

GAS-FREE CITIES

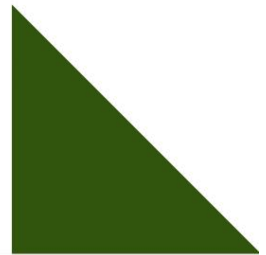
GREENPEACE



EUROPEAN URBAN HEAT TRANSITION RANKING

A ranking of 15 European cities on fossil-heat phase-out, infrastructure, delivery and social fairness.

Author: Dr. Mehmet Börühan Bulut, Independent Energy & Climate Consultant



Imprint

Analysis by Greenpeace Central and Eastern Europe
Wiedner Hauptstraße 120–124
1050 Vienna, Austria
Phone: +43 1 545 4580
Email: office@greenpeace.at
September 2026

Photo credits:

Cover: ©Stefano Montesi / Greenpeace
Cover: ©Nathalie Bertrams / Greenpeace

Contents

No.	Title	Page
1	Executive summary	2
2	Why cities matter politically and strategically	4
3	How the ranking works	6
4	Where Europe's cities stand on the heat transition	9
5	What shapes urban heat-transition performance	10
6	Cities at risk of fossil-gas lock-in	13
7	City profiles	16
	1. Stockholm	17
	2. Paris	18
	3. Vienna	19
	4. Copenhagen	20
	5. Amsterdam	21
	6. Budapest	22
	7. Prague	23
	8. Berlin	24
	9. Warsaw	25
	10. Brussels	26
	11. Madrid	27
	12. Lisbon	28
	13. Athens	29
	14. Rome	30
	15. Bucharest	31
8	What the heating transition delivers	32
9	What cities and mayors should do next	35

1. Executive summary

Europe's transition away from fossil gas will be won or lost in large part at the local level. Cities and other local governments are where climate targets become practical decisions about boilers, heat networks, renovation, investment and consumer protection. The strongest performers are those that connect political direction with delivery.

This study compares 15 major European cities to assess how effectively they are moving building heating away from fossil fuels. It examines current outcomes alongside the conditions for completing the transition: emissions and heating-system performance, policy and planning, infrastructure, governance and finance, and social safeguards. Together, these dimensions show which cities are making the strongest progress away from fossil-based heating, which have credible pathways for change, and where major gaps or fossil-fuel lock-in risks remain.

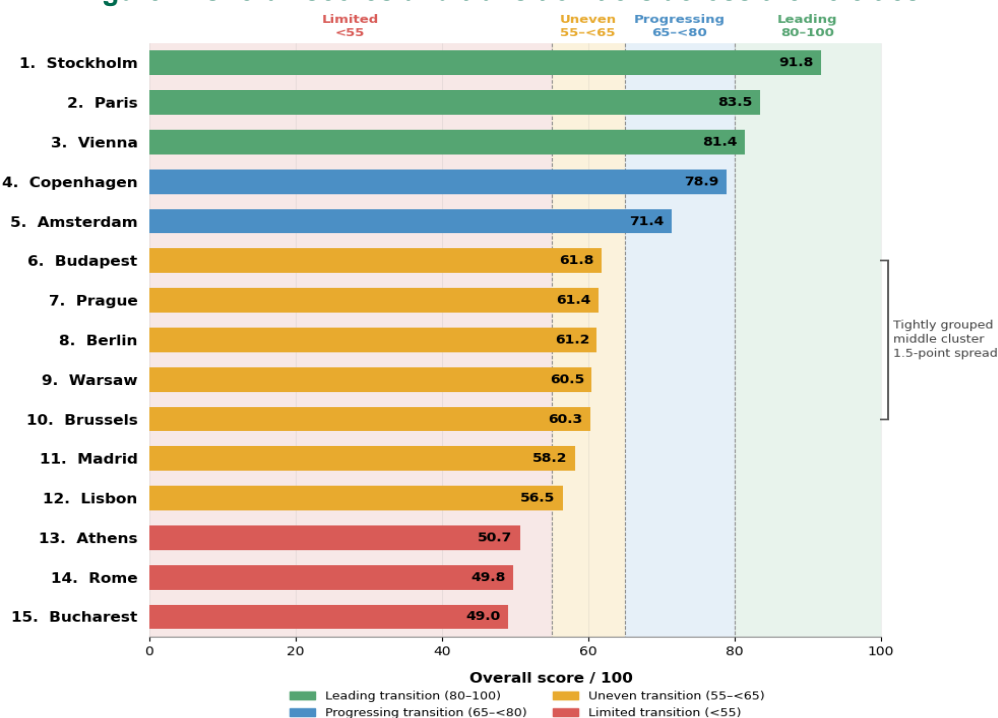
Key findings

- Three cities form the leading group. Stockholm ranks first at 91.8, followed by Paris at 83.5 and Vienna at 81.4. Stockholm combines extremely low direct fossil use with a mature heat system and strong delivery capacity, while Paris and Vienna rank highly despite greater remaining fossil dependence because of stronger planning, investment and implementation.
- Stockholm leads, but its heat system is not impact-free. Direct fossil use in buildings is extremely low and emissions are falling, but substantial reliance on waste incineration, including fossil plastics, prevents its district heating from being treated as fully renewable or fossil-free.
- Paris ranks second, combining rapid reductions in building emissions from direct fossil-fuel use with major heat-network investment, strong financing and social protections, although direct fossil heating and gas use in district heating remain significant.
- Vienna ranks third and has one of the clearest long-term gas-exit pathways. Its Heat Plan 2040 maps the replacement of roughly 600,000 gas-heating systems and is backed by strong governance and investment, although district heating remains substantially fossil-dependent.
- Copenhagen ranks fourth in the Progressing tier. Direct fossil-fuel use in buildings is extremely low and district-heating electrification is advancing rapidly, but waste incineration remains significant and the planned Svanemølle Energy Centre includes substantial gas-boiler capacity without a verified binding exclusion of fossil gas.
- Amsterdam ranks fifth in the Progressing tier, combining a clear 2040 gas-free objective, neighbourhood delivery and strong social measures with substantial current gas dependence and a new gas-fired auxiliary heat plant that triggers a Major Fossil Investment Flag.
- The middle of the ranking is exceptionally tight. Budapest, Prague, Berlin, Warsaw and Brussels are separated by just 1.5 points, with very different strengths and weaknesses. Some perform better on governance and planning, while others have stronger current outcomes, but fossil dependence and incomplete transition pathways constrain all five.
- Low emissions do not necessarily mean a mature heat transition. Madrid and Lisbon perform comparatively well on emissions-related outcomes but still show limited delivery in replacing fossil heating and lack complete citywide phase-out pathways. Madrid ranks eleventh, ahead of Lisbon, where the mild climate and evidence of inadequate winter heating also complicate interpretation of low emissions.
- The lowest-ranked cities face more fundamental transition gaps. Athens, Rome and Bucharest remain in the Limited tier because fossil dependence, incomplete planning and limited transition delivery outweigh emerging renovation and electrification measures. Bucharest is further weakened by major new gas-fired district-heating investment.

- Fossil lock-in remains a major dividing line. Amsterdam, Prague, Berlin, Warsaw and Bucharest receive Major Fossil Investment Flags for material new fossil-heating infrastructure, while Copenhagen, Budapest, Brussels, Lisbon, Athens and Rome remain on Watch because potentially significant fossil risks are not yet sufficiently resolved.
- District heating is only an advantage when its heat sources are genuinely transitioning away from fossil fuels. Networks can enable system-wide change, but fossil gas, coal and waste incineration continue to constrain performance in several cities, showing that network coverage alone is not a measure of heat-transition success.
- Planning quality and current performance often diverge. Vienna has one of the clearest long-term gas-exit strategies, while cities such as Berlin also perform strongly on governance despite weaker emissions outcomes and continued gas investment, creating tension with its emerging pathway for phased gas-network retirement.
- The central challenge is increasingly delivery rather than target-setting. The strongest cities combine clear direction with infrastructure investment, fossil-asset retirement, governance, financing and household protection; weaker performers often have climate ambitions without an equally credible pathway for replacing fossil heating in practice.

Overall, the decisive question is whether cities can turn climate targets into a coordinated programme of fossil-infrastructure retirement, renewable and other fossil-free heat solutions, building renovation and social protection.

Figure 1. Overall scores and transition tiers across the 15 cities.



¹ In this report, "renewable and other fossil-free heat" refers to renewable thermal energy (heat pumps, geothermal, solar thermal), direct renewable electrification (such as electric boilers powered by renewable electricity), and circular energy-efficiency measures (recovered or waste heat). This category explicitly excludes fossil fuels, nuclear power, non-renewable hydrogen, and waste incineration containing fossil materials.

2. Why cities matter politically and strategically

Europe's transition away from fossil gas will be won or lost in large part at the local level. Cities and other local governments are where climate targets become practical decisions about boilers, heat networks, renovation, investment and consumer protection. The strongest performers are those that connect political direction with delivery.

A successful local heat transition depends not on a single technology or climate target, but on combining fossil-fuel phase-out with building renovation, renewable and other fossil-free heat infrastructure², effective governance and social protection. These choices play out across buildings, neighbourhoods and energy networks, shaping how quickly fossil heating is replaced and how fairly the transition is delivered.

For Greenpeace, moving beyond fossil gas is not simply a question of switching heating technologies. It is part of building a fossil-free future based on affordable, renewable and increasingly locally controlled energy, while reducing energy demand and ending Europe's exposure to volatile fossil-fuel prices and imported gas. Greenpeace has called for a full European fossil-gas phase-out by 2035, alongside an end to new fossil-fuel infrastructure and much greater investment in renewables, electrification and building renovation.

The urban heating transition is therefore also a question of security, affordability and fairness. A poorly managed phase-out can leave households exposed to rising gas-network costs, unaffordable renovation, high connection charges or unequal access to renewable heating. A well-managed transition can reduce energy demand and bills, improve buildings and neighbourhoods, and direct public support towards households most exposed to energy poverty. These distributional choices are central to whether the transition is both durable and publicly supported.

Cities are therefore not merely implementing national climate policy. Through planning, public and social housing, municipal utilities, procurement, renovation programmes and local investment, they help shape how the fossil-gas phase-out happens in practice. Their role is to coordinate changes across buildings and infrastructure while ensuring that today's investment decisions support, rather than delay, a fossil-free heat system.

Cities shape the practical levers of heat transition

National and EU rules, regional planning frameworks, and energy-market structures can significantly shape, and sometimes constrain, the ability of cities to drive the heating transition. Within these limits, however, municipal and metropolitan actors can still control or influence many of the decisions that determine whether fossil heating is actually replaced:

- where heat networks are expanded, decarbonised or retired
- how public and social housing is renovated
- whether neighbourhood plans provide a credible route away from fossil heating
- how advice and financial support reach residents
- whether municipal utilities avoid prolonging fossil assets
- how tenants and consumers are protected during conversion

Institutional capacity is only valuable if it translates into delivery. Cities may have planning powers, public utilities, funding programmes or ambitious targets, but these tools need to be used consistently to retire fossil heating, scale renewable and other fossil-free alternatives and avoid new fossil lock-in.

² "Fossil-free heat infrastructure" refers to heating infrastructure that does not rely on fossil-fuel combustion, including renewable heat, heat pumps, geothermal energy, solar thermal, electric boilers and appropriate sources of recovered or waste heat. Waste incineration containing fossil-derived materials is not treated as fully fossil-free.

The practical test is not simply what powers a city holds, but whether its decisions across planning, finance and infrastructure point in the same fossil-free direction.

Today's investments shape tomorrow's heat system

Urban heating infrastructure is long-lived. Decisions taken today about boilers, gas networks, combined heat and power plants and heat-network generation can shape energy systems for decades. New fossil investment can therefore make the transition harder and more expensive by creating assets that must later be retired early, converted or kept operating to recover their costs.

The same applies to declining gas networks. As buildings leave the gas system, the fixed costs of maintaining pipelines may be spread across a smaller customer base, potentially increasing costs for those who remain connected. Without coordinated planning for gas-network decline and renewable-heat expansion, households with the least ability to invest may be among the last left on an increasingly expensive system.

This makes the sequencing of urban heat policy especially important. Cities need not only long-term fossil-free targets, but investment decisions today that are consistent with those targets. Expanding renewable heat, renovating buildings and planning the orderly retirement of fossil infrastructure need to proceed together if cities are to avoid new lock-in and an unnecessarily costly transition.

Heating is spatial

A credible transition cannot rely on a single technology. Dense districts may favour heat networks, while other neighbourhoods may depend on individual or shared heat pumps. Historic buildings may require staged renovation, while geothermal, wastewater or industrial heat depends on local geography and infrastructure. Municipal heat planning turns these differences into a practical sequence for change, helping identify where different solutions fit and when buildings and networks need to be upgraded.

Good heat planning must also coordinate the timing of infrastructure, renovation and investment. Decisions about heat-network expansion, building upgrades and gas-network retirement need to reinforce one another. Without that coordination, cities risk creating stranded assets, delaying fossil-heating phase-out or leaving households facing uncertain and potentially higher transition costs.

Heating is political

The transition changes who pays, who owns infrastructure and who bears risk. Decisions about renovation, network investment and heating-system replacement can shift costs between utilities, landlords, homeowners, tenants and public budgets. Without strong safeguards, energy savings can be offset by rent increases, connection charges or high upfront costs, while unmanaged gas-network decline can leave remaining customers carrying rising costs. Cities therefore need to treat affordability, consumer protection and ownership alongside infrastructure planning, so that the move away from fossil heating strengthens rather than undermines public support for the transition.

3. How the ranking works

This ranking assesses how 15 major European cities are moving building heating away from fossil fuels, combining recent emissions and heating-system performance with policy, infrastructure, governance, finance and social safeguards. The ranking assesses the urban heat-transition system affecting each city, including relevant municipal, metropolitan, regional and utility actions; it should not be interpreted solely as an assessment of the performance of the mayor or municipal administration.

The cities were selected to reflect different climates, heating systems and governance contexts, making this a comparative sample rather than a comprehensive ranking of all European cities. Twelve indicators across five categories produce a score of up to 100 points, alongside a performance tier and separate fossil-investment status. Full definitions, scoring, data boundaries, sensitivity tests and the evidence dataset are provided in the accompanying methodology.³

Table 1. Indicator structure and weights used in the ranking

Category	Indicator	Measures	Weight
Policy and leadership — 15%	P1. Dated and scoped fossil-heating phase-out objective	Explicit, dated objective covering relevant fossil fuels and building sectors.	6
	P2. Operational urban heat-transition plan	Heat-specific delivery plan with spatial or budget links, responsibilities and implementation.	9
Emissions and outcomes — 15%	E1. Weather-adjusted change in modelled direct building CO₂	2020–2024 change in EDGAR-modelled direct building-combustion CO ₂ emissions, adjusted for interannual weather variation. ⁴	10
	E2. Climate-standardised direct building CO₂ per resident	2024 direct building-combustion CO ₂ emissions per resident, standardised to a common reference climate.	5
Heating transition — 30%	H1. Remaining direct fossil-fuel share	Share of building final energy supplied directly by on-site fossil fuels.	9
	H2. District-heating current performance	Current fossil dependence and transition performance of material district-heating systems.	9
	H3. Fossil-free heating transformation	Scale and direction of physical heating-system transformation away from fossil lock-in.	12
Governance and finance — 20%	G1. Effective use of governance and delivery powers	Active use of planning, regulatory, ownership, concession, procurement and delivery powers.	13
	F1. Funded near-term heat-transition delivery programme	Material near-term transition actions backed by committed financing.	7
Social fairness — 20%	S1. Accessible technical and targeted financial support	Practical and targeted support for households facing transition costs or energy poverty.	7
	S2. Tenant, affordability and consumer safeguards	Implemented protections against unaffordable costs, displacement and unfair rent impacts.	8
	S3. Participation and workforce inclusion in the heat transition	Heat-linked participation and workforce measures that influence planning or delivery.	5
Disclosure safeguard	L1. Major Fossil Investment Flag	Flags material heating investments that could prolong fossil dependence.	0
Total			100

The category weights reflect the study's definition of a successful urban heat transition. The greatest weight is assigned to the physical transformation of heating systems, while emissions and outcomes,

³ Greenpeace, *Methodology for the European Urban Heat Transition Ranking* (2026).

⁴ Crippa, M., Guizzardi, D., Ciarlantini, S., Pagani, F., Banja, M., Muntean, M. & Pisoni, E. (2026), *EDGAR GHG by city 2026*, European Commission Joint Research Centre (JRC), annual GHG emissions by sector and urban centre, 1990–2024. Based on EDGAR_2025_GHG and GHS-UCDB city definitions. Weather adjustment applied by the authors; see Methodology.

policy, governance and finance, and social fairness also make substantial contributions. The weighting is designed to limit, but not eliminate, compensation between dimensions. The overall score should therefore be interpreted alongside the category scores and the Major Fossil Investment Flag.

Each indicator is scored on a common 0–4 scale, but the meaning of each score is defined separately for that indicator to reflect the type of evidence being assessed. In broad terms:

- **0:** absent, contradictory or very weak performance
- **1:** limited or early-stage performance
- **2:** partial progress or implementation
- **3:** strong performance with substantial implementation
- **4:** leading or near-complete performance

Each indicator is assessed against its own predefined scoring rule.

E1, E2 and H1 are quantitative indicators scored continuously from 0 to 4 against predefined thresholds, with linear interpolation between them. Scores therefore reflect absolute performance rather than a city's position relative to others. Values beyond the outer scoring anchors are capped at 0 or 4.

E1 and E2 cover direct combustion emissions from buildings and exclude district-heat generation and electricity supply. They are outcome indicators, not estimates of municipal policy impact, and may reflect national policy, market conditions, behaviour and structural differences as well as local action. The 2020–2024 period was chosen to capture recent transition progress and is the most recent harmonised Emissions Database for Global Atmospheric Research (EDGAR) period available across all cities. District-heating fossil dependence is assessed separately under H2. Where waste incineration supplies at least 20% of district-heating energy, H2 is capped at 3, because, under this methodology, waste combustion, including fossil-derived plastics, is not treated as equivalent to a fully renewable or fossil-free heat system.

H1 measures remaining direct fossil-heating dependence using the most recent sufficiently robust source available. Data years and geographic boundaries therefore vary, and some cities rely on regional proxies or conservative upper bounds; these are disclosed for each city.

