



# European Green City Index

Assessing the environmental impact of Europe's major cities

A research project conducted by the Economist Intelligence Unit, sponsored by Siemens



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# The cities

The European Green City Index measures and rates the environmental performance of 30 leading European cities from 30 European countries. It takes into account 30 individual indicators per city, touching on a wide range of environmental areas, from environmental governance and water consumption to waste management and greenhouse gas emissions.





# Executive summary



**Why cities matter:** More than one-half of the world's population now lives in urban areas, but they are blamed for producing as much as 80% of humanity's greenhouse gas emissions. Furthermore, increasing urbanisation can negatively impact everything from the availability of arable land and vital green spaces to potable water and sanitary waste disposal facilities. Living in such close proximity tends to intensify the demands that urban settlements impose on their surrounding environments.

It is clear, then, that cities must be part of the solution if an urbanising world is to grapple successfully with ecological challenges such as climate change. In concentrated urban areas, it is possible for environmental economies of scale to reduce the impact of human beings on the earth. This has already started to happen in Europe. According to the UN Population Division, 72% of the continent's population is urban but the European Environment Agency (EEA) says that its cities and towns account for just 69% of energy use. This is achieved in a range of

ways, from increased use of public transport due to greater population density to smaller city dwellings that require less heating and lighting. Many European cities have demonstrated their commitment to reducing their environmental impact by joining the Covenant of Mayors, a European Commission initiative launched in January 2008 that asks mayors to commit to cutting carbon emissions by at least 20% by 2020. This is encouraging the creation — often for the very first time — of a formal plan for how cities can go about reducing their carbon impact, which bodes well for the future.

Of course, environmental performance inevitably varies from city to city, but some encouraging trends are emerging. Of the 30 diverse European cities covered by this study, nearly all had lower carbon dioxide (CO<sub>2</sub>) emissions per head than the overall EU27 average of 8.46 tonnes<sup>1</sup>. Part of this success comes from several advantages which European urban areas share. Compared to other regions of the world, the continent has enjoyed remarkable political

stability, with only the Balkan wars breaking the general peace of recent decades. Moreover, citizen awareness of the importance of protecting the environment and of green objectives has markedly increased in recent years. This is boosted in part by a growing body of environmentally focussed EU legislation.

But even in environmentally conscious Europe, problems abound. Across the cities profiled in this report, an average of one in three residents drive to work, contributing to increased CO<sub>2</sub> emissions and general air pollution. The average proportion of renewable energy consumed is just 7.3%, a long way short of the EU's stated goal of increasing the share of renewable energy usage to 20% by 2020. Nearly one in four litres of water consumed by cities is lost through leakage. And less than one fifth of overall waste is currently recycled. Moreover, encouraging environmentally helpful behavioural change is not a straightforward matter: cities often have little leverage to induce citizens, companies, or even other levels of gov-

ernment to modify their actions or policies. In particular, increased costs or taxes are usually met with scepticism, if not hostility. In the current financial situation, this difficulty may well grow. Although many green technologies help to reduce costs in the long run, immediate financial concerns may impede the greater upfront investment which they also frequently require.

**How the study was conducted:** To aid efforts and understanding in this field, the European Green City Index seeks to measure and rate the environmental performance of 30 leading European cities both overall and across a range of specific areas. In so doing, it offers a tool to enhance the understanding and decision-making abilities of all those interested in environmental performance, from individual citizens through to leading urban policymakers. The methodology was developed by the Economist Intelligence Unit in co-operation with Siemens. An independent panel of urban sustainability experts provided important insights and feed-

back on the methodology. This study is not the first comparison of the environmental impact of European cities, nor does it seek to supplant other worthwhile initiatives, such as the European Urban Ecosystem Survey or the European Green Capital Award. Instead, its value lies in the breadth of information provided and in the form in which it is presented. The index takes into account 30 individual indicators per city that touch on a wide range of environmental areas — from environmental governance and water consumption to waste management and greenhouse gas emissions — and ranks cities using a transparent, consistent and replicable scoring process. The relative scores assigned to individual cities (for performance in specific categories, as well as overall) is also unique to the index and allows for direct comparison between cities.

Of course, numbers alone only give part of the picture. To complement the core data within the index, this study also seeks to provide context, with in-depth city portraits that not only explain the challenges, strengths and weaknesses





es of each city, but also highlight emerging best practice and innovative ideas that others might wish to emulate.

The index also differs from other studies in the fact that it is independently researched, rather than being reliant on voluntary submissions from city governments. This has enabled us to cover 30 main cities — either political or business capitals — from 30 European countries.

The goal of the index is to allow key stakeholder groups — such as city administrators, policymakers, infrastructure providers, environmental non-governmental organisations (NGOs), urban sustainability experts, and citizens — to compare their city’s performance against others overall, and within each category. The index also allows for comparisons across cities clustered by a certain criteria, such as geographic region or income group. In short, this tool is provided in the hope that it will help European cities move towards being a bigger part of the solution to climate change and other environmental challenges.

# Key findings

**Highlights of the 2009 European Green City Index include the following:**

→ Nordic cities dominate the index top tier. Copenhagen leads the index overall, coming marginally ahead of Stockholm, while third-place Oslo rounds out a trio of Scandinavian cities on the medal podium. Fellow Nordic capital Helsinki follows in seventh place. Vienna, Amsterdam and Zurich occupy fourth, fifth and sixth places, respectively.

→ There is a strong correlation between wealth and a high overall ranking on the index. Nine of the top 10 cities in the index have a GDP per head (measured at purchasing power parity, PPP) of more than €31,000. In many ways, this is

unsurprising: wealthier cities can invest more heavily in energy-efficient infrastructure and afford specialist environmental managers, for example. Wealth isn’t everything, however: some individual cities punch above their weight within individual sub-categories: low-income Vilnius, for example, leads the air quality category; while Berlin, with a relatively low GDP per head, tops the buildings category and is ranked eighth overall.

→ Among east European cities (which also represent the low-income cities of the index, with GDP per head below €21,000), Vilnius performs best of all, ranked in 13th place. It is followed most closely by Riga, in 15th place. The rest of the east European cities rank at the bottom of the index. The wealth divide aside, these cities

also face the legacy of history, dealing with decades of environmental neglect during the communist period. This is most visible in the poorly insulated concrete-slab mass housing that was widely used, as well as the remains of highly polluting heavy industry. Although many have innovative ideas regarding specific environmental initiatives, such as a “lottery” in Ljubljana that promotes the sorting of waste for recycling, these cities must also balance with other pressing issues, ranging from unemployment and economic growth to informal settlements.

→ The index shows little overall correlation between city size and performance. However, the leading cities in both the East and the West do tend to be smaller, with populations of less than 1 million. To some degree, this makes sense: physically smaller cities make it easier for people to cycle or walk to work, for example. However, wealth, and more importantly experience, can overcome the difficulties of size as policies that take advantage of environmental economies of

scale, such as district heating or large public transport networks, come into their own. Accordingly, the index’s larger cities, with populations of 3 million or more, perform relatively well, generally occupying the top half of the rankings. Berlin does best overall (8th), followed closely by Paris (10th), London (11th) and Madrid (12th). This isn’t universal, though: Athens (22nd) and Istanbul (25th) both perform relatively poorly.

→ Cities with an active civil society perform well in the index. Although it was beyond the scope of this study to measure specific citizen engagement in environmental issues, a strong correlation exists between high-performing cities in this index and other independent studies that explore the strength of civil society in European countries. The rank of a country in the voluntary participation of citizens in organisations—from religious groups to professional and charitable bodies — was a strong predictor of the performance of that country’s main city in the European Green City Index. Of the applicable cities,

Copenhagen, Stockholm and Amsterdam featured in the top places in both lists, whereas Bucharest and Sofia fared poorly in both.

The complete results from the index, including both overall rankings and individual rankings within the eight sub-categories, follows next. For insights into what some of the leading cities have done to top the rankings within individual categories, specific case studies are available from page 22. Finally, detailed insights into the individual performances of all 30 cities included in the European Green City Index are available within the city portraits section of this report, starting on page 40. These explore both the current status within each city on all eight categories, while also highlighting past, current and planned future initiatives to improve their relative performance. The wealth and diversity of initiatives detailed here provide encouraging insights into the current directions that Europe’s main cities are taking and their varying paths towards a more sustainable future.



# The results

The complete results from the index, including the overall result of each city as well as the individual rankings within the eight categories.

Overall		CO <sub>2</sub>		Energy		Buildings		Transport		Water		Waste and land use		Air quality		Environmental governance	
City	Score	City	Score	City	Score	City	Score	City	Score	City	Score	City	Score	City	Score	City	Score
1 Copenhagen	87,31	1 Oslo	9,58	1 Oslo	8,71	=1 Berlin	9,44	1 Stockholm	8,81	1 Amsterdam	9,21	1 Amsterdam	8,98	1 Vilnius	9,37	=1 Brussels	10,00
2 Stockholm	86,65	2 Stockholm	8,99	2 Copenhagen	8,69	=1 Stockholm	9,44	2 Amsterdam	8,44	2 Vienna	9,13	2 Zurich	8,82	2 Stockholm	9,35	=1 Copenhagen	10,00
3 Oslo	83,98	3 Zurich	8,48	3 Vienna	7,76	3 Oslo	9,22	3 Copenhagen	8,29	3 Berlin	9,12	3 Helsinki	8,69	3 Helsinki	8,84	=1 Helsinki	10,00
4 Vienna	83,34	4 Copenhagen	8,35	4 Stockholm	7,61	4 Copenhagen	9,17	4 Vienna	8,00	4 Brussels	9,05	4 Berlin	8,63	4 Dublin	8,62	=1 Stockholm	10,00
5 Amsterdam	83,03	5 Brussels	8,32	5 Amsterdam	7,08	5 Helsinki	9,11	5 Oslo	7,92	=5 Copenhagen	8,88	5 Vienna	8,60	5 Copenhagen	8,43	=5 Oslo	9,67
6 Zurich	82,31	6 Paris	7,81	6 Zurich	6,92	6 Amsterdam	9,01	6 Zurich	7,83	=5 Zurich	8,88	6 Oslo	8,23	6 Tallinn	8,30	=5 Warsaw	9,67
7 Helsinki	79,29	7 Rome	7,57	7 Rome	6,40	7 Paris	8,96	7 Brussels	7,49	7 Madrid	8,59	7 Copenhagen	8,05	7 Riga	8,28	=7 Paris	9,44
8 Berlin	79,01	8 Vienna	7,53	8 Brussels	6,19	8 Vienna	8,62	8 Bratislava	7,16	8 London	8,58	8 Stockholm	7,99	8 Berlin	7,86	=7 Vienna	9,44
9 Brussels	78,01	9 Madrid	7,51	9 Lisbon	5,77	9 Zurich	8,43	9 Helsinki	7,08	9 Paris	8,55	9 Vilnius	7,31	9 Zurich	7,70	9 Berlin	9,33
10 Paris	73,21	10 London	7,34	10 London	5,64	10 London	7,96	=10 Budapest	6,64	10 Prague	8,39	10 Brussels	7,26	10 Vienna	7,59	10 Amsterdam	9,11
11 London	71,56	11 Helsinki	7,30	11 Istanbul	5,55	11 Lisbon	7,34	=10 Tallinn	6,64	11 Helsinki	7,92	11 London	7,16	11 Amsterdam	7,48	11 Zurich	8,78
12 Madrid	67,08	12 Amsterdam	7,10	12 Madrid	5,52	12 Brussels	7,14	12 Berlin	6,60	12 Tallinn	7,90	12 Paris	6,72	12 London	7,34	12 Lisbon	8,22
13 Vilnius	62,77	13 Berlin	6,75	13 Berlin	5,48	13 Vilnius	6,91	13 Ljubljana	6,17	13 Vilnius	7,71	13 Dublin	6,38	13 Paris	7,14	=13 Budapest	8,00
14 Rome	62,58	14 Ljubljana	6,67	14 Warsaw	5,29	14 Sofia	6,25	14 Riga	6,16	14 Bratislava	7,65	14 Prague	6,30	14 Ljubljana	7,03	=13 Madrid	8,00
15 Riga	59,57	15 Riga	5,55	15 Athens	4,94	15 Rome	6,16	15 Madrid	6,01	15 Athens	7,26	15 Budapest	6,27	15 Oslo	7,00	=15 Ljubljana	7,67
16 Warsaw	59,04	16 Istanbul	4,86	16 Paris	4,66	16 Warsaw	5,99	16 London	5,55	=16 Dublin	7,14	16 Tallinn	6,15	16 Brussels	6,95	=15 London	7,67
17 Budapest	57,55	=17 Athens	4,85	17 Belgrade	4,65	17 Madrid	5,68	17 Athens	5,48	=16 Stockholm	7,14	17 Rome	5,96	17 Rome	6,56	17 Vilnius	7,33
18 Lisbon	57,25	=17 Budapest	4,85	18 Dublin	4,55	18 Riga	5,43	18 Rome	5,31	18 Budapest	6,97	18 Ljubljana	5,95	18 Madrid	6,52	18 Tallinn	7,22
19 Ljubljana	56,39	19 Dublin	4,77	19 Helsinki	4,49	19 Ljubljana	5,20	=19 Kiev	5,29	19 Rome	6,88	19 Madrid	5,85	19 Warsaw	6,45	19 Riga	6,56
20 Bratislava	56,09	20 Warsaw	4,65	20 Zagreb	4,34	20 Budapest	5,01	=19 Paris	5,29	20 Oslo	6,85	20 Riga	5,72	20 Prague	6,37	20 Bratislava	6,22
21 Dublin	53,98	21 Bratislava	4,54	21 Bratislava	4,19	21 Bucharest	4,79	=19 Vilnius	5,29	21 Riga	6,43	21 Bratislava	5,60	21 Bratislava	5,96	=21 Athens	5,44
22 Athens	53,09	22 Lisbon	4,05	22 Riga	3,53	22 Athens	4,36	=19 Zagreb	5,29	22 Kiev	5,96	22 Lisbon	5,34	22 Budapest	5,85	=21 Dublin	5,44
23 Tallinn	52,98	23 Vilnius	3,91	23 Bucharest	3,42	23 Bratislava	3,54	23 Istanbul	5,12	23 Istanbul	5,59	23 Athens	5,33	23 Istanbul	5,56	=23 Kiev	5,22
24 Prague	49,78	24 Bucharest	3,65	24 Prague	3,26	24 Dublin	3,39	24 Warsaw	5,11	24 Lisbon	5,42	24 Warsaw	5,17	24 Lisbon	4,93	=23 Rome	5,22
25 Istanbul	45,20	25 Prague	3,44	25 Budapest	2,43	25 Zagreb	3,29	25 Lisbon	4,73	25 Warsaw	4,90	25 Istanbul	4,86	25 Athens	4,82	25 Belgrade	4,67
26 Zagreb	42,36	26 Tallinn	3,40	26 Vilnius	2,39	26 Prague	3,14	26 Prague	4,71	26 Zagreb	4,43	26 Belgrade	4,30	26 Zagreb	4,74	26 Zagreb	4,56
27 Belgrade	40,03	27 Zagreb	3,20	27 Ljubljana	2,23	27 Belgrade	2,89	27 Sofia	4,62	27 Ljubljana	4,19	27 Zagreb	4,04	27 Bucharest	4,54	27 Prague	4,22
28 Bucharest	39,14	28 Belgrade	3,15	28 Sofia	2,16	28 Istanbul	1,51	28 Bucharest	4,55	28 Bucharest	4,07	28 Bucharest	3,62	28 Belgrade	4,48	28 Sofia	3,89
29 Sofia	36,85	29 Sofia	2,95	29 Tallinn	1,70	29 Tallinn	1,06	29 Belgrade	3,98	29 Belgrade	3,90	29 Sofia	3,32	29 Sofia	4,45	29 Istanbul	3,11
30 Kiev	32,33	30 Kiev	2,49	30 Kiev	1,50	30 Kiev	0,00	30 Dublin	2,89	30 Sofia	1,83	30 Kiev	1,43	30 Kiev	3,97	30 Bucharest	2,67



# Analysis of city trends



The European Green City Index makes an effort to quantify and compare environmental performance. Analysing the results more deeply reveals relationships and factors which help to explain why some cities are more successful in a range of environmental areas than others. In particular, the data strongly suggest the following key correlations:

**Wealth matters:** → *The European Green City Index shows a close correlation between wealth and overall performance.*  
→ *This link is not only evident in infrastructure, but also in policy: richer cities appear more ambitious with their goals.*

One of the closest correlations in the data collected for the index is that between the GDP per head of cities and their overall score — an aggregate figure between 0 and 100 reflecting performance across all the environmental indicators measured. Although greater pollution is often associated with economic development, at least in early stages, the reverse holds true in

urban Europe where most economic growth is oriented towards services-led industries. Here, an increase in average output per person of €1,000 seems to yield a gain of two-thirds of a point in a city's overall index score — a relationship that on its own explains up to two-thirds of the variance between cities.

