

REDUCING EMISSIONS AND BUILDING CLIMATE RESILIENCE IN TÜRKİYE'S CITIES

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Globally, cities play a key role in driving climate change while bearing the costly repercussions on basic services, infrastructure, housing, and the well-being of their citizens. Turkish cities are no exception to this trend, as they increasingly contribute to the country's growing GHG emissions. This article looks at effects of climate change on Turkish cities and the actions taken by the local and national government to increase climate resilience and reduce GHG emissions. It also aims to provide selected development and climate priorities for policy makers and urban residents in their efforts to follow low-carbon and resilient development pathways.

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Developing resilience to the consequences, both immediate and anticipated, of global warming while mitigating greenhouse gas (GHG) emissions is imperative for tackling the developmental limitations posed by a changing climate. Globally, cities play a key role in driving climate change while bearing the costly repercussions on basic services, infrastructure, housing, and the well-being of their citizens. Turkish cities are no exception to this trend, as they increasingly contribute to the country's growing GHG emissions.

Meanwhile, urbanization is also an important driver of economic growth and opportunity in Türkiye. Turkish cities have played a pivotal role in driving the nation's substantial economic growth and progress in recent decades, substantially promoting economic productivity. Since the rapid urbanization after 1980, the urban population now makes up 74.6 percent of the population, a substantial increase from the 25 percent recorded in 1950.¹ Yet, Turkish cities, like all urban centers worldwide, struggle with the challenges of a shifting climate. However, they also have a unique opportunity to strengthen urban resilience, enhance the quality of life, while continue serving as engines for economic growth.

This article looks at effects of climate change on Turkish cities and the actions taken by the local and national government to increase climate resilience and reduce GHG emissions. It also aims to provide selected development and climate priorities for policy makers and urban residents in their efforts to follow low-carbon and resilient development pathways.

Cities and Rising GHG Emissions

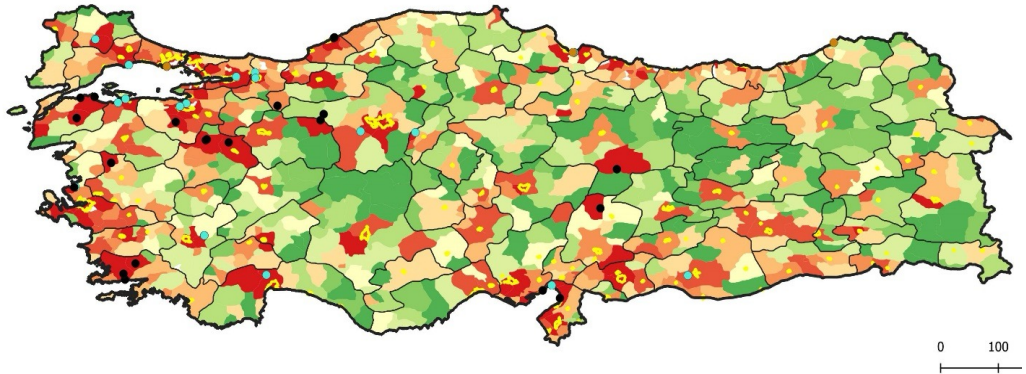
Türkiye's urban areas contribute a large and growing proportion of country's GHG emissions. In 2015, urban areas in Türkiye were responsible for 65 percent of the nation's CO₂ emissions, including suburban and peri-urban regions, as well as densely populated and semi-dense settlement clusters. It's worth noting that this figure doesn't reflect emissions originating in rural areas due to the direct result of people and activities in urban centers, such as power plants in rural regions generating electricity consumed in cities, making the proportion of Türkiye's total emissions tied to urban areas most likely even higher.

GHG emissions in Turkish cities result from various sectors, spanning from the heart of urban centers to the peri-urban outskirts. In a broad context, urban areas contribute to GHG emissions through various means, including transportation, energy consumption for heating and cooling buildings, illumination for streets

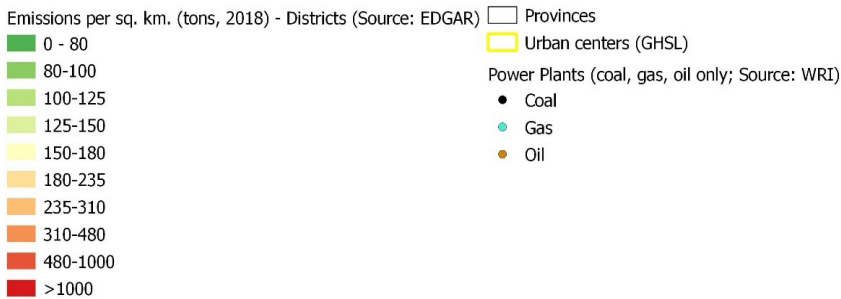
1) [https://databank.worldbank.org/source/country-climate-and-development-report-\(ccdr\)](https://databank.worldbank.org/source/country-climate-and-development-report-(ccdr))

and structures, industrial processes, waste management, and the carbon footprint embedded in urban infrastructure, among other origins. Notably, nearly half of Türkiye's total emissions stem from the energy sector,² with a significant 81 percent of these emissions in 2015 originating in urban areas.³ Simultaneously, urban areas account for 69 percent of Türkiye's residential sector emissions, with a substantial portion originating from densely populated urban centers -population density exceeding 1,500 individuals per square kilometer.

