase III: Implementation - The City Council reviews and approves the winning proposals, which are then implemented by the relevant departments. Progress is monitored and communicated transparently to ensure accountability and completion before the next cycle begins.

**Climate City Dash 2.0 (NZC Pilot):** Climate City Dash 2.0, Munich's pilot project supported by NetZeroCities in partnership with Dortmund and Heidelberg, plays a central role in advancing Munich's climate neutrality transition through social innovation. To implement the NZC Climate Transition Map and empower local Transition Teams to co-create effective climate action portfolios, Climate City Dash 2.0 aims to create effective, information-based governance processes around interactive and user-friendly climate dashboards. The project leverages mutual learning and good practice exchange among the project cities Dortmund, Heidelberg and Munich for rapid success towards net zero, and aims to collaborate and share practical experiences with other cities in Germany and across Europe. Local stakeholders from private sector and civil society gain an unprecedented systemic understanding of cause and effect of climate action and are be empowered to implement effective, measurable, and visibly impactful climate mitigation projects. The empowerment of engaged stakeholders as climate action change agents will enable them to collaborate on shared action pathways and within their respective communities. Businesses will benefit from enhanced planning security for strategy development and the potential to unlock new business models based on concrete climate data. Civil society actors will gain the evidence needed to convince others and plan effective local actions. Over time, with the increasing engagement of additional actors, local climate action is expected to transition from a government-based to a governance-based approach. This shift will see businesses adopting climate-positive practices as standard, profiting from emission reductions and understanding how climate indicators and city strategies shape their market environment. Civil society and research entities will become more autonomous in securing large-scale funding and financing for their initiatives. Consequently, local governments will be more effective in driving climate action in collaboration with the community, rather than acting alone.

**Digital Twin:** Munich's local digital twin (<https://muenchen.digital/twin/en>) has been under development since 2018 and in productive use for over three years. It is based on an extensive (geo-) database and IT infrastructure, which enables target group-oriented visualisations and applications to be implemented for all forms of stakeholder engagement in governance processes. Via digital twin applications, transparency is increased in citizen participation and the efficiency of the city administration can be improved. What-if scenarios (analysis, simulation) help to focus the use of resources. The existing foundation of Munich's digital twin can be expanded and enriched with further information and thus serve as a crucial toolbox for information accessibility, transparency and understandability while monitoring Munich's transition towards a climate-neutral city. Complementing regular planning processes, the geo-data basis has already been integrated into innovation projects such as REACT-EU (EU ERDF, 2022-23) with microclimate simulations for Munich's historic city centre and 'Deine Stadt' for the gamification of planning processes (BMBF, 2023-26). At the same time, this approach requires a financial framework both for the purposes of an up-to-date data basis as well as a sovereign and secure IT infrastructure, which must be constantly updated.

**Re:Think München:** The "Re:Think Munich" campaign, initiated by the Department of Climate and Environmental Protection (RKU), aims to engage citizens in climate protection. The campaign focuses on local neighbourhoods, encouraging residents to adopt climate-neutral behaviours and participate in climate-friendly activities through events and informational services, such as energy consultations and



funding programs. Public participation processes enable residents to actively shape their living environment.

Munich has launched a comprehensive climate package to achieve climate and energy efficiency goals, embedding climate protection in the city's administration and implementing a holistic climate strategy with concrete measures. Munich aspires to be the first German metropolis to replace fossil fuels with renewable energy in all districts while maintaining affordable heating costs. The city, in collaboration with Stadtwerke München GmbH, is developing a municipal heat strategy to ensure future climate-neutral heating for buildings.

The RKU has developed two funding programs to promote climate-neutral mobility and buildings, motivating property owners and businesses to undertake energy-efficient renovations and switch to renewable energy sources. The RKU also supports greening initiatives, the sponge city principle for climate adaptation, sustainable food standards, and biodiversity conservation, striving to make Munich a sustainable, resilient, circular, climate-neutral, and liveable city.

**Social Lab:** The Social Lab is a novel format of active citizen participation and was tested by the City of Munich for the first time as part of the update to the city's overall development vision "Perspektive München". Five events were held from October 2019 to March 2020, featuring experimental dialogue and work processes. Throughout the process, participants addressed developments and conflicts of interest, proposing solutions, and creating future visions for Munich, which were visualised in shared future scenarios. The outcomes of the series of events are documented in the final report of the Social Lab process, and the methodology for the Social Lab is described in a dedicated [Social Lab Handbook](#).

A unique aspect of the Social Lab process was the representation of the diversity of Munich's urban society in the participation process. Thirty Munich residents were selected to represent a diverse cross-section of society, including 1) Civil society, academia, social economy, 2) business and the public sector, 3) actors who are often underrepresented in political or participation processes. Together, they discussed visions for a sustainable and liveable Munich across social, cultural, political, and other boundaries. Based on inputs from the Perspective Workshops – two large participation workshops held in May 2019 – the Social Lab participants delved into key areas of future urban development in their sessions, including social cohesion, digitalisation, environment, mobility and affordable housing.