At an infrastructure level, the link is obvious. High-quality green infrastructure typically involves up-front costs that wealthier governments can better afford. Conversely, poorer cities must simultaneously grapple with a wider range of development issues, from unemployment levels to growing informal settlements, which can easily distract from a green agenda.

But a further finding is that the link between GDP and the policy indicators within the index (which track environmental action plans and public participation in green policy, among other things) is statistically even stronger. In other words, wealthier cities are not only able to afford more sustainable infrastructure, they are also setting more ambitious policy goals than

their less wealthy peers. To give but one example, two of the three cities that lack even a basic environmental plan are also two of the three poorest.

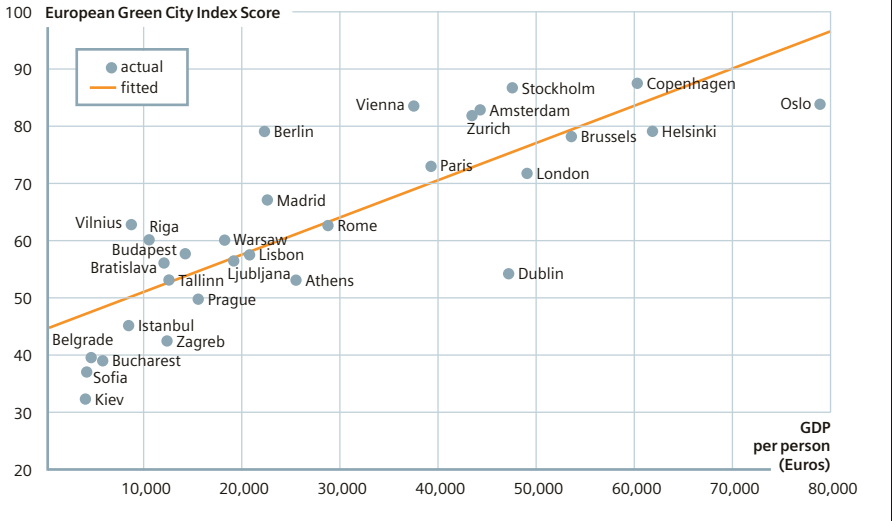
“Money is extremely important,” says Pedro Ballesteros Torres, principal administrator at the European Commission’s Directorate-General for Energy and Transport and in charge of the Covenant of Mayors. “Normally, the most advanced cities in environmental terms in Europe are also the richest. When you have a good infrastructure, it is easier to implement things.”

It need not be this way. As the city portraits later in this report show, Berlin, with only a mid-level GDP per capita, has a score that benefits from advanced policy in various areas, and Warsaw, while in the bottom half of the wealth table, is ranked in joint-fifth place in the environmental governance category. Moreover, while costs may constrain certain policy options, they do not do so in general. “Money is in some ways very difficult,” admits Outi Väkevä, part of

Helsinki’s Air Protection Group, “but it is possible to do quite a lot without having to pay more.” She notes that energy efficiency, for example, can save money and cut emissions. Similarly, Guttorm Grundt, Environment Coordinator in Oslo’s Department of Transport, Environment and Business, agrees that Oslo’s relative wealth helps, but notes that measures such as eco-certification are not expensive, and that the city’s own efforts to lead by example in increasing the efficiency of buildings and vehicles “is saving us money, together with reducing consumption and waste.” Mr Grundt adds that the link may be indirect. A relatively wealthy place like Oslo does not have certain policy concerns – there are no slums for example – which poorer cities need to address, drawing on time and resources which richer peers might use elsewhere.

The tie between money and environmental performance, however, looks set to grow stronger as a result of the current economic downturn. Ms Väkevä notes that even relatively well-off Helsinki has little money to devote to

The link between wealth and environmental performance







the expansion of current environmental efforts. The city portraits for this report note specifically that cities as far apart as Dublin, Budapest and Belgrade are likely to scale back because of current economic troubles, and others will doubtless be doing so as well. It remains to be seen how cities will balance maximising the benefits of enhanced environmental performance while minimising the financial costs in the near term.

**History matters: infrastructure and attitudes:**

→ *Cities in eastern Europe have a tougher challenge to overcome, in terms of their relatively aged and inefficient infrastructure.*

→ *Historical attitudes and aspirations are also difficult to overcome. For example, the adoption of consumer culture in the East has led, understandably, to greater demand for vehicles.*

Twenty years ago, the Berlin wall fell and Europe moved toward binding the wounds inflicted from a turbulent century. While there has been much progress on the political and economic levels, there remains a marked envi-

ronmental effect from the former divide between East and West. Thirteen of the top 15 index performers are in western Europe; 11 of the bottom 15 were part of the old eastern bloc.

Aside from the wealth divide, this also has to do with legacy. As the city portraits show, various eastern cities are still dealing with the fallout from decades of environmental neglect during the communist period: for example, even though polluting industries have mostly disappeared in the face of market competition, poorly insulated, concrete-slab, mass housing remains. In Belgrade's case, its relatively recent international isolation — it was embargoed for years and eventually bombed in 1999 — only adds to the difficulty. Similarly, certain bureaucratic habits can also outlive the transition to democracy. "People (in the east) are ready to learn and change things quickly, but the inertia is quite heavy," argues Mr Ballesteros Torres.

On the other hand, if three Nordic cities are jostling each other for the overall leading position in the index, it is because they have a legacy

that is the mirror image of the east. As the city portraits note, Copenhagen has been taking environmental issues and sustainable energy seriously since the oil shock of the 1970s; Stockholm also has a long tradition, and is now on its sixth consecutive environmental plan.

As with wealth, history has a variety of impacts, some less obvious than others. Infrastructure — whether building stock, transport facilities, or water pipes — develops over the long term, and is hard to change quickly. Longevity of systems does not seem to matter so much as upkeep.

For example, Vienna's and Ljubljana's water systems both date back to the late 1800s, but the former city comes in second in the water category, and the latter 27th. Whatever the difficulties — practical and financial — of upgrading physical assets, however, infrastructure age is certainly not decisive. Copenhagen's buildings, for example, are among the most energy-efficient anywhere, even though only 7% were built in the last 20 years, and Berlin — the joint leader

in the index's building category — has had tremendous success in retrofitting housing stock, including nearly halving the energy use of 273,000 concrete-slab buildings in the eastern part of the city. Looking forward, Oslo's efforts to provide charging points for electric cars and Vienna's to promote vehicles that run on natural gas are both creative ways to use existing infrastructure — in this case roads — in a more environmentally friendly way.

More difficult to change than the physical environment are the attitudes and aspirations of individual citizens. With so much of a city's environmental performance reliant on how its residents act individually, in groups and as a whole, winning hearts and minds is crucial (see next section). Accordingly, one area of concern is how the legacy of suppressed demand in the countries of eastern Europe, after decades of being economically less well off than their western neighbours, may play out. As these communities get wealthier, some citizens may use newfound wealth to make choices that impact nega-

tively on the environment choices. For example, many eastern urban areas — including the top five performers in this metric — score highly in the index on the number of people taking public transport to work while Copenhagen, Stockholm and Oslo are amongst the lowest scorers.

This superior eastern performance, however, seems less a result of enlightened environmental choice than a lack of alternatives, and there are signs that the balance may be shifting. Bratislava is a case in point. The city has the highest share of people taking public transport to work but has also seen a surge in newly registered cars in the last decade. Tallinn, Zagreb, Ljubljana, and Prague all have similar news, and the Mayor of Vilnius cites this increased car usage as his city's leading environmental challenge.

**People matter:** → *The individual decisions of cities' inhabitants are, collectively, more powerful than their governments' ability to intervene.*

→ *Accordingly, there is a correlation between*

*citizen engagement and environmental performance.*

Good environmental results generally do not happen by chance. European governments, for example, have had to regulate private carbon use through carbon trading because existing economic markets did not price the negative externalities of carbon emission. Even with such efforts, green choices sometimes still have a higher price tag than other options, especially in the short term. Moreover, city administrations, on their own, have relatively limited power. The sum of the individual decisions of their residents — from actions such as choosing to insulate their homes, to opting to commute to work via public transport — have a deeper impact on the environment than an army of policies. According to a 2008 report produced by Siemens in conjunction with McKinsey & Company and the Economist Intelligence Unit<sup>2</sup>, about three-quarters of the existing technological changes that would help London to meet its long-term carbon reduction targets depended on the decisions of

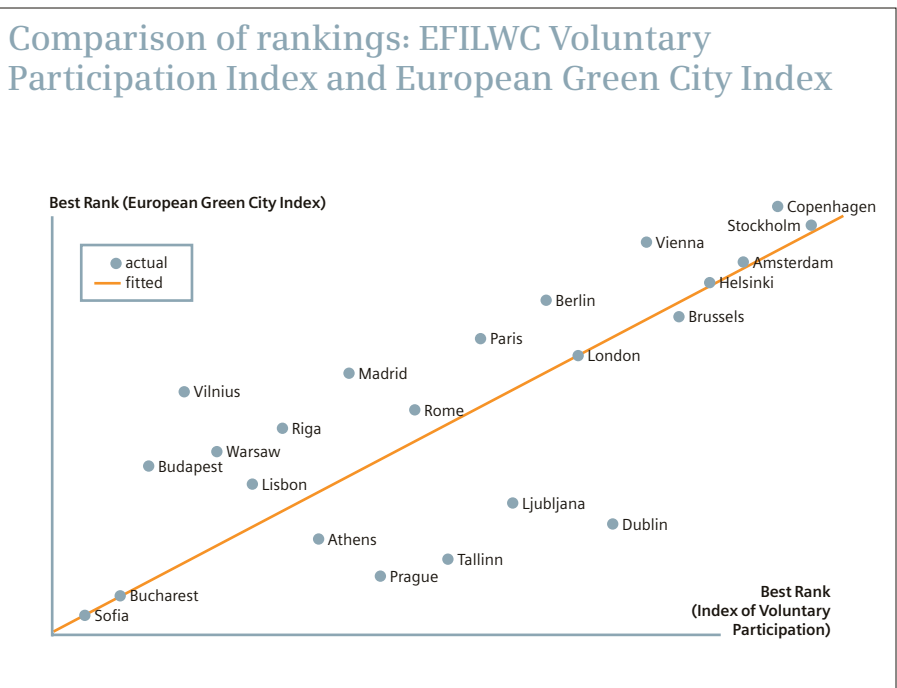




citizens or companies, not of governments. As a result, the engagement of individuals with societies around them — or the strength of civil society in a city — has a strong link to environmental performance.

This link is underscored by comparing the results of the European Green City Index with an independent report from the European Foundation for the Improvement of Living and Working Conditions (EFILWC)<sup>3</sup>. The Foundation's 2006 study looked specifically at participation in civil society, based on a wide-ranging survey of European citizens. As part of this study, the Foundation created two indices. One was of voluntary participation in organisations (based on the average number of voluntary organisations, such as religious groups, trade unions and sports, professional or charitable bodies that citizens belonged to), which is a useful proxy for the strength of civil society.

The second was of political participation (based on the proportion of citizens engaging in political activities, such as voting, attending



meetings or contacting officials). Twenty-three of the countries in these indices contain cities that are included in the European Green City Index. A comparison between these indices yields two interesting findings. The first is a relatively low correlation between the level of political participation and a city's environmental performance. The second is a high correlation between voluntary participation and a city's environmental performance. In other words, while political engagement is not closely linked to environmental strength, an active civil society is extremely important. City leaders hoping to improve their city's overall performance would do well to explore ways of engaging more closely with their citizens.

**Size matters — at first:** → *Although there is little correlation between city size and performance in the index overall, the leading cities do tend to be smaller in both the East and the West* → *Among east European cities, however, there is a correlation between larger populations and*

*poorer performance. Each additional 120,000 inhabitants correlates, approximately, with a score that is one point lower*

Greater city size could be either a drawback or an advantage in this index. All things being equal, a given environment should be able to handle the emissions and activities of a million people more easily than those of ten million — the wind could blow the resultant air pollutants away more quickly and waste would build up more slowly. On the other hand, larger cities can benefit from economies of scale, having greater collective resources to pursue policies or create greener infrastructure.

At first glance, there seems to be little link between the size and population of cities and their index performance, with smaller ones scattered between Copenhagen at number one (with a population of about half a million) and Zagreb at twenty-six (with a population of about three-quarters of a million). Individual metrics also demonstrate few links with size, except that those cities with lower populations may be

slightly more likely to have people walk or cycle to work — the average distance obviously being less in a physically smaller place. Even here, however, the correlation is weak.

Looking at eastern and western cities separately, however, it becomes clearer that small urban areas have some advantage. The highest scores in the survey overall, belong to smaller western cities (Copenhagen, Stockholm and Oslo), and the top performers in the old east, Vilnius and Riga, are also on the small side for that grouping. All of these cities have populations of less than one million people. For east European cities, there is an identifiable correlation between higher population and poorer index performance. Onehundred and twenty thousand more people leads to, roughly, one less point. In particular, an increase in population has a noticeable negative effect on scores for measures of air pollutants and carbon dioxide intensity. Nature's greater ability to cope with the environmental demands of small cities than of large ones remains relevant in these urban areas.