L1 separately identifies major heating investments that could prolong fossil-fuel dependence. “Watch” indicates an unresolved lock-in risk; a “Major Fossil Investment Flag” indicates a sufficiently advanced material fossil investment. L1 does not affect the score, rank or tier, although the same investment may inform H3 where relevant to the direction of heating-system transformation.

Table 2. Quantitative indicator scoring thresholds and interpolation anchors

Indicator	Analytical anchors
E1 — emissions change	–30% = 4; –20% = 3; –10% = 2; 0% = 1; +10% = 0 , with piecewise interpolation between these points.
E2 — emissions/person	0.5 = 4; 0.8 = 3; 1.1 = 2; 1.4 = 1; 1.7 tCO₂/person = 0 , with piecewise linear interpolation between these points.
H1 — direct fossil share	15% = 4; 35% = 3; 50% = 2; 60% = 1; 70% = 0 , with piecewise linear interpolation between anchors.

Each indicator contributes weighted points according to the following formula:

Weighted points = indicator weight × (score / 4)

The city score is the sum of weighted indicator points. Where district heating is immaterial, H2 is treated as not applicable rather than scored as zero. Its 9-point weight is redistributed within the Heating Transition category, proportionally between H1 and H3 according to their original 9:12 weighting. H1 therefore receives an effective weight of 12.9 points and H3 17.1 points, while the category remains worth 30 points overall. This preserves the intended category weight without awarding points simply because a city lacks a material district-heating system.

Table 3. Overall score thresholds used for tier classification

Tier	Score range and meaning
Leading transition	80–100 — Strong overall performance across the assessed dimensions, with clear direction and substantial delivery.
Progressing transition	65–<80 — Relatively strong overall performance, but material gaps remain in outcomes or delivery.
Uneven transition	55–<65 — Mixed performance, with important strengths offset by significant fossil or delivery gaps.
Limited transition	<55 — Weak overall performance, with major gaps across key dimensions of the heat transition.

Tiers are assigned solely on the basis of the overall score. They indicate broad performance groups, and small differences between city scores should not be over-interpreted.

4. Where Europe's cities stand on the heat transition

The ranking reveals both clear differences in overall performance and a tightly clustered middle. Stockholm, Paris and Vienna form the leading group, while Copenhagen and Amsterdam sit in the progressing tier. Seven cities fall into the uneven-transition tier, reflecting different combinations of fossil dependence, policy strength, infrastructure choices and delivery gaps. Scores should therefore be read as broad comparative signals rather than precise measures of distance between cities.

The three leading cities reach their positions through different pathways. Stockholm combines extremely low direct fossil-fuel use with a mature heating system and strong delivery capacity. Paris and Vienna rank highly despite greater remaining fossil dependence because of strong planning, investment and implementation. Copenhagen sits just below the leading threshold: direct fossil heating is almost eliminated, but substantial waste incineration and planned gas-capable infrastructure weaken its assessment.

The middle remains tightly clustered. Budapest, Prague, Berlin, Warsaw and Brussels are separated by only 1.5 points, making their shared pattern of uneven performance more significant than their exact rank positions. Madrid and Lisbon also remain in this tier, with relatively favourable emissions outcomes but limited fossil-heating replacement and incomplete phase-out pathways. Berlin shows the opposite pattern, with comparatively strong planning and governance but weak current outcomes and continued gas investment, creating tension with its emerging pathway for phased gas-network retirement.

Athens, Rome and Bucharest remain in the limited-transition tier. Emerging renovation and electrification measures are outweighed by persistent fossil dependence, incomplete planning or weak delivery. Rome remains heavily dependent on gas, Athens lacks a comprehensive spatial pathway away from fossil heating, and Bucharest combines major district-heating challenges with substantial new gas-fired investment.

Table 4. Overall ranking, scores, transition tiers and fossil-investment status across the 15 cities

Rank	City	Score	Tier	Major Fossil Investment Flag
1	Stockholm	91.8	Leading transition	No flag
2	Paris	83.5	Leading transition	No flag
3	Vienna	81.4	Leading transition	No flag
4	Copenhagen	78.9	Progressing transition	Watch
5	Amsterdam	71.4	Progressing transition	Major Fossil Investment Flag
6	Budapest	61.8	Uneven transition	Watch
7	Prague	61.4	Uneven transition	Major Fossil Investment Flag
8	Berlin	61.2	Uneven transition	Major Fossil Investment Flag
9	Warsaw	60.5	Uneven transition	Major Fossil Investment Flag
10	Brussels	60.3	Uneven transition	Watch
11	Madrid	58.2	Uneven transition	No flag
12	Lisbon	56.5	Uneven transition	Watch
13	Athens	50.7	Limited transition	Watch
14	Rome	49.8	Limited transition	Watch
15	Bucharest	49.0	Limited transition	Major Fossil Investment Flag

5. What shapes urban heat-transition performance

The category scores show that similar overall results can arise from very different combinations of strengths and weaknesses. Across the ranking, the main differences lie not simply in whether cities have climate targets, but in whether they translate those targets into operational heat plans, align infrastructure investment with fossil-fuel retirement, mobilise governance and finance for delivery, and protect households through the transition. The discussion below synthesises findings from the ranking and city profiles; detailed evidence and source references for individual cities are provided in the respective profiles.

Figure 2. City performance across the five ranking categories; colours range from red for weaker performance to green for stronger performance.



Policy and planning — from targets to delivery

Most cities now have climate or building-decarbonisation objectives. The stronger distinction is whether those objectives have been converted into a practical pathway for replacing fossil heating.

Vienna provides one of the clearest examples. Its Heat Plan 2040 spatially identifies how roughly 600,000 gas-heating systems are to be replaced and connects the phase-out of gas with decisions on district heating, heat pumps and other alternatives.⁵ Paris similarly links its long-term objectives to major heat-network expansion and decarbonisation. These approaches provide greater clarity over what replaces fossil heating, where investment is required and how implementation will proceed.

⁵ City of Vienna, [Vienna Heat Plan 2040 - The Path to Climate Neutral Heat Supply](#) (2024).

Amsterdam also illustrates this gap: it has a clear 2040 gas-free objective, but at the assessment cut-off, its updated Warmteprogramma had not yet been formally adopted, leaving the citywide transition pathway incomplete.

Elsewhere, substantial climate and renovation policies do not yet amount to an equally comprehensive fossil-heating transition plan. The important distinction is therefore not simply whether a city has a climate target, but whether it has translated that target into an operational strategy for buildings, neighbourhoods and heating infrastructure.

Emissions and outcomes — low emissions are not the same as transition readiness

Current emissions and recent emissions trends show how heating systems are performing today, but they do not necessarily indicate how prepared a city is to eliminate its remaining fossil heating.

Madrid and Lisbon illustrate this distinction particularly clearly. Both perform comparatively well on emissions-related outcomes, although Lisbon's results should be interpreted cautiously given its mild climate and evidence of inadequate winter heating and thermal discomfort⁶. Their citywide fossil-heating pathways are less developed, so relatively favourable current outcomes do not automatically translate into equally strong transition readiness.

Berlin shows the reverse pattern. It has comparatively strong governance and planning structures, but weaker current emissions performance and continued investment in gas infrastructure. These contrasts are why the ranking assesses current outcomes alongside policy, infrastructure and delivery capacity rather than treating low emissions alone as evidence of an advanced transition.

Heating systems — infrastructure can accelerate or obstruct the transition

The physical heating system is where the transition ultimately has to occur. This means reducing direct fossil-fuel use in buildings while also transforming the networks and generation assets that provide heat.

Stockholm and Copenhagen demonstrate the advantages of mature district-heating systems combined with very low direct fossil-heating dependence and large-scale system transformation. Their networks can integrate heat pumps and recovered heat from wastewater, water sources and industry across large numbers of buildings, alongside thermal storage. However, substantial waste incineration remains part of both systems, and Copenhagen also plans significant gas-capable capacity, meaning neither should be treated as fully fossil-free.

District heating is therefore not inherently a climate advantage. Fossil-heavy systems continue to constrain the transition in Warsaw, Prague, Budapest and particularly Bucharest, while fossil gas and waste incineration also remain important in several higher-ranked systems. The key question is not whether a city has district heating, but what supplies it and whether investment is moving the system towards genuinely fossil-free operation.

The same principle applies beyond heat networks. Investments in new or prolonged fossil capacity can undermine otherwise positive transition measures. Infrastructure choices made today can either accelerate fossil-fuel phase-out or create long-lived assets that risk becoming stranded as the transition advances.

Governance and finance — capacity matters when it changes investment

Cities operate within very different national regulatory, ownership and market frameworks, which shape how much direct influence they have over heating systems. Some control municipal utilities or housing companies, while others depend more heavily on national regulation, private operators or concession

⁶ Lisboa E-Nova, [Energy Poverty: Thermal Comfort and Human Health in the Municipality of Lisbon](#) (Accessed 29 August 2026).

arrangements. The relevant question is therefore not whether every city has the same powers, but how effectively it uses the levers available to it.

Berlin illustrates this tension. Strong governance structures and public-sector capacity coexist with weaker current outcomes and continued gas infrastructure investment, even as the city develops a pathway for phased gas-network retirement. Amsterdam similarly combines substantial municipal influence and neighbourhood-level delivery with only mid-range current heating performance and a Major Fossil Investment Flag.

Finance presents a related challenge. Many cities have funded renovation programmes, network investments or subsidies, but evidence of sustained financing for wider heat-transition delivery is more uneven.

Social fairness — protection must be part of the transition

Moving away from fossil heating can redistribute costs and responsibilities between households, landlords, utilities and public authorities. Renovation and heating-system replacement can create affordability pressures through upfront costs, rents or energy bills if appropriate safeguards are not in place. Social protections therefore matter not only for fairness, but also for whether the transition can be delivered at scale.

Stronger approaches combine targeted financial support with accessible advice and protections for tenants and vulnerable households. Paris, Amsterdam and Brussels provide comparatively strong examples, although their performance varies across individual measures. The key distinction is whether support is designed to reach households most exposed to energy poverty and whether safeguards reduce the risk that transition costs fall disproportionately on those least able to absorb them.

Participation adds another dimension. Resident and tenant involvement is strongest where it can influence concrete decisions on renovation, neighbourhood heating or programme design, rather than functioning only as consultation. Workforce measures are also important for building the capacity needed to deliver renovation and fossil-free heating programmes. Together, these elements show that a socially robust heat transition depends not only on technological change, but also on how costs, protections, participation and delivery opportunities are distributed.

The common thread: coordinated delivery

Across the five dimensions, the strongest approaches are those in which policy, infrastructure, governance, finance and social protection reinforce the same fossil-free direction. The ranking therefore points to a broader shift in the urban heat transition: setting targets is increasingly the easier part. The harder task is turning them into a coordinated programme of fossil-infrastructure retirement, renewable and other fossil-free heat, building renovation and household protection.

6. Cities at risk of fossil-gas lock-in

A city can have an ambitious climate plan while still making investment decisions that prolong fossil-gas dependence for decades. The ranking therefore considers not only targets and current performance, but also major heating investments that could lock in new or extended fossil-fuel use.

A Major Fossil Investment Flag identifies a material and sufficiently advanced fossil-heating investment that conflicts with the direction of the transition. A Watch identifies a credible lock-in risk where a decisive condition, such as final approval, project scale, lifetime or the extent of fossil-fuel expansion, remains unresolved. Neither status mechanically affects the score, rank or tier, although the same investment may inform the Fossil-Free Heating Transformation indicator (H3) where relevant.

Five cities receive Major Fossil Investment Flags

Amsterdam has one of the clearest gas-phase-out objectives in the ranking, but new fossil capacity is still being added to its district-heating system. Westpoort Warmte, the district-heating company serving large parts of Amsterdam North and West, is constructing a new auxiliary heat plant in Amsterdam-Noord with two gas-fired boilers providing around 66 MW of total nominal thermal input for peak and back-up heat as the network expands. Expected operating hours are relatively limited, but fossil gas is the permitted fuel and no binding non-fossil conversion or retirement condition was verified. Because the plant is under construction, it triggers the fossil-investment safeguard despite Amsterdam's broader shift towards electrification.⁷

Prague faces a major coal-to-gas lock-in risk. Energotrans, a subsidiary of the Czech energy utility ČEZ Group and a major producer of heat for Prague's district-heating system, is developing the Mělník PPC1 combined-cycle gas plant, including 183 MWth of heat capacity, as a new source for Prague's district-heating system. The project is backed by CZK 7.26 billion in investment support and 15 years of operating support and is expected to become a major source of heat for Prague. Replacing coal will reduce emissions, but the scale of the new plant and the long-term support attached to it, without a binding non-fossil conversion requirement, risk locking fossil gas into Prague's heat supply for decades.⁸

Berlin combines strong heat planning and public control with substantial new gas investment by city-owned utility BEW. The largest project is Charlottenburg, where a February 2026 permit authorises three new gas-fired turbines providing 340 MWth of heat output; a further gas-fired hot-water plant with 126 MW of firing input is permitted at Moabit. These investments form part of a wider transition away from coal and older assets and are described as hydrogen-ready. However, given their scale, and in the absence of a binding non-fossil fuel condition or dated conversion requirement, they create a significant risk of prolonging fossil-gas dependence within Berlin's district-heating system.⁹

Warsaw is already embedding a substantial coal-to-gas transition at the Siekierki CHP plant. ORLEN Termika, part of Poland's ORLEN energy group and the main heat producer for Warsaw, plans a combined-cycle unit of around 350 MWth of heat output, alongside an additional gas boiler and dedicated gas-supply infrastructure. Construction of the approximately 16 km Gassy–Siekierki gas pipeline is under way, while the new generation project is advancing. The project is expected to consume around 0.75 billion m³ of fossil gas annually. While replacing coal can reduce emissions, the

⁷ Province of North Holland / North Sea Canal Area Environmental Service, [Permit Granted — Amsterdam North Auxiliary Heat Plant](#) (2024); Vattenfall / Westpoort Warmte, [Construction of Auxiliary Heat Plant and District-Heating Expansion in Amsterdam-Noord](#) (Accessed 29 August 2026).

⁸ ČEZ Group / Energotrans, [The Country's Largest Steam-gas Heat Source to be Built at Mělník](#) (2025); ČEZ Group, [Annual Financial Report 2025](#) (2026); Energotrans, [Supported Projects — EGT Transition to Low-emission Heat and Electricity Generation, Stage 1](#) (Accessed 29 August 2026).

⁹ Berlin State / LAGetSi, [Permit for Major Modification of Charlottenburg CHP Plant](#) (2026); Berlin Energy and Heat (BEW), [Construction Measures at Spreebord: Current Status and Background](#) (Accessed 29 August 2026); Berlin State / LAGetSi, [Permit for Major Modification of Moabit CHP Plant](#) (2025).

scale of the new generation and enabling gas infrastructure, without a binding non-fossil conversion requirement, risks locking fossil gas into Warsaw's heat system for decades.¹⁰

Bucharest urgently needs to modernise its unreliable district-heating system, but network renewal is being accompanied by major new gas generation. ELCEN, Romania's state-controlled energy producer and the main producer of heat for Bucharest's district-heating system, is implementing three fossil gas-fired cogeneration projects at Grozăvești, Progresu and București Sud totalling around 328 MWth of heat capacity. Financing agreements have been signed, including roughly €362 million from the Modernisation Fund, and procurement and implementation are under way. The projects improve efficiency and reliability compared with ageing existing capacity, but without binding non-fossil conversion conditions they risk embedding gas in the system well into the future.¹¹

Six more cities remain on Watch

These cases do not yet meet the threshold for a Major Fossil Investment Flag. In each case, however, planned or pending investments could prolong gas use, while important questions about their scale, fossil-fuel exposure or implementation remain unresolved.

- **Copenhagen:** HOFOR, Copenhagen's municipal utility responsible for district heating and other energy infrastructure, plans a new Svanemølle Energy Centre combining up to 50 MW of heat pumps, 200 MW of electric boilers and 140 MW of gas boilers. The project forms part of a wider district-heating electrification strategy, and HOFOR says the gas boilers are intended primarily for peak load and are planned to run on biogas. However, no binding fuel restriction or other condition excluding fossil gas was verified. Given the substantial gas capacity but the wider electrification context and stated biogas intention, Copenhagen remains on Watch rather than receiving a Major Fossil Investment Flag.¹²
- **Budapest:** The Kelenföld power plant remains a material part of the district-heating system, with 270 MWth contracted to FŐTÁV, Budapest's district-heating company. A 2026 proceeding seeks to extend the validity of its integrated environmental permit, which is currently valid until 31 December 2026. Because no final extension decision had been verified by the study cut-off date, the case remains on Watch rather than triggering a Major Fossil Investment Flag.¹³
- **Brussels:** Brussels' gas and electricity distribution-system operator Sibelga's final 2026–2030 gas-network development plan contains around €76 million of planned gas-network expenditure, including spending on low-pressure branch connections. However, the available evidence does not distinguish new fossil-heating connections from replacement, relocation, safety and other network works, while the 2027–2031 plan was still being finalised at the study cut-off date. The scale of genuine gas-network expansion therefore remains unresolved.¹⁴
- **Lisbon:** The gas distribution company serving Lisbon and surrounding municipalities Lisboagás' proposed 2027–2031 plan includes €66.16 million for fossil gas network development and expansion, around 220 km of new distribution network and 48,002 additional connections across its 14-municipality concession. The plan remains in the regulatory process

¹⁰ ORLEN Termika, [Siekierki CCGT — EPC Prequalification Launched](#) (2026); ORLEN Termika, [Siekierki Combined-cycle Gas Project](#) (Accessed 29 August 2026); ORLEN Termika, [Gas pipeline to Siekierki CHP Plant](#) (Accessed 29 August 2026).

¹¹ ELCEN, [Ongoing Investments — Three New High-Efficiency Cogeneration Projects](#) (Accessed 29 August 2026); ELCEN, [Owner's Engineer Contracts for Three new Cogeneration Projects](#) (2025); ELCEN, [București Sud — Active Competitive Dialogue for New Gas-fired CHP](#) (2026); ELCEN, [Progresu — EPC Procurement for New High-efficiency Cogeneration Capacity](#) (2026).

