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Zero-Waste Cities As Climate Governance Instruments: A Zero Waste City Master Plan 2.0 Model For Türkiye Within UNFCCC–COP Process

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Abstract

Urban waste decisions affect territorial methane emissions and emissions embedded in production and consumption, yet municipal plans rarely link both effects to national climate reporting. This study develops a Zero Waste City Master Plan 2.0 model for Türkiye through a structured review, updated through 17 September 2026, of 34 peer-reviewed and official sources and three comparative cases: San Francisco, Ljubljana and China's Zero-Waste City pilot programme. Sources were coded for targets, waste-stream coverage, instruments, governance, climate accounting, equity and adaptive review. The resulting framework combines established zero-waste measures through four integration protocols: separate territorial and avoided-emission accounting; a municipal-to-national monitoring, reporting and verification hand-off; service-readiness and equity checks before enforcement; and predetermined review triggers. A transparent scenario for a representative city of one million residents estimates that diverting an additional 30% of an assumed 40% organic fraction from landfill to composting would avoid about 29,200 tCO₂e per year, with a sensitivity range of 19,500–38,900 tCO₂e for 20–40% diversion. This is a screening estimate, not a verified city inventory. Municipal results can inform Türkiye's national inventory, NDC implementation, and Biennial Transparency Reports only when national authorities apply consistent activity data, emission factors, quality assurance, and attribution rules. The framework remains an analytically derived proposition; expert review and municipal pilots are required before its effectiveness can be assessed.

Keywords: zero-waste cities; climate governance; circular economy; municipal policy; Türkiye

1. Introduction

Municipal waste policy affects the climate through two distinct accounting pathways. Landfill and treatment generate territorial emissions, especially methane from biodegradable waste. Prevention, reuse, and material recovery can also reduce upstream energy use and emissions by displacing virgin production. Global assessments therefore place waste prevention and dependable municipal services ahead of downstream treatment, while warning that benefits vary with local systems and baselines (Kaza *et al.*, 2018; United Nations

Environment Programme & International Solid Waste Association [UNEP & ISWA], 2024). A recycling activity should not be assigned a quantified climate benefit without specifying the waste stream, counterfactual treatment, collection system, energy mix, and accounting boundary (Intergovernmental Panel on Climate Change [IPCC], 2019, 2023).

Cities concentrate consumption, infrastructure and service-delivery decisions, which makes municipal institutions central to urban environmental policy (United Nations Human Settlements Programme [UN-Habitat], 2022). Recent research therefore treats urban circularity as both a governance and a technical problem. Studies of European cities emphasize integrated planning, public procurement, material-flow mapping and public participation (Felekiet *et al.*, 2025), while climate-governance scholarship shows that municipal experimentation depends on authority and coordination across levels of government (Bulkeley & Broto, 2013). Quasi-experimental evidence from China links the Zero-Waste City pilot programme with green and low-carbon transformation and green technological innovation (Bi *et al.*, 2024; Liu *et al.*, 2024). These findings cannot be transferred mechanically to Türkiye. Recent Türkiye-specific evidence points to differences in municipal expertise and finance, incomplete data, coordination problems, and sensitivity to market conditions (Zaikova *et al.*, 2026). The model developed here therefore specifies responsibilities, data hand-offs, implementation conditions, and policy instruments.

This article addresses four questions:

1. Which design components recur in recent research and selected zero-waste policy cases?
2. Which components require modification for Türkiye's legal, administrative, and waste context?
3. How can city-level outcomes be connected to national climate reporting without double counting?
4. What order-of-magnitude mitigation might one intervention produce in a representative Turkish city? The study offers a traceable policy architecture and a bounded scenario for Türkiye; it does not evaluate an implemented Master Plan 2.0.

2. Conceptual Background

2.1 Zero waste as a demand-side climate strategy

Zero waste prioritizes prevention, reuse, repair, source separation, high-quality recycling, and biologically appropriate treatment over residual disposal (Zero Waste International Alliance [ZWIA], 2018; Awino & Apitz, 2024). It overlaps with circular economy policy but concentrates more directly on material and waste flows. A recent global assessment likewise identifies prevention and universal collection as essential parts of a circular transition (UNEP & ISWA, 2024). Prevention and reuse can affect consumption-based emissions, whereas diverting biodegradable waste can reduce emissions recorded in a territorial inventory's waste sector. These two effects fall under different sectors and accounting scopes. Circular interventions may also cause rebound effects, so avoided-emission claims require an explicit baseline and conservative attribution (Ghisellini *et al.*, 2016; Zink & Geyer, 2017).