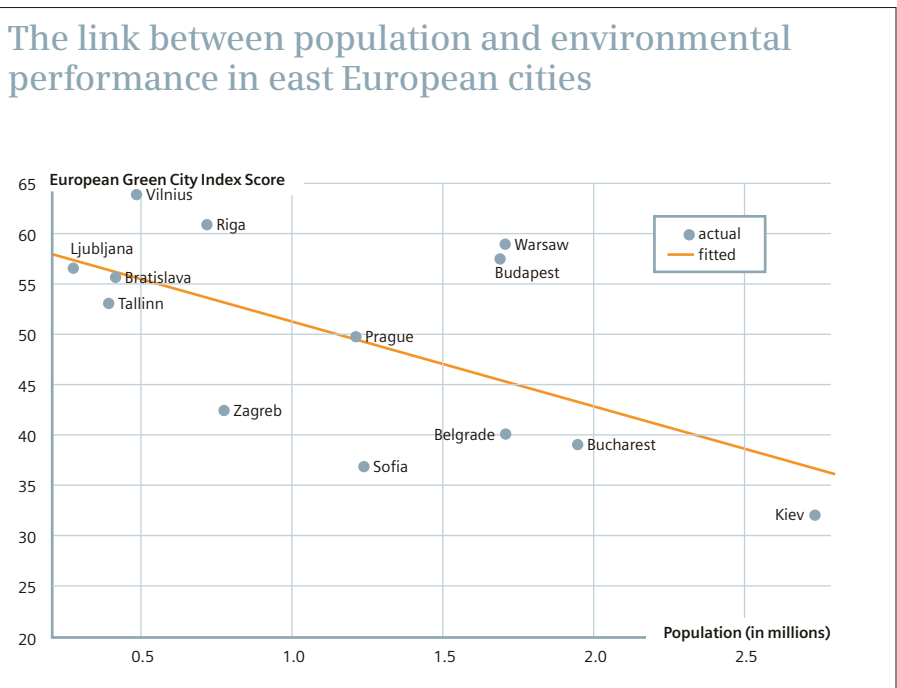




In western cities the effect, if still present, is residual. The statistical significance of the link is very low, and it takes nearly a million extra people before a city's score goes down a point. The explanation for the strong correlation in east European cities is likely — again — to be historical. Eastern cities have less experience with environmental policy.

The disadvantages of greater size, while present initially, may be possible to overcome as larger cities gain more experience in environmental management. "Some smaller cities are doing very well because at one moment or another there were leaders who decided policy and there was a consensus among the population in order to make things exemplary," says Mr Ballesteros Torres. "In absolute and statistical terms, large cities have more resources, and some are doing particularly well."

**Europe matters: public funding and culture:** → Accession to the EU has had a huge positive impact in energising environmental policy.



→ EU funding is a crucial factor in enabling low-income cities to improve their environmental performance.

This study highlights ways in which Europe — both through its institutions and more amor- phously as a community — is having an impor- tant impact on urban environmental performance. The first, very practical contribution of European institutions is cash. As noted above, there is an important link between money, at the very least for investment, and environmental success. As the city portraits show, inter alia, the EU is providing funding for water plants in Budapest and Vilnius, as well as for Prague's ring road; the European Investment Bank (EIB) is helping with Tallinn's water supply and sewage systems; and the European Bank for Reconstruction and Development is providing finance for the reha- bilitation of Zagreb's largest landfill site. As the downturn hits city budgets more deeply, such assistance will be more important.

The expansion of the EU is also having an impact, with EU environmental law now cover- ing a huge portion of the continent. Broad Euro- pean goals, such as the EU's 20-20-20 goal of cutting carbon emissions, increasing renew- ables and cutting energy consumption are also driving change. The requirements of accession have led to the adoption of much more advanced environmental legislation and policy in all of the newest eastern members of the Union in recent years, as they did for south Euro- pean entrants before them. It is having a similar effect on candidate countries and it may be no accident that the one eastern city whose coun- try is not yet an EU accession candidate scores worst in the survey.

In addition to the force of law, voluntary insti- tutions have been developing that seek to har- ness and increase a growing sense that environ- mental stewardship is part of what is expected from a modern European city. The European Sustainable Cities and Towns campaign, for example, dates back to 1994, and its 2004 Aal- borg Commitments on a series of sustainability issues have been signed by over 600 European

urban governments large and small. The EU is now tapping into the same sentiment. In early 2008 it launched the Covenant of Mayors, which focuses specifically on matters of climate change and sustainable energy. The covenant too has over 600 signatories and, as several of the city portraits later in this report show, the very fact of membership is committing a num- ber of cities to put forward sustainable energy plans for the first time.

Ultimately, although money spent on physi- cal infrastructure is important, it is this increas- ingly pervasive notion that responsible and effective environmental governance ought to be the norm for all European countries that could provide the long-term political foundation which green efforts need for success.

**Location matters:** → Environmental sustain- ability depends as much on the resources avail- able as how they are used.

A problem of any comparative environmen- tal index is that the natural resources available,





and the robustness of the local ecology, can differ markedly from place to place. Sustainability involves, to quote the Brundtland Report<sup>4</sup>, a study from the UN's World Commission on Environment and Development on sustainable development, meeting “the needs of the present without compromising the ability of future generations to meet their own needs.” Behaviour that might exhaust resources rapidly in one place, then, may be perfectly sustainable in another, making comparative scores harder to interpret.

Two examples from high performers in the index illustrate the point. Stockholm, with the second-highest overall score, is ranked a surprising 16th place when it comes to water. The problem is not sewage, which it treats and even uses as a source of energy, nor leakages, which are below average. Instead, residents simply use a lot of water, and the city makes little effort to discourage them. While this behaviour might be problematic in hot, dry cities, such as Madrid, or even in London, which receives less rainfall per head than Addis Ababa, it poses less of a con-

cern in Stockholm where fresh water is plentiful and therefore even the high levels of current use are sustainable.

In the related fields of carbon emissions and energy use, location might seem less important because released CO<sub>2</sub> contributes to the global problem of climate change. However, some issues remain. Oslo, for example, is ranked joint 24th in the index for the amount of energy used — one of several sub-indicators that go into scoring the energy category, where the city comes first overall. On the other hand, the overwhelming majority of this power, including all the electricity and much of the district heating, comes from renewable sources, in particular hydroelectricity and waste. The city does have an energy efficiency fund, which seeks to reduce power usage, but the question does arise of just how important it is to cut consumption of entirely green energy rather than focussing on other areas. Mr Grundt agrees: “As long as Norway cannot export much of its abundant hydroelectricity, and we have enough, it is not a press-

ing problem. But when we get better integrated into the European grid, it becomes important.”

**Looking ahead: implementing sustainable cities:** Cities have an array of options or levers at their disposal when it comes to the task of improving their overall environmental performance. First, policy and good environmental governance clearly play an important role. These help ensure that new buildings and infrastructure are developed (or retrofitted) with certain minimum efficiency standards in mind, for example. They also encourage (either through incentives, or through penalties) citizens to change their behaviour, such as the establishment of a congestion charge to reduce traffic or a subsidised bicycle scheme to promote affordable alternative means of commuting. At a different level, by ensuring that green spaces and other areas are off limits to further development, city leaders can ensure that the natural environment remains preserved within the city's boundaries.

Second, technology can help cities to reduce

their environmental impact. This encompasses areas where a city administration can lead the way, as well as measures which the residents of a city will have to implement themselves. The aforementioned *Sustainable Urban Infrastructure: London Edition* study highlighted that simply by improving building insulation, using energy-efficient lighting and appliances, and installing more advanced environmental controls in structures, London could move over one-quarter of the way towards its overall aspiration of reducing carbon emissions by 60% by 2025. Over a 20-year lifecycle, the upfront investments required for these technologies would more than pay back in the form of reduced energy bills.

More advanced capabilities can go even further: Amsterdam's state of the art waste-to-energy plant achieves high levels of energy efficiency that allow it to power more than three-quarters of the city's households. It can even profitably extract gold and other metals from the resultant ash, while sending just 1% of the original waste to landfill.

Of course, not all technologies are cost-effective. The study referenced above showed that in the context of London hybrid cars and photovoltaic panels on houses are expensive relative to the impact they make on carbon reductions, for example. Also, the economics of some technologies are often dependent on the policies that accompany them, such as the subsidies required to support the generation of solar energy in many countries.

Third, as shown above, engaging and motivating communities within cities is also critical to delivering increased sustainability. Education and public awareness are important here, giving people the necessary information to help them make greener choices. This can come in many forms and go well beyond the basics of publishing advice. For example, a number of cities in the index have rolled out water meters and smart electricity meters, thus giving consumers a means of quantifying their own consumption and choosing to be more careful about how much they use.

This engagement isn't necessarily a one-way process: citizens often lead the way, encouraging city leaders and others to embrace change. In Oslo, for example, early adopters of electric cars banded together and lobbied the city government to waive tolls and parking fees and allow access to the city's dedicated public transport lanes. Whatever form it takes, this engagement is critical. Ritt Bjerregaard, Lord Mayor of Copenhagen, the top ranked city in the index, points out that for the city to reach its climate change goals, citizens themselves have to change their habits. “Campaigns to motivate lifestyle change are an important tool. We are also working hard to involve the citizens in developing solutions to the problems.”

The next section of this report, Lessons from the leaders, highlights the work that Copenhagen and other leading cities in the index are doing across a range of key categories to improve their relative environmental performance.



# CO<sub>2</sub> emissions



It would be easy to be complacent about greenhouse gas emissions in Oslo. The city's carbon dioxide (CO<sub>2</sub>) emissions per head, at 2.2 tonnes, are less than one-half of the 30-city average of about 5 tonnes — itself lower than the overall EU27 average of 8.46 tonnes. The city benefits from its local natural resources: high levels of rainfall, along with a mountainous countryside, provide significant opportunity for clean hydroelectric power. This is a boon in Oslo's efforts to reduce CO<sub>2</sub> emissions. As a result, Oslo's emissions per unit of GDP, at 20.2 tonnes per million euros, are paltry compared with the average across the study of around 356 tonnes or the broader European figure of more than 339 tonnes. Simply put, if Europe as a whole were to perform as well as Oslo, it would surpass its overall carbon reduction targets.

Nevertheless, Oslo is at the top of the CO<sub>2</sub> emissions category because it has not been satisfied with its natural advantages, but has instead drawn on leadership initiatives and a range of sticks and carrots to increase its suc-

cess. To begin with, Oslo has set itself one of the most ambitious carbon reduction targets in the index: aiming to reduce emissions by 50% from 1990 levels by 2030, or a further 37.5% from today. Guttorm Grundt, the environmental affairs co-ordinator in Oslo's Department of Transport, Environment and Business, remarks that such long-term goals are very helpful in keeping progress on track.

The city administration has also tried to put its own house in order. "To be credible we have to act as a good example: 60 % of the city's own car fleet, for example, has no or very low (greenhouse gas) emissions," says Mr Grundt. The city is even planning to use of biofuels derived from human waste in its buses in 2012.

To spur residents to reduce their CO<sub>2</sub> emissions, Oslo provides both penalties and incentives. It has promoted district heating, use of which expanded by 36% between 2000 and 2006, and which relies largely on biofuels and the city's carbon-free electricity. Progress was initially the result of regulatory fiat: Oslo gave a

monopoly to a district heating company, which it largely owned, to provide all heat to any new or thoroughly renovated buildings by refusing permits to any construction plan that had other sources of supply. At the same time, it required municipal buildings to convert to district heating and exerted strong moral pressure on other public institutions such as hospitals and universities. Mr Grundt says that others are now seeking the service for commercial reasons. "More and more private owners and developers are joining," he notes. "The prices are not much cheaper, but district heating involves a lot less maintenance."

The city has also taken an active role in reducing transport-related CO<sub>2</sub> emissions. Here, the stick — in the form of Oslo's congestion charge — has had some effect, cutting existing traffic by between 4% and 7% since its introduction. Moreover, the charge has stopped private vehicle travel from increasing in line with the city's fast growing population.

For those residents who wish to continue driving, despite Oslo's good public transport,

another emission-reduction strategy is the switching of fuels. The city is encouraging the use of electric and hybrid cars through various inducements, including the waiving of city tolls and parking charges, as well as the establishment of electric charging points. "It started with the enthusiasts," notes Mr Grundt. "They formed an association and put pressure on the politicians to change the rules." One key step was allowing commuters with electric or hybrid vehicles to drive in the city's dedicated public transport lanes. As a result, the Oslo region now has about 1,700 electric-only vehicles, excluding hybrid cars.

Other strategies have also made judicious use of taxes and inducements. The city's €100 million Climate and Energy Fund, for example, was funded by a tax on local electricity. Among other things, it now provides a 50% grant for the conversion of oil heaters to ones powered by biofuels. With similar national grants in place, Mr Grundt argues that there is "no excuse left not to change."

## Ideas from other cities

**Berlin's** renewable energy focus is on solar power. Among the city's many initiatives is Europe's largest photovoltaic system on a residential building, which produces 25,000 kwh annually.

**Helsinki** now has the world's largest heat pump, under centrally located Katri Vala Park. It uses heat from wastewater and seawater to provide district heating and cooling.

In January 2008, **Madrid** approved a €14 million Ecobarrio project to revitalise several run-down neighbourhoods. These will include a thermoelectric plant using biogas from urban waste treatment and buildings that capture solar power.

In **Paris**, Aéroports de Paris has launched an intra-company car-sharing network. If just 5% of airport employees use the network regularly, it will save around 4,000 tonnes of CO<sub>2</sub> emissions.

**Copenhagen** has set an ambitious goal of becoming carbon neutral by 2025, building on its existing climate plan which targets 50 specific initiatives in energy production, transport, buildings and consumption.



# Buildings



When it comes to buildings, no city can start from scratch: each has to work with the legacy of generations. An unattributed quote, meant for humorous effect, captures the problem neatly: “Our problem is that the buildings from 100 years ago were built to last 100 years; the buildings of 50 years ago were built to last 50 years; and the buildings of 20 years ago were built to last 20 years.”

This highlights one of the key difficulties in reducing the environmental impact of buildings. Take Berlin, the category co-leader: since 1990, the reunified city has had to find ways to shift the carbon requirements of a host of building types towards a more sustainable level. One obvious place to start is not with the buildings themselves, but with the kind of energy powering them.

The city’s heating modernisation programme, for example, encouraged a substantial shift in fuel source through grants, advice and tighter regulation on new buildings. In 1990, over 400,000 apartments still had coal furnaces; by 2005, the number had dropped to just 60,000. Most of the shift was towards cleaner, although still carbon releasing, natural gas.

While improving the energy mix, Berlin has also attempted to address the deficiencies of some of its buildings. It has not been so much a case of making do with existing infrastructure, but rather improving to make it greener. An “Energy Saving Partnership”, for example, has

private companies improving the energy efficiency of public buildings with both the contractors and the city benefiting from the cost savings. So far, the scheme has led to €60 million in private investment, saved the city €2.4 million in costs, and brought carbon emissions down by 600,000 tonnes.

An even bigger effect has come from the city’s efforts to improve what local experts call the once “ramshackle” flats built of prefabricated concrete under the previous East German regime. Of the 273,000 apartments, the city has fully refurbished about two-thirds of them, and partially upgraded the other 35%, at an average cost of €20,000.

Not all of this goes to better energy efficiency. It is a broad-ranging programme to increase the attractiveness of these properties: about 5% of spending, for example, goes on the surroundings. Energy efficiency is, however, an important consideration.