¹² City of Copenhagen / HOFOR, [Status of Construction Projects – Svanemølle Energy Centre](#) (2026); HOFOR, [New Plant Secures Warm Homes When Svanemølleværket Closes](#) (2025).

¹³ Pest County Government Office, [Kelenföld Power Plant — Proceeding to Extend the Validity of the Integrated Environmental Permit and Five-year Comprehensive Environmental Review](#) (2026); Veolia Hungary, [Kelenföld Power Plant](#) (Accessed 29 August 2026).

¹⁴ BRUGEL, [Opinion 409 — Sibelga Gas-Network Development Plan 2026–2030](#) (2025); Sibelga, [New low-pressure gas connection tariffs — 2026](#) (Accessed 29 August 2026); Sibelga, [Public consultation — Development Plans 2027–2031](#) (2026).

and the share attributable specifically to Lisbon has not been established. The case therefore remains on Watch rather than triggering a Major Fossil Investment Flag.¹⁵

- **Athens:** A €14.2 million municipal school-upgrade tender includes replacing existing oil boilers with new fossil-gas boilers. The project clearly conflicts with the city's emerging electrification direction, but the capacity, lifetime and gas-specific share of the investment, and a final award or contract, were not verified. It therefore remains on Watch.¹⁶
- **Rome:** The city's 2026 procurement programme includes a 12-year ATEM Roma 1 gas-distribution concession, while Italgas Reti, the company responsible for operating and maintaining the gas-distribution network in the concession area, has submitted a 2026–2028 intervention programme to Roma Capitale. However, the available evidence does not establish that the proposed interventions involve material expansion of the conventional gas network, new customer growth or explicit asset-life extension. The €1.06 billion concession value cannot itself be treated as a gas-expansion budget, so Rome remains on Watch rather than receiving a Major Fossil Investment Flag.¹⁷

¹⁵ Energy Services Regulatory Authority (ERSE) / Lisboagás, [PDIRD-G 2026 Proposal — Lisboagás 2027–2031 Investment Plan](#) (2026); ERSE, [PDIRD-G 2026 — Public Consultation No. 141](#) (2026).

¹⁶ City of Athens, [Nine-School Energy-Upgrade Procurement](#) (2026); City of Athens, [Technical Description of School Heating Replacements](#) (2026).

¹⁷ City of Rome, [2026–2028 Programme of Acquisitions of Goods and Services — ATEM Roma 1 Gas Distribution Concession](#) (2026); City of Rome, [Approval of the 2026–2028 Public-Utility Intervention Programme](#) (2025); Italgas, [2026–2032 Strategic Plan](#) (2026).

7. City profiles

The following profiles show how each city performs in practice, combining its overall ranking with current emissions and heating-system performance, the main strengths and weaknesses shaping its score, a notable transition initiative and a priority next step.

Profile guide

1. Stockholm Very low direct fossil-heating dependence and a mature heat system, backed by strong delivery capacity.	2. Paris Rapid recent emissions reductions and strong heat-network delivery, despite substantial remaining fossil heating.	3. Vienna One of the clearest spatial gas-exit pathways in the ranking, backed by substantial investment and building-scale implementation.
4. Copenhagen Near-zero direct fossil heating and strong system-wide transformation, with some remaining fossil-capable infrastructure.	5. Amsterdam A clear 2040 gas-free objective and strong neighbourhood delivery, but current fossil dependence and new gas investment concerns remain.	6. Budapest Strong affordability protections and transition measures, but significant fossil dependence remains across the heating system.
7. Prague Improving emissions and strong monitoring, but major new coal-to-gas investment is locking fossil gas into the heat system.	8. Berlin Strong heat planning and public control, but weak current outcomes and new gas investment risk prolonging fossil dependence.	9. Warsaw A major district-heating system with significant transition potential, but large-scale coal-to-gas investment is creating new fossil lock-in.
10. Brussels Strong regulation and household protections, but fossil dependence remains high and the heat-transition pathway incomplete.	11. Madrid Renovation and electrification plans exist, but fossil-heating replacement remains minimal and no gas-exit pathway is in place.	12. Lisbon Low direct building emissions, but no sufficiently developed citywide pathway for eliminating remaining fossil heating.
13. Athens Renovation and electrification are advancing, but the heating transition remains limited, mixed and without a clear fossil-heating exit.	14. Rome A developing renovation and electrification strategy, but gas remains dominant and the long-term network pathway is unresolved.	15. Bucharest Urgent district-heating renewal is improving reliability, but major new gas generation risks prolonging fossil dependence.

1. Stockholm | Sweden

Very low direct fossil-heating dependence and strong governance

Overall score	Tier	Major Fossil Investment Flag
91.8 / 100	Leading transition	No flag

Why Stockholm leads

Stockholm’s first-place position reflects a transition already visible in its heating system. Direct fossil-fuel use in buildings is very low, modelled direct building emissions have fallen substantially, and district heating relies overwhelmingly on renewable and recovered energy. The city’s main district-heating supplier reports that **98.5% of heat supplied in 2025 came from renewable, recovered or otherwise fossil-free sources.** However, around **one-third of the heat mix comes directly from residual-waste incineration**, including 14% from fossil-origin waste, primarily plastics, which remains a significant source of fossil-carbon emissions.¹⁸

This performance is reinforced by clear targets, strong governance and continued investment. Stockholm aims to become **climate-positive by 2030 and fossil-free by 2040**, with the **municipal organisation fossil-free by 2030**. Municipal influence over the heat system supports continued investment in recovered heat, storage and network modernisation. No material new fossil-heating investment was identified; remaining weaknesses relate mainly to targeted social support and continued fossil-carbon emissions from waste incineration.¹⁹

Category scores	Quantitative signals
Policy: 100 Emissions/outcomes: 92 Heating transition: 93 Governance/finance: 100 Social fairness: 76	• Building emissions ↓25.4% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 0.098 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~0.25% direct fossil-fuel use in buildings²⁰ (2024; sectoral proxy)

What drives the score

- **Direct fossil-fuel heating is almost eliminated.** Direct fossil-fuel use in buildings is extremely low, with building emissions still falling.
- **District heating enables system-wide decarbonisation.** Renewable and recovered heat benefit large numbers of buildings at once.
- **Policy, public influence and finance support delivery.** The 2040 fossil-free target is backed by annual monitoring, 50% municipal ownership of the main district-heating supplier and continued investment.^{17,18}

What holds it back

- **Some emissions remain.** Fossil plastics in waste incineration, peak fuels and other combustion impacts still require attention.
- **Targeted household energy support is weaker.** Advice is well established, but major financial support for low-income or energy-vulnerable households is limited.
- **Participation is stronger in renovation.** Tenant feedback has shaped renovation practice, but resident influence over major heating investments is less evident.

Notable initiative

Open District Heating lets businesses supply surplus heat to the network. Together with recovered heat from wastewater, water sources and district cooling, this equalled **around 19% of the main district-heating utility’s heat sales in 2025.**¹⁷

Priority action

Reduce remaining fossil and waste-related emissions, **expand renewable heat with seasonal storage**, and strengthen targeted support and monitoring for energy-vulnerable households.

¹⁸ Stockholm Exergi, [Annual and Sustainability Report 2025](#) (2026) and [Environmental Key Indicators 2025](#) (2026).

¹⁹ City of Stockholm, [Climate Action Plan 2030](#) (2024).

²⁰ Statistics Sweden (SCB), [Final energy use \(MWh\) by Region, Consumer Category, Energy Carrier and Year](#) (2024).

2. Paris | France

Falling emissions alongside ambitious heat-network expansion

Overall score	Tier	Major Fossil Investment Flag
83.5 / 100	Leading transition	No flag

Why Paris ranks second

Paris’ second-place position reflects rapid recent reductions in direct building emissions, strong policy and substantial investment in transforming its heating system. Modelled direct building emissions fell faster than in almost any other city. The scale of the decline likely reflects a combination of lower building energy demand, declining gas and oil use, and Paris’ high use of electric heating, while EDGAR’s buildings category captures direct combustion rather than emissions from electricity or district-heat generation.²¹

The Greater Paris Metropolis aims for **carbon neutrality by 2050**, while Paris **targets 100% renewable and recovered district heat by 2050**. A new €3.4 billion concession will expand the network and raise renewable and recovered heat to 76% by 2034. However, **much of the recovered heat comes from waste incineration**, which carries its own emissions and sustainability concerns, while fossil gas remains significant.²²

Category scores	Quantitative signals
Policy: 100	• Building emissions ↓ 27.4% between 2020 & 2024 (EDGAR modelled and weather-adjusted)
Emissions/outcomes: 80	• 1.065 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
Heating transition: 77	• ~36.8% direct fossil-fuel use in buildings (2022) ²³
Governance/finance: 84	
Social fairness: 84	

What drives the score	What holds it back
• Direct building emissions are falling rapidly. Paris recorded one of the strongest recent declines in weather-adjusted, EDGAR-modelled direct building emissions in the ranking.	• Direct fossil heating remains significant. A substantial share of building energy still comes from fossil fuels. ²²
• A clear metropolitan heat-transition framework is in place. It combines fossil-heating phase-out, renovation and district-heating expansion.	• District heating is not yet fully decarbonised. Renewable and recovered heat are growing, but fossil gas remains material and much of the recovered heat comes from waste incineration. ²¹
• Major investment is turning plans into delivery. It is backed by substantial network funding, social support and consumer protections.	• Governance and participation gaps remain. Gas-network retirement is unclear, and resident influence over major decisions is limited.

Notable initiative

Paris’ new district-heating concession commits **€3.4 billion** to expand the network, increase **renewable and recovered heat** and move the system towards fully fossil-free operation.²¹

Priority action

Accelerate the phase-out of remaining direct fossil heating and move district heating away from waste incineration. Pair network expansion with a clearer **gas-network retirement** pathway and prioritise genuinely renewable heat sources.

²¹ City of Paris, [Annual Report on the Ecological and Social Transition 2024](#) (2025); APUR, [Final Energy Consumption of Parisian Housing in 2023 – Part 2: The Private Housing Stock and Renovation Operations](#) (2025); European Commission JRC / EDGAR, [EDGAR Urban Centres – Sector Definitions and Methodology](#) (2026).

²² Greater Paris Metropolis, [Metropolitan Climate-Air-Energy Plan](#) (2026); City of Paris, [New Paris District-Heating Concession](#) (2026); CPCU, [Heating – 2024](#) (2025)

²³ ROSE / Airparif / Institut Paris Region, [ENERGIF – Atlas](#) (2025)

3. Vienna | Austria

The clearest spatial gas-exit plan in the ranking, moving into building-scale delivery

Overall score	Tier	Major Fossil Investment Flag
81.4 / 100	Leading transition	No flag

Why Vienna ranks third

Vienna’s third-place position reflects the strength of one of the clearest citywide heat-transition frameworks in the ranking. The Vienna Heat Plan 2040 maps heating pathways across the entire built-up city, while the Raus aus Gas programme, monitoring framework and major projects such as Alt-Erlaa show that implementation is already moving from planning to delivery. This is underpinned by Vienna’s target to become **climate-neutral by 2040** and to **phase out fossil-fuel heating in buildings by 2040**. Vienna also combines strong municipal powers with funded near-term programmes, giving it maximum scores for both policy and governance.²⁴

Its score is held back by current heating performance. **District heating remains heavily fossil-linked and relies substantially on waste incineration**²⁵, while recent reductions in EDGAR modelled direct building emissions are relatively moderate. Social protections are strong, but evidence that residents materially influence major heat-transition decisions remains limited.

Category scores

Policy: 100
Emissions/outcomes: 60
Heating transition: 79
Governance/finance: 100
Social fairness: 69

Quantitative signals

- Building emissions ↓ **12.9%** between 2020 & 2024 (EDGAR modelled and weather-adjusted)
- **0.931 t CO₂/resident** from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
- **~30.8%** direct fossil-fuel use in buildings²⁶ (2024; derived estimate)

What drives the score

- **Vienna has one of the clearest citywide heat-transition plans.** The Heat Plan 2040 maps heating pathways and links them to delivery and monitoring.²³
- **Implementation is already under way.** Projects such as Alt-Erlaa are replacing gas with heat pumps, geothermal and heat recovery.²²
- **Municipal capacity and funding support delivery.** Strong public-sector control and funded programmes reinforce implementation.

What holds it back

- **Direct fossil heating remains substantial.** Gas still supplies a significant share of building energy.²⁵
- **District heating remains heavily fossil-linked.** Over 60% is fossil-based, with waste incineration also providing around one third.^{23, 24}
- **Social participation is less developed than policy delivery.** Support and tenant protections are in place, but evidence that residents systematically shape major heat-transition decisions remains limited.

Notable initiative

Alt-Erlaa is **replacing gas heating for more than 3,000 homes** with heat pumps, geothermal probes, air heat exchangers and heat recovery, demonstrating Vienna’s fossil-free heating transition at neighbourhood scale.²³

Priority action

Accelerate the **shift away from gas while decarbonising district heating**. Scale successful pioneer projects citywide and embed resident co-design and decision-making in heat and renovation projects.

²⁴ City of Vienna, [Vienna Heat Plan 2040 — The Path to Climate-Neutral Heat Supply](#) (2024); City of Vienna, [Vienna Climate Roadmap Monitoring — Buildings / Phase Out Gas](#) (2025); Wien Energie, [Heat-Transition Investment Programme](#) (2025); City of Vienna, [New Energy System Makes Alt-Erlaa Fit for the Future](#) (2026).

²⁵ Wien Energie, [Where Does Vienna’s District Heating Come From?](#) (2026); Wien Energie, [Vienna Model – Electricity and Heat from Waste Heat](#) (Accessed 29 August 2026).

²⁶ Austrian Institute of Economic Research (WIFO) / City of Vienna, [Report on the Vienna Economy 2025 – Economic Conditions, Labour Market and Ecological Transformation](#) (2026).

4. Copenhagen | Denmark

Advanced district heating and rapid electrification, but new gas risks remain

Overall score	Tier	Major Fossil Investment Flag
78.9 / 100	Progressing transition	Watch

Why Copenhagen ranks fourth

Copenhagen’s fourth-place position reflects a mature district-heating system with very low direct fossil-fuel use in buildings and an increasingly electrified heat supply. Copenhagen’s district-heating utility HOFOR reports that 94% of district heat was CO₂-neutral in 2025, while the city’s Climate Strategy puts oil- and gas-fired peak and reserve heat at around 5%. However, this does not mean the system is fully fossil-free, and **combustion-based heat, including waste incineration, remains important.**²⁷

The **Climate Strategy 2035** backs further electrification through around 300 MW of heat pumps and 550 MW of electric boilers, alongside storage and lower-temperature heat. But the planned **Svanemølle Energy Centre includes 140 MW of gas boilers** alongside 50 MW of heat pumps and 200 MW of electric boilers. HOFOR intends these boilers to use biogas, but no binding restriction excluding fossil gas was verified, creating a potential fossil lock-in risk.²⁸

Category scores	Quantitative signals
Policy: 90	Building emissions ↓10.8% between 2020 & 2024 (EDGAR modelled and weather-adjusted)
Emissions/outcomes: 68	0.427 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
Heating transition: 83	≤1.7% direct fossil-fuel use in buildings²⁹ (2024; conservative upper bound)
Governance/finance: 84	
Social fairness: 69	
What drives the score	What holds it back
Direct fossil heating is largely eliminated. Direct fossil use is extremely low and building emissions are among the lowest, though waste incineration remains significant.²⁸ District heating enables system-wide decarbonisation. Heat pumps, electric boilers and storage are rapidly electrifying the network. Public control and coordinated investment support delivery. Municipal and regional utilities are jointly driving the transition.	Svanemølle creates a transition risk. Its planned 140 MW gas-boiler capacity lacks a verified binding exclusion of fossil gas.²⁷ Affordability safeguards remain uneven. Support exists, but limited evidence shows affordability impacts systematically shaping delivery. Participation has limited influence. Residents are consulted, but there is weaker evidence that this shapes major heat-system decisions.

Notable initiative

HOFOR’s wider electrification programme plans around **300 MW of heat pumps and 550 MW of electric boilers**, alongside storage and lower-temperature district heating²⁷.

Priority action

Ensure Svanemølle cannot lock in fossil gas by **binding the new gas-boiler capacity to non-fossil fuels** while accelerating district-heating electrification.

²⁷ City of Copenhagen, [CO₂ Accounts 2024](#) (2025); HOFOR, [Environmental Declaration for District Heating](#) (Accessed 29 August 2026); City of Copenhagen, [CPH Climate Strategy 2035](#) (2025);
²⁸ City of Copenhagen, [CPH Climate Strategy 2035](#) (2025); HOFOR, [Large Electric Boilers and Heat Pumps — DKK 3–5 Billion Green Heat-Transition Investment Programme](#) (Accessed 29 August 2026). City of Copenhagen / HOFOR, [Status of Construction Projects – Svanemølle Energy Centre](#) (2026); HOFOR, [New Plant Secures Warm Homes When Svanemølleværket Closes](#) (2025).
²⁹ City of Copenhagen — Technical and Environmental Administration, [CO₂ Accounts 2024](#) (2025).

5. Amsterdam | The Netherlands

Clear gas-free ambition, but fossil investment sends mixed signals

Overall score	Tier	Major Fossil Investment Flag
71.4 / 100	Progressing transition	Major Fossil Investment Flag

Why Amsterdam ranks fifth

Amsterdam ranks fifth thanks to strong local delivery, social protections and a clear long-term direction away from gas. The city retains its **2040 gas-free objective**, backed by neighbourhood planning, household support and active municipal involvement in heat-system development. It also performs strongly on social fairness, with comparatively robust support, participation and tenant protections.³⁰

However, Amsterdam has acknowledged that it is **not on track to meet the 2040 goal at the current pace**. Direct gas use remains substantial, district heating is still materially fossil-based, and the successor **Warmteprogramma** has not yet been adopted. National regulatory and financing constraints are also slowing implementation. **A new 66 MW gas-fired auxiliary heat plant further weakens the coherence of the transition**, even if intended mainly for peak and back-up use.³¹

Category scores

Policy: 85
Emissions/outcomes: 56
Heating transition: 62
Governance/finance: 75
Social fairness: 84

Quantitative signals

- Building emissions ↓ **18.0%** between 2020 & 2024 (EDGAR modelled and weather-adjusted)
- **1.381 t CO₂/resident** from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
- **~46.2%** direct fossil-fuel use in buildings³² (2024; best-available estimate)

What drives the score

- **Amsterdam has a clear gas-free direction.** Its 2040 objective is backed by neighbourhood planning and municipal involvement.
- **Local delivery is well developed.** Projects, advice and financial support are helping the transition.
- **Social fairness is a strength.** Targeted support, tenant safeguards and participation stand out.