2.2 From a conventional plan to Master Plan 2.0

Conventional municipal waste plans usually specify collection, treatment capacity, compliance, and disposal. Recent reviews and city studies show that implementation also depends on policy coherence, procurement, public participation, and coordination across institutions (Almansour & Akrami, 2024; Felekiet *et al.*, 2025). Master Plan 2.0 keeps the conventional functions and adds rules that connect waste targets to emissions accounting, municipal action to national reporting, enforcement to service readiness, and plan revision to observed performance. This study terms these rules integration protocols. The instruments are established in the literature; the contribution is combining them into a planning system designed for Türkiye's institutions.

3. Methodology

3.1 Design, search and selection

The study used structured qualitative document analysis (Bowen, 2009) and comparative policy analysis. Searches covered English-language material published or current between January 2016 and 17 September

2026. Search strings combined 'zero-waste city', 'municipal zero waste', 'waste climate mitigation', 'Türkiye zero waste', 'NDC waste', 'BTR waste', 'municipal circular economy', 'organics treatment', 'municipal waste transition' and 'green innovation'. Searches covered Crossref metadata, publisher records, UNFCCC, IPCC, OECD, World Bank, official Turkish sources, and official case-government websites. Backward citation checking identified foundational sources. A targeted update captured 2024-2026 studies on Türkiye's municipal waste transition, organics treatment, local GHG accounting, urban circularity, and zero-waste policy.

A source was included when it (a) reported empirical zero-waste or municipal-waste outcomes, (b) set out an adopted city or national policy with implementable instruments, (c) described Türkiye's waste or climate-governance arrangements, or (d) provided a recognised emissions-accounting method. Commentary without a traceable document, duplicate summaries and records whose title, authorship or DOI could not be independently verified were excluded. The final analytical corpus comprised 34 sources, including peer-reviewed research, official national and intergovernmental documents, legislation and municipal case records. This is a structured review for policy-model construction rather than an exhaustive systematic review.

3.2 Comparative case selection

We selected cases through maximum-variation purposive sampling. Each case had to provide official documentation and at least three of the following features: an explicit long-term target, mandatory or economic instruments, organics management, monitoring, multi-level coordination, or evidence of implementation. The cases differ in scale and policy pathway: a municipal regulatory portfolio in San Francisco (San Francisco Environment Department, n.d.); an integrated municipal-utility system in Ljubljana (City of Ljubljana, 2014); and a nationally coordinated multi-city pilot programme in China that has been evaluated with quasi-experimental methods (Bi *et al.*, 2024; Liu *et al.*, 2024). They are used to identify design principles, not to rank cities or assume direct equivalence with Türkiye.

Table 1. Comparative cases and limits of transfer

Case and selection rationale	Observed design features	Transfer boundary for Türkiye
San Francisco, United States - mature municipal regulatory portfolio (San Francisco Environment Department, n.d.)	Mandatory separation of recyclables, compostables and residuals; food recovery; construction and demolition rules; procurement and producer-responsibility advocacy	Shows instrument bundling and enforcement, but legal authority and market conditions differ.
Ljubljana, Slovenia - integrated long-term municipal strategy within EU rules (City of Ljubljana, 2014)	Long-term planning, separate collection, public utility implementation, prevention and regional infrastructure	Relevant to metropolitan coordination; EU funding and regulatory conditions are not identical.
China Zero-Waste City pilots - nationally coordinated programme with peer-reviewed evaluation (Bi <i>et al.</i> , 2024; Liu <i>et al.</i> , 2024)	Central guidance, local pilots, industrial upgrading, monitoring and documented low-carbon and innovation effects	Shows national-local alignment; the reported causal estimates are context-specific and are not imported into the Turkish scenario.

Note. The cases are used to identify governance functions rather than to rank performance or transfer numerical targets directly.