According to Peter Wollschläger of the Berlin Senate Department of Urban Development, the

city has found that the optimal, cost-effective measures for saving heat energy are insulation of the outer walls and top floor ceiling; new air-tight windows; and renovation of the building’s heating system. These three measures reduce annual carbon emissions by between 1 and 1.4 tonnes per flat.

However, Mr Wollschläger points out that even over the long term the energy savings do not pay the entire cost of the refurbishment of these flats. The benefits extend beyond energy savings, however, such as lower maintenance costs for these flats given that the improvements reduce mould and mildew, as well as keeping temperatures more even. Quite simply, they are nicer places to live.

The lessons which the city has learned could have a substantial impact worldwide. Across central and eastern Europe, the city estimates that there are nearly 50 million flats of similar construction, and in China there are about 200 million.

Between 2005 and 2007, through the Baltic

Energy Efficiency Network for Building Stock (BEEN), Berlin shared its knowledge with cities in Poland and the Baltic states and worked with them on understanding how best to finance such renovation. Now the EU is funding the Urb Energy project to take things further, looking not just at individual buildings but at urban infrastructure and holistic rehabilitation of whole residential areas.

By contrast, Stockholm, the other joint leader in the buildings category, has been at the forefront of energy-efficient building standards for some time. The city benefits from its extensive use of heat pumps, which make more efficient use of electricity for heating. Insulation standards are also high. All this pays off: Sweden has years of experience building homes with a total annual energy consumption of well below 2,000 kwh, despite its cold climate. By contrast, new houses built in the UK that comply with the country’s latest energy-related building standards will consume an average of about 3,600 kwh.

## Ideas from other cities

From April 2010, **London** will start a trial scheme for retrofitting homes to save energy, providing some energy-efficiency equipment for free, such as low-energy light bulbs and standby switches, while charging for more advanced measures.

Residents of **Prague** can benefit from a national Czech programme for retrofitting buildings with a €1 billion budget, which is financed from a sale of CO<sub>2</sub> emission permits to Japan.

In 2001, **Vienna** began permitting the construction of multi-storey buildings made primarily of timber. This has helped to bring about the development of a new kind of environmentally friendly passive housing.



# Transport



City transport is one of the key areas where cities have a direct ability to influence the choices that residents make in how they commute. This is most obviously done through the make-up and extensiveness of public transport, but consumers can also be directly encouraged to do more walking and cycling (the greenest possible options) through the provision of dedicated cycle paths, pedestrianised areas and bicycle subsidies. In Stockholm, the index's leader in environmentally friendly transport, three important building blocks come together: the ability of residents to easily access public or private alternatives that are green, safe and convenient; government policy that encourages use of such alternatives; and the application of green technology solutions to vehicles and infrastructure.

**Opportunity:** To begin with, in the promotion of walking and cycling, Stockholm excels. For every square kilometre, it has over four kilometres of cycle lanes, a figure second only to Helsinki. This, combined with Stockholm's small

size, allows an astonishing 68% of people to cycle or walk to work, even though it has the second-lowest average temperature of any city in the index. Nor does a relatively small public transport network unduly restrict use: intelligent city planning has created a network which takes one-quarter of people to work each day, leaving only about 7% using private vehicles. This is even more marked at peak times: Stockholm Public Transport (SL), the county council-owned transport company, reports that over three-quarters of rush hour journeys into Stockholm's centre use its services. Looking forward, the €1.7 billion Citybanan project will double rail capacity. At the same time, Stefan Wallin, SL's environmental manager, explains that it is trying to make travel easier for customers with efforts to provide real-time information on waiting times for buses and trains and a commitment to make all of SL's vehicles accessible for the handicapped by next year.

**Policy:** Stockholm made permanent a trial con-

gestion tax on vehicles driving in the central part of the city in August 2007, with the support of residents there but over the objections of those living in outer areas. It has certainly had an effect on car use, reducing the number of cars entering or leaving the zone by about 20%. According to Mr Wallin, the tax also raised the number of daily travellers on SL by approximately 5%. Income from the tax is used to reduce congestion and improve the environment in the city. Equally important, the city does not just forbid driving, there is universal political support for providing a green public alternative so that people have a genuine choice. "Almost regardless of political colour," Mr Wallin says, "politicians are quite keen to put their mark on sustainable development. We are continuously pushed by political pressure to come up with new solutions."

Amsterdam, which came second in the transport category, also has a mix of restrictions and encouragements. There, geography and policy combine to make cycling one of the leading ways to get around. In addition to creating spe-

cial cycling zones where cars are banned, the city also tries to make cycling easier. This includes everything from giving cyclists information on traffic flows to free, secure parking to prevent bicycle theft — a serious problem in the city.

**Technology:** Other cities are using congestion charges, and Mr Wallin notes that many of Stockholm's strategies to make travel easier, while important, "are probably not very original." What sets the city apart is its experimentation with new technology. One of SL's environmental principles is to "actively participate in, initiate and push on the development of an eco-adapted transport system." It is no accident that SL has one of the largest fleets of ethanol buses in the world: it has been using the technology since 1989. Mr Wallin explains: "I have a picture on my office wall which shows ten different bus types we have tested — battery buses, flywheel buses, fuel cell buses, old versions of ethanol buses. SL has been almost an engineer's playground." Its current targets include having one-half of its

buses running on renewable fuel by 2011, and all of them by 2025. Meanwhile, the city's Trafik Stockholm system constantly gathers data from a wide range of sources about the state of traffic. It then not only provides the analysed information to drivers to help them choose their routes, it also adjusts traffic lights or uses variable road signs to reduce congestion. Advanced technology can be expensive. Mr Wallin notes that pioneering is particularly costly. "You have to pay the prices for problems you could not foresee when you start up." Over time, the relative cost premium of green technology has been coming down and will continue to do so as it matures, he adds, but in Stockholm's case it has still not completely disappeared. Even with 20 years' experience, for example, it remains more expensive to run ethanol than standard diesel buses. Being a public company, however, gives SL the opportunity to pursue green solutions because such spending is a political choice, and, says Mr Wallin "so far the political view is that we are ready to pay that premium."

## Ideas from other cities

**Budapest** held a "Clever Commuting Race" where local VIPs demonstrated the efficiency of travelling via public transport, by "racing" from a suburban district to the city centre.

**Brussels** supports "Voiture avec Passagers", a formalised hitch-hiking scheme.

**Dublin's** "Bike to Work" scheme allows employers to divert up to €1,000 in wages on behalf of employees for the purchase of a bicycle. This money is subsequently not taxed, leading to up to a 47% savings on the price of a bicycle for the employee.

**Tallinn** is fitting buses with electronic equipment to alert traffic lights to their approach and give them speedier passage through intersections.



# Waste



Amsterdam and Zurich come in first and second respectively in the waste category of the index (which also encompasses land use). The reasons for their success in waste management, however, differ greatly and show how communities can take various paths to the same end.

Zurich's strength in recent decades has been waste reduction. As early as 1985, the city decided that it could not continue to incinerate all the garbage that it was producing. It chose to place the cost of dealing with waste on producers.

Since the early 1990s residents have had to use specially purchased "Zueri-sacks" to dispose of all rubbish or face substantial fines. The sacks are sold in local stores, with costs varying on the size of the sack, giving a significant incentive to throw out as little as possible and to use one of the many free collection points across the city for recyclable materials. Within three years, waste production in the city dropped by 24%. Now Zurich creates only 406 kg of garbage per resident, well below the index average of 511 kg and putting the city in fourth place among those in the index. At the same time, it recycles 34% of waste, the fourth best figure in that category.

Despite various public information campaigns, Amsterdam does only modestly well at waste reduction: its actual levels of waste production per resident, at 487 kg, is below average, but it still ranks 17th out of the 30 cities in the index. Instead, the city's strength is in what it does with the garbage. As Carolien Gehrels, an Amsterdam City Council Alderwoman whose areas of responsibility include waste management,

explains: "We always say 'garbage is gold.' Waste is not a problem but a valuable raw material." This begins with recycling: the city recycles 43% of all its waste, second only to Helsinki, and Ms Gehrels notes that for household waste the overall Dutch and Amsterdam figure is 64%. She sees three reasons for success here. One is the city's ongoing efforts to raise public awareness. A second is tradition: given how long it takes to reform people's habits, Ms Gehrels believes the fact that the Dutch have been separating their garbage already for decades is important for achieving consistently high levels of participation. A third is ensuring that sorting and recycling is very easy, with collection points on nearly every street corner.

Other cities have similar, if less successful, recycling efforts. But what really sets Amsterdam apart is its use of non-recyclable waste. The city has been incinerating waste for over 90 years, and Amsterdam's Waste and Energy Company (AEB) has become a leader in waste-to-energy technology. Its newly built power plant,

with some 30 process innovations developed in-house, has the world's highest energy efficiency for a waste-powered facility, at 30%. The company produces enough energy to power more than three-quarters of Amsterdam's households, and provide 300,000 gigajoules of district heat, reducing CO<sub>2</sub> production in the city by 470 kilotonnes. The resultant ash is richer in minerals than most mine ore, and AEB is able to profitably recover various metals, including iron and gold, and sell most of the rest as raw material for buildings. Only 1% of the 1.4 million tonnes of waste entering the system goes to landfill. The city eventually hopes to go further, and move from a waste management approach to sustainable material and energy cycles. Ms Gehrels says that it is important for AEB to be at the cutting edge of technology to give it a competitive advantage. However, she argues that what is really needed now to allow such development to flourish is a level playing field in Europe, with an open market and a common European standard for energy from waste. AEB, she notes, makes a

good, profitable return using its technology and approach (despite high upfront investment costs), yet it is not allowed to compete for processing waste generated in Germany, for example, while German companies can take Dutch waste. Everyone needs to play by the same rules to have an "honest chance that your investment will have the right return."

Amsterdam and Zurich are not polar opposites: the former is increasing its use of waste-powered district heating, and the latter still sees waste prevention as the most environmentally friendly approach to the issue. Nevertheless, the different emphasis by each may be no accident. Ms Gehrels notes that scale is important in getting energy from waste, although she adds that smaller municipalities can work with others within the same region. It is likely to be easier for smaller cities to make an impact by focusing on reduction. Nevertheless, the two examples do show that treating waste as a problem and as a resource both have their place in urban environmental management.

## Ideas from other cities

The recently established **London** Waste and Recycling Board has created a "dating agency" to attract companies interested in using different kinds of waste for either fuel or recycling.

**Ljubljana** introduced a lottery in late 2008 to encourage recycling. A household or office recycling bin is randomly selected to win money—if it contains the correct type of waste.

**Vienna** has created the Vienna Repair Network, a group of over 50 repair shops which people are encouraged to visit rather than throwing away broken goods. "Frequent user" cards give customers a discount on every fourth item repaired.



# Water



Water management has been central to Amsterdam's existence for centuries. At an elevation of just two metres and with some surrounding countryside below sea level, the area has been shaped for centuries by its association with the sea and, more recently, the IJsselmeer, a lake. As a result, the city's relationship with water is deeply ingrained, and is reflected in its overall first place ranking in the index. One of its

obvious strengths is its low water consumption. It uses just 53.5 cubic metres per person, the second-lowest figure among cities in the index and half the overall per head average of 105 cubic metres.

There is, however, no single easy answer as to why this figure is so low. An obvious start is simply keeping control of leaks. Here the Dutch city comes first in the survey with only 3.5% of

water lost to seepage, tiny compared with the overall index average of nearly 23%. Jan van der Hoek, executive officer at Waternet, Amsterdam's water company, explains that this low rate has been achieved through the use of good materials, and intensive maintenance, as well as the city's beneficial geography, which allows for relatively low pressure in its pipes thanks to the limited height variation. Berlin, the third-placed city in the water category, shows the importance of leak management. Its overall leakage is not far behind Amsterdam's at 5.2%. This is a result of significant efforts to address the problems which surfaced in the eastern part of the city before unification and in the years immediately afterwards. Burst pipes there tripled between 1965 and 1995, but since that year have dropped by nearly one-half. This helps to explain how total supply requirements have gone from about 292 million cubic metres in 1991 to about 196 million in 2007.

Another strategy in both cities is metering water usage. Mr van der Hoek says that over

one-half of households in Amsterdam are metered, a process that started in 1998. Completing the job will take much longer, as the easy locations have been hooked up and the more difficult ones, such as rooms within houses, remain. It is worth the effort, however. The price itself may not make water use prohibitive, but awareness of the extent of consumption in itself has a positive effect and nobody wishes to pay for wasted water. Mr van der Hoek explains that the very fact of installing a meter leads to an average reduction in household water use of 10-15%. He adds that people are happy with metering: "They see that they pay for what they use."

In fact, Amsterdam's position illustrates how water consumption is an area where city governments and companies can do relatively little beyond public education and the use of charges to give an incentive to reduce consumption. Mr van der Hoek explains that his organisation does not have many instruments to affect consumer behaviour.

Prices are kept low for what is a human necessity and, he says, making the link to sustainable development in the popular mind is difficult as there is no mental tie between waste or over-consumption and the consumer's carbon footprint, even though water transport and wastewater treatment do cause a carbon impact.

Even so, Amsterdam is not resting on its laurels. During 2009, it is instituting differential pricing, based on the time of day, to encourage more evenly distributed water use. Waternet is also looking to water's contribution to broader sustainability issues, reducing the emissions associated with pumping water around the city and processing waste water.

"One of the main challenges is to make the whole water system climate neutral," adds Mr van der Hoek.

To achieve this goal, Waternet is seeking to use renewable sources of energy, while also generating energy from the sludge from sewage treatment.

## Ideas from other cities

By 2013, waste water will be used to clean all of **Lisbon's** streets and water all of its green spaces.

**Sofia** is carrying out an integrated water improvement plan addressing a range of issues, including purification, leakage and treatment.

**Tallinn's** water company is "biomanipulating" Lake Ulemiste — the city's water source — to improve the quality of drinking water. This long-term project involves increasing native fish diversity, and re-establishing a healthier ecological balance in the lake.

**Warsaw's** new sewage works will be able to provide not only biogas for heat, but also fertiliser for sale to farmers.



# Interview



## with Ritt Bjerregaard, Lord Mayor of Copenhagen

*Ritt Bjerregaard, a former Danish cabinet minister and European commissioner for the environment, is now Lord Mayor of the city at the top of the European Green City Index Copenhagen. We talked to her about the city's environmental successes and challenges.*

**What are the biggest factors contributing to your city's broad success in so many areas of environmental performance?**

We are quite unique when it comes to bicycles and district heating. Today, nearly 40% of Copenhageners ride their bikes when they go to work or school, and more than 97% of all Copenhageners have district heating. We are very proud of that.

**Conversely, what are the biggest environmental challenges your city is currently facing, and how do you hope to address them?**

Traffic is the biggest challenge. The number of private cars is growing, and this means higher CO<sub>2</sub> emissions and more air pollution. Today, traffic is responsible for 20% of the city's carbon emissions. We will reduce private use of cars by offering people good opportunities to walk, cycle or use public transport. I have also worked hard to introduce a congestion charge such as they

have in Stockholm, but the national government hasn't allowed it yet.