What holds it back

- **Direct fossil heating remains widespread.** Gas use and building emissions remain relatively high.³¹
- **The next heat plan is still pending.** The Warmteprogramma has not yet been adopted.
- **New gas capacity weakens the transition.** A peak and back-up gas plant triggers the Major Fossil Investment Flag.³⁰

Notable initiative

A new **150 MW electric boiler** supplies heat to around **20,000 homes**, using surplus renewable electricity and thermal storage.³³

Priority action

Adopt the new Warmteprogramma and accelerate the shift away from fossil heating. Cut gas use in buildings and district heating while avoiding new fossil lock-in and scaling up electrified heat.

³⁰ Municipality of Amsterdam, [Amsterdam Heat Programme](#) (Accessed 29 August 2026); Amsterdam Research & Statistics, [Gas-Free Amsterdam 2024](#) (2024); City of Amsterdam / OpenResearch Amsterdam, [Amsterdam Heat Transition Vision](#) (2020).

³¹ Municipality of Amsterdam / Amsterdam City Council, [New Course Heat Transition and Handling of Motions](#) (2025); Municipality of Amsterdam, [Amsterdam Heat Programme](#) (Accessed 29 August 2026); Municipality of Amsterdam, [Omgevingsvisie Amsterdam 2050](#) (Accessed 29 August 2026); Alliander, [Public heat company moves a step closer, but the national government must ensure affordability](#) (Accessed 29 August 2026); Province of North Holland / North Sea Canal Area Environmental Service, [Permit Granted — Amsterdam North Auxiliary Heat Plant](#) (2024); Vattenfall / Westpoort Warmte, [Construction of Auxiliary Heat Plant and District-Heating Expansion in Amsterdam-Noord](#) (Accessed 29 August 2026).

³² Netherlands Enterprise Agency (RVO), [Regional Climate Monitor — Built Environment Energy Consumption, Amsterdam Municipality](#) (2024).

³³ Vattenfall, [Electric Boiler for District Heating](#) (Accessed 29 August 2026).

6. Budapest | Hungary

Growing transition efforts, but gas dependence remains high

Overall score	Tier	Major Fossil Investment Flag
61.8 / 100	Uneven transition	Watch

Why Budapest ranks sixth

Budapest ranks sixth within a tightly clustered middle group, reflecting solid planning, growing delivery capacity and relatively strong social protections. The city’s Climate City Contract aims for **climate neutrality by 2030**, with its transition scenario assigning a **73% emissions reduction to buildings and heating**. Its earlier climate plan also envisages significant residential renovation and greater use of renewable and recovered heat. However, Budapest has **no adopted date for fully phasing out gas or other fossil heating**. The Budapest Climate Agency, Green Panel programme and funded district-heating and geothermal projects strengthen delivery capacity, while municipal ownership of the district-heating operator gives the city meaningful influence over the heat network.³⁴

The physical transition remains less advanced. **Fossil gas still plays a major role in buildings and remains important in district heating**, renewable heat remains limited, and the unresolved Kelenföld gas-plant permit extension creates uncertainty over the pace of phase-out.³⁵

Category scores	Quantitative signals
Policy: 75	• Building emissions ↓10.1% between 2020 & 2024 (EDGAR modelled and weather-adjusted)
Emissions/outcomes: 50	• 1.104 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
Heating transition: 44	• ~47.7% direct fossil-fuel use in buildings (2020; older-year estimate)³⁶
Governance/finance: 75	
Social fairness: 75	
What drives the score	What holds it back
• Plans are moving into delivery. Investment supports renovation, district-heating connections and geothermal heat. • Municipal ownership strengthens delivery. It gives Budapest practical influence over network development and renovation. • Social fairness is a strength. Targeted support and affordability safeguards protect vulnerable households.	• Heating remains fossil-heavy. Both buildings and district heating still rely substantially on gas.^{34,35} • The fossil-heating exit remains unclear. There is no adopted end date for gas or fossil heating. • Renovation support is not yet citywide. Green Panel remains limited, while the home-renovation fund was oversubscribed and suspended.³³

Notable initiative

A funded Zugló geothermal project will add around **31,900 GJ of renewable heat annually** to Budapest’s district-heating system.³⁷

Priority action

Scale renewable heat and set a clear fossil-heating phase-out pathway, while resolving uncertainty around continued gas-fired generation.

³⁴ Budapest General Assembly, [2030 Climate-Neutrality Commitments](#) (2024); City of Budapest, [2030 Climate Neutrality Action Plan](#) (2024); City of Budapest, [2030 Climate Neutrality Investment Plan](#) (2024); City of Budapest, [Sustainable Energy and Climate Action Plan of Budapest \(SECAP\)](#) (2025); Municipality of Budapest, [Proposal for the implementation of the Budapest Green Panel Programme](#) (2025).

³⁵ BKM / FŐTÁV, [2024 Sustainability Report](#) (2025); Pest County Government Office, [Kelenföld permit-extension proceeding](#) (2026); Veolia Hungary, [Kelenföld Power Plant](#) (Accessed 29 August 2026).

³⁶ European Commission JRC, [GCoM – MyCovenant, 6th Release – January 2025](#) (2025).

³⁷ BKM / FŐTÁV, [Geothermal Energy Integration into Zugló District Heating](#) (2025).

7. Prague | Czech Republic

Improving emissions, but fossil-heavy heating and new gas investment slow progress

Overall score	Tier	Major Fossil Investment Flag
61.4 / 100	Uneven transition	Major Fossil Investment Flag

Why Prague ranks seventh

Prague ranks seventh within the tightly clustered middle group, reflecting strong monitoring, improving building emissions and growing delivery capacity. Prague has a 2030 target to replace coal-fired district heat, backed by monitoring, renovation programmes and heat-system investment. However, it has no adopted date for phasing out gas or all fossil heating, and its citywide Heating Strategy was still under preparation in 2026.³⁸

The physical transition remains incomplete, with fossil fuels still important in both buildings and district heating and a mixed infrastructure pathway. The new Mělník fossil-gas-fired combined heat and power plant will replace coal but adds substantial long-lived gas capacity, while fossil-free options such as wastewater heat and large heat pumps remain at the planning or preparation stage rather than operating at comparable scale. Prague’s heat transition is underway, but it is not yet on a clearly fossil-free pathway.³⁹

Category scores Policy: 80 Emissions/outcomes: 74 Heating transition: 48 Governance/finance: 59 Social fairness: 60	Quantitative signals • Building emissions ↓15.7% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 0.565 t CO₂/resident from building fossil-fuel use (2024, EDGAR modelled and climate-standardised) • ~38.7% direct fossil-fuel use in buildings⁴⁰ (2018, older-year sector-based estimate)
What drives the score • Policy is relatively strong. Prague has a clear framework for renovation, renewable heating and heat-system modernisation. • Building emissions are improving. Recent reductions support Prague’s score. • Solid implementation capacity. Monitoring, investment programmes and institutions support delivery.	What holds it back • District heating remains heavily fossil-based. Coal is still dominant, and its phase-out has been delayed to 2029.³⁸ • New gas investment weakens the transition. The Mělník gas CHP is under construction and now expected to enter service in 2029.³⁸ • The full fossil-heating exit is not yet defined. No adopted end date for gas or all fossil heating.

Notable initiative

Prague is developing a wastewater-heat *Energocentrum* using large heat pumps to supply district heating and reduce fossil-gas use.⁴¹

Priority action

Accelerate large-scale renewable heat deployment and define a credible fossil-heating phase-out pathway. Scale wastewater heat, heat pumps and renewable heat sources while limiting fossil lock-in from new gas-fired district-heating capacity.

³⁸ Capital City of Prague, [Prague Climate Plan 2030](#) (2021); Capital City of Prague, [Third Monitoring Report on Implementation of the Prague Climate Plan to 2030](#) (2025); Capital City of Prague, [Prague for People, Nature and Climate — Sustainable Energy and Heat-Transition Update](#) (2026).
³⁹ Pražská teplárenská, [Annual Report 2025](#) (2026); ČEZ Group / Energotrans, [The Country’s Largest Steam-Gas Heat Source to Be Built at Mělník](#) (2025); ČEZ Group, [Annual Financial Report 2025](#) (2026); Energotrans / Czech Ministry of the Environment, [Application to Amend the Integrated Permit — Mělník II / Mělník III](#) (2026).
⁴⁰ Czech Ministry of Industry and Trade (MPO), [Regional Energy Balances — Capital City of Prague, 2018](#) (2021).
⁴¹ Capital City of Prague, [Action Plan 2023–2025 – Project SC2/4: Energy Centre for the Use of Low-Potential Heat from the Central Wastewater Treatment Plant](#) (2023).

8. Berlin | Germany

Strong plans, but fossil-heavy heating and new gas investment constrain progress.

Overall score	Tier	Major Fossil Investment Flag
61.2 / 100	Uneven transition	Major Fossil Investment Flag

Why Berlin ranks eighth

Berlin ranks eighth within the tightly clustered middle group, combining strong planning with weak current outcomes. The city has a detailed Heat Plan, public ownership of district heating and major investment in electrification, storage and the **2030 coal phase-out**. However, the 2045 climate-neutral heat objective is strongly shaped by national law, and a detailed, time-bound gas-network retirement schedule is still missing.⁴²

The transition remains mixed. Heating is still heavily fossil-based, while new gas-capable capacity at Moabit, Charlottenburg and Klingenbergn creates lock-in risks. Berlin’s publicly owned district-heating utility BEW keeps several post-2035 pathways open, some with substantial renewable-hydrogen use, adding uncertainty over how quickly fossil gas will ultimately be displaced.^{43,44}

Category scores	Quantitative signals
Policy: 75 Emissions/outcomes: 25 Heating transition: 48 Governance/finance: 84 Social fairness: 75	• Building emissions ↓ 1.3% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 1.463 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~38.8% direct fossil-fuel use in buildings⁴⁵ (2024; sectoral proxy)
What drives the score	What holds it back
• Policy is relatively strong. A detailed Heat Plan supports the transition. • Governance is a strength. Public ownership of BEW gives Berlin strong delivery leverage. • Investment capacity is substantial. Large-scale funding supports electrification, storage, heat-network upgrades and coal phase-out.	• Outcomes still lag behind ambition. System-wide progress remains slow. • District heating remains fossil-heavy. Gas and coal still dominate.⁴² • The transition signal is mixed. New gas-capable projects and the missing gas-retirement pathway create lock-in risks.

Notable initiative

Berlin’s publicly owned utility BEW plans around **€3.5 billion of investment by 2030** to transform district heating, including large heat pumps, power-to-heat, thermal storage and other projects supporting the coal phase-out.⁴¹

Priority action

Deliver the 2030 coal phase-out and set a clear gas-retirement pathway. Scale heat pumps, power-to-heat, storage and building renovation while reducing reliance on future hydrogen.

⁴² Berlin State, [Berlin Heat Plan](#) (2026); Berlin State, [Heat-Supply Areas and Target Scenario](#) (Accessed 29 August 2026); Berlin Senate, [Berlin Brings Heat Back Home — BEW Returns to the Family of State-Owned Companies](#) (2024); Federal Republic of Germany, [Heat Planning Act \(Wärmeplanungsgesetz – WPG\)](#) (2023); Berlin Energy and Heat (BEW), [Decarbonisation Roadmap for Berlin’s Heat Networks](#) (2026).

⁴³ Berlin Energy and Heat (BEW), [District-Heating Energy Mix and GHG Emissions for Reporting Year 2025](#) (2026); Berlin Energy and Heat (BEW), [Strong 2025 Financial Year, Clear Course to Climate Neutrality](#) (2026).

⁴⁴ Berlin State / LAGetSi, [Permit for Major Modification of Moabit CHP Plant](#) (2025); Berlin State / LAGetSi, [Permit for Major Modification of Charlottenburg CHP Plant](#) (2026); Berlin Energy and Heat (BEW), [Supervisory Board Approves Investment Framework for Klingenbergn](#) (2026).

⁴⁵ Berlin-Brandenburg Statistics Office, [Energy and CO₂ Balance in Berlin 2024](#) (2025).

9. Warsaw | Poland

Progress underway, but gas dependence is already locking in.

Overall score	Tier	Major Fossil Investment Flag
60.5 / 100	Uneven transition	Major Fossil Investment Flag

Why Warsaw ranks ninth

Warsaw ranks ninth within the tightly clustered middle group, reflecting credible planning and investment in heat-system modernisation, but a transition that remains deeply dependent on fossil fuels. Warsaw's Green Vision envisages a long-term shift towards renewable and waste heat, while **ORLEN Termika, which operates Warsaw's main heat and power plants, including Żerań and Siekierki**, plans to end coal use in its Warsaw plants by 2035. However, Warsaw has **no comprehensive citywide pathway for phasing out gas or other fossil heating**, even as heat recovery, storage, wastewater heat and building-renovation measures advance.⁴⁶

The central challenge is an existing coal-to-gas pathway. Major gas-fired capacity is already operating at Żerań, ORLEN Termika projects gas supplying around **81% of its heat-production mix in 2035**, and further gas-fired capacity and dedicated pipeline infrastructure are advancing at Siekierki, potentially prolonging fossil heating for decades.⁴⁷

Category scores	Quantitative signals
Policy: 65 Emissions/outcomes: 35 Heating transition: 52 Governance/finance: 75 Social fairness: 75	• Building emissions ↑3.7% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 0.806 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~31.0% direct fossil-fuel use in buildings⁴⁸ (2021; conservative upper bound)

What drives the score	What holds it back
• Strong governance and delivery tools. Planning, grants and municipal assets support delivery. • Relatively strong social support. Targeted renovation, affordability measures and participation. • Some transition investment is advancing. Wastewater heat recovery, storage and system upgrades are underway.	• No complete fossil-heating exit. Warsaw lacks a citywide end date for gas and other fossil heating. • District heating remains highly fossil-based. Coal and gas still dominate the system. • Gas lock-in is already established. Existing Żerań gas capacity is being reinforced by major new investment at Siekierki.

Notable initiative
Warsaw is developing a 50 MW wastewater-heat recovery system at Żerań, using **two large heat pumps to supply heat equivalent to around 20,000 homes**.⁴⁹

Priority action
Break the coal-to-gas pathway. Accelerate coal retirement while scaling genuinely fossil-free heat and setting a clear route to phase out existing and planned gas capacity.

⁴⁶ City of Warsaw, [Warsaw Green Vision — Green City and Climate Action Plan](#) (2023); City of Warsaw / NetZeroCities, [2030 Climate Neutrality Action Plan — Climate City Contract](#) (2024); Warsaw City Council, [Resolution No. XXIII/878/2025 — Assumptions for Heat, Electricity and Gas Supply](#) (2025); ORLEN Termika, [Investments that will Transform Warsaw District Heating](#) (2025).

⁴⁷ ORLEN Termika, [Combined-cycle gas unit at Żerań CHP Plant](#) (2026); ORLEN Termika, [Investments that will transform Warsaw district heating](#) (2025); ORLEN Termika, [Siekierki CCGT — EPC prequalification launched](#) (2026); ORLEN Termika, [Gas pipeline to Siekierki CHP Plant](#) (2026).

⁴⁸ City of Warsaw / Warsaw City Council, [Resolution No. XXIII/878/2025 — Assumptions for Heat, Electricity and Gas Supply](#) (2025)

⁴⁹ ORLEN Termika, [Record Financing for Flue-Gas Heat Recovery at Żerań CHP Plant](#) (2026); National Fund for Environmental Protection and Water Management, [PLN 125.4 million for Wastewater Heat Recovery at Żerań](#) (2026).

10. Brussels | Belgium

Strong social protections and improving policy, but fossil heating remains dominant.

Overall score	Tier	Major Fossil Investment Flag
60.3 / 100	Uneven transition	Watch

Why Brussels ranks tenth

Brussels ranks tenth within the tightly clustered middle group, combining relatively strong policy and household protections with very high remaining fossil dependence. The City aims for territorial carbon neutrality by 2050 and energy-carbon neutrality in public buildings by 2040. Regional rules applying within the city prohibit new oil boilers from 2025, restrict fossil heating in new buildings from 2025 and major renovations from 2030, and phase out oil heating by 2040. However, there is **no adopted date for phasing out fossil-gas heating across the existing building stock**, while the regional spatial heat plan and a clearer gas-exit pathway remain unfinished.⁵⁰

The physical transition remains limited, with fossil fuels still supplying most building heat. **Neder-Over-Heembeek** and **Be.SHARE** show material transition investment, but remain concentrated in northern Brussels and are not yet citywide in scale. Household support has also weakened following the suspension of RENOLUTION grants, although targeted advice and financing remain available. Continued gas-network investment raises lock-in and stranded-cost concerns, but the evidence does not yet justify a Major Fossil Investment Flag.⁵¹

Category scores

Policy: 75
Emissions/outcomes: 47
Heating transition: 34
Governance/finance: 75
Social fairness: 85

Quantitative signals

- Building emissions ↓**15.0%** between 2020 & 2024 (EDGAR modelled and weather-adjusted)
- **1.528 t CO₂/resident** from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
- **~65.4%** direct fossil-fuel use in buildings⁵² (2023; Brussels-Capital Region proxy)

What drives the score

- **Household protections are strong.** Income-targeted support and adaptive consumer safeguards strengthen the score.
- **Policy is relatively strong, but incomplete.** Fossil-heating restrictions are in place, but there is no gas phase-out date.
- **Delivery is advancing.** Funded renovation and renewable-heat projects are under way.

What holds it back

- **Heating remains highly fossil-dependent.** Direct fossil use is still high.⁵¹
- **The gas phase-out remains incomplete.** Existing gas heating has no final exit date.
- **The spatial transition pathway is still unfinished.** Brussels still lacks a completed heat plan.