3.3 Coding and model construction

We coded each source in a spreadsheet against seven predetermined domains: baseline and targets; sectoral and waste-stream scope; policy instruments; institutional responsibility; implementation sequence; climate accounting and reporting; and equity and adaptive review. Open codes were added when evidence did not fit the initial domains. A component was retained when it was supported by at least two independent sources or by one binding Türkiye-specific instrument together with a documented implementation need. Missing baselines, unclear attribution, and absent reporting channels were coded as design constraints. Retained components were then mapped to Türkiye's institutional setting in the evidence-to-framework matrix.

The authors addressed reliability through an audit trail rather than inter-coder statistics. The search terms, inclusion rules, DOI checks, case records, coding fields, and calculation method are stated or reproduced in the article. The authors maintained bibliographic records in a structured reference database; they checked authors, dates, titles, journal details, DOIs, and official URLs against publisher or institutional records, and matched every in-text citation to the reference list. One author performed the coding, so interpretive bias remains possible. The framework has not been validated through Delphi review, interviews, or implementation. Analytical triangulation and the scenario are therefore preliminary checks; external expert and case validation remain necessary.

4. Results: Evidence-to-Framework Derivation

Table 2. Evidence-to-framework matrix for Master Plan 2.0

Master Plan 2.0 component	Evidence and comparative-case basis	Türkiye-specific reason	Operational output
1. Baseline and bounded targets	IPCC waste accounting; facility-level GHG estimation (IPCC, 2019; Aydın & Akkaya, 2025)	Municipal waste data and GHG inventories use different boundaries	Reference year; waste-stream mass balance; territorial and avoided-emission indicators kept separate
2. Prevention and reuse first	Waste hierarchy and prevention evidence (ZWIA, 2018; Awino & Aritz, 2024; UNEP & ISWA, 2024)	National recovery-rate emphasis needs complementary prevention indicators	Per-capita waste, food-waste prevention, repair/reuse and procurement targets
3. Organics pathway	Waste methane, Turkish NDC measures and current organics infrastructure (IPCC, 2019; Republic of Türkiye, 2023; Musluoğlu <i>et al.</i> , 2026)	Biodegradable waste is a material mitigation opportunity	Separate collection coverage, contamination, treatment destination and methane estimate
4. Sector portfolios	Household, commercial and construction rules; integrated city planning (City of Ljubljana, 2014; San Francisco Environment Department, n.d.; Felekiet <i>et al.</i> , 2025)	Metropolitan municipalities coordinate heterogeneous districts and generators.	Household, commercial, construction/demolition and municipal-operations programmes
5. Vertical MRV hand-off	Paris Agreement transparency arrangements and Türkiye's NDC and BTR (Republic of Türkiye, 2023, 2024; UNFCCC, n.d.)	City results are not automatically included in national reporting	Data dictionary, ownership, QA/QC, aggregation and double-counting rules agreed with national authority
6. Readiness and equity gate	Evidence on service access, participation, municipal	Municipal service and income differences make	Minimum service-access threshold,

	capacity and finance (Ikizoglu, 2024; Zaikova <i>et al.</i> , 2026)	uniform enforcement risky	affordability test and staged compliance
7. Adaptive review triggers	Urban climate experimentation and city monitoring (Bulkeley & Broto, 2013; Felekiet <i>et al.</i> , 2025)	Capacity and waste composition vary over time.	Annual dashboard; three-year review; automatic correction when contamination, access or target deviation thresholds are breached

Note. The matrix links each component to named evidence and to a Türkiye-specific implementation need.

4.1 Why the framework is tailored to Türkiye

Türkiye's institutional structure requires a national-local design. The Zero Waste Regulation establishes a national system, while Municipal Law No. 5393 and Metropolitan Municipality Law No. 5216 assign collection and service functions to municipal authorities (Republic of Türkiye, 2004, 2005, 2019). The National Circular Economy Strategy and Action Plan 2025-2028 adds priorities for waste prevention, sectoral transformation, data-based monitoring, and broader use of zero-waste practices (Republic of Türkiye Ministry of Environment, Urbanization and Climate Change [MoEUCC], 2025).