Figure 1: CO2 Emissions per sq. km. in Türkiye, by District in 2018



Turkey - CO2 emissions



Source: World Bank, using EDGAR Data⁴

2) This is the "energy-industry" figure from EU EDGAR data. Energy-industry includes *the combustion in the power and non-power generation industries, fugitive emissions, fuel production, refineries and transformation industries.*

3) Carter and Boukerche. 2020. *Catalyzing Private Sector Investment in Climate Smart Cities* (English). Invest4Climate Knowledge Series Washington, D.C.: World Bank Group. <http://documents.worldbank.org/curated/en/179101596519553908/Catalyzing-Private-Sector-Investment-in-Climate-Smart-Cities>

4) Monica Crippa, Diego Guizzardi, Marilena Muntean, Edwin Schaaf, Eleonora Lo Vullo, Efsio Solazzo, Fabio Monforti-Ferrario, Jos Olivier and Elisabetta Vignati, "EDGAR v6.0 Greenhouse Gas Emissions," European Commission, Joint Research Centre (JRC) [Dataset] (2021), PID. <http://data.europa.eu/89h/97a67d67-c62e-4826-b873-9d972c4f670b>

Cities and Climate Vulnerabilities

The concentration of people, infrastructure, and economic activity in Türkiye's urban areas highly exposes them to climate change's effects. Coastal cities in Türkiye, for instance, face the imminent threat of rising sea levels and coastal flooding due to the country's extensive coastline. 28 Turkish cities, in addition to 181 towns and villages, are located along its coastal areas, all situated at elevations of less than 10 meters above sea level, and host more than 22.2 million residents. Specifically, cities like Adana, Edirne, Izmir, and Samsun are identified as being at highest risk, primarily due to their geographical characteristics of low elevation and proximity to river deltas. A one-meter increase in sea level would submerge an area of 1,600 square kilometers, displacing more than 214,000 residents.⁵ Furthermore, extreme rainfall events compound the risk of sea level rise, amplifying the threat of urban flooding in Türkiye's cities. In Adana alone, as of 2015, over 195,000 people were deemed vulnerable to flood risk.⁶ Unfortunately, in addition to sea level rise and floods, Türkiye's urban centers are also exposed to heatwaves, wildfires (including smoke and air pollution resulting from fires occurring outside urban areas), and water scarcity.⁷

Yet, Türkiye's cities have a significant opportunity to make substantial emissions reductions and adapt effectively to a changing climate, enhance urban resilience, the well-being of city residents, and bolster local economies. Global estimates propose that cities have the potential to cut emissions by nearly 90 percent by 2050 through readily available, technically feasible measures, underscoring the pivotal role cities must assume in mitigating climate change.⁸ This presents Turkish cities, along with other cities around the world, with a considerable responsibility. Cities must tackle this responsibility from all sides, addressing various fronts to reduce emissions. This includes transitioning to clean energy sources, implementing urban planning that promotes compact, transit-oriented development; investing in public transit and climate-friendly transportation options like walking, bicycling, and electric vehicles; providing incentives for energy efficiency in buildings and industries; and improving solid waste management practices.

5) SumeYra Duman Kurt and Xingong Li, "Potential Impacts of Sea Level Rise on the Coasts of Türkiye," *Journal of Environment and Earth Science*, Vol. 10 (2020): 40-47. DOI: [10.7176/JEES/10-5-04](https://doi.org/10.7176/JEES/10-5-04)

6) Urban Centre Database UCDB R2019A – Aneta Florczyk, Christina Corbane, Marcello Schiavina, Martino Pesaresi, Luca Maffenini, Michele Melchiorri, Panagiotis Politis, Filip Sabo, Sergio Freire, Daniele Ehrlich, Thomas Kemper, Pierpaolo Tommasi, Donato Airaghi and Luigi Zanchetta, "GHS Urban Centre Database 2015, Multitemporal and Multidimensional Attributes," R2019A. European Commission, Joint Research Centre (JRC) [Dataset] (2019), PID. <https://data.jrc.ec.europa.eu/dataset/53473144-b88c-44bc-b4a3-4583ed1f547e>