Notable initiative

Brussels is expanding the **Neder-Over-Heembeek heat network by 3.7 km**, using recovered heat from waste incineration to connect more than **30 buildings** and save an estimated **10 GWh of gas and 2,000 tonnes of CO₂ annually**.⁵⁰

Priority action

Complete the spatial heat plan and establish a clear pathway for phasing out gas heating. Scale fossil-free heat and reduce long-term reliance on the gas network.

⁵⁰ City of Brussels, [Brussels Climate Plan — Objectives, Actions and Implementation Status](#) (2026); Brussels Environment / Brussels-Capital Region, [Brussels Air-Climate-Energy Plan](#) (2025); Brussels Environment, [PEB Heating and Cooling Requirements](#) (2025); Brussels Environment, [Energy 2050 Task Force — Preparation of a Regional Heat Plan](#) (2024).

⁵¹ City of Brussels, [Neder-Over-Heembeek District-Heating Network](#) (2026); Sibelga, [Be.SHARE — Low-Carbon Heating and Cooling Network](#) (2025); BRUGEL, [Opinion 409 — Sibelga Gas-Network Development Plan 2026–2030](#) (2025); Brussels Environment, [Energy Consumption — Brussels-Capital Region](#) (2026). Brussels-Capital Region / RENOLUTION, [RENOLUTION Grants](#) (2022).

⁵² Brussels Environment, [Energy Consumption — Brussels-Capital Region](#) (2026).

11. Madrid | Spain

Strong plans, but actual fossil-heating replacement remains minimal.

Overall score	Tier	Major Fossil Investment Flag
58.2 / 100	Uneven transition	No flag

Why Madrid ranks eleventh

Madrid’s eleventh-place score masks a sharp gap between ambition and delivery. The city performs relatively well on planning and social support, but **direct fossil fuels remain a major source of building energy** and fossil-free heating deployment is still limited. In 2025, the oil-boiler replacement programme supported only 14 projects citywide, totalling €1.36 million, with some eligible replacements still allowing hybrid fossil systems.⁵³

The Roadmap promotes electrification and assigns municipal buildings an exemplary role in demonstrating fossil-free solutions, but it still allows renewal of gas condensing boilers more broadly and sets no citywide gas-retirement pathway. The Local Heating and Cooling Plan remains preparatory, leaving **too little fossil-heating replacement to demonstrate a material citywide transition away from gas.**⁵⁴

Category scores Policy: 75 Emissions/outcomes: 51 Heating transition: 42 Governance/finance: 59 Social fairness: 75	Quantitative signals • Building emissions ↓4.7% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 0.739 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~41.8% direct fossil-fuel use in buildings (2023)⁵⁵
What drives the score • Established renovation funding. Madrid has a multi-year municipal renovation programme. • Clear electrification direction. The Roadmap prioritises heat pumps and electrification. • Concrete near-term targets. Madrid aims to scale renovation to 20,400 homes per year by 2030 and halve oil-boiler use by 2027.⁵³	What holds it back • No citywide fossil-heating exit. There is no adopted deadline for ending gas or fossil heating. • The Roadmap still accommodates new gas boilers. Continued replacement with gas condensing boilers weakens credibility. • Fossil-free heating deployment remains marginal. Only 14 projects were subsidised in 2025, with some allowing hybrid fossil systems.⁵²

Notable initiative

In Orcasitas, Madrid **adapted rehabilitation grant rules following resident participation**, enabling a cooperative-led housing renovation project to move into implementation.⁵⁶

Priority action

Adopt a clear gas-exit pathway and citywide heat plan. Scale up fossil-free heating replacement so gas boilers are retired rather than renewed.

⁵³ Madrid City Council, [Madrid Municipality Energy Balance — 2023](#) (2025); Madrid City Council, [BOAM No. 10176/2912 — Final Grant Resolution for 2025 Thermal-Installation Renewal](#) (2026); Madrid City Council, [*Thermal-Installation Renewal Grants 2025 — Frequently Asked Questions*](#) (2025).

⁵⁴ Madrid City Council, [Roadmap to Climate Neutrality by 2050](#) (2026); Madrid City Council, [Coal Boilers Will No Longer Be Allowed to Operate in Madrid from 1 January](#) (2021); Madrid City Council, [Madrid Heating and Cooling Plan Diagnosis — Preliminary Summary](#) (2026); Madrid City Council, [City Government Approves €50 Million for the Madrid Rehabilitation Plan 2026](#) (2026).

⁵⁵ Madrid City Council, [Madrid Municipality Energy Balance — 2023](#) (2025).

⁵⁶ Madrid City Council, [City Council Promotes Madrid’s First Eco-Solar Neighbourhood in Orcasitas](#) (2024); Madrid City Council, [Orcasitas Takes a Historic Step Toward Becoming Madrid’s Major Eco-Solar Neighbourhood](#) (2026).

12. Lisbon | Portugal

Low emissions, but weak fossil-heating delivery and no clear exit pathway.

Overall score	Tier	Major Fossil Investment Flag
56.5 / 100	Uneven transition	Watch

Why Lisbon ranks twelfth

Lisbon ranks twelfth, reflecting relatively low building emissions and an emerging building-transition framework, but limited progress in replacing fossil heating. The city aims for **climate neutrality by 2030**, with at least an **80% reduction in greenhouse-gas emissions from 2002 levels**, and its Climate City Contract supports renovation, renewable energy and efficient heating systems such as heat pumps. However, Lisbon has **no dated city-specific target for phasing out gas or other fossil heating**, and no completed spatial heat plan setting out where and when fossil heating will be replaced.⁵⁷

The physical transition remains limited in scale, while Lisbon’s low building emissions should be interpreted in light of its mild climate and evidence of **inadequate winter heating and thermal discomfort**. Household-facing energy support is largely advisory, fossil-free heat deployment has not reached citywide scale, and proposed gas-network expansion creates uncertainty, although the Lisbon-specific share remains unclear and therefore only warrants a Watch.⁵⁸

Category scores	Quantitative signals
Policy: 55 Emissions/outcomes: 74 Heating transition: 50 Governance/finance: 50 Social fairness: 60	• Building emissions ↓14.5% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 0.309 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~27.7% direct fossil-fuel use in buildings⁵⁹ (2024; activity-sector proxy)

What drives the score	What holds it back
• Building-sector outcomes are comparatively strong. Emissions are low and declining, though climate and under-heating matter. • Some social protections remain relatively strong. Households have access to advice, affordability support and tenant safeguards. • A transition framework is emerging. Renovation, renewables and heat pumps feature in plans.	• There is no clear fossil-heating exit. No dated phase-out target for gas or other fossil heating. • Delivery remains limited. Renewable heat and targeted household support are not yet citywide. • The spatial pathway is unfinished. Lisbon still lacks a completed heat plan for moving areas away from fossil heating.

Notable initiative

Lisbon’s Lisbon Alliance received €1.6 million in EU funding to prepare and develop a planned **€44.6 million programme of energy-efficiency and renewable-energy upgrades in public buildings**.⁶⁰

Priority action

Set a dated fossil-heating phase-out and complete a citywide spatial heat plan. Scale heat pumps and building electrification while avoiding expansion of the gas network.

⁵⁷ Lisbon City Council, [Lisbon Climate City Contract 2030 — Action Plan and Investment Plan](#) (2024); Lisbon City Council, [Lisbon Climate City Contract 2030 — Public Consultation](#) (2026).

⁵⁸ ERSE / Lisboagás, [PDIRD-G 2026 Proposal — Lisboagás 2027–2031 Investment Plan](#) (2026); ERSE, [PDIRD-G 2026 — Public Consultation No. 141](#) (2026).

⁵⁹ Directorate-General for Energy and Geology (DGEG), 2024 municipal data for [Natural Gas Consumption](#), [Electricity Consumption](#) and [Petroleum-Product Sales](#) (2024)

⁶⁰ Lisboa E-Nova, [Lisbon Alliance — Accelerating Public Building Renovation and Public-Lighting Energy Efficiency](#) (2025).

13. Athens | Greece

A transition is emerging, but delivery remains limited and mixed.

Overall score	Tier	Major Fossil Investment Flag
50.7 / 100	Limited transition	Watch

Why Athens ranks thirteenth

Athens ranks thirteenth within the tightly grouped lower cluster, reflecting a relatively clear policy direction toward more efficient buildings but limited evidence of a large-scale fossil-free heating transition. The city has established climate and renovation programmes, supported by external financing and project-development assistance, and is implementing building-efficiency and renewable-energy projects. Its policy score is comparatively strong, although social protections and delivery capacity are more moderate. Municipal delivery is also constrained because key regulatory and funding decisions depend on national frameworks.⁶¹

Implementation remains limited and building-sector outcomes are comparatively weak. The city lacks a dated phase-out target for gas or other fossil heating, and no dedicated citywide spatial heat plan or sequenced fossil-heating retirement pathway has been identified, despite funded implementation of building and heating measures. A 2026 municipal school-upgrade project plans to replace existing oil boilers with new fossil-gas boilers, while governance and financing remain less developed than in higher-ranked cities.⁶²

Category scores Policy: 75 Emissions/outcomes: 24 Heating transition: 49 Governance/finance: 50 Social fairness: 56	Quantitative signals • Building emissions ↓4.2% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 2.011 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~30.5% direct fossil-fuel use in buildings (2019; constructed from official city carrier totals)⁶³
What drives the score • Direct fossil-fuel use is comparatively moderate. Around 30.5% of assessed building energy comes from direct fossil fuels.⁶² • The policy direction is mixed. Athens supports renovation, electrification and fossil-free heating, although it lacks a dated fossil-heating phase-out and some municipal measures still include fossil heating. • Renovation activity is progressing. Municipal retrofit programmes are moving from planning into funded and procured projects.	What holds it back • There is no clear fossil-heating exit. Athens has no dated citywide phase-out objective for gas or other fossil heating. • Transition delivery remains limited. No material citywide heating transition progress has yet been verified, while some municipal projects still propose replacing oil boilers with gas. • Financing remains fragmented. Funding exists for individual projects, but not for a citywide fossil-free heat transition.

Notable initiative

European Investment Bank-backed technical assistance is being used to prepare and structure larger energy-efficiency and renewable heating investments to move projects toward implementation.⁶⁰

Priority action

Set a dated fossil-heating phase-out and complete a citywide spatial heat plan. Scale heat pumps and electrification, and avoid replacing oil heating with new gas systems.

⁶¹ City of Athens, [Athens Climate Pact 2024](#) (2024); European Investment Bank, [EIB Advisory Support for Greek Mission Cities](#) (2025); City of Athens, [Co-Funded ESIF Projects 2021–2027 — Energy Upgrade of Municipal Buildings](#) (2026).
⁶² City of Athens, [Energy Upgrade of Nine School Complexes — Procurement](#) (2026); City of Athens, [Technical Description — Energy Upgrade of Nine School Complexes](#) (2026).
⁶³ Municipality of Athens / NetZeroCities, [Climate City Contract — 2030 Climate Neutrality Action Plan of the City of Athens](#) (2024)

14. Rome | Italy

Electrification is emerging, but gas remains central to heating.

Overall score	Tier	Major Fossil Investment Flag
49.8 / 100	Limited transition	Watch

Why Rome ranks fourteenth

Rome ranks fourteenth within the tightly grouped lower cluster, reflecting an increasingly clear direction toward building electrification and energy renovation. The city’s Climate City Contract links building decarbonisation to substantial planned investment, while municipal programmes are renovating schools and other public buildings, with some projects incorporating renewable energy and low-carbon heating solutions. Rome has therefore moved beyond planning, but the transition is still emerging rather than established. It should be noted, however, that some of the policies and decisions shaping the heating transition are determined at regional or national level rather than at the city level.⁶⁴

Fossil gas remains widely used for heating and hot water, and Rome has no explicit citywide deadline for ending fossil heating. The 2026 building-renovation strategy points towards progressive replacement of gas with heat pumps, insulation, solar energy and geothermal solutions, but this has not yet translated into a material citywide transition. Rome also lacks a dedicated spatial heat plan, while the long-term ATEM Roma 1 gas-distribution concession adds **uncertainty over the pace at which the fossil-gas network will be phased down.**⁶⁵

Category scores	Quantitative signals
Policy: 75	
Emissions/outcomes: 28	
Heating transition: 42	
Governance/finance: 59	
Social fairness: 50	
	• Building emissions ↓6.5% between 2020 & 2024 (EDGAR modelled and weather-adjusted) • 1.674 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised) • ~57.6% direct fossil-fuel use in buildings⁶⁶ (2022; constructed from official carrier data)

What drives the score	What holds it back
• Policy increasingly favours electrification. Heat pumps and renewable heating are prioritised, but no fossil-heating exit date exists. • Some transition activity is emerging. Funded projects include heat pumps and renewables. • Building emissions are declining. Progress is positive, but emissions remain comparatively high.	• No clear fossil-heating exit. Rome has no dated phase-out for gas or other fossil heating. • Gas remains deeply embedded in buildings. Direct fossil fuels dominate building energy use.⁶⁵ • Transition delivery remains limited. Heat pumps and renewables are growing, but gas boilers remain part of the pathway.

Notable initiative

Rome is developing its **first nearly zero-energy school in Torrino-Mezzocammino**, designed with **geothermal heating and cooling, solar thermal and 192 kWp of rooftop solar**, with the aim of making the building energy self-sufficient.⁶⁷

Priority action

Set a dated fossil-heating phase-out and complete a citywide spatial heat plan. Scale heat pumps and renewable heating while ensuring renovation programmes no longer install new fossil-fuel boilers.

⁶⁴ City of Rome/Rome for the Climate, [Rome Climate City Contract](#) (2025); City of Rome, [Energy Renovation and Upgrading of School Buildings in Rome Capital — Phase 2](#) (Accessed 29 August 2026).
⁶⁵ City of Rome / ENEA, [Energy Retrofit Strategy for Rome Capital's Real Estate Stock](#) (2026); City of Rome, [2026–2028 Programme of Acquisitions of Goods and Services](#) (2026).
⁶⁶ City of Rome / ENEA, [Energy Retrofit Strategy for Rome Capital's Real Estate Stock](#) (2026)
⁶⁷ City of Rome, [Torrino-Mezzocammino, Green School Approved](#) (2024).

15. Bucharest | Romania

District-heating repairs are progressing, but new gas investment risks fossil lock-in.

Overall score	Tier	Major Fossil Investment Flag
49.0 / 100	Limited transition	Major Fossil Investment Flag

Why Bucharest ranks fifteenth

Bucharest ranks fifteenth within the tightly grouped lower cluster, reflecting substantial district-heating infrastructure and targeted support for vulnerable households, but very weak current heating-system performance and an incomplete fossil-free transition pathway. Major investment is going into repairing and modernising the heat network, backed by committed financing, while newer planning frameworks aim to reduce fossil-fuel use in buildings and decarbonise district heating. However, formal adoption of the latest Green City Action Plan was not verified, and these measures have not yet translated into strong system-wide outcomes.⁶⁸

The physical transition remains weak. District heating is highly fossil-dependent and inefficient, with **37.73% real heat losses in 2024**. The city has no dated fossil-heating phase-out, while **three new fossil-gas-fired CHP projects** create a major lock-in risk. Geothermal, large heat pumps and waste heat are being explored, but remain far less developed.⁶⁹

Category scores	Quantitative signals
Policy: 65	• Building emissions ↑9.3% between 2020 & 2024 (EDGAR modelled and weather-adjusted)
Emissions/outcomes: 23	• 0.919 t CO₂/resident from building fossil-fuel use (2024; EDGAR modelled and climate-standardised)
Heating transition: 30	• ~56.4% direct fossil-fuel use in buildings ⁷⁰ (2021; constructed city-level estimate)
Governance/finance: 59	
Social fairness: 75	

What drives the score	What holds it back
• Policy direction is becoming clearer. Targets aim to reduce fossil-fuel use and decarbonise district heating, but no full phase-out date exists.	• District heating remains highly fossil-dependent and inefficient. The system still relies heavily on gas, while network losses remain extremely high. ⁶⁷
• District-heating modernisation is substantial. Major investment is replacing ageing network infrastructure and improving system reliability.	• There is no clear fossil-heating exit. Bucharest has no dated citywide phase-out objective for gas or other fossil heating.
• A transition framework is in place. Responsibilities and implementation steps are defined.	• New gas investment undermines the transition. Three planned gas-fired CHP projects risk locking the heat system into fossil fuels for decades.

Notable initiative
Bucharest is replacing around **106 km of ageing district-heating transmission pipelines**, backed by European Investment Bank financing, to cut losses and improve reliability.⁶⁷

Priority action
Set a dated fossil-heating phase-out and redirect district-heating investment toward fossil-free heat. Scale geothermal energy, large heat pumps and waste heat, such as from wastewater treatment plants and industrial processes, while avoiding long-term lock-in from new gas-fired combined heat and power capacity.

⁶⁸ Municipality of Bucharest / EBRD Green Cities, [Bucharest Green City Action Plan](#) (2025); Municipality of Bucharest / M100, [Bucharest Climate City Contract / Climate Neutrality Action Plan](#) (2025); European Investment Bank, [Bucharest Sustainable Urban Infrastructure](#) (Accessed 29 August 2026).
⁶⁹ General Council of Bucharest Municipality / Termoenergetica, [Decision 244/2026 — 2024 District-Heating Energy Balance](#) (2026); ELCEN, [Ongoing Investments — Three New High-Efficiency Cogeneration Projects](#) (Accessed 29 August 2026); ELCEN, [Owner's Engineer Contracts for Three New Cogeneration Projects](#) (2025).
⁷⁰ Municipality of Bucharest / M100, [Bucharest Climate City Contract / Climate Neutrality Action Plan](#) (2025)

8. What the heating transition delivers

Moving buildings away from fossil heating can deliver benefits beyond reducing greenhouse-gas emissions. Evidence from cities in this ranking shows that fossil-heating demand can be reduced through heat pumps, renewable district heating and building renovation while maintaining heating services and, in documented cases, lowering running costs. Renovation can amplify these benefits by reducing the amount of heat that replacement systems need to provide.

The evidence below prioritises measured outcomes and completed projects with officially quantified results, supported where useful by wider research. All figures are externally reported by public authorities, utilities, researchers or other project bodies. The examples below are illustrative rather than representative estimates of average benefits. Evidence quality varies between monitored outcomes, independently assessed results and estimates reported by project owners or public authorities; the source and status of each figure are identified where material. Costs remain sensitive to energy prices, tariffs, subsidies and building characteristics.