**Unser.München:** The participation platform [unser.muenchen](#) functions as an interactive online space where Munich's residents can actively engage in the city's development. It allows citizens to share their ideas, provide feedback, and participate in discussions on various urban projects and initiatives. The platform facilitates transparent communication between the municipality and the public, ensuring that diverse voices are heard in the decision-making process. Through surveys, polls, and forums, [unser.muenchen](#) empowers residents to contribute to shaping their city's future, fostering a sense of community involvement and collaboration in urban planning and policymaking.



## 5 Outlook and next steps

This section highlights next steps and plans for refining the CCC Action Plan as part of the Climate City Contract in future iterations.

### Plans for next CCC and CCC Action Plan iteration

**CCC Iteration Process:** The two-year iteration process for the MCM's CCC starts after the first submission of the CCC in February 2025, follows the **official MCM process framework** described in Governance Innovation (AP C-1) and is planned to run over a period of about 2 years until the first half of 2027, under close but agile alignment with:

- the Bavarian city council elections in March 2026 and the subsequent inauguration and uptake of business of the next election cycle's city council.
- future European Cities Mission timelines for iteration and resubmission, as well as the next multi-annual funding period at European level from 2028-2035.

**Hit the ground running:** Building on Munich's extensive work towards climate neutrality, the MCM launches its Mission activities and city-wide governance process with the first iteration and submission of the CCC as a basis in 2025. While this means for many Actors and People in Munich that the MCM officially and visibly kicks off after the first submission of the CCC towards NetZeroCities, many steps of the MCM's process framework (and thereby the NZC climate transition map) are already well under way in practice.

Table 15 qualitatively captures the implementation status of the official MCM process at the time of latest CCC submission to NetZeroCities and indicates desired timelines for the advancement of completion of unfinished steps. In practice, this process goes hand in hand with the MCM's governance and orchestration activities, is subject to adjustment and does not follow a strict chronological order. Timelines are indicative and subject to adjustment as needed.

**Table 16: Implementation Status of the official MCM process**

Phases	Activities	Status	Next Steps	Timeline
Analyse	Commit and Mobilize		Analyse ecosystem and set up Transition Team	Q1-Q2 / 2025
			Secure CCC commitment of stakeholders	Q1-Q4 / 2025
	Research and Assess		Assess action gaps, barriers and enablers	Q3 / 2024 – Q3 / 2025
			Assess stakeholder needs	Q2 – Q4 / 2025
	Set Baseline		Review GHG inventories& Target Scenario	Q1 / 2024 – Q4 / 2024
			Prioritize Action Areas by Impact	Q1 / 2024 – Q4 / 2024
Act	Develop Strategy		Co-create project portfolio	Q1 / 2024 – Q4 / 2025
			Revise CCC Action Plan (Iteration)	Q1 / 2025 – Q3 / 2026
	Detail and finance projects		Rapid Costing for Project Portfolio	Q3 / 2025 – Q1 / 2026
			Revise CCC Investment Plan	Q1 / 2025 – Q3 / 2026
	Implement and Monitor		Project Development & Due Diligence	Q4 / 2025 – Q4 / 2026
			Define Indicators for Project Monitoring	Q3 / 2024 – Q2 / 2026



## Action Plan



Accelerate	Integrate and Collaborate		Set up project management structure (PMO)	Q2 / 2025 – Q2 / 2026
			Integrate funding and financing opportunities (LCH)	Q3 / 2025 – Q4 / 2026
	Review and Upscale		Streamline processes for project delivery	Q4 / 2025 – Q4 / 2026
			Review project impact for repetition & upscaling	Q3-Q4 / 2026
	Report, Inspire, Advocate		Share success and engage EU platforms, networks & cities	Q2 / 2025 – Q4 / 2026
			Advocate and advertise locally to new stakeholders	Q1 / 2025 – Q4 / 2026



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## 6 Annexes

**The annexes contain any textual or visual material** to the 2030 Climate Neutrality Action Plan as necessary.

1. Baseline inventory 2018
2. Klimasatzung / City climate statute
3. Klimarat Satzung / Climate council statute
4. Klimanotstandbeschluss / Decision of principle '0'
5. Grundsatzbeschluss I / Decision of principle I
6. Grundsatzbeschluss II / Decision of principle II
7. Grundsatzbeschluss III / Decision of principle III
8. Jahresabschluss LHM 2023 Band 1 / Annual report City of Munich 2023 part 1
9. Jahresabschluss LHM 2023 Band 2 / Annual report City of Munich 2023 part 2