7) <https://thinkhazard.org/en/report/249-Turkiye/>

8) Coalition for Urban Transitions 2019. Climate Emergency, Urban Opportunity. World Resources Institute (WRI) Ross Center for Sustainable Cities and C40 Cities Climate Leadership Group. London and Washington, DC. <https://urbantransitions.global/urban-opportunity/>

Simultaneously, cities must adapt to climate change through risk-sensitive land use planning; strengthening and building defenses against disasters, including nature-based solutions like green spaces, retention ponds, and wetlands, employing permeable and reflective materials; enforcing building regulations that minimize disaster-related damage, investing in early warning systems, emergency response mechanisms, and other appropriate measures.

Adaptation and Mitigation Measures in Türkiye

Türkiye can potentially derive advantages from climate-smart initiatives, whether in the immediate or distant future. These benefits confine both adaptation and mitigation efforts and the growth in worldwide demand for eco-friendly products, the advancement of green technologies, enhanced energy security owing to reduced energy imports, improved air and water quality, and the creation of more habitable and productive urban environments. To realize these benefits, local authorities must be equipped with the technical expertise and decision-making authority necessary for planning, coordinating, and executing various urban investments. Furthermore, they should have greater access to climate finance and establish a strong financial foundation enhancing their creditworthiness to attract, and manage the necessary funding for these investments effectively.

Some cities and municipalities have already introduced local climate change action plans, policies, and measures to strengthen resilience to climate change, while some sectoral policies and plans incorporate aspects or elements of climate change. Twenty-seven Turkish cities and municipalities have joined the Global Covenant of Mayors for Climate and Energy, the largest global alliance for city climate leadership with over 10,000 city and local government members. Of these, 16 have committed to a climate change mitigation target, but much remains to be done: 10 are still working on their emissions inventories and mitigation plans; none has an adaptation plan; 18 and only one (Izmir) has a climate change action plan and Green Cities Action Plan.

These actions are also supported at the national government level. The Ministry of Environment, Urbanization, and Climate Change (MOEUCC), which coordinates activities to combat climate change in Türkiye established its Climate Change Presidency in 2021 in recognition of this challenge. On the other hand, IIBank, the municipal development bank as the primary vehicle to finance loans for municipalities for urban infrastructure, has been shifting its priorities to meet climate change mitigation and adaptation needs of municipalities in addition to basic infrastructure services by establishing a climate change unit.

Nonetheless, there remains a significant journey ahead. Swift and decisive measures are essential to redirect Türkiye's urbanized economy on to a low-carbon path, preventing the lock-in effects of carbon-intensive urban development for future generations. Projections indicate that Türkiye's urbanization rate will increase to 80 percent by 2030 and to 86 percent by 2050. Given the ongoing expansion of the economy and rising incomes within Türkiye's predominantly urban population, the development and management of urban areas will have a substantial influence on its emissions trajectory for the years to come. Urban form has a lock-in effect with long-term implications for climate mitigation and adaptation. Urban infrastructure only has a lifespan of several decades, but its consequent urban form can have persistent impacts for centuries. This is especially crucial when considering urban sprawl and expansion in Türkiye's major cities, most notably Istanbul.

Paths Towards Resilience and Decarbonization

Navigating the complicated relationship between climate challenges and the imperatives of urban development, various strategies and policies are needed that can steer Türkiye's cities toward a future marked by increased sustainability and readiness. Below are some areas with particular potential to both strengthen the resilience and decarbonization endeavors of Turkish cities. These recommendations focus on select areas of action and their interlinkages, setting the stage for a comprehensive exploration of transformative strategies for decarbonization and resilience building in cities:

• **Planning of low-carbon cities:** Compact and coordinated urban growth, characterized by higher density, mixed-use development, and walkable, interconnected streets, is critical to reducing emissions particularly through transit-oriented planning (e.g. the Copenhagen approach⁹). This approach should encompass the widespread adoption of electric vehicles, the enhancement of accessible public transportation systems, the promotion of shared mobility solutions, and the encouragement of non-motorized transport options. Proactively managing a low-carbon transition in the transportation sector presents a significant developmental opportunity for Türkiye. This strategic approach is essential for a sustainable, low-carbon future, positioning Turkish cities to thrive while mitigating the effects of climate change. Compact growth can also reduce the energy required per capita for heating and cooling buildings. In some cities, denser urban growth can reduce future energy consumption from buildings as