Official data show that municipal waste generation averaged 375.95 kg per person in 2022. The reported recovery rate rose from 30.13% in 2022 to 34.92% in 2023 (Turkish Statistical Institute [TurkStat], 2023; MoEUCC, n.d.-a, n.d.-b). These national values do not describe local composition, treatment performance, or facility emissions. Recent Türkiye-specific research reinforces that distinction. Treatment choices carry different environmental risks (Konyalıoğlu&Oturakçı, 2025); facility-based work in Istanbul shows the importance of local activity data for GHG estimation (Aydın & Akkaya, 2025); and full-scale anaerobic digestion capacity exists, but plant size and utilisation vary (Musluoğlu *et al.*, 2026). Expert evidence also identifies limited municipal finance, data gaps, and coordination problems as barriers to circularity (Zaikova *et al.*, 2026).

Implementation also depends on residents' access to collection points and on visible performance reporting (Ikizoglu, 2024). Türkiye's updated NDC and First Biennial Transparency Report provide the national climate-policy and transparency context for verified local mitigation data (Republic of Türkiye, 2023, 2024). These conditions explain the model's emphasis on vertical MRV, service readiness and metropolitan coordination.

4.2 Policy architecture and sequencing

Table 3. Proposed implementation sequence

Phase	Readiness condition	Priority actions	Climate/reporting output
0. Baseline (0–12 months)	Waste-flow reconciliation and institutional mandate	Characterisation; service-access map; facility and contract inventory; stakeholder/equity assessment	Base-year mass balance; inventory boundary; data-sharing protocol
1. Enable (years 1–2)	Separate collection accessible to a defined minimum share of population	Procurement, reuse, repair, organics pilots, technical assistance and public communication	Pilot activity data; contamination and participation indicators
2. Scale and regulate (years 2–5)	Verified capacity and affordability safeguards	Expand source separation; commercial and C&D requirements; graduated enforcement; PAYT feasibility where lawful.	Annual territorial GHG estimate; separate avoided-emission estimate
3. Optimise (year 5 onward)	Stable QA/QC and target tracking	Contract reform, market development, advanced prevention and corrective action	Externally reviewable dataset for national

			aggregation and plan revision
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Note. The sequence is the authors' synthesis of the reviewed evidence, including service-access, capacity, monitoring and governance findings (Ikizoglu, 2024; Felekiet al., 2025; Zaikovaet al., 2026).

4.3 Scenario-based GHG estimate for a representative Turkish city

The scenario is deliberately simple and reproducible. It represents a city of 1,000,000 residents generating 375.95 kg of municipal waste per person per year, equal to 375,950 tonnes annually (TurkStat, 2023; MoEUCC, n.d.-a). Because the reviewed official dataset does not establish a current nationally representative organic fraction, the calculation assumes that 40% of municipal waste is mixed food and garden waste. The intervention diverts an additional 30% of that organic fraction from landfill to composting: $375,950 \times 0.40 \times 0.30 = 45,114$ tonnes per year.

For transparent screening, the 2025 UK Government conversion factors are used: 656.086 kgCO₂e per tonne for landfill and 8.983 kgCO₂e per tonne for composting of mixed food and garden waste (Department for Energy Security and Net Zero, 2025). The differential is 647.103 kgCO₂e per tonne. Estimated annual avoidance is $45,114 \times 0.647103 = 29,191$ tCO₂e, rounded to 29,200 tCO₂e. At diversion rates of 20% and 40%, the estimate is approximately 19,500 and 38,900 tCO₂e per year, respectively. This range is neither a forecast nor an IPCC-compliant inventory result. It excludes landfill-gas capture, transport changes, facility energy, upstream prevention benefits, and local composition differences. Facility-level research in Istanbul illustrates why activity data and treatment conditions must be measured locally (Aydın & Akkaya, 2025). Formal reporting must replace all screening assumptions with local data and Türkiye's national inventory methods.