**Copenhagen has been addressing environmental issues and sustainability since at least the 1970s. How helpful is having a long tradition in this area?**

Yes, that is very important. In Copenhagen, the water in the harbour is so clean that you can even swim in it. We have only achieved this by years of hard work. Also, if you take our high number of bicycles, I am quite sure we have reached this by investing in better infrastructure and bike lanes over the years.

**How important is getting citizens on board?**

A large proportion of the city's carbon emissions is generated by Copenhageners themselves. So if we want to reach our goal, then Copenhageners must change their daily habits. Campaigns to motivate lifestyle change are an important

tool. We are also working hard to involve the citizens in developing solutions to the problems.

**Similarly, how important are integrated plans, and especially city targets—such as carbon emissions reduction targets—in trying to bring about environmental improvements?**

Plans and targets help you to set an ambitious goal but, of course, a target is not enough. It must be followed by action.

**What role do international environmental commitments which cities make through the various environmental city organisations play?**

It is very important that cities stand together and that we learn from each other. More than 75% of the world's CO<sub>2</sub> emissions are produced by the world's cities. As former European commissioner for the environment, I took part in the negotiations in Kyoto in 1997.

Back then the cities did not play a role; we did not even consider it. One of the reasons for this might be that cities did not then stand together with one strong voice. This has changed.

Today, I am very proud that Copenhagen has become an exemplary C40 city (a group of the world's largest cities committed to tackling climate change) in its work to fight climate change.

I am even more proud of the fact that Copenhagen and the C40 are gathering 100 mayors from the world's largest cities for the "Copenhagen Climate Summit for Mayors" in parallel to the UN Climate Change Conference this December.

**What are Copenhagen's big environmental goals in the coming years?**

We want to be the first capital city in the world to be completely carbon neutral, by 2025. Already by 2015 we want a 20% reduction in emissions. This means hard work but I am sure we will reach our goal.



# Interview



## with Vilius Navickas, Mayor of Vilnius

*Vilnius is ranked in 13th position overall in the European Green City Index, but is first from eastern Europe. We talked to the Mayor, Vilius Navickas, an engineer by training, about some of the environmental challenges facing the city and its goals.*

**Vilnius has done very well among east European cities, but as a group these cities seem to lag behind in terms of environmental performance. What are the particular environmental challenges in your region?**

After the collapse of the Soviet Union, when east Europeans moved towards democracy and the free market, the region experienced many significant changes, including the loss of Eastern markets. It is a paradox that the resulting economic downturn played a positive environmental role. In Lithuania, for example, a number of heavy industrial companies shut down, as a result of which there was less pollution and the water quality in Lithuanian rivers and lakes improved.

The rapid economic growth of the last decade, on the other hand, has posed new challenges for urban areas. Because the transport infrastructure in Vilnius has not been designed for its increasing number of cars, for example, traffic jams have become one of its biggest problems,

and are among our biggest environmental issues today. We have to find ways to encourage the use of public transport and bicycles.

**What are the biggest environmental challenges your city is currently facing, and how do you hope to address them?**

We are using EU structural funds to widen streets, install modern traffic systems and build bypasses. We will introduce a payment system for cars going through the Old Town of Vilnius — UNESCO Protected Site — as it cannot tolerate intensive traffic. The municipality also plans to turn Vilnius into a bicycle capital like Amsterdam or Copenhagen. We are investing in bicycle routes and parking facilities, and in 2010 a bicycle rental system will become operational along the lines used in a number of west European towns. These should all help to reduce traffic jams and air pollution.

Another important challenge for Vilnius is waste management. A comprehensive waste

management infrastructure has been created: old landfills have been closed; a new regional landfill, in line with the EU requirements, has been set up; a construction waste management enterprise has been established; and organic waste is sorted and processed separately.

**To what extent is cost a barrier to better environmental performance for your city, and how are you addressing it?**

It goes without saying that the city must allocate huge funds for environmental protection: although infrastructure is expensive, it is necessary. The question of funding is particularly relevant now, at a time of economic recession. In carrying out environmental and ecological projects, we therefore look for the most effective ways of funding. The EU offers favourable conditions for the funding of environmental projects and therefore we use it. The municipality also looks for other sources of funding. For instance, seeking to renovate Sereikiskes Park we have proposed to

businesspeople that they should sponsor certain spaces. Both sides benefit. The city gets a well-managed environment and the company can give its name to the site.

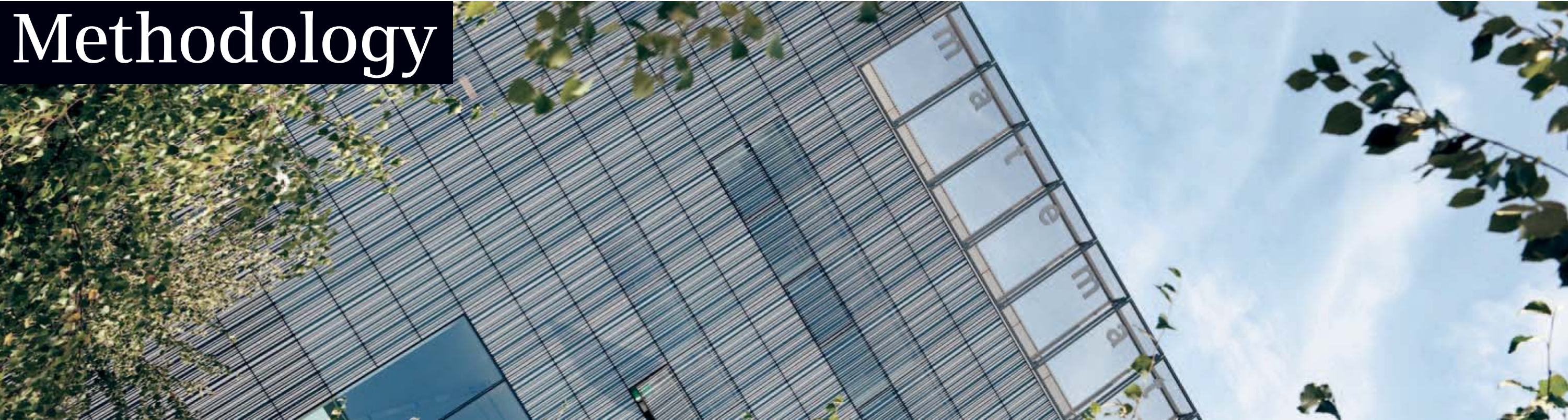
**What are the big environmental goals you would like to see Vilnius try to achieve in the coming years?**

In 2008, a new action plan for the reduction of air pollution was adopted. We also hope to develop a system of rapid public transport, and more city buses will run on natural gas and biofuel. In addition to the bicycle measures mentioned earlier, the central part of the city will have a broadened network of pedestrian zones that will be made accessible for all, including the disabled.

Also, although visitors to Vilnius always say that our city is green — surrounded by many forests and parks — we have the objective to make it even greener. Today we have 20 square metres of green space for every resident, and our goal is to increase this to 24 square metres.



# Methodology



The European Green City Index measures the current environmental performance of major European cities, as well as their commitment to reducing their future environmental impact by way of ongoing initiatives and objectives. The methodology was developed by the Economist Intelligence Unit in cooperation with Siemens. An independent panel of urban sustainability experts provided important insights and feedback on the methodology.

The Index scores cities across eight categories — CO<sub>2</sub> emissions, energy, buildings, transport, water, waste and land use, air quality and environmental governance — and 30 individual indicators. Sixteen of the index's 30 indicators are derived from quantitative data and aim to measure how a city is currently performing — for example, its level of CO<sub>2</sub> emissions, the amount of energy it consumes, how much waste it produces or levels of air pollution. The remaining 14 indicators are qualitative assessments of cities' aspirations or ambitions — for example, their commitment to consuming more renewable energy, to improving the energy efficiency of buildings, to reducing congestion or to recycling and reusing waste.

**Data sources:** A team of in-house and external contributors from the Economist Intelligence Unit collected data for the index over the period February to August 2009. Wherever possible, publicly available data from official sources have been used. Primary sources included national sta-

tistical offices, local city authorities, and city and national environmental bureaux. In most cases data are for the year 2007, which is the latest year available for most indicators, given the time needed to collect, record and publish official data.

Where gaps in the data existed, the Economist Intelligence Unit produced estimates from national averages. The CO<sub>2</sub> and energy categories deserve special mention here. Owing to a lack of statistical resources, around one-third of the 30 cities do not measure the full amount of energy consumed in their city, or the associated CO<sub>2</sub> emissions. In most cases, the cities calculate only how much energy is consumed from electricity, gas and district heating (if applicable), since such data are fairly easily attainable from distribution companies. But on average, such data miss around 30% of energy consumed, particularly from liquid fuels consumed in the transport sector. However, as part of their Kyoto commitments, all countries included within the study must report national data on energy consumption across all sources, as well as associat-

ed CO<sub>2</sub> emissions. For those cities with missing data, the Economist Intelligence Unit took national per-head averages of other types of energy consumption, and used the city's population data to create an estimate for overall energy consumption. To calculate associated CO<sub>2</sub> emissions for the city, the project team adopted a widely accepted (albeit crude) technique of using national CO<sub>2</sub> emissions factors associated with the combustion of each energy source.

**Indicators:** In order to be able to compare data points across countries, as well as to construct aggregate scores for each city, the project team had first to make the gathered data comparable.

To do so, the quantitative indicators were "normalised" on a scale of 0 to 10, where 10 points were assigned to cities that met or exceeded certain criteria on environmental performance. Cities were scored either against an upper benchmark or lower benchmark. Benchmark targets were chosen from international or European directives. For example, an upper

## Clusters

In order to conduct deeper analysis of the city trends, the 30 cities in the index were clustered into a series of groups, calculated on income, temperature and size. These included:

- **Income:** "low income", with GDP per head of less than €21,000; "middle income" of €21,000 to €31,000; and "high income" of more than €31,000;
- **Temperature:** "cold", with an average temperature of 4-8 degree Celsius; "temperate", with an average temperature of 9-12 degrees Celsius; and "hot", with an average temperature of more than 13 degrees Celsius;
- **Size:** "small", with a population of less than 1 million; "middle-sized", with a population of between 1 million and 3 million; and "large", with a population of more than 3 million.





benchmark of 50% was set for the amount of waste cities should aim to recycle, which is in line with the EU’s 2020 target for recycling waste. Cities that met or exceeded this benchmark scored 10 points, and the rest received a score between 0 and 10, based on their distance away from the target. For other indicators, lower benchmarks were set, such as for the maximum amount of pollutants cities should emit on an average daily basis (for example, 40 ug/m<sup>2</sup> in the case of nitrogen dioxide). In such cases, any city scoring the same or higher than the benchmark received a score of 0, while the city furthest below the benchmark scored 10. Remaining cities received a score according to their distance away from the best-performing city.

Where no targets existed, the cities were scored instead using a min-max calculation, where the score is the standard deviation from the mean, with the best city scoring 10 points and the worst scoring 0 points. In some cases, reasonable benchmarks were inserted to prevent outliers from skewing the distribution of

indicators assigned to the other cities. Qualitative indicators were scored by Economist Intelligence Unit analysts with expertise in the city in question, based on objective scoring criteria that considered concrete actions, strategies and targets being taken and set by cities. The qualitative indicators were again scored on a scale of 0 to 10, with 10 points assigned to cities that met or exceeded the check-list of criteria. In the case of the “CO<sub>2</sub> reduction strategy” indicator, for example, cities were assessed according to whether they actively and regularly monitor CO<sub>2</sub> emissions, what targets have been set and how ambitious they are, given the time period within which they are supposed to be met. The independent expert panel provided input into the criteria assigned to each indicator.

**Index construction:** The index is composed of aggregate scores of all of the underlying indicators. The index is first aggregated by category — creating a score for each area of infrastructure and policy (for example, energy) — and finally,

overall, based on the composite of the underlying category scores. To create the category scores, each underlying indicator was aggregated according to an assigned weighting. In general, most indicators receive the same weighting — or importance — in the index. The category scores were then rebased onto a scale of 0 to 10. To build the overall index scores, the Economist Intelligence Unit assigned even weightings on each category score — that is, no category is lent greater importance than another, and the index is essentially the sum of all category scores, rebased out of 100. This equal weighting reflects feedback from the expert panel, as well as wider research on measuring environmental sustainability, which indicated that all categories in this index merit equal weighting.

List of categories, indicators and their weightings					
Category	Indicator	Type	Weighting	Description	Normalisation technique
CO <sub>2</sub>	CO <sub>2</sub> emissions	Quantitative	33%	Total CO <sub>2</sub> emissions, in tonnes per head.	Min-max.
	CO <sub>2</sub> intensity	Quantitative	33%	Total CO <sub>2</sub> emissions, in grams per unit of real GDP (2000 base year).	Min-max; lower benchmark of 1,000 grams inserted to prevent outliers.
	CO <sub>2</sub> reduction strategy	Qualitative	33%	An assessment of the ambitiousness of CO <sub>2</sub> emissions reduction strategy.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Energy	Energy consumption	Quantitative	25%	Total final energy consumption, in gigajoules per head.	Min-max.
	Energy intensity	Quantitative	25%	Total final energy consumption, in megajoules per unit of real GDP (in euros, base year 2000).	Min-max; lower benchmark of 8MJ/EGDP inserted to prevent outliers.
	Renewable energy consumption	Quantitative	25%	The percentage of total energy derived from renewable sources, as a share of the city's total energy consumption, in terajoules.	Scored against an upper benchmark of 20% (EU target).
	Clean and efficient energy policies	Qualitative	25%	An assessment of the extensiveness of policies promoting the use of clean and efficient energy.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Buildings	Energy consumption of residential buildings	Quantitative	33%	Total final energy consumption in the residential sector, per square metre of residential floor space.	Min-max.
	Energy-efficient buildings standards	Qualitative	33%	An assessment the extensiveness of cities’ energy efficiency standards for buildings.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Energy-efficient buildings initiatives	Qualitative	33%	An assessment of the extensiveness of efforts to promote energy efficiency of buildings.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Trans- port	Use of non-car transport	Quantitative	29%	The total percentage of the working population travelling to work on public transport, by bicycle and by foot.	Converted to a scale of 0 to 10.
	Size of non-car transport network	Quantitative	14%	Length of cycling lanes and the public transport network, in km per square metre of city area.	Min-max. Upper benchmarks of 4 km/km <sup>2</sup> and 5 km/km <sup>2</sup> inserted to prevent outliers.
	Green transport promotion	Qualitative	29%	An assessment of the extensiveness of efforts to increase the use of cleaner transport.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Congestion reduction policies	Qualitative	29%	An assessment of efforts to reduce vehicle traffic within the city.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Water	Water consumption	Quantitative	25%	Total annual water consumption, in cubic metres per head.	Min-max.
	Water system leakages	Quantitative	25%	Percentage of water lost in the water distribution system.	Scored against an upper target of 5%.
	Wastewater treatment	Quantitative	25%	Percentage of dwellings connected to the sewage system.	Scored against an upper benchmark of 100% and a lower benchmark of 80%.
	Water efficiency and treatment policies	Qualitative	25%	An assessment of the comprehensiveness of measures to improve the efficiency of water usage and the treatment of wastewater.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Waste and land use	Municipal waste production	Quantitative	25%	Total annual municipal waste collected, in kg per head.	Scored against an upper benchmark of 300 kg (EU target). A lower benchmark of 1,000 kg inserted to prevent outliers.
	Waste recycling	Quantitative	25%	Percentage of municipal waste recycled.	Scored against an upper benchmark of 50% (EU target).
	Waste reduction and policies	Qualitative	25%	An assessment of the extensiveness of measures to reduce the overall production of waste, and to recycle and reuse waste.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Green land use policies	Qualitative	25%	An assessment of the comprehensiveness of policies to contain the urban sprawl and promote the availability of green spaces.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
Air quality	Nitrogen dioxide	Quantitative	20%	Annual daily mean of NO <sub>2</sub> emissions.	Scored against a lower benchmark of 40 ug/m <sup>3</sup> (EU target).
	Ozone	Quantitative	20%	Annual daily mean of O <sub>3</sub> emissions.	Scored against a lower benchmark of 120 ug/m <sup>3</sup> (EU target).
	Particulate matter	Quantitative	20%	Annual daily mean of PM <sup>10</sup> emissions.	Scored against a lower benchmark of 50 ug/m <sup>3</sup> (EU target).
	Sulphur dioxide	Quantitative	20%	Annual daily mean of SO <sub>2</sub> emissions.	Scored against a lower benchmark of 40 ug/m <sup>3</sup> (EU target).
Environ- mental gover- nance	Clean air policies	Qualitative	20%	An assessment of the extensiveness of policies to improve air quality.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Green action plan	Qualitative	33%	An assessment of the ambitiousness and comprehensiveness of strategies to improve and monitor environmental performance.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Green management	Qualitative	33%	An assessment of the management of environmental issues and commitment to achieving international environmental standards.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.
	Public participation in green policy	Qualitative	33%	An assessment of the extent to which citizens may participate in environmental decision-making.	Scored by Economist Intelligence Unit analysts on a scale of 0 to 10.