9) If Türkiye's cities in 2050 resemble a sprawling, car-oriented city like Houston, USA (population density ~1,400 people per sq. km.) today, they will produce 593 million tons of CO₂ from transport alone. If instead, they resemble a compact, transit-oriented city like Copenhagen, Denmark, which is similarly wealthy but has nearly five times the population density of Houston (~6,900 people per sq. km.), they will instead emit 79 million tons of CO₂ from transport. <https://ourworldindata.org/grapher/transport-emissions-city-density>

much as improve the energy efficiency of buildings.¹⁰ Adopting urban densities as Turkish cities accommodating the projected urban population expansion in Türkiye not only safeguards land and natural greenery but also substantially mitigates the embodied emissions linked to materials used in construction, notably steel and cement, which collectively contribute to 10-15 percent of global greenhouse gas emissions. The long-term implications of climate-smart urban form would have a profound effect on climate mitigation and adaptation, given that urban infrastructure can persist for centuries.

• **Utilizing nature-based solutions to fight against urban heat island (UHI) effect:**

The growing threat of extreme heat in urban landscapes, driven by the twin forces of climate change and the urban heat island (UHI) effect, has long-term economic and health consequences. Urban areas, being the epicenter of this heat crisis, are experiencing the dire effects of the UHI, a phenomenon born from the heat-absorbing tendencies of artificial surfaces, the absence of greenery, and the trap of heat within buildings, all exacerbated by the heat emanating from human activities, including industrial operations and vehicular traffic. Notably, extreme heat is unevenly felt within low-income neighborhoods where they endure the heavier burden, primarily due to limited urban greenery. To confront this escalating challenge, Turkish cities must take the necessary steps to protect their communities from the threats of extreme heat while bolstering the resilience of their most vulnerable residents. Although the Mediterranean coast and Southeastern Anatolia regions of Türkiye have historically grappled with hot and arid summers, forward-looking actions are imperative in the face of impending heat extremes. These strategies involve cooling urban areas by fostering greenery for shade and evaporative cooling, leveraging reflective materials, optimizing street layouts and building designs to maximize shade and airflow, and facilitating public awareness and education on the health risks associated with extreme heat. These coordinated efforts must be finely tuned to cater to the needs of vulnerable neighborhoods, specific demographic groups, and occupational sectors, such as construction and manufacturing, ultimately charting a course toward a cooler, safer, and more resilient urban future.

10) Güneralp et al., “Global Scenarios of Urban Density and Its Impacts on Building Energy Use through 2050,” *Proceedings of the National Academy of Sciences*, Vol. 114, No. 34 (2017): 8945–50.
<https://doi.org/10.1073/pnas.1606035114>

• **Low-carbon waste management and recycling programs:** Solid waste management is an important component in addressing climate change in Türkiye's cities.¹¹ For example, 10 percent of Istanbul's emissions are from the solid waste sector.¹² Waste generation in Türkiye is expected to increase from 36.4 million tons in 2020 to 58.2 million tons in 2050, which is below the projected global increase of 73 percent during the same period. Improving waste management, more significantly open dumping, can reduce GHG emissions and generate significant co-benefits including reduced soil and marine pollution; better local health and environmental outcomes; improved quality and access to a basic local government service; a more integrated informal sector; enhanced public environmental awareness; and stronger local economic development, city competitiveness, and livability conditions. Türkiye also has significant potential for circular economy practices that reduce emissions, as one of the largest polypropylene importers. Improving appropriate recycling capacities would reduce both emissions from waste and its dependence on imports.

The acute need to reduce emissions and enhance resilience in Turkish cities cannot be overstated. As urbanization continues to drive economic growth and opportunity in Türkiye, cities are poised to be the engines of progress. However, their rapid expansion is coupled with climate vulnerabilities, requiring swift action to safeguard their residents and future prosperity. The stakes are high, with rising sea levels, urban flooding, heatwaves, wildfires, and water scarcity threatening the well-being of urban residents.

The policy recommendations outlined in this article provide a number of ways for Turkish cities to navigate the complexities of climate change, fostering sustainability and readiness and offering a comprehensive approach to decarbonization. Turkish cities have the potential to make substantial emissions reductions and adapt effectively to a changing climate, enhancing the well-being of their residents and bolstering local economies. In sum, Türkiye's urbanized economy must avoid the lock-in effects of carbon-intensive development for future generations, aligning urban growth with climate goals and building a more sustainable, resilient future for all.

11) S. Kaza, L. Yao, P. Bhada-Tata and F. Van Woerden, "What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050. Urban Development Series," Washington DC: World Bank (2018).
<https://openknowledge.worldbank.org/handle/10986/30317>

12) C40 Cities Knowledge Hub, https://www.c40knowledgehub.org/s/article/C40-cities-greenhouse-gas-emissions-interactive-dashboard?language=en_US