Table 4. Assumptions used in the organic's diversion scenario

Input	Central assumption	Sensitivity/qualification
Population	1,000,000	Representative scale, not a named city
Municipal waste generation	375.95 kg/person/year (TurkStat, 2023)	Official 2022 national average (MoEUCC, n.d.-a)
Organic share	40%	Analytical assumption; replace with local characterisation
Additional diversion	30%	20-40% diversion sensitivity
Emission-factor differential	0.647103 tCO ₂ e/t (Department for Energy Security and Net Zero, 2025)	UK screening factor; not Türkiye-specific
Result	29,200 tCO ₂ e/year	19,500-38,900 tCO ₂ e/year sensitivity

Note. The population is illustrative. Waste generation is based on TurkStat (2023); treatment factors are from the UK Government's 2025 conversion factors. Local application requires measured composition, destination and landfill-gas data.

4.4 Formal connection to the UNFCCC, NDC and COP process

The UNFCCC does not provide a routine channel for a municipality to submit a waste result directly into a Party's inventory or NDC accounting. Under the Paris Agreement Enhanced Transparency Framework, Türkiye reports its national inventory and progress in implementing and achieving its NDC through Biennial Transparency Reports (Republic of Türkiye, 2023, 2024; UNFCCC, n.d.). Municipal data can contribute only when the competent national authority accepts the activity data, emission factors, quality assurance and quality control procedures, and attribution rules. The model therefore proposes a municipal-to-national MRV hand-off rather than a direct city-to-COP reporting route.

Table 5. Municipal-to-national reporting pathway

Level/process	Possible role of city zero-waste data	Required safeguard
National GHG inventory - waste sector (IPCC, 2019; Republic of Türkiye, 2024)	Locally measured disposal, treatment and methane-management activity data may improve national estimates.	National methodology, QA/QC, completeness and avoidance of overlap across facilities and jurisdictions
NDC implementation tracking (Republic of Türkiye, 2023)	Municipal actions may be mapped to waste, circular-economy and demand-side measures in the national implementation system	Ex ante baseline, responsible entity, indicator definition and attribution rule
Biennial Transparency Report / ETF (Republic of Türkiye, 2024; UNFCCC, n.d.)	Aggregated, quality-controlled city information may support descriptions of policies, measures and progress.	National approval and consistency with inventory and structured-summary reporting
COP and Global Climate Action Agenda	Cities may showcase initiatives, participate in non-Party stakeholder processes and support implementation narratives.	Do not describe voluntary visibility as formal NDC accounting or a COP decision mechanism.
COP31 in Antalya, 9-20 November 2026 (UNFCCC, 2026)	A policy window for presenting credible national–local implementation arrangements	Hosting creates visibility, not an automatic reporting route or evidence of effectiveness

Note. Formal national reporting remains subject to Türkiye's inventory, NDC and BTR methods and approval procedures (Republic of Türkiye, 2023, 2024; UNFCCC, n.d.).

5. Discussion

5.1 Contribution and limits of novelty

Master Plan 2.0 combines established measures in an auditable architecture. Dual accounting keeps territorial methane reductions separate from upstream avoided emissions. The MRV hand-off specifies how municipal activity data could enter national systems. Readiness and equity checks link enforcement to service access, while review triggers turn monitoring results into decisions. This design responds to recent findings that urban circularity depends on coordinated governance and that Türkiye's transition is constrained by data, finance and inter-agency coordination (Felekiet *al.*, 2025; Zaikovaet *al.*, 2026). Implementation can be tested against the stated data requirements, thresholds and institutional responsibilities.

5.2 Interpretation of the comparative evidence

The comparative cases support instrument bundling, long-term targets and monitoring. The Chinese studies provide evidence from a national pilot system; San Francisco documents a broad regulatory portfolio; Ljubljana shows integrated municipal planning and service delivery; and a recent six-city European study describes the importance of integrated planning, procurement and public engagement (Felekiet *al.*, 2025). None of these sources proves that the same package will produce the same outcome in Türkiye. The transferable lesson concerns governance function: clear rules, accessible services, coordinated delivery and feedback. The model therefore does not borrow a diversion rate or enforcement schedule from another jurisdiction.

5.3 Validation agenda

Validation should begin with a Delphi or structured expert assessment involving municipal waste managers, national inventory specialists, district municipalities, facility operators and civil-society representatives. The framework should then be piloted in at least two Turkish metropolitan municipalities with different capacity

profiles. Each pilot should recalculate the scenario with measured composition, destination, and landfill-gas data and test whether the indicators can enter national NDC and BTR systems without double counting. Until that work is completed, the framework should be described as analytically derived and scenario-tested rather than empirically validated.