# Amsterdam\_Netherlands



### Select city data

Population:	743,000
GDP per head, PPP:	€ 41,443
CO <sub>2</sub> emissions per head:	6.66 tonnes
Energy consumption per head:	74.51 gigajoules
Percentage of renewable energy consumed by the city:	5.8 %
Total percentage of citizens walking, cycling or taking public transport to work:	62 %
Annual water consumption per head:	53.47 m <sup>3</sup>
Share of waste recycled:	43 %

Amsterdam is the Netherlands’ largest city, with just 750,000 inhabitants. The city is the business and financial centre of the country, with a wide range of business services. There is little manufacturing in Amsterdam itself, but there is considerable industry beyond the city borders. Amsterdam is ranked fifth

overall in the European Green City Index, with a score of 83.03 out of 100. It ranks highest out of all cities for water and also for waste and land use. Even in its weaker categories its performance is still strong. Like many of the index’s best performers, Amsterdam has a fairly small population, allowing it to address environmental concerns with a tighter focus.

**CO<sub>2</sub> emissions:** Amsterdam’s worst performance is in the category carbon dioxide (CO<sub>2</sub>) emissions, at 12th out of 30. The city’s main weak spot is CO<sub>2</sub> emissions per head, which at 6.7 tonnes per inhabitant per year is among the highest levels measured and well above the average of 5 tonnes. Most emissions are caused by transport, with industry and building heating also contributing.

**Initiatives:** The city is targeting an aggressive reduction of 40% in its emissions by 2025 (compared with 1990 levels), equivalent to a reduction of 34% by 2020, far beyond the EU target of a 20% reduction by 2020.

**Energy:** Amsterdam ranks fifth in energy. The Netherlands’ primary energy sources are natural gas, coal and oil, although the country also has significant installed wind capacity. Amsterdam’s energy consumption per head per year (at 74.5 gigajoules) is slightly below the average of 81 gigajoules. The city performs better in terms of energy consumption per unit of GDP, at 1.7 megajoules per euro (compared with an average of 5.2 megajoules), and it is among the top scorers for policies promoting clean and efficient energy use. Nearly 6% of the energy that the city consumes is sourced from renewables, just below the average of 7.3%.

**Initiatives:** Amsterdam has one of the most energy-efficient district heating networks in Europe. Most of the heat is produced by the Waste and Energy Company, by converting biomass and biogas derived from waste and sewage into heat and electricity.

**Buildings:** Amsterdam ranks sixth for buildings. The city’s stock is old, but it is providing incen-

tives for renovation to a higher level of energy efficiency. There are also energy-efficiency requirements for new constructions. In terms of the energy consumption of residential buildings, Amsterdam ranks 12th, with a consumption of 720 megajoules per square metre (below the average of 909 megajoules), a level that the city is working to reduce.

**Initiatives:** Amsterdam runs an alliance in cooperation with local housing corporations. These are required to employ energy-saving and energy-efficient measures across their housing portfolios, and especially in new-build housing.

**Transport:** Amsterdam ranks second for transport. As the city is criss-crossed by canals, there is little heavy road traffic and a large number of pedestrian zones and cycle paths. Public transport is provided by bus, tram, canal boat and local trains. Amsterdam boasts 3.2 km of public transport network per square km and 2.8 km of cycle lanes per square km. Walking or cycling is used for 38% of journeys and public transport for 24%.

**Water:** The city is ranked number one for water.



Amsterdam is served by numerous canals and is protected from the sea only by a system of polders (dams). But despite an abundance of water, consumption per head is low, at about 53 cubic metres per inhabitant per year, one-half of the average consumption level of 105 cubic metres. In terms of leakages Amsterdam is the best-performing city, losing just 3.5% of water, compared with an average of 22.6%.

**Initiatives:** The city is working to fit every home with water meters, in order to make water use more efficient and equitable. The goal is to fit 300,000 homes by 2010, leaving 100,000 homes that are unsuitable for water meters — for these, alternative solutions are being sought.

**Waste and land use:** Amsterdam ranks first for waste and land use. The city recycles around 43% of its waste, second only to Helsinki, and is only a moderate producer of waste. In terms of land use, Amsterdam is a compact city. The Netherlands is densely populated and green spaces are highly protected; in Amsterdam this is covered by the Main Green Structure urban plan. A “wedge structure” provides green spaces that reach deep into the city from the surrounding green belt. The waterways around the city are another type of green space.

**Initiatives:** Much of the city bus network uses fuel from the Waste and Energy Company that is produced from waste.

**Air:** Amsterdam performs relatively poorly in this category for a city so committed to clean air, ranking 11th. The main pollutants are fine dust and nitrogen oxides. Amsterdam suffers particularly from its proximity to heavy industry in the Netherlands, Germany and Belgium, as well as from traffic congestion in the wider Randstad area.

**Initiatives:** The 2009 action plan on air quality aims to reduce transport bottlenecks, extend park-and-ride facilities and encourage electric



### Smart City Amsterdam

In mid-2009 Amsterdam launched Smart City Amsterdam, a collaborative project with its inhabitants and businesses. It will launch a series of environmental pilot schemes over a two year period, which if successful could be translated to national and European level. The schemes are intended to reduce energy consumption and reduce CO<sub>2</sub> emissions. The initial schemes include:

- for businesses, the establishment of a “climate street” in the city centre, which will combine smart meters, an energy feedback display, energy scans and smart plugs to encourage lower energy use; and
- shore power units that allow cargo vessels and river cruisers to connect to the electricity grid when in port, rather than using on-board diesel generators.

vehicles, among other targets, to enable Amsterdam to meet legal standards for particulate matter by 2010 and those for nitrogen dioxide by 2015.

**Environmental governance:** Amsterdam ranks tenth in green environmentalgovernance, but is within reach of the best performers. The city is strongly committed to improving its environmental performance, despite already leading the way in some fields. Amsterdam has a highly developed environmental action programme with measurable environmental goals and regular reviews. It suffers slightly on the level of public participation in developing and adopting these goals.





# Athens\_Greece



Although Greece’s capital, Athens, accounts for just under one-third of its total population, it contributed approximately one-half of the country’s GDP in 2007. As has occurred in other developed cities, there has been a shift from industrial production to business-related services, such as shipping and tourism, over the past decade. In 2001 industry accounted for 16.7% of total gross value added in Athens. By 2006 this figure had fallen to 13.2%.

Athens ranked 22nd out of 30 countries in the European Green Cities Index with a score of 53.09 out of 100. The city’s overall score was constrained by its air quality, its performance on waste and land use, and the green credentials of its buildings. However, its score was bolstered by its environmental policies on water and transport. Athens’ environmental programme is divided between the city and various ministries at the national level. With several overlapping jurisdictions, the city must often receive approval from a designated ministry in order to move ahead with an initiative, which can delay the planning and implementation of programmes.

**CO<sub>2</sub> emissions:** Precise data on carbon dioxide (CO<sub>2</sub>) emissions are not available for Athens, but based on estimates made from fuel combustion in the city, it ranks joint 17th overall, with



Budapest. It emits approximately 6 tonnes of CO<sub>2</sub> per inhabitant per year, slightly higher than the 30-city average of 5 tonnes. At the national level, the government aims to ensure that CO<sub>2</sub> emissions are no more than 25% higher in 2012 than they were in 1990.

**Initiatives:** Athens has been extending its subway train network since before the Olympic Games were held in the city in 2004, in order to reduce transport-related emissions.

**Energy:** Athens ranks 15th overall in energy, largely because of its high levels of energy con-

sumption per head — nearly 89 gigajoules per inhabitant in 2006, compared with a 30-city average of about 81 gigajoules. Less than 4% of Athens’s energy is derived from renewable sources, compared with the 30-city average of about 7%.

**Initiatives:** To boost the availability of renewable energy, around 270 wind turbines have been established around Athens, with a total capacity of around 160,000 kw.

**Buildings:** Athens ranks 22nd overall for buildings, in large part because of the city’s lack of energy-efficient building standards or incentives. With residential buildings consuming an estimated 695 megajoules per square metre per year, Athens ranks behind other cities with high average temperatures.

The city is also held back by an absence of energy-efficiency regulations for new buildings and incentives to construct efficient new buildings (or retrofit old ones).

**Initiatives:** Although not yet implemented, there is a bill under discussion at national level to introduce energy performance certificates.

**Transport:** Athens ranks 17th overall for trans-



2nd among cities with hot climates. The city consumes nearly 105 cubic metres per person per year, almost identical to the 30-city average. It ranks slightly worse than average for water system leakages, with an estimated leakage rate of 25% (the average is about 23%).

**Waste and land use:** Athens ranks 23rd for waste and land use, in large part because of its poor green land-use policies. It does score well (12th) for its municipal waste production, with around 465 kg of waste produced per inhabitant per year, below the 30-city average of 511 kg. The city has some strong initiatives under way to promote recycling activities. It also has a policy to contain sprawl in the city centre, but this does not apply to the suburbs. As a result, there is a significant degree of suburban sprawl.

**Initiatives:** Athens has highlighted recycling as the core of its environmental agenda. Separate bins have been provided for glass, metals and batteries since 2005.

**Air quality:** Athens ranks 25th overall for air quality. There is a daily public report on air pollution levels in Attica (Athens and its surrounding areas), measuring a range of emissions such as

Fluid education

The water utility, EYDAP, has hosted an educational programme called “The Water Cycle” since 2002. This programme is targeted at local students who visit the EYDAP headquarters, and aims to increase awareness about rational water-resource management and wastewater treatment. The educational programme includes a detailed overview of water supply and sewerage facilities in the city from ancient times to today, including information on the transfer of water from reservoirs to water treatment plants and the treatment of water to make it potable. The Water Cycle programme has helped to raise awareness among younger generations about the significance of water throughout Athens’s history and about how to reduce the wastage of water. EYDAP aims to use knowledge about water to stimulate interest among the city’s youth in environmental areas.

## Select city data

Population:	3.4 million
GDP per head, PPP:	€ 29,641
CO <sub>2</sub> emissions per head:	5.92 tonnes*
Energy consumption per head:	88.77 gigajoules*
Percentage of renewable energy consumed by the city:	2.66 %
Total percentage of citizens walking, cycling or taking public transport to work:	65.5 %
Annual water consumption per head:	106.88 m <sup>3</sup>
Share of waste recycled:	10 %

\* Estimate



port. The city has an extensive network of buses, many of which are fuelled by compressed natural gas (CNG), as well as yellow trolleys (electric trams). However, there is currently no network of cycle lanes or fast lanes for car-pooling. An estimated 56% of people take public transport to work, while a high degree of personal vehicle use persists, resulting in severe congestion.

**Initiatives:** Athens has converted about 20% of its fleet of some 2,000 buses to run on CNG, which reduces overall emissions.

**Water:** Athens ranks 15th overall for water and

nitrogen dioxide, sulphur dioxide and particulate matter. However, the government has not stipulated specific targets for air quality. While Athens has high nitrogen dioxide and particulate matter emissions, it has low levels of ozone emissions.

**Initiatives:** Athens has attempted to improve air quality by limiting traffic within the city. This has been achieved in part by allowing vehicles with odd-numbered licence plates into certain zones in the city on odd-numbered dates vehicles with even-numbered plates on even-numbered dates.

**Environmental governance:** Athens ranks 21st, along with Dublin, in environmental governance. The city’s environmental programme is divided between the city authorities and various ministries in the national government, creating some confusion with respect to the boundaries of jurisdictions. While there is a dedicated environmental authority in Athens, many issues relating to the environment are dealt with by the Athens division at the Ministry of the Environment or by the Ministry of Transport. Consequently, the city’s environmental programme is piecemeal and provides few actual targets.



# Belgrade\_serbia



## Select city data

Population:	1.7 million
GDP per head, PPP:	€ 12,780
CO <sub>2</sub> emissions per head:	3.85 tonnes*
Energy consumption per head:	41.07 gigajoules
Percentage of renewable energy consumed by the city:	8 %*
Total percentage of citizens walking, cycling or taking public transport to work:	75 %
Annual water consumption per head:	147.17 m <sup>3</sup>
Share of waste recycled:	0*

\* Estimate

Belgrade, the capital of Serbia and its largest city, has been rebuilt and developed into a major industrial centre in the post-war period. Belgrade is the most economically developed part of Serbia and its largest industrial centre, generating more than 30% of the country's GDP and accounting for 31% of national employment. Manufacturing accounts for about 25% of Belgrade's GDP. As Serbia is a potential candidate country for EU accession, Belgrade has added reason to increase its environmental improvement efforts.

Belgrade ranks 27th in the European Green City Index, with a score of 40.03 out of 100. The city's best performance is in the energy category, in which it is ranked 17th. Despite the absence of heavy industry in the city, decades of underinvestment — especially during the war years of the 1990s — have had a detrimental impact on Belgrade's environment.

**CO<sub>2</sub> emissions:** Belgrade ranks 28th in the cat-

egory for carbon dioxide (CO<sub>2</sub>) emissions. Measured in terms of units of GDP, Belgrade's CO<sub>2</sub> emissions are nearly triple the 30-city average, and as a result, although Serbia has a national target for reducing CO<sub>2</sub> emissions, Belgrade's ranking is low.

**Initiatives:** Under the Kyoto Protocol, Serbia aims to reduce emissions of harmful gases by 20% by 2020. Belgrade will be required to match or better this performance.