Affordability

Heat pumps can substantially reduce the energy required to provide the same amount of heat, but whether this produces lower bills depends on electricity and gas prices, upfront costs and building performance.⁷¹

Several cities provide concrete evidence of savings. In Vienna, the City estimates annual operating-cost savings of around €5,500 and €2,700 from two completed gas-to-heat-pump projects. In Madrid, a 56-home building shifted from gas heating to a hybrid system based mainly on heat pumps and solar PV. An independent assessment found a 58% reduction in annual energy costs, equivalent to around €65,000, alongside a 70% reduction in energy use.⁷²

Reducing heating demand through renovation can provide additional savings. Paris Habitat, Paris' public social-housing provider, reports that its climate renovations have generated average energy-bill savings of around €400 per family per year, alongside substantial improvements in thermal performance.⁷³

These examples should not be treated as universal predictions. Upfront costs can be substantial, and savings depend strongly on tariffs and building performance. Grants, affordable finance and tenant protections therefore remain important to ensure that the transition improves affordability rather than shifting costs onto households.

Resilience

Reducing fossil-gas dependency can make heating systems less vulnerable to fuel-price and supply shocks, particularly when combined with storage, flexible demand and diversified heat sources.

Cities in this ranking show how this can work in practice. In Berlin, a 56-million-litre thermal store connected to a power-to-heat plant can supply 200 MW of heat for up to 13 hours, even in very cold weather, allowing heat to be produced when electricity is abundant and used when demand rises. In Amsterdam, an electric boiler serving the city's heat network can respond rapidly to periods of

⁷¹ International Energy Agency, [Heat Pump Monitor 2026 — Key Findings](#) (2026).

⁷² City of Vienna, [“Raus aus Gas” Showcase Project Erzherzog-Karl-Straße](#) (Accessed 29 August 2026); City of Vienna, [“Raus aus Gas” Showcase Project Oberlaa](#) (Accessed 29 August 2026); Remica, [O'Donnell 46 — Plan Remica Hybrid Coste Cero](#) (2026).

⁷³ Paris Habitat, [Energy Sobriety: A Global Ambition](#), (2022).

abundant wind and solar generation and store surplus heat for periods of higher demand. A flexible grid contract also allows its electricity use to be reduced during grid peaks.⁷⁴

Warsaw provides a different example of resilience through improved reliability. In the Skorosze neighbourhood, the heat provider reports that ageing local gas-boiler infrastructure had caused numerous failures; replacing it with connections to the city heat network reduced the risk of breakdowns while improving the efficiency and control of heat supply.⁷⁵

Electrification does not eliminate supply risks: resilient heating systems also require adequate electricity networks, storage and flexible demand. The transition can strengthen resilience by replacing dependence on a single fuel with a more diverse and flexible mix of energy sources.

Energy security

Resilience and energy security are related but distinct. Resilience concerns the ability to withstand a disruption, while energy security also concerns reducing the underlying dependence on internationally traded fossil fuels. This is particularly significant in Europe, where 85.6% of gas was imported in 2024.⁷⁶

Stockholm and Copenhagen show how heating transitions can substantially reduce dependence on internationally traded fossil fuels. Stockholm's district-heating system was once dominated by fossil fuels, but by 2025 98.5% of district heat supplied was classified as renewable, recovered or fossil-free, although fossil-carbon emissions remain, particularly from plastics in residual waste. In Greater Copenhagen, coal, fossil gas and oil together supplied around 48% of district heat in 2014 but only around 6% in 2024, with coal falling to 0% of the reported fuel mix. These changes substantially reduce direct exposure to internationally traded fossil fuels.⁷⁷

Vienna is beginning a similar shift away from gas. A large heat pump commissioned at the Spittelau waste-to-energy plant in 2026 recovers previously unused heat and can supply heating and hot water to around 16,000 households. Other projects use wastewater, geothermal energy and industrial heat, and by 2040 Vienna expects 55% of district heat to come from geothermal energy and large heat pumps as part of its pathway towards eliminating fossil gas from the system.⁷⁸

These examples illustrate an important energy-security benefit: cities can replace imported fossil fuels with electricity, ambient and geothermal heat, and locally recovered energy. At European level, the IEA estimates that without existing heat pumps, gas consumption for building heating would have been more than 10% higher in Europe in 2025.⁷⁹

Public health and thermal comfort

Reducing on-site combustion can improve local air quality by cutting pollutants released directly into neighbourhoods. Cities in this ranking provide measurable or quantified examples. In Warsaw, connecting the Skorosze neighbourhood to district heating and closing five local gas boiler houses was

⁷⁴ Berlin Energy and Heat (BEW), [Power-to-Heat and Heat Storage](#) (Accessed 29 August 2026); Vattenfall, [Electric Boiler for District Heating](#) (Accessed 29 August 2026).

⁷⁵ Veolia / Energia dla Warszawy, [Development of the District-Heating Network in Warsaw's Ursus District — Skorosze Project](#) (Accessed 29 August 2026).

⁷⁶ Eurostat, [Energy statistics — EU natural-gas import dependency](#) (2026).

⁷⁷ London School of Economics and Political Science (LSE), [Stockholm: Green Economy Leader Report](#) (2013); Stockholm Exergi, [Annual and Sustainability Report 2025](#) (2026); European Commission Joint Research Centre, [Efficient District Heating and Cooling Systems in the EU](#) (2016); Greater Copenhagen District-Heating Environmental Network (CTR, VEKS and HOFOR), [Environmental Declaration for District Heating 2024](#) (2025).

⁷⁸ Wien Energie, [No Waste: Wien Energie Now Uses Heat in Spittelau Three Times](#) (2026); Wien Energie, [Vienna District-Heating Production and 2040 Heat-Transition Pathway](#) (2025).

⁷⁹ International Energy Agency, [Heat Pump Monitor 2026 — Key Findings](#) (2026).

estimated to reduce local low-stack emissions by 8.5 tonnes of NO_x and 0.07 tonnes of particulate matter per year.⁸⁰

In Stockholm, annual mean sulphur-dioxide concentrations on Södermalm declined around 99% between 1984 and 2024. The City's air-quality reporting attributes the sharp decline partly to reduced oil combustion and lower sulphur content in heating oil, with the expansion of district heating also contributing, alongside cleaner fuels in shipping and road transport. The city's district-heating provider separately reports that sulphur-oxide and particulate emissions over Södermalm have fallen by around two-thirds since the Hammarby heat-pump plant opened in 1986, largely as buildings shifted from individual heating to district heating.⁸¹

These local air-quality benefits do not mean that district heating is inherently clean or renewable. Moving combustion out of individual buildings can reduce pollution within neighbourhoods, but fossil-fuelled district-heating plants still produce emissions elsewhere in the system and may shift rather than eliminate fossil dependence. Networks therefore need a credible pathway towards fossil-free heat to deliver their full climate and air-quality benefits.

When the heating transition is combined with building renovation, the benefits can extend further. Warmer, more efficient homes can reduce exposure to cold and damp, improve thermal comfort and support better respiratory, cardiovascular and mental health. WHO finds strong evidence that improving the thermal performance of cold homes can produce health benefits and recommends combining insulation with adequate ventilation.⁸²

City projects illustrate these improvements. In Paris, completed public-housing renovations have reduced energy use by 64% in one residence and around 77% in another, alongside substantial improvements in thermal performance and comfort⁸³. In Berlin, three years of monitoring of a comprehensively renovated residential building found around 70% lower final-energy use and very high residential comfort following the renovation⁸⁴.

Heating transition can also support adaptation to rising summer temperatures. Many heat pumps can provide both heating and cooling, allowing the same infrastructure to protect residents from winter cold and summer heat. In Vienna, one completed gas-to-heat-pump conversion reduces indoor summer temperatures by around 2°C, while newer integrated systems recover heat removed during cooling for use elsewhere in the heating network. This benefit is becoming increasingly important as extreme heat poses a growing health risk in European cities⁸⁵.

Taken together, these examples show that reducing fossil-gas dependency can deliver benefits across household costs, system resilience, energy security, local air quality and thermal comfort. The scale of these benefits is not automatic: it depends on building efficiency, energy prices, electricity-system readiness, social protections and ensuring that district heating itself transitions away from fossil fuels.

⁸⁰ Veolia / Energia dla Warszawy, [Development of the District-Heating Network in Warsaw's Ursus District — Skorosze Project](#) (Accessed 29 August 2026).

⁸¹ City of Stockholm / SLB-analys, [Air Quality in Stockholm 2024](#) (2025); City of Stockholm, [Statistical Yearbook of Stockholm 2008](#) (2007); Stockholm Exergi, [Hammarby Plant](#) (Accessed 29 August 2026)

⁸² World Health Organization, [WHO Housing and Health Guidelines](#) (2018).

⁸³ Paris Habitat, [Spotlight on the Renovation of the Frédérick Lemaître–Rigoles Residence \(20th arrondissement\)](#) (2024); Paris Habitat, [Inauguration of Passage Molière \(3rd arrondissement\)](#) (2022)

⁸⁴ degewo, [Zukunftshaus - Final report](#) (2020).

⁸⁵ Wien Energie, [Climate-Friendly Building Cooling at Donaufeld](#) (2026); City of Vienna, ["Raus aus Gas" Showcase Project Oberlaa](#); World Health Organization Regional Office for Europe, [Keep cool in the heat](#) (2024).

9. What cities and mayors should do next

Six policy priorities

The ranking shows that the biggest gap is no longer ambition, but delivery. Six priorities emerge for cities seeking to retire fossil heating without transferring costs and risks to residents.

1. Set a dated zero-fossil heating end-state

Establish an end date for gas, oil and coal across buildings and heat networks, backed by interim retirement milestones.

2. Turn spatial heat planning into an investable retirement plan

Translate spatial heat plans into named projects, budgets and delivery dates, linking renovation, heat pumps, fossil-free heat networks, electricity grids and storage to explicit decisions on when fossil assets will be retired.

3. Stop public money extending fossil dependence

Exclude new fossil boilers and avoid coal-to-gas replacement. Major public heat investments should demonstrate compatibility with the zero-fossil end-state before approval, procurement or contracting.

4. Manage the gas-network phase-down explicitly

Set out a clear pathway to retire gas connections completely, prevent further network expansion and protect remaining customers from escalating stranded-network costs during the transition.

5. Make fossil-free heat affordable and prioritise vulnerable households

Target inefficient and energy-poor homes first, protect tenants from unaffordable renovation-related costs, and track bills, comfort and access to adequate warmth after conversion.

6. Publish annual delivery data and correct course

Publish annual data on fossil systems retired, buildings renovated, fossil-free heat added, network performance, heat prices and household outcomes, and adjust programmes when delivery or affordability falls short.

Seven things a mayor can do in the next 12 months

FROM COMMITMENT TO DELIVERY

Cities do not need to wait for perfect national frameworks. Mayors can use existing powers, budgets, procurement, public assets and partnerships to accelerate fossil-heating retirement and protect residents through the transition.

- 1 Put someone clearly in charge:** Appoint a senior political lead and establish a delivery team spanning housing, energy, planning, finance and social policy, with clear responsibility for implementation.
- 2 Review the biggest lock-in decisions now:** Examine planned gas plants, boilers, network extensions and major refurbishments before contracts, permits or investment decisions make them difficult to reverse.
- 3 Choose where delivery starts:** Identify priority neighbourhoods for renovation and fossil-heating replacement using building conditions, energy poverty, heat demand and infrastructure readiness.
- 4 Build a bankable project pipeline:** Turn priority areas into named projects with owners, costs, funding routes, delivery dates and annual completion targets.
- 5 Protect residents before works begin:** Put grants, rent protections, tariff safeguards, relocation measures where needed and independent advice in place before major interventions.
- 6 Close the critical data gaps:** Publish the heating-fuel mix, heat sources, network losses, fossil systems still in use and annual retirement rates needed to manage the transition transparently.
- 7 Secure delivery agreements with the institutions that matter:** Bring utilities, housing providers, grid operators and major building owners around the same timetable, with clear commitments on investment, infrastructure and fossil-asset retirement.

Some of Europe's leading cities are already demonstrating that fossil heating can be replaced and heat systems transformed at scale, but progress remains uneven. The strongest performers combine clear end-dates, spatial planning, fossil-free infrastructure, public investment and protections for residents; weaker performers often have ambitious climate goals without an equally clear pathway for retiring fossil assets. The next phase of the urban heat transition is therefore less about setting new targets than about converting existing commitments into projects, budgets and measurable fossil-fuel retirement. Cities that act now can reduce emissions while also improving affordability, resilience, energy security and living conditions.

Appendix Methodology for the European Urban Heat Transition Ranking

1. Research purpose

This study develops a comparative assessment of how 15 major European cities are progressing in the transition of building heating away from fossil fuels. It combines current outcomes with evidence on policy, infrastructure, governance, finance and social fairness rather than treating any single variable as a complete measure of transition performance.

The assessment is designed to answer five related questions:

- What outcomes are cities currently achieving?
- How far has the building-heating system already moved away from direct fossil-fuel use?
- Is the physical heating transformation moving in a fossil-free direction and being implemented at material scale?
- Do the responsible authorities and utilities possess and use the governance and financial capabilities needed to deliver the transition?
- Is the transition designed and implemented with meaningful social safeguards and participation?

A city may have low present-day direct building emissions because of climate, historic urban form or an already-low-carbon heat system while still lacking a credible pathway for completing the transition. Conversely, a city may have ambitious plans and strong institutions while remaining highly dependent on fossil heating. The ranking therefore uses a multidimensional composite-indicator framework. This follows the OECD–JRC principle that composite indicators can be useful for multidimensional phenomena when the conceptual framework, data selection, normalisation, weighting, aggregation and robustness choices are explicit and decomposable⁸⁶.

The ranking is consequently treated as a structured benchmarking and diagnostic instrument. It is not a causal evaluation of municipal policy, a direct physical measurement of an abstract concept called “heat-transition performance”, or a statistically representative estimate of all European cities

⁸⁶ OECD/European Union/EC-JRC, [Handbook on Constructing Composite Indicators: Methodology and User Guide](#), OECD Publishing, Paris (2008).

2. Overall research design

The study is comparative, cross-sectional and partially longitudinal. The same operational definitions and scoring rubrics are applied to all 15 cities. The overall ranking uses the most recent evidence verified by the research cut-off supplemented by selective post-cut-off verification as described in Section 6, while E1 measures change in modelled direct building emissions between 2020 and 2024 and several qualitative indicators distinguish intention, adoption, implementation and monitored delivery.

Four evidence types are combined:

- Harmonised modelled evidence, principally EDGAR direct building-combustion CO₂ for harmonised urban centres.
- Reported quantitative evidence, including city energy balances, fuel use, district-heating performance and committed investment.
- Structured qualitative evidence, including adopted plans, legislation, governance arrangements, funded programmes and social safeguards.
- Applicability and evidence-quality metadata, including evidence year, geographical and sectoral scope, limitations and confidence.

The design is therefore a theory-driven mixed-methods comparative index rather than a purely statistical league table.

3. Conceptual framework and theory of change

The framework separates three analytical stages so that plans are not mistaken for outcomes and current outcomes are not interpreted without regard to trajectory.

Current outcomes and system structure

- E1: direction and magnitude of change in direct building-combustion CO₂.
- E2: current direct building-combustion CO₂ per resident after common-climate standardisation.
- H1: remaining direct fossil-fuel share of building final energy.
- H2: current performance of material district-heating systems.

Transition pathway and delivery

- P1: a dated and scoped fossil-heating phase-out objective.
- P2: an operational urban heat-transition plan.
- H3: fossil-free heating transformation at system scale.
- F1: committed near-term finance for the transition.

Enabling institutions and social conditions

- G1: effective use of governance and delivery powers for fossil-heat phase-out.
- S1: accessible technical and targeted financial support.
- S2: tenant, affordability and consumer safeguards.
- S3: participation and workforce inclusion in the transition.

The framework is theory-led rather than data-led: indicator selection reflects the substantive components of an urban heat transition, consistent with the OECD–JRC recommendation that the conceptual model should precede variable selection⁸⁷.

4. Case selection

The assessment covers Paris, Madrid, Berlin, Rome, Brussels, Athens, Warsaw, Vienna, Lisbon, Budapest, Amsterdam, Stockholm, Bucharest, Copenhagen and Prague.

The sample was chosen to compare major European cities with different climates, building stocks, heating systems, district-heating penetration, governance structures, energy-market arrangements and municipal powers. Results are suitable for comparative benchmarking but are not statistically representative of all European cities.

5. Unit of analysis and geographical boundaries

Administrative city as primary assessment unit

The administrative city is the primary assessment unit for policy, governance, finance and social evidence. Metropolitan, regional or national evidence may be used where the rule, programme or institution demonstrably applies within the named city, but the wider authority and jurisdiction are recorded explicitly. The unit of interpretation is therefore the urban heat-transition system affecting the named city, not the municipal administration in isolation.

Harmonised EDGAR/GHSL outcome proxy

E1 and E2 use the EDGAR/GHSL Urban Centre as a harmonised proxy for direct building-emission outcomes. The Degree of Urbanisation methodology identifies urban centres using common density, population and contiguity criteria applied to gridded population data⁸⁸.

These boundaries may differ from administrative city borders; E1 and E2 are therefore harmonised urban proxies rather than municipal greenhouse-gas inventories.

The fixed 2025 EDGAR urban-centre population is used only as the denominator for E2. It is not used in E1 or to rescale municipal policy, governance, finance or social evidence. The

⁸⁷ OECD/European Union/EC-JRC, [Handbook on Constructing Composite Indicators: Methodology and User Guide](#), OECD Publishing, Paris (2008).

⁸⁸ European Commission, Eurostat, [Degree of urbanisation — Methodology](#); Joint Research Centre (JRC), [EDGAR — Methodology](#) (accessed 29 August 2026); Joint Research Centre (JRC), [EDGAR — Greenhouse Gas Emissions by City](#) (accessed 29 August 2026). EDGAR calculates emissions using country-specific activity data, technology mixes and emission factors and spatially allocates emissions using sector-specific geographic proxy data.

study does not multiply or divide EDGAR emissions or city scores by municipal-to-urban population ratios.