6. Conclusions and Policy Implications

Zero-waste planning can support climate governance when prevention and treatment changes are tied to explicit baselines, credible emissions methods, and responsible institutions. Recent Türkiye-specific research confirms that local treatment conditions, infrastructure, finance, data quality, and service access matter to implementation (Aydın & Akkaya, 2025; İkizoglu, 2024; Musluoğlu *et al.*, 2026; Zaikova *et al.*, 2026). Master Plan 2.0 provides a testable way to connect these conditions to national policy and reporting.

Municipalities applying the framework should first reconcile waste-flow data and complete a local composition study. They should report territorial waste-sector emissions separately from broader avoided-emission estimates, assign each action to a responsible unit and a budget and data owner, and phase binding requirements based on service access and affordability. The reporting arrangement should be agreed with the national authority before local results are described as support for NDC implementation or BTR reporting. The illustrative organics scenario explains the potential scale of mitigation, but the central estimate of 29,200 tCO₂e is not a city commitment and must be recalculated with local data.

The framework's external validity has not yet been tested. Field application, expert assessment, and independent GHG verification are required before making claims of effectiveness. The present result is an auditable design proposition that municipalities and national institutions can examine and pilot.

7. Data Availability and Research Transparency

All sources used in the analysis are publicly accessible through the publisher or official institutional links in the reference list. The manuscript reports the search dates, search terms, selection criteria, coding domains, comparative-case rationale, and scenario equation. Bibliographic metadata and the one-to-one correspondence between in-text citations and references were checked before submission.

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inputs and calculations. The scenario uses published inputs and explicitly stated analytical assumptions rather than primary municipal measurements.

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10. References

- Almansour, M., & Akrami, M. (2024). Towards zero waste: An in-depth analysis of national policies, strategies, and case studies in waste minimisation. *Sustainability*, 16(22), 10105.
- Awino, F. B., & Apitz, S. E. (2024). Solid waste management in the context of the waste hierarchy and circular economy frameworks: An international critical review. *Integrated Environmental Assessment and Management*, 20(1), 9–35.
- Aydın, Ç., & Akkaya, E.K. (2025). Evaluating greenhouse gas emissions and carbon credit potential of solid waste disposal facilities: The case of Istanbul. *International Journal of Environmental Science and Technology*, 22, 15529–15542.
- Bi, S., Du, J., Yan, Z., & Appolloni, A. (2024). Can 'zero waste city' policy promote green technology? Evidence from econometrics and machine learning—*Journal of Environmental Management*, 370, 122895.
- Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2), 27–40.
- Bulkeley, H., & Broto, V. C. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions of the Institute of British Geographers*, 38(3), 361–375.
- City of Ljubljana. (2014). Strategy for the development of waste-management activities in the City of Ljubljana, 2014–2035.
- Department for Energy Security and Net Zero. (2025). Greenhouse gas reporting: Conversion factors 2025. UK Government. <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2025>
- Feleki, E., Tschapke, V., Borngesser, W., & Kiesel, L. (2025). Transforming urban landscapes: Circular economy practices in European cities. *Circular Economy and Sustainability*, 5, 4945–4956.
- Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, 114, 11–32.
- Ikizoglu, B. (2024). The development of a zero waste and sustainable waste management behavior scale in Türkiye: sustainability, 16(23), 10181.
- Intergovernmental Panel on Climate Change. (2019). 2019 refinement to the 2006 IPCC guidelines for national greenhouse gas inventories: Volume 5 Waste. <https://www.ipcc-nggip.iges.or.jp/public/2019rf/vol5.html>
- Intergovernmental Panel on Climate Change. (2023). Climate change 2023: Synthesis report. <https://doi.org/10.59327/IPCC/AR6-9789291691647>
- Kaza, S., Yao, L., Bhada-Tata, P., & Van Woerden, F. (2018). What a waste 2.0: A global snapshot of solid waste management to 2050. World Bank. <https://doi.org/10.1596/978-1-4648-1329-0>
- Konyalıoğlu, A. K., & Oturakçı, M. (2025). Developing a comprehensive framework for municipal solid waste management alternatives: A case study in Turkey. *International Journal of Environmental Science and Technology*, 22, 9825–9838.
- Liu, M., Chen, L., Sheng, X., Xu, Y., Yuan, X., Wang, Q., Ma, Q., & Zuo, J. (2024). Zero-waste city pilot and urban green and low-carbon transformation: Quasi-experimental evidence from China: resources, Conservation and Recycling, 206, 107625.
- Musluoğlu, A., Övez, S. S., Dereli, R. K., Maçın, K. E., Özçelik, K., Waqas, M., & Arkan, O. A. (2026). Development and current status of full-scale anaerobic digestion plants for organic fraction of municipal solid waste in Türkiye. *BioEnergy Research*, 19(1), Article 68.
- Republic of Türkiye. (2004). Metropolitan Municipality Law (Law No. 5216). Official Gazette No. 25531, 23 July 2004. <https://www.mevzuat.gov.tr/>
- Republic of Türkiye. (2005). Municipal Law (Law No. 5393). Official Gazette No. 25874, 13 July 2005. <https://www.mevzuat.gov.tr/>