**Energy:** By far its strongest area of performance, Belgrade ranks 17th overall in the energy category, and thus is ranked second in this category among east European cities.

This is because of the city's below-average energy consumption per head and its relatively high use of renewable energy. The outdated technologies used for energy production and the partial lack of emissions abatement technology are the main causes of negative environmental impacts.

**Initiatives:** Belgrade's district-heating company is beginning to close down the city's boiler stations, connecting the district heating system instead to gas-fired plants that have a less detrimental environmental impact (see highlight project "Hot air?").

**Buildings:** Belgrade ranks 27th in the buildings category. Poor insulation of buildings is a major cause of heat loss: energy savings of 30-40% could be achieved by meeting the requirements laid down in the existing national standards. Belgrade's ranking is also brought down by its relatively high estimated energy consumption per square metre by residential buildings.

**Initiatives:** The reconstruction of the USCE tower, Belgrade's tallest building, was completed in 2005 and features a range of energy-efficient technologies, such as solar thermal, intended in part to promote energy efficiency in the city.

**Transport:** Belgrade is ranked 29th overall in the transport category, despite performing well (at fifth in the rankings) for its use of non-car transport. The city's good result for use of non-car transport is thanks to its extensive public transport system, although much of the net-

**Initiatives:** The city plans to direct about 17% of its environmental expenditure, as part of its National Environment Strategy, into the construction, operation and maintenance of new water assets.

**Waste and land use:** Belgrade ranks 26th in the waste and land use category. The city produces an estimated 496 kg of waste per inhabitant, slightly below the average of 511 kg. However, recycling levels are negligible, with most municipal waste ending up in landfill.

**Initiatives:** The International Finance Corporation (IFC), an arm of the World Bank, is assisting the Belgrade municipality in improving solid-waste services and rehabilitating the Vinca landfill to conform to EU environmental and waste-management standards.

**Air quality:** Belgrade is ranked 28th for air quality. Levels of nitrogen dioxide, sulphur dioxide, ozone and particulate matter are not especially high.

However, Belgrade's score is relatively low because of its failure to pursue clean air policies more systematically.

**Initiatives:** Reconstruction of ash landfills, which lead to uncontrolled secondary emis-



work is in need of modernisation and expansion. Belgrade's overall score in the transport category would be higher if it were to make more effort to promote green transport policies and greater progress in reducing traffic congestion.

**Initiatives:** Congestion is expected to be alleviated by the construction of a bypass around Belgrade, connecting two major highways, the E70 and the E75.

**Water:** Belgrade ranks 29th in the water category, partly because its water consumption per head is higher than the average. High levels of untreated wastewater run-off and the inefficiency of the distribution system further undermine Belgrade's overall score.

sions, has been identified as a priority task for 2009-12.

**Environmental governance:** Consistent with its performance in other categories, Belgrade ranks 25th for environmental governance, but could improve its score significantly were the city authorities to adopt an environmental action plan.

**Initiatives:** Under the provisions of the law on local self-government, all cities and towns in Serbia are supposed to have their own development strategies. Belgrade has yet to adopt such a strategy, but is expected to do so in the near future. The strategy is likely to have a major focus on environmental protection.

## Hot air?

One important green initiative by the city administration — aimed at improving energy efficiency and the quality of the air in the city — is the renewal and gasification of Belgrade's district-heating system. Small individual solid-fuel-operated boiler houses are being closed down and the system is being reconnected to central gas-fired plants. The timeframe for the replacement of the 70 boilers will depend on the availability of financial support. Gas-fired district-heating plants have a lesser detrimental environmental impact than plants using other fossil fuels. The replacement of some parts of the gas-fired district-heating plants by gas-fired cogeneration plants, which produce both electricity and heat, is also under discussion; such a system would be far more fuel-efficient. Cogeneration plants also allow the use of the heat that they generate for cooling purposes in summer, and would therefore decrease electricity consumption for airconditioning.





# Berlin\_Germany



Berlin is Germany's capital and the country's most populous city, with some 3.4 million inhabitants within its city limits. The city's economy is primarily based on services, encompassing various media and creative industries, tourism, life sciences and pharmaceuticals, and conferences, among other activities. Nevertheless, relative to other German cities unemployment in Berlin is high, and more than 20% of the city's tax revenue is allocated to servicing its high debt levels.

Berlin is ranked eighth overall in the European Green City Index, with a score of 79.01 out of 100, outperforming other large cities such as London and Paris. This is a creditable achievement in the light of the city's difficult history and the financial constraints under which it has to operate.

**CO<sub>2</sub> emissions:** Berlin is ranked just 13th in the category for carbon dioxide (CO<sub>2</sub>) emissions, but has performed well. It has already reached its original target of a 25% reduction in emissions by 2010, and has now set a new target of a 40% reduction compared with 1990 levels by 2020.

## Select city data

Population:	3.4 million
GDP per head, PPP:	€ 21,561
CO <sub>2</sub> emissions per head:	6.57 tonnes
Energy consumption per head:	77.7 gigajoules
Percentage of renewable energy consumed by the city:	1.84 %
Total percentage of citizens walking, cycling or taking public transport to work:	54.8 %
Annual water consumption per head:	55.55 m <sup>3</sup>
Share of waste recycled:	35 %



**Initiatives:** The rebuilding of the Berlin-Mitte powerstation for €300 million has resulted in nearly 90% of its primary energy being converted into electricity and district heating for more than 60,000 dwellings and 500 public buildings.

**Energy:** Berlin ranks 13th in the energy category. As of 2006, 58% of Berlin's electricity came from coal, 39% from natural gas and 1% each

from oil, waste and renewables. The city benefits in part from western Europe's largest district-heating network, but its ranking suffers from the fact that 43% of that heat was still generated from coal in 2006.

**Initiatives:** Under a 1997 agreement between the Berlin Senate and the Berlin business community, 75% of all new buildings constructed in any given year must include solar thermal strategies in their design.

**Buildings:** Berlin ranks first in the buildings category, largely because of its progress in improving the energy efficiency of its housing stock over the past two decades. This is resulting in a reduction in energy consumption from 150 kwh to 80 kwh per year per square metre.

The city's energy consumption for residential buildings is far below the 30-city average, and Berlin far outperforms other large cities in this category.

**Initiatives:** The Berlin Solar Campaign, launched in 2000 by the Berlin Senate's department of administration for urban development, offers grants for the installation of solar panels, financed from over €2 million set aside by Investitionsbank Berlin (IBB), within the Senate's modernisation and maintenance programme for housing construction support.

**Transport:** Berlin ranks 12th in the transport

federal government envisages that there will be up to 1 million electric cars on German roads by 2020.

**Water:** Berlin ranks third in the category for water, largely because of the efficiency with which it is managing its resources. Water leakage from the supply system is low at 5.2%. The provision of water meters and the promotion of low-consumption appliances are the norm, and the latter, together with changes in lifestyle, are furthering a highly sustainable trend.

**Waste and land use:** Berlin ranks fourth in the water and land use category, thanks to its success in reducing waste and promoting recycling, and also because of its progressive approach to treatment. About 35% of waste is recycled, well above the 30-city average of 18%, in part thanks to a relatively engrained culture among residents of sorting waste.

**Initiatives:** A federal strategy paper dating back to 1999 envisages that all municipal solid waste should be completely recycled and recovered by 2020 at the latest.

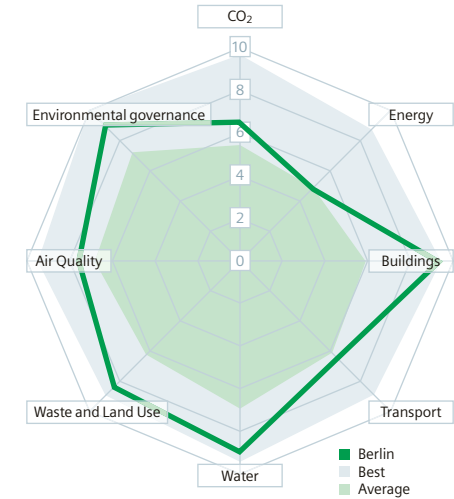
**Air quality:** Berlin ranks in eighth place in the category for air quality. Quality has benefited from the shift away from industry, but also from the lacklustre performance of the economy, which has reduced car use.

**Initiatives:** Berlin's environmental zone, introduced in 2008, aims to improve air quality by substantially cutting nitrogen oxide emissions and particles attributable to traffic.

**Environmental governance:** Berlin ranks ninth in the category for environmental governance, reflecting the openness of its plans and strategies, but also its underlying problems. Environ-

Energising alliances

In 1996 the City of Berlin instituted the Berlin Energy Saving Partnership (Energiepartnerschaft Berlin), a joint initiative by the city and the Berlin Energy Agency. The city receives a guaranteed 25% saving on its annual energy costs, while the partners provide financing and expertise to improve the energy efficiency of properties. Over 6% of these savings are delivered directly to the city budget, while the rest are used to finance the modernisation and optimisation of buildings. In return, the partners receive any savings achieved over and above the amount guaranteed to the city, while the city retains ownership of any newly installed equipment. Following the end of the 12-year contract period, all energy savings achieved will directly benefit the city. The refurbishment of schools, day-care centres, universities, administrative buildings and public swimming pools has amounted to annual savings of €11 million in energy costs. This initiative has made Berlin a model city for energy-saving programmes in public buildings.



mental issues are taken seriously throughout the German political system, and environmental protection is an objective under the 1995 Berlin constitution.

**Initiatives:** In October 2008 the Berlin Climate Alliance, a joint initiative between the city and local companies, was launched with the aim of encouraging co-operation on climate change projects.



# Bratislava\_slovakia



As the capital and largest city of Slovakia, Bratislava is the country's centre of economic, financial, cultural, educational and political activity. Its commercial activity is mainly services-oriented, but several important industrial companies are still active in the city, in sectors including chemicals and automobile manufacture, making it the fourth most industrial city in the index. Furthermore, the city is positioned at an intersection of major transit roads, which results in large amounts of through traffic.

Bratislava is ranked 20th in the European Green City Index, with a score of 56.09 out of 100 — better than most of the east European cities and other industrial cities tracked. However, despite many environmental problems, the issues are generally still of only marginal interest to locals, partly because they received little attention under communist rule.

**CO<sub>2</sub> emissions:** Bratislava ranks 21st for carbon dioxide (CO<sub>2</sub>) emissions. The city's inhabitants are each responsible for 5.1 tonnes of emissions annually, close to the average of 5 tonnes. The main sources of emissions are the local chemicals industry, energy supply and transport. The ongoing closure of obsolete production facilities and the installation of more efficient technologies mean that the city's situation is better than it was

several years ago, but a surge in vehicle numbers has raised transport-related emissions. Bratislava does not have any specific emission targets.

**Initiatives:** To reduce traffic-related emissions, Bratislava has proposed building a new city transport bypass.

**Energy:** Bratislava ranks 21st for energy. Slovakia's energy production is primarily nuclear- and coal-derived, with renewable energy — almost all consisting of hydroelectric power — accounting for less than 20%. Within Bratislava, however, energy is sourced entirely from non-renewable sources. On other metrics, the city performs reasonably well: energy consumption per head, at nearly 83 gigajoules per year, is slightly above the average of 81 gigajoules, while energy consumption per unit of GDP is about one-half of the average.

**Initiatives:** New gas-fired power facilities have recently been built, which are far more efficient than existing sources; a new project is currently being planned.

**Buildings:** Bratislava ranks 23rd for buildings. It has a large stock of buildings built 60 or more years ago, and many buildings were constructed during the communist period, when limited attention was paid to energy efficiency. Bratislava

now has criteria for the reconstruction of its buildings, including energy-efficiency standards, but there are few incentives and little support. However, there is state-based financial assistance to improve insulation.

**Transport:** Bratislava ranks eighth for transport, its best result. The public transport network has more than 1,800 km of lines — just over 6 km per square km, far above the average of 2.3 km. Bratislava has the largest share of people taking public transport to work (at 70%, compared with an average of 42%). However, there has been a significant rise in private car ownership in the past decade.

**Initiatives:** To promote the use of public transport, the city has introduced a new bus fleet, simplified ticket purchases via mobile phones and created an integrated system of regional tickets. A fast-tram project in a large residential district should kick-start efforts to revamp public transport.

**Water:** Bratislava is ranked 14th for water, performing well on key sub-indicators; it scores 7.5 out of 10 for its water efficiency and treatment

(kg). The primary disposal method is via modern waste incinerator incorporating waste-to-energy technology. Separate waste collection is available for recyclable materials. Consequently, more than 7% of waste is recycled, although this is below the average of about 18%. Bratislava does not yet have measures to inhibit waste creation, such as progressive taxation. In terms of land use, the city has an estimated 110 square metres of inner-city green space per inhabitant; however, its quality is often subject to criticism. **Initiatives:** In June 2009 nearly 2,000 volunteers from 40 companies, in partnership with the municipal government of Bratislava, cleaned parks, restored playgrounds and planted flowers in a third annual event.

**Air quality:** Bratislava is ranked 21st for air quality. Monitored air pollution is not markedly high. However, while Slovakia has adopted commitments and targets at national level, these are not replicated at municipal level. The city's current strategy is to solve existing problems incrementally, for example through engagement with the main producers of emissions, as a first step towards overall improvements in air quality.



## Reforming Bratislava's infrastructure and skills

In December 2007 the European Commission approved a programme for Bratislava running until 2013, with a total budget of €102 million, that aims to develop the region's competitiveness while improving quality of life, with specific initiatives aimed at stimulating renewable energy use and energy efficiency. About one-half of the funding will focus on infrastructure, with the balance focusing on "knowledge economy" initiatives and technical assistance. One aspect of the infrastructure element of the programme will focus on regenerating urban areas and improving the energy performance of buildings. On the knowledge economy front, the project will focus on supporting innovation and technology transfers, such as on those aimed at reducing energy intensity and increasing renewable-energy use, as well as reducing and preventing air pollution.

## Select city data

Population:	427,000
GDP per head, PPP:	€ 22,243
CO <sub>2</sub> emissions per head:	5.08 tonnes*
Energy consumption per head:	82.80 gigajoules
Percentage of renewable energy consumed by the city:	0 %
Total percentage of citizens walking, cycling or taking public transport to work:	73.9 %
Annual water consumption per head:	88.09 m <sup>3</sup>
Share of waste recycled:	7.17 %

\* Estimate

policies and 9.3 out of 10 for its wastewater treatment. Water consumption stood at 88 cubic metres per head in 2007 (compared with an average of 105 cubic metres), with system leakages at about 25% (slightly above the average of 23%). **Initiatives:** The Water Research Institute Bratislava, with the Ministry of Environment, the Slovak Water Management Enterprise and private companies, has introduced an initiative to ensure that Slovakia meets certain water-related EU commitments by 2015.

**Waste and land use:** Bratislava ranks 21st for waste and land use, scoring well on waste-reduction policies and waste production (with about 465 kg of municipal waste produced per inhabitant per year, below the average of 511

**Environmental governance:** Bratislava ranks 20th for environmental governance. This partly reflects a general lack of awareness among both citizens and politicians regarding environmental issues. Despite often having only limited influence, the public has access to information on the city's environmental performance and policies, and citizen participation has been greater in terms of the decision-making process on larger projects, via public consultation.