Heating-system territories and sectoral scope

Material district-heating or utility systems can extend beyond municipal boundaries. H2 and relevant H3, G1 or F1 evidence may therefore follow the material service territory where necessary, with that system boundary recorded. Sector-limited evidence, such as municipal housing or a defined beneficiary group, is recorded separately as a scope limitation.

Scope disclosure

Every scored observation records boundary or jurisdiction, evidence year, sectoral scope and material limitations. Scope differences are treated as comparability information rather than automatic performance penalties. Where a boundary mismatch materially weakens applicability, it is reflected in evidence confidence or, if evidence is insufficiently applicable, in the missing-data rule.

6. Evidence collection and source hierarchy

Evidence cut-off: **24 August 2026**. The central assessment is based on evidence systematically reviewed and verified up to this date. Selective post-cut-off verification was subsequently undertaken for specific factual questions, project-status clarifications and reviewer feedback, including some checks in September 2026. These later checks were not conducted systematically across all cities and indicators and therefore do not constitute a new common evidence cut-off. Where such evidence corrected or clarified information already assessed, the relevant audit and final reporting were updated accordingly.

Source hierarchy

Evidence was prioritised in the following order:

Level 1: Primary official evidence

- adopted legislation and regulations
- municipal, metropolitan or regional plans and council decisions
- budgets, investment programmes, procurement and tender documents
- official statistical energy balances and regulatory filings
- municipal monitoring reports
- utility annual reports, investment plans and project documentation

Level 2: Harmonised official or intergovernmental evidence

- European Commission JRC EDGAR and GHSL
- Eurostat
- JRC MyCovenant / Global Covenant of Mayors datasets

- EU Covenant of Mayors reporting
- EU Mission / NetZeroCities documentation
- OECD and Eurostat urban-boundary datasets

Level 3: Peer-reviewed or technical secondary evidence

Peer-reviewed research and robust technical reports are used where primary evidence is unavailable or where they clarify the derivation or interpretation of an official value.

Secondary reporting is not used to override clear primary evidence.

Indicator confidence and evidence quality

Each indicator assessment is assigned High, Medium or Low confidence for each city. High confidence normally indicates that the indicator is supported by recent, directly applicable and clearly defined official evidence. Medium confidence is used where the indicator is supported by robust evidence but has moderate limitations, including a modelled component, boundary mismatch, partial scope, older reference year or interpretive requirement. Low confidence is reserved for indicators relying on weak proxies, incomplete scope, unclear definitions or highly dated evidence.

Confidence factors are 1.00, 0.85 and 0.70 respectively. Confidence does not alter the central ranking; it is used only in a separate evidence-quality sensitivity test. The accompanying Indicator Confidence Matrix provides the High, Medium and Low confidence classification assigned to each indicator for every city⁸⁹.

7. Indicator structure and weights

The final index contains 12 scored indicators and one non-scored fossil-investment safeguard. Category weights sum to 100 points:

- Policy and leadership: 15 points — P1 — Dated and scoped fossil-heating phase-out objective (6); P2 — Operational urban heat-transition plan (9).
- Emissions and outcomes: 15 points — E1 — Weather-adjusted change in modelled direct building CO₂ (10); E2 — Climate-standardised direct building CO₂ per resident (5).
- Heating transition: 30 points — H1 — Remaining direct fossil-fuel share (9); H2 — District-heating current performance (9); H3 — Fossil-free heating transformation (12).
- Governance and finance: 20 points — G1 — Effective use of governance and delivery powers for fossil-heat phase-out (13); F1 — Funded near-term heat-transition delivery programme (7).
- Social fairness: 20 points — S1 — Accessible technical and targeted financial support (7); S2 — Tenant, affordability and consumer safeguards (8); S3 — Participation and workforce inclusion in the heat transition (5).
- Major Fossil Investment Flag: L1 — Major Fossil Investment Flag (non-scored safeguard)

⁸⁹ European Urban Heat Transition Ranking — [Indicator Confidence Matrix](#) (2026).

For cities where H2 is applicable, the heating category is allocated as H1 = 9 points, H2 = 9 points and H3 = 12 points.

Where H2 is structurally not available (N/A) because district heating is not material, its 9 points are redistributed only within the heating category, proportionally to the H1:H3 ratio of 9:12. The resulting effective heating weights are H1 = 12.8571 points and H3 = 17.1429 points. No H2 weight is transferred to policy, outcomes, governance or social indicators, and the overall denominator remains 100.

L1 is non-scored and has weight 0. Heating remains the largest physical-system category, while governance and social fairness each receive 20 points because delivery capability and distributional safeguards are treated as substantive components of the transition rather than optional co-benefits. The Covenant of Mayors explicitly incorporates energy poverty into local climate planning and reporting⁹⁰.

8. General scoring procedure

Qualitative indicators use the ordinal scale $s \in \{0,1,2,3,4\}$. E1, E2 and H1 use continuous analytical scores on the same 0–4 range. Weighted points for indicator i are:

$$p_i = w_i \left(\frac{s_i}{4} \right)$$

For qualitative indicators, 0, 1, 2, 3 and 4 therefore receive 0%, 25%, 50%, 75% and 100% of the applicable indicator weight.

The hybrid approach retains policy-interpretable qualitative categories while avoiding quantitative cliff edges. Fixed anchors are used instead of sample-relative min–max or z-score normalisation so that the standard does not change merely because a city is added or removed and so that future assessments can be compared against the same thresholds. The choice of normalisation is a normative modelling decision and is tested through sensitivity analysis, in line with OECD–JRC guidance⁹¹.

9. Quantitative indicators

E1 — Weather-adjusted change in modelled direct building CO₂, 2020–2024

Purpose

E1 measures the trajectory of modelled direct building-combustion CO₂ between 2020 and 2024. EDGAR provides harmonised emissions estimates built from activity data, technology information, emission factors and spatial allocation procedures⁹². The study uses direct on-

⁹⁰ Covenant of Mayors – Europe, [Reporting Guidelines on Energy Poverty](#) (2025).

⁹¹ OECD/European Union/EC-JRC, [Handbook on Constructing Composite Indicators: Methodology and User Guide](#), OECD Publishing, Paris (2008).

⁹² Joint Research Centre (JRC), [EDGAR — Methodology](#) (accessed 29 August 2026); Joint Research Centre (JRC), [EDGAR — Greenhouse Gas Emissions by City](#) (accessed 29 August 2026). EDGAR calculates emissions using country-specific activity data, technology mixes and emission factors and spatially allocates emissions using sector-specific geographic proxy data.

site building combustion only; electricity generation, district-heat production outside the building sector, embodied emissions and consumption-based emissions are excluded.

Weather adjustment

E1 reduces the effect of unusually warm or cold winters by adjusting each city-year toward that city-region's own 1991–2020 heating-degree-day normal. The World Meteorological Organisation (WMO) defines 1991–2020 as the current standard 30-year climatological normal period⁹³. Eurostat regional HDD data are taken from the NUTS 3 annual series⁹⁴.

For city c and year t :

$$M_{ct} = (1 - h_c) + h_c \left(\frac{\overline{\text{HDD}}_{c, 1991-2020}}{\text{HDD}_{ct}} \right)$$

where h_c is the national household share of final energy used for space heating, derived from harmonised Eurostat household end-use data⁹⁵; HDD_{ct} is the city-region's NUTS 3 HDD value for year t ; and $\overline{\text{HDD}}_{c, 1991-2020}$ is the arithmetic mean of the complete 1991–2020 series for the same regional unit.

Weather-adjusted emissions are:

$$A_{ct} = \text{CO}_{2, ct} M_{ct}$$

and the E1 change is:

$$\Delta A_c = \left(\frac{A_{c, 2024}}{A_{c, 2020}} \right) - 1$$

Because E1 measures the percentage change in emissions within the same city over time, no population adjustment is required. Population is used separately in E2, where emissions intensity is compared across cities.

Scoring

Analytical E1 scoring is piecewise linear through the fixed anchors +10% = 0, 0% = 1, –10% = 2, –20% = 3 and –30% = 4. Scores are capped at 0 for increases of at least 10% and at 4 for reductions of at least 30%. Intermediate values are linearly interpolated.

Limitation

E1 is a transparent climate-sensitivity correction, not a fully weather-normalised municipal inventory or a causal estimate of policy impact. It uses NUTS 3 climate data and a national household space-heating share, does not explicitly model commercial-sector heating sensitivity or cooling, and does not correct for structural changes in floor area or population. The 2020–2024 window was selected to capture recent transition progress using the most

⁹³ World Meteorological Organization (WMO), [WMO Climatological Normals](#) (accessed 29 August 2026).

WMO defines climatological standard normals as consecutive 30-year periods and identifies **1991–2020** as the current standard normal period.

⁹⁴ Eurostat, [Energy statistics — cooling and heating degree days \(nrg_chdd\)](#) (accessed 29 August 2026). HDD and CDD are derived from gridded meteorological observations, aggregated to **NUTS 3** level; annual values are calculated by Eurostat as the sum of monthly data.

⁹⁵ Eurostat, [Energy consumption in households](#), dataset **nrg_d_hhq** (accessed 29 August 2026). The dataset provides harmonised national household final-energy consumption by end use, including space heating, water heating, cooling, cooking, lighting and appliances.

recent harmonised EDGAR years available consistently across all 15 cities. Because this period includes the COVID-19 pandemic and the European energy-price crisis, E1 should be interpreted as a recent outcome trend rather than a causal or fully structural measure of decarbonisation; changes may reflect policy, prices, economic activity and behaviour as well as long-term heating-system transformation.

E2 — Climate-standardised direct building CO₂ per resident

Purpose and method

E2 measures current 2024 direct building-combustion CO₂ per fixed 2025 EDGAR urban-centre resident after standardising all cities to a common reference climate. The reference is 2,653.47 HDD, defined as the median of the 15 cities' 1991–2020 NUTS 3 regional HDD normals. Unlike E1, which adjusts each city to its own historical climate normal, E2 places all cities on the same climate basis so that current direct-emissions intensity is more comparable across warm and cold locations.

For city i :

$$E2_i = \frac{CO_{2,i,2024}}{POP_{i,2025}} \times \left[(1 - s_i) + s_i \times \frac{2,653.47}{HDD_{i,2024}} \right]$$

where s_i is the estimated CO₂-weighted share of direct fossil building emissions that is sensitive to space-heating demand; $HDD_{i,2024}$ is the city-region's 2024 NUTS 3 HDD. The heating-sensitive share is derived from harmonised national household fuel and end-use evidence and regionalised for the city audit; it is therefore an estimated city-specific parameter rather than a directly observed city-level space-heating share. National and regional HDD series, direct-fossil end-use shares and fuel CO₂ factors are retained in the calculation trail⁹⁶. The adjustment approach is informed by European Commission climate-adjustment guidance⁹⁷.

Scoring

E2 is scored continuously from 0 to 4 using piecewise linear interpolation through the fixed anchors 0.50 tCO₂/person = 4, 0.80 = 3, 1.10 = 2, 1.40 = 1 and 1.70 = 0. Values at or below 0.50 are capped at 4 and values at or above 1.70 at 0. Between each adjacent pair of anchors, the score is linearly interpolated. These anchors are fixed analytical thresholds, not sample-relative breakpoints.

Robustness

Because E2 estimates how the heating-sensitive component of emissions would compare under a common climate, the calculation assumes a proportional relationship between

⁹⁶ Eurostat, [Cooling and Heating Degree Days by NUTS 3 Regions — Annual Data \(nrg_chddr2_a\)](#); Eurostat, [Disaggregated Final Energy Consumption in Households — Quantities by End Use \(nrg_d_hhg\)](#); Eurostat, [Cooling and Heating Degree Days by Country — Annual Data \(nrg_chdd_a\)](#); IPCC, [2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2: Energy](#) (2006) (all accessed 29 August 2026).

⁹⁷ European Commission, [Commission Recommendation \(EU\) 2024/1716 of 19 June 2024 setting out guidelines for the interpretation of Articles 5, 6 and 7 of Directive \(EU\) 2023/1791, Appendix B: Climate adjustment](#) (2024). The guidance recommends adjusting only the climate-dependent share of energy consumption and identifies heating degree days as the standard climatic parameter for heating.

heating-sensitive emissions and HDD. The audit retains three explicit robustness tests: heating-sensitive share –20%, heating-sensitive share +20%, and an HDD elasticity of 0.75 to test a less-than-proportional response to HDD. These tests assess sensitivity to the two principal modelling assumptions and are particularly important where climate standardisation is large. E2 should therefore be interpreted as a comparative climate standardisation, not as a prediction of actual city emissions under a different climate. Like E1, E2 is an outcome indicator rather than a measure of municipal policy effectiveness; even after climate standardisation it reflects structural characteristics of the building and heating system, national policy and market conditions as well as local action.

H1 — Remaining direct fossil share of building final energy

H1 measures direct fossil-fuel dependence in buildings:

$$H1_c = \frac{\text{Gas} + \text{fossil Oil/LPG} + \text{Coal/Peat}}{\text{Total building final energy}}$$

Electricity, district heat, renewables and other reported non-fossil final energy remain in the denominator but not the fossil numerator. H1 therefore measures direct on-site fossil use and does not attribute upstream fossil fuels used to produce electricity or district heat.

Analytical H1 scoring is piecewise linear through 15% = 4, 35% = 3, 50% = 2, 60% = 1 and 70% = 0, capped at 4 at or below 15% and 0 at or above 70%. For bounded evidence, the conservative fossil-share bound is used rather than a fabricated midpoint.

The latest sufficiently comparable official city-level observation is used; a newer value is accepted only if its geography, sector scope, carrier definition, final-energy basis and denominator are sufficiently clear. H1 remains the least temporally harmonised quantitative indicator. Data from 2020 onward are preferred, 2016–2019 values are accepted with disclosure, and older values receive explicit recency scrutiny and sensitivity testing. H1 should therefore be interpreted as a structural indicator of remaining direct fossil dependence rather than a perfectly synchronous comparison across all cities.

10. Policy and leadership indicators

P1 — Dated and scoped fossil-heating phase-out objective

P1 evaluates the precision and implementation status of the fossil-heating transition objective.

- 0 — contrary policy or verified absence of a relevant transition objective.
- 1 — generic climate-neutrality or emissions-reduction commitment.
- 2 — dated or specifically scoped heating/building fossil-fuel target.
- 3 — integrated delivery target connected to implementation responsibilities.
- 4 — explicit fossil-heating phase-out with monitored implementation.

A whole-economy net-zero target is not sufficient for a high P1 score unless it contains a dated or specifically scoped heating/buildings objective. National law can count where it directly applies within the city, but a restriction on one fuel cannot be treated as an all-fossil phase-out where other fossil heating remains unaddressed. A finding that no adopted phase-

out date was identified is a time-bounded absence finding based on the completed review of the listed official policy and regulatory sources as of the evidence cut-off; it is not treated as proof that no relevant document could exist outside the reviewed evidence base.

P2 — Operational urban heat-transition plan

P2 assesses whether an authority has moved beyond general climate strategy to an operational heating pathway.

- 0 — no relevant plan.
- 1 — studies, diagnostics or feasibility work.
- 2 — adopted plan with assigned responsibilities.
- 3 — spatially specific or budget-linked implementation.
- 4 — milestones, monitoring and corrective mechanisms.

Relevant evidence includes heat-demand or source mapping, neighbourhood sequencing, technology pathways, responsibility allocation, timelines, links to investment and mechanisms for monitoring and adjustment. Score 3 requires genuinely heat-specific spatial or budget-linked implementation rather than a generic climate investment list. The Covenant of Mayors SECAP framework similarly treats planning as a process linking inventory, targets, actions, implementation and monitoring⁹⁸.

11. Heating-system indicators

Treatment of heat sources and terminology

For H2 and H3, fossil gas, coal and oil are treated as fossil energy. Geothermal heat, ambient heat captured by heat pumps, and recovered industrial, data-centre or wastewater heat are treated as fossil-free heat sources for the purpose of assessing fossil dependence and transformation. Electricity used in heat pumps, electric boilers or other electric heating can therefore support a fossil-free transition when it replaces direct fossil combustion, but electricity is not treated as inherently zero-emission; power-sector emissions are outside the direct-building scope of E1 and E2 and are not separately scored.

Biomass, waste and source-specific labels require separate treatment. Biogenic fuels are not classified as fossil fuels, but this does not imply zero lifecycle emissions or absence of air-pollution impacts. Where evidence permits, the fossil fraction of waste is treated as fossil-derived, while recovered heat is distinguished from primary fuel input. Utility or authority terms such as “CO₂-neutral”, “renewable”, “recovered”, “low-carbon” and “fossil-free” are retained when reporting source evidence but are not assumed to be synonymous. H2 and H3 scoring follows the best available evidence on actual fuel or input mix, residual fossil use and the direction of system transformation. For H2, waste incineration supplying at least 20% of district-heating energy triggers the score-3 cap described below.

⁹⁸ **EU Covenant of Mayors**, [How to develop a Sustainable Energy and Climate Action Plan \(SECAP\)](#) (2025); see also [Covenant Reporting Guidelines](#). The SECAP process links baseline emissions inventories and assessments to targets, actions, implementation, monitoring and periodic reporting.

H2 — District-heating current performance

H2 applies where district heating is approximately 10% or more of relevant building heat or is demonstrably city-shaping even when an exact share is unavailable. If district heating is immaterial, H2 is N/A rather than zero and the special within-heating redistribution rule in Section 7 applies.

- 0 — high or increasing fossil dependence, major losses or clearly poor performance.
- 1 — high fossil reliance.
- 2 — material transition underway.
- 3 — strong low-fossil performance.
- 4 — near-fossil-free operation with residual fuels and losses actively managed; not available where waste incineration supplies at least 20% of district-heating energy.

H2 is assessed qualitatively because district-heating performance cannot be captured fairly by a single harmonised metric. Fuel mix, recovered heat, network losses, residual peak fuels and decarbonisation progress all affect performance, while these data are reported differently across cities. The score therefore uses the overall evidence against consistent 0–4 performance anchors. A high district-heating market share is not itself evidence of strong H2 performance. Where waste incineration supplies at least 20% of district-heating energy, H2 is capped at 3 even if recovered waste heat is classified by an operator or authority as renewable, recovered or CO₂-neutral. This reflects the fossil-derived fraction of residual waste, particularly plastics, and the methodology's treatment of combustion-based recovered waste heat as distinct from near-fossil-free operation. The 20% threshold is a study-specific analytical guardrail rather than a scientific or regulatory threshold.