- Republic of Türkiye. (2019). Zero Waste Regulation. Official Gazette No. 30829, 12 July 2019, as amended. <https://www.resmigazete.gov.tr/eskiler/2019/07/20190712-9.htm>
- Republic of Türkiye. (2023). Updated first nationally determined contribution. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/NDC/2023-04/T%C3%9CRK%C4%B0YE_UPDATED%201st%20NDC_EN.pdf
- Republic of Türkiye. (2024). First biennial transparency report of Türkiye. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/T%C3%BCrkiye_1BTR.pdf
- Republic of Türkiye Ministry of Environment, Urbanization and Climate Change. (2025). National circular economy strategy and action plan 2025-2028. https://webdosya.csb.gov.tr/db/cygm/haberler/udesep_eng-20251020103224.pdf
- Republic of Türkiye Ministry of Environment, Urbanization and Climate Change. (n.d.-a). Municipal waste amount and disposal amount. Retrieved September 17, 2026, from <https://cevreselgostergeler.csb.gov.tr/belediye-atiklari-miktari-ve-bertaraf-miktari-85749>
- Republic of Türkiye Ministry of Environment, Urbanization and Climate Change. (n.d.-b). Municipal waste recovery rate. Retrieved September 17, 2026, from <https://cevreselgostergeler.csb.gov.tr/belediye-atigi-geri-kazanim-orani-111689>
- San Francisco Environment Department. (n.d.). Policies related to zero waste. Retrieved September 17, 2026, from <https://www.sfenvironment.org/zero-waste-legislation>
- Turkish Statistical Institute. (2023). Waste statistics, 2022. <https://data.tuik.gov.tr/Bulten/Index?dil=2&p=Waste-Statistics-2022-49570>
- United Nations Environment Programme, & International Solid Waste Association. (2024). Global waste management outlook 2024: Beyond an age of waste - Turning rubbish into a resource. <https://wedocs.unep.org/handle/20.500.11822/44939>
- United Nations Framework Convention on Climate Change. (n.d.). Biennial transparency reports. Retrieved September 17, 2026, from <https://unfccc.int/biennial-transparency-reports>
- United Nations Framework Convention on Climate Change. (2026). The road to Antalya: COP31. <https://unfccc.int/cop31/the-road-to-antalya>
- United Nations Human Settlements Programme. (2022). World cities report 2022: Envisaging the future of cities. <https://unhabitat.org/wcr/>
- Zaikova, A., Hauge, B., Çağman, S., Havukainen, J., Astrup, T. F., & Horttanainen, M. (2026). Transition towards circularity in municipal solid waste management: Analysis of barriers and drivers through the multi-level perspective framework. *Circular Economy and Sustainability*, 6, Article 113.
- Zero Waste International Alliance. (2018). Zero waste definition. <https://zwia.org/zero-waste-definition/>
- Zink, T., & Geyer, R. (2017). Circular economy rebound. *Journal of Industrial Ecology*, 21(3), 593–602.