H3 — Fossil-free heating transformation

H3 evaluates whether the physical transformation of the heating system is materially underway and whether its direction is predominantly away from fossil lock-in. It deliberately distinguishes scale of activity from direction of travel.

- 0 — transformation is mainly fossil-based, or no credible transition exists.
- 1 — fossil-free direction exists, but implementation is still limited.
- 2 — material transition is underway, but remains limited or includes major fossil investment.
- 3 — material transition is predominantly fossil-free; any new fossil-capable investment is limited in operational role and does not dominate the material transition portfolio.
- 4 — system-wide fossil-free transformation is advanced, with no new material fossil investment.

Eligible evidence includes district-heating conversion, large heat pumps, geothermal energy, recovered heat, thermal storage, lower-temperature networks, appropriate network expansion, gas-network retirement, building electrification, municipal-building conversion and heat zoning.

A material new fossil investment prevents H3 = 4 and, where it is structurally important to the transition portfolio or is not credibly limited in operational role, caps H3 at 2. Fossil-capable

peak or backup capacity can remain compatible with H3 = 3 where its expected operational role is limited and the principal material transformation is demonstrably fossil-free. H3 therefore internalises fossil direction in the scored index, while L1 separately provides a prominent publication disclosure.

12. Governance and finance indicators

G1 — Effective use of governance and delivery powers for fossil-heat phase-out

G1 evaluates whether available governance and delivery powers are actively used specifically to advance fossil-heat phase-out. Four dimensions are audited: operative regulatory or planning power; ownership, concession or procurement control over strategic assets; system coordination and delivery authority; and demonstrated exercise of those powers.

- 0 — powers are absent or predominantly used to reinforce fossil heating.
- 1 — mainly soft coordination or action limited to the authority's own estate.
- 2 — material governance levers are used, but phase-out reach or system control is limited.
- 3 — multiple powers are used, but reach, coherence or direction remains constrained.
- 4 — strong integrated powers actively drive citywide fossil-heat phase-out.

A high score requires demonstrated use, not merely institutional capacity on paper. Material contradictory use of the same powers can prevent score 4. Finance is scored separately in F1 and plan/infrastructure maturity in P2/H3, reducing double counting.

F1 — Funded near-term heat-transition delivery programme

F1 evaluates whether material near-term transition actions are linked to committed financing. The principal assessment window is 2026–2030, while earlier or longer programmes can qualify where they remain active.

- 0 — no credible funding or financing identified for defined heat-transition action.
- 1 — costs or possible funding sources identified, but no committed allocation.
- 2 — committed funding for discrete projects, measures or grant calls.
- 3 — multi-year programme or contractual financing covers a material portfolio of measures.
- 4 — an integrated investment/financing plan covers the main heat-transition programme and is tied to implementation milestones or expenditure monitoring.

Eligible commitments include adopted public budgets, contracted utility investment, approved national or EU grants, public-housing programmes and committed private or blended finance linked to defined actions. Unallocated climate budgets, generic bond issuance, cost estimates, aspirational funding and possible future private investment do not count as secured finance. Financing instrument type is neutral. Absolute monetary amounts are not directly compared because city size, currencies, construction costs, utility ownership and national funding systems differ. The approach is consistent with the NetZeroCities

Investment Plan logic linking actions, costs, capital needs, financing sources, ownership and delivery milestones⁹⁹.

13. Social fairness indicators

S1 — Accessible technical and targeted financial support

- 0 — no meaningful support or exclusionary design.
- 1 — limited pilot.
- 2 — accessible support.
- 3 — scaled and targeted delivery.
- 4 — distribution monitored and delivery corrected.

Score 4 requires evidence that monitoring identifies who or which places support is reaching or missing and that delivery is retargeted, redesigned or otherwise corrected in response. Scale and targeting with monitoring but without a verified correction loop remain score 3.

S2 — Tenant, affordability and consumer safeguards

- 0 — costs are shifted to vulnerable households without safeguards.
- 1 — general affordability language.
- 2 — specific safeguards adopted.
- 3 — safeguards implemented.
- 4 — relevant outcomes monitored and safeguards corrected or recalibrated.

Relevant measures include rent-increase limitations, social tariffs, disconnection protection, payment plans, district-heating consumer rights, renovation safeguards and rules linking rent changes to realised energy savings. Score 4 requires a verified feedback loop, not monitoring alone. Where the correction loop covers only a narrow part of the relevant housing or consumer population, that limitation is disclosed.

S3 — Participation and workforce inclusion in the heat transition

- 0 — no meaningful heat-transition participation/workforce measures or an exclusionary process.
- 1 — ad hoc or generic participation with a weak or indirect heat-transition link.
- 2 — structured heat-linked participation/workforce measures, but no verified delivery-shaping output.
- 3 — a verified participant/workforce output materially influences heat-relevant programme or plan design.

⁹⁹ NetZeroCities, [2030 Climate Neutrality Investment Plan — Guidance and Explanations](#) and [Investment Plan Template](#) (2023). The framework links the actions identified in the Climate Neutrality Action Plan with their costs and capital requirements, available and prospective funding/financing sources, responsible project owners and implementation/delivery planning.

- 4 — participation/workforce inclusion demonstrably shapes implemented or funded heat-transition delivery at material scale.

S3 counts only evidence materially linked to building heating, thermal renovation, district or ambient heat networks, fossil-heating replacement or retirement, heat-transition affordability or energy-poverty impacts, or the workforce and skills required to deliver these changes. Generic climate participation or broad housing engagement does not qualify on its own. One-way communication is not treated as participation.

14. L1 — Major fossil investment status

L1 is a non-scored publication safeguard designed to ensure that a serious fossil-investment contradiction is visible even in an additive composite score. Its public statuses are Major Fossil Investment Flag, Watch and No flag. L1 has weight 0 and does not mechanically alter the overall score, rank or tier.

A Major Fossil Investment Flag requires sufficiently committed primary evidence of a material fossil-heating expansion or life-extension decision, such as new fossil-gas heat capacity, material fossil-gas network expansion or new-customer enabling investment, or substantial fossil-asset life extension without a credible near-term retirement or non-fossil conversion condition.

A Watch is used where fossil-investment risk is credible but a decisive condition remains unresolved, including approval or procurement status, city attribution, materiality, operational fuel, expected role, operating life or retirement/conversion conditions.

No flag is used where no qualifying project is verified, where the evidence establishes a credible declining/retirement pathway, or where the relevant infrastructure is sufficiently verified as dedicated to a non-fossil fuel or purpose and does not materially extend fossil-gas use.

Routine maintenance, safety work and like-for-like replacement needed to operate a declining legacy network do not automatically trigger L1. Conversely, a peak or backup project can still trigger L1 if it is materially sized, fossil-committed and enables material expansion or new connections; limited operating hours do not by themselves remove the capacity-expansion risk. No universal MW, kilometre or monetary threshold is applied; materiality is assessed in relation to the scale and role of the investment within the relevant city heating system, including whether it enables new fossil capacity, connections or material asset-life extension.

Gas-capable equipment is assessed from the best verified evidence on intended and committed operational fuel, purpose, scale and project status rather than from the equipment label alone. Specific, current official evidence that a project is designed for biogas or another non-fossil gas can resolve a previous Watch where the evidence is sufficiently clear. Generic claims such as “hydrogen-ready” or “renewable gases later” do not by themselves remove fossil-lock-in risk.

H3 and L1 ask related but different questions. H3 scores the direction and maturity of the physical transformation and can be capped by fossil investment. L1 separately discloses a material fossil-capacity or life-extension contradiction to readers. The same project may therefore affect H3 and L1 for distinct analytical reasons.

15. Missing data and applicability

Missing is not zero

Missing evidence indicates that the operational definition could not be verified; zero indicates verified poor performance. Assigning zero to missing observations would confound performance with reporting capacity and could penalise cities with fragmented documentation or weaker publication systems.

No qualitative score is statistically imputed from other cities. Mean, regression or nearest-city imputation would risk inventing policy performance because missing urban-policy evidence is unlikely to be missing completely at random.

Structural non-applicability

H2 is the principal structural N/A case. When district heating is not material, H2 is not scored and its weight is redistributed only to H1 and H3 according to the fixed 9:12 ratio. This preserves the 30-point heating category and the 100-point overall denominator without giving non-district-heating cities extra influence from unrelated categories.

Other missing scored indicators

If a scored indicator other than H2 cannot be verified, it is treated as missing rather than assigned a zero. The city's overall score is then calculated only from the indicators with sufficient applicable evidence, with the remaining applicable weights re-normalised to 100 for that city. Any such case is explicitly disclosed and the resulting score should be interpreted as provisional or less directly comparable.

16. Aggregation

The final audits use effective indicator weights that sum to 100 for every city after the H2 applicability rule is applied. The score is therefore:

$$\text{Score}_c = \sum_i w_{ci} \left(\frac{s_{ci}}{4} \right)$$

where w_{ci} is the effective city-specific weight after any H2 redistribution and $\sum_i w_{ci} = 100$. L1 is excluded.

Category scores are reported separately:

$$\text{CategoryScore}_{ck} = 100 \frac{\sum_{i \in k} w_{ci} \left(\frac{s_{ci}}{4} \right)}{\sum_{i \in k} w_{ci}}$$

The model is additive and therefore partially compensatory: strength in one dimension can offset weakness in another. This is intentional because cities can follow different institutional and technological pathways, but the consequences of compensability are made visible through category profiles, H3 directionality and L1 disclosure. OECD–JRC guidance recommends making compensability assumptions explicit¹⁰⁰.

¹⁰⁰ OECD/European Union/EC-JRC, [Handbook on Constructing Composite Indicators: Methodology and User Guide](#), OECD Publishing, Paris (2008).

17. Geographical scope and comparability

Geographical scope is treated as an interpretation and comparability issue rather than a separate performance variable. The administrative city remains the primary unit for policy and social assessment, E1/E2 use harmonised EDGAR/GHSL urban-centre proxies, and material heating-system evidence can follow service territories.

No weighted municipal coverage percentage or population-ratio correction is applied. Wider-jurisdiction evidence is labelled as such, and sector-limited evidence is disclosed. If a mismatch is too large to support the indicator's operational definition, the evidence is treated as missing rather than mechanically down-weighted.

18. Robustness and sensitivity analysis

Robustness checks were conducted during development of the methodology to assess the sensitivity of the results to key analytical choices. These included alternative category weights; variation in the E2 heating-sensitive share and HDD response; tests excluding E2 or the EDGAR-based outcome indicators; alternative treatment of older H1 observations; reduced H1 weighting; and confidence-adjusted scoring.

These checks were used as internal validation of the methodology rather than as alternative rankings. The published ranking therefore reports only the central specification. Exact rank positions should in any case be interpreted alongside overall score differences, category-level performance, evidence limitations and the Major Fossil Investment Flag, particularly where cities are closely grouped.

19. Tier classification

The exact ordinal ranking is complemented by four interpretive tiers based on the overall score:

- Leading transition: 80–100.
- Progressing transition: 65–<80.
- Uneven transition: 55–<65.
- Limited transition: <55.

The tier names are deliberately framed around transition performance rather than implying that high-scoring cities have already completed fossil-heat phase-out. A high aggregate score can coexist with important residual weaknesses, which must remain visible in the category profile and L1 status.

Tiers reduce false precision because a one- or two-point difference between adjacent cities should not be interpreted as a statistically significant performance gap.

20. Rounding and publication precision

Calculations retain full numerical precision. Published overall scores are rounded to one decimal; category scores are rounded to the nearest whole number. Rank order and tier assignment are determined from the unrounded underlying overall scores, not the displayed rounded values. Consequently, two cities may display the same one-decimal score while

retaining different rank positions. Published rank differences should still be interpreted cautiously and read alongside tiers, category profiles and fossil-investment status.

21. Reliability and reproducibility

Reliability is supported by fixed indicator definitions, scoring rubrics, weights and calculation rules applied consistently across all 15 cities. The accompanying source register and city audit files identify the principal data sources used for each indicator, while this methodology documents the quantitative formulas and key methodological assumptions required to interpret the scores.

For quantitative indicators, the published methodology and referenced datasets provide the basis for independently reconstructing the calculations. For qualitative indicators, source references and scoring criteria allow readers to assess the evidential basis for the assigned scores, although some expert judgement remains unavoidable.

The study does not claim formal inter-rater reliability. The principal remaining reliability risk is therefore judgement in qualitative coding. This is mitigated through common rubrics, cross-city calibration, consistent evidence standards and internal factual review.

22. Principal limitations

H1 temporal and sectoral heterogeneity

H1 uses the best sufficiently comparable official carrier mix available for each city, but data years, sector classifications and denominators are not perfectly harmonised. This remains the most important reported-data comparability limitation.

Modelled EDGAR evidence

EDGAR provides strong spatial and methodological harmonisation, but its city emissions are modelled from activity data, emission factors and spatial proxies rather than measured from municipal gas meters or local inventories¹⁰¹.

Weather adjustment and standardisation

E1 and E2 use transparent but simplified climate corrections. E1 applies a city-region historical-normal sensitivity adjustment using a national household heating share; E2 standardises current intensity to a common 2,653.47-HDD reference, defined as the median of the 15 cities' 1991–2020 NUTS 3 regional HDD normals, using a CO₂-weighted direct-fossil heating-sensitive share. Neither indicator constitutes a full building-stock weather-normalisation model. E2 is additionally sensitive to assumptions about the heating-sensitive

¹⁰¹ Joint Research Centre (JRC), [EDGAR — Methodology](#) (accessed 29 August 2026); Joint Research Centre (JRC), [EDGAR — Greenhouse Gas Emissions by City](#) (accessed 29 August 2026). EDGAR calculates emissions using country-specific activity data, technology mixes and emission factors and spatially allocates emissions using sector-specific geographic proxy data.

share and the relationship between heating demand and HDD, particularly for warmer cities where climate standardisation can involve larger adjustments.

Administrative and institutional heterogeneity

Cities differ in legal powers, utility ownership and relationships with national or regional governments. G1 measures effective use and direction of available powers but cannot eliminate those structural differences.

Qualitative scoring judgement

Qualitative indicators are ordinal. Treating adjacent categories as equally spaced for weighted aggregation is a transparent modelling convention, not an empirical claim that every policy step is equally large.

Weighting judgement

Weights express the study's theory of transition and are not statistically estimated. The results may be sensitive to the choice of category weights; alternative weighting configurations were therefore considered during methodological development.

H3/L1 materiality judgement

Whether new fossil-capable capacity is material, genuinely limited to peak/backup use, or sufficiently committed to a non-fossil fuel can require judgement across permits, procurement, utility plans and project descriptions. The audit makes those conditions explicit and separates scored H3 directionality from the L1 publication safeguard, but borderline cases remain evidence-sensitive.

Small and purposive sample

With 15 cities, multivariate statistical weight estimation would be unstable and results cannot be generalised statistically to all European cities.

Incomplete measurement of renovation, grid readiness and cooling

Renovation delivery, electricity-grid readiness and cooling are important to the transition but are not separately scored because consistently comparable city-level evidence was insufficient.

Finance comparability

F1 evaluates the completeness and credibility of financing relative to a defined transition portfolio rather than comparing absolute euros per city. A large investment can still receive a mid-range score if the wider programme, funding gap, ownership or monitoring is unclear.

Rank precision

Adjacent ranks should not be interpreted as statistically significant differences. The ranking does not produce inferential confidence intervals; uncertainty is communicated through tiers,

category scores, score differences, evidence limitations and indicator-confidence classifications.

23. Use of artificial intelligence

Generative AI tools were used to support selected research, translation, editing and quality-assurance tasks during preparation of this report. They were not treated as primary evidence sources and were not used as a substitute for authorial judgement. Data, references, calculations, methodological decisions and final interpretations were independently reviewed and verified by the author against the underlying sources.

24. References and data sources

The evidence base for this study is documented in an accompanying consolidated source register¹⁰². The register lists the common methodological sources followed by the sources used for each city. The accompanying city audit files provide the indicator-level evidence trail, including calculations, scope limitations and confidence assessments.

Appendix Indicator Confidence Matrix

European Urban Heat Transition — Indicator Confidence Matrix														
Rank	City	Policy and leadership		Emissions and outcomes		Heating transition			Governance and finance		Social fairness			L1
		P1	P2	E1	E2	H1	H2	H3	G1	F1	S1	S2	S3	L1
1	Stockholm	High	High	Medium	Medium	High	High	High	High	High	High	High	High	High
2	Paris	High	High	Medium	Medium	High	High	High	High	High	High	High	High	High
3	Vienna	High	High	Medium	Medium	High	High	High	High	High	High	High	High	High
4	Copenhagen	High	High	Medium	Medium	High	High	High	High	High	High	High	High	High
5	Amsterdam	High	High	Medium	Medium	High	High	High	High	High	High	High	High	High
6	Budapest	High	High	Medium	Medium	Medium	High	High	High	High	Medium	High	Medium	High
7	Prague	High	High	Medium	Medium	Medium	High	High	High	High	High	High	High	High
8	Berlin	High	High	Medium	Medium	Medium	High	High	High	High	High	High	High	High
9	Warsaw	High	High	Medium	Medium	Medium	High	High	High	High	High	High	High	High
10	Brussels	High	High	Medium	Medium	Medium	High	High	High	High	High	High	High	High
11	Madrid	High	High	Medium	Medium	High	Medium	High	High	High	High	High	High	High
12	Lisbon	High	High	Medium	Medium	High	Medium	High	High	High	High	High	High	High
13	Athens	High	High	Medium	Medium	Medium	High	Medium	Medium	Medium	Medium	Medium	High	Medium
14	Rome	Medium	High	Medium	Medium	High	High	High	High	High	High	High	High	Medium
15	Bucharest	Medium	Medium	Medium	Medium	Medium	High	High	High	High	High	High	High	High

Appendix Consolidated Source Register

Full data available [HERE](#).

¹⁰² European Urban Heat Transition Ranking — Consolidated Source Register and City Audit Files (2026).