**Initiatives:** The city administration is preparing the Programme of Economic and Social Development, Slovak Capital City of Bratislava, which aims to provide a definition of economic, social and environmental development, as well as setting out Bratislava's targets in order to assist with obtaining EU funding.





# Brussels\_Belgium



Brussels is the capital of Belgium, and also serves as the location for the EU’s headquarters. With just one-tenth of the country’s population, the Brussels-Capital region contributes around 17% of Belgian GDP. As in many other developed cities, there has been a shift from manufacturing towards business-related services. Brussels ranks ninth overall in the index, with a score of 78.01 out of 100. The city scores particularly well for water, and environmental

## Select city data

Population:	1.05 million
GDP per head, PPP:	€ 49,554
CO <sub>2</sub> emissions per head:	3.91 tonnes
Energy consumption per head:	86.88 gigajoules
Percentage of renewable energy consumed by the city:	0.58 %
Total percentage of citizens walking, cycling or taking public transport to work:	37 %
Annual water consumption per head:	54.04 m <sup>3</sup>
Share of waste recycled:	23.68 %

governance is another strong area, with its environmental plan ranking joint first. The city’s overall score is held back by high levels of energy consumption per head.

**CO<sub>2</sub> emissions:** Brussels ranks fifth for carbon dioxide (CO<sub>2</sub>) emissions. The city emits 3.9 tonnes of CO<sub>2</sub> per head, well below the average of 5.2 tonnes. Its CO<sub>2</sub> emissions per unit of GDP are about one-quarter of the index average, putting it third in this subcategory. In terms of its CO<sub>2</sub> reduction strategy, Brussels ranks joint eighth with Helsinki and Vienna.

**Initiative:** Brussels aims to reduce its emissions by 15% between 1999 and 2010, through initiatives in the areas of transport, energy, enterprises and private households, as laid out in the region’s Air Climate Plan. Several measures have already been implemented, including promoting passive and low-energy building construction, educating households on reducing their energy use, promoting the use of public transport and supporting renewable-energy initiatives.

**Energy:** Brussels ranks eighth for energy, and is set back primarily by its relatively poor performance on energy consumption and use of renewables. Energy consumption in Brussels is mainly driven by the heating of buildings using fossil fuels: the Brussels-Capital region consumes about 87 gigajoules per head annually, higher than the average of 81 gigajoules. About one-half of the city’s energy is derived from oil, and one-quarter comes from gas. Brussels ranks 24th for the percentage of renewable energy consumed, which at less than 1% is far below the average of 7.3%.

**Buildings:** Brussels ranks 12th for buildings. Its score is pulled down by the high energy consumption of its residential buildings, at nearly 800 megajoules per square metre per year. While this is better than the average of 909 megajoules, it is far worse than the 553 megajoules consumed in the leading high-income, mid-size city, Copenhagen.

However, Brussels has developed a series of

incentives for measures to make buildings more energy-efficient.

**Initiative:** Brussels encourages companies to qualify as “eco-dynamic enterprises”. To do this, they must obtain a certificate with one, two or three stars, according to their level of energy efficiency. Companies can advertise their status as an example of their commitment to sustainable development.

**Transport:** Brussels ranks seventh for transport. Its score is boosted by the availability of public transport links: it ranks fourth for length of public transport network. However, while commuter links between the capital and surrounding areas have improved recently, around 186,000 workers living outside Brussels commute by car. Only 2% of the population cycle or walk to work, significantly below the average of 21%. Brussels is relatively spread out, and its public transport system, while adequate in the centre, does not provide extensive coverage on the outskirts.

**Initiative:** If citizens cancel their car licence plates, indicating that they will be getting rid of

**Waste and land use:** Brussels ranks tenth for waste and land use. Since 1992 the Brussels-Capital Region has implemented a plan that aims to reduce waste production through recycling and other approaches. Brussels has 13 nature reserves, which are protected owing to their unique biological qualities. The reuse of brownfield sites is not specifically promoted, but they are acknowledged by the regional authority as being habitats for flora and fauna.

**Initiative:** In 2008 Brussels participated in the pilot edition of the European Waste Reduction week, part of preparation for an official European Waste Reduction Week in November 2009.

**Air quality:** Brussels ranks 16th for air quality. Transport accounts for 80% of carbon monoxide emissions and 77% of nitrogen oxide emissions. The heating of buildings accounts for 25% of sulphur dioxide emissions.

**Initiative:** The regional authority and the 19 municipalities offer various subsidies for the retrofitting of buildings or for new constructions that incorporate environmentally friendly heat-

ing. For example, a cash bonus is given for solar water heaters equal to 50% of their purchase and installation costs.

**Environmental governance:** Brussels ties for first place with Copenhagen, Helsinki and Stockholm for environmental governance. The region’s various environmental targets are mostly delineated in an “Agenda Iris 21” plan. The Brussels Energy Agency provides guidelines and advice for citizens on how to reduce energy consumption, while the Brussels Institute for Management of the Environment (IBGE) provides information on how citizens can reduce their carbon footprint, use grants to make their houses more energy efficient and embrace environmentally friendly transportation.

**Initiative:** To foster environmental awareness and action, IBGE launched the Quartier Durable (Sustainable Neighbourhood) project. Residents are encouraged to form groups and identify a sustainable project in their neighbourhood, with the most promising projects receiving subsidies, expert advice and technical support.



their car, the regional authority offers a subsidy for public transport or the purchase of a bicycle.

**Water:** Brussels ranks fourth for water, largely because of its low consumption per head, at 54 litres per inhabitant per day, around one-half of the average of 105 litres. Brussels also performs well on water system leakage, at just 6%, compared with an average of 23%. The city’s water is tested for bacteria and concentrations of nitrates, pesticides and heavy metals. All wastewater is sent to a plant before being discharged into the sewer system that leads into the Zenne river.

**Initiative:** Brussels has a “Do not waste water!” video, which promotes the use of water meters, low-flush toilets, and showers instead of baths. It also offers subsidies for the installation or repair of rainwater tanks.



## Green Tuesdays

The alderman for the environment and the City of Brussels’s eco-advice unit organise monthly meetings, Environment Tuesdays, which are held throughout Brussels and are used to disseminate information to the public on specific environmental issues. Following a presentation by the eco-advice unit, an informal debate takes place. Recent topics have included urban noise, various green bonuses offered by the city, sustainable food consumption and renewable energy.



# Bucharest\_Romania



## Select city data

Population:	1.9 million
GDP per head, PPP:	€ 19,800
CO <sub>2</sub> emissions per head:	5.23 tonnes*
Energy consumption per head:	72.13 gigajoules*
Percentage of renewable energy consumed by the city:	0.01 %
Total percentage of citizens walking, cycling or taking public transport to work:	76 %
Annual water consumption per head:	96.02 m <sup>3</sup>
Share of waste recycled:	1.8 %

\* Estimate

Romania’s capital, Bucharest, has nearly 2 million inhabitants and is the heart of the national economy, accounting for about 15% of GDP and 25% of industrial production. Bucharest’s main manufacturing industries include food and beverage processing, electrical machinery, broadcasting, and the production of communications equipment and chemicals. The services sector has also grown in the past decade, and the city is now Romania’s largest centre for information and communication technology.

Bucharest ranks 28th in the overall index, with a score of 39.14 out of 100. Its best ranking is in the buildings category (21st rank). However, the presence of heavy industry in the city, together with years of neglect and underinvest-

ment — a feature common to other post-communist countries — has a detrimental impact on Bucharest’s environment and contributes greatly to its relatively low score.

**CO<sub>2</sub> emissions:** Bucharest ranks 24th for carbon dioxide (CO<sub>2</sub>) emissions. The city’s CO<sub>2</sub> emissions are estimated at about 5.2 tonnes per head per year, slightly above the average of about 5 tonnes. However, its relatively poor score is also partly explained by its high level of energy intensity. This reflects low energy efficiency in both production and consumption; the construction boom of the past decade; and the rapid increase in car ownership in the post-communist period and consequent traffic congestion.

**Initiative:** In February 2009 Bucharest’s mayor signed a non-binding declaration of intent to reduce CO<sub>2</sub> emissions by at least 20% by 2020 compared with 1990 levels. However, no concrete action plan has been yet been drafted.

**Energy:** Bucharest ranks 23rd in the energy category. At national level, just over 30% of Romania’s electricity is derived from hydropower sources. However, other renewable-energy sources make only a small contribution to national energy supply — and to the city’s supply directly. In terms of policies on energy, Bucharest performs best among east European cities.

**Initiative:** As Romania is now a member of the EU, the city will be obliged to conform with EU directives on energy efficiency among end users and energy suppliers.

**Buildings:** Bucharest ranks 21st for buildings. The existing Romanian Building Code sets low standards for the quality of new buildings in terms of energy efficiency and environmental impact. However, in recent years there has been a growing awareness of the need for energy-efficient buildings.

**Initiative:** Romania was the first country in south-east Europe to establish a Green Building

important role in reducing noise and air pollution.

**Water:** Bucharest ranks 28th in the water category. Its ranking is pulled down by a number of factors: household water consumption has continued to increase over the past decade, and water loss in the distribution system is also extremely high, at nearly one-half of all water distributed in the city.

**Initiative:** There are plans to rehabilitate the wastewater treatment plant in Bucharest, with the aim of alleviating pollution levels in the Danube river. This is widely regarded as the most important environmental project in Romania.

**Waste and land use:** Bucharest ranks 28th for waste and land use. At 479 kg per head in 2007, municipal waste production is slightly below the 30-city average of 511 kg. However, less than 2% of Bucharest’s waste is recycled, with the remainder sent to landfill, severely constraining the city’s score.

**Initiative:** Bucharest’s Municipal Waste Management Plan for 2007-13 envisages the construction of two waste-sorting plants, a mechanical biological plant and two composting plants.

## Lakeview: Romania’s first BREEAM building rating

In 2009 AIG/Lincoln’s Lakeview office building in Bucharest was the first building in Romania to achieve a design and procurement rating of “very good” from BREEAM, a widely used international environmental assessment standard for buildings. Facilities for cyclists are provided, such as changing rooms, showers and lockers, encouraging staff to cycle to work. The building is situated on a former industrial site, and a commitment has been made to increase the ecological value of the site once the development is complete. Under the “health and well-being” section of the BREEAM assessment, the building was judged to have a pleasant internal environment, with a good supply of natural daylight to more than 80% of floor area. In the area of “land use and ecology”, credits were gained by reusing land that had previously been developed and had been assessed as having low ecological value.



Council (RoGBC), which was launched in Bucharest in 2008 and has since played an extremely active role in promoting green-building awareness and best-practice policies.

**Transport:** Bucharest is ranked 28th in the transport category. In some respects, the city performs well: it has a relatively extensive public transport network and an above-average share of users. However, Bucharest scores relatively poorly on transport because of its chronic traffic congestion problems and a lack of focus on green transport policies.

**Initiative:** RATB, a public transport operator, has done much to develop a clean public transport fleet, based on low emissions and quieter vehicles, with new technologies playing an

**Air quality:** Bucharest ranks poorly on air quality, at 27th, because of high levels of nitrogen dioxide, sulphur dioxide, ozone and particulate matter. The major sources of pollution are power plants, road transport and industry.

**Initiative:** After years of deforestation around Bucharest, the city authorities are creating a green belt around the city to improve air quality.

**Environmental governance:** Bucharest ranks 30th in the environmental guidelines category. This is primarily because the city lacks a specific environmental action plan that addresses the main issues and sets targets. Bucharest’s score could be higher if it improved the level of environmental information available and communicated more effectively with its citizens on environmental issues.







Select city data

Population:	1.7 million
GDP per head, PPP:	€ 23,814
CO <sub>2</sub> emissions per head:	5.8 tonnes*
Energy consumption per head:	98.85 gigajoules*
Percentage of renewable energy consumed by the city:	0.44 %
Total percentage of citizens walking, cycling or taking public transport to work:	69 %
Annual water consumption per head:	84.59 m <sup>3</sup>
Share of waste recycled:	2.2 %

\* Estimate

Budapest is Hungary's capital and its main hub of economic, financial, political and cultural activity. With about 17% of the country's population, Budapest contributed 34% of Hungary's GDP in 2006. The city's primary commercial activities are financial and business services, which account for close to 80% of gross value added.

The capital traditionally had a stronger industrial focus, but many factories have closed since the transition from communism in 1989, and this has had a beneficial effect on the city's overall environmental impact.

Budapest ranks 17th among the 30 cities in the European Green City Index, with a score of 57.55 out of 100. However, when compared with other low-income cities it ranks third. This relatively good performance can be attributed in part to the reduced importance of industry to the city's economy.

**CO<sub>2</sub> emissions:** Budapest ranks joint 17th in the category for carbon dioxide (CO<sub>2</sub>) emissions — a relatively good score compared with other east European cities, behind only Ljubljana, Riga and Istanbul. However Budapest's CO<sub>2</sub> emissions are higher than the average for the 30 cities surveyed, both per unit of GDP and per head.

**Initiative:** The municipality targets a 10%

energy intensity. The majority of households in Budapest use gas for heating and hot water, with district heating supplying about one-third of all homes.

**Initiative:** The government has moved to encourage households to use district heating, by reducing value-added tax on this form of heating in August 2009. The municipal district-heating company, Fotav, is equipping homes with metering devices to regulate usage in order to reduce costs.

**Buildings:** Budapest ranks 20th in the buildings category, in part because of high household energy consumption, which is well above the 30-city average. Budapest performs well with regard to energy-efficient building standards (being ranked joint 14th): for example, building certificates, while not mandatory, are becoming more widespread.

**Initiative:** The city, jointly with the national government, subsidises the retrofitting of buildings to reduce heating-energy loss as a result of inefficient insulation and old windows.

**Transport:** Budapest ranks joint tenth, along with Tallinn, in the transport category — its best ranking in the index. In eastern Europe, only Bratislava scores higher. The capital's public

being 20% below the 30-city average, while water leakages are slightly above average. Virtually all households are connected to the sewage system, but only 50% of wastewater is currently treated.

**Initiative:** The proportion of biologically purified wastewater will be increased to 95% following the completion of a central wastewater-treatment plant on Budapest's Csepel island, scheduled for July 2010.

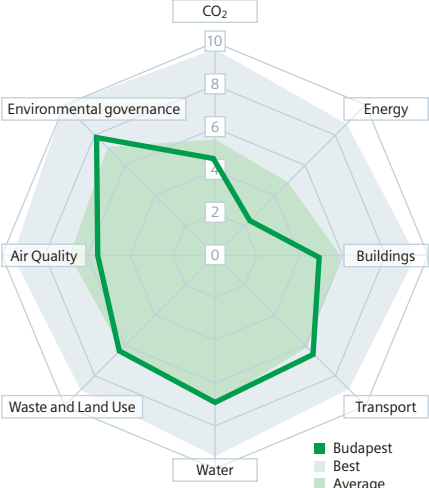
**Waste and land use:** Budapest ranks 15th in the waste and land use category, with a large discrepancy between a favourable ranking (joint sixth) for waste production and a poor one (26th) for recycling and reuse. The city produced 441 kg of waste per head in 2007, below the 30-city average of 511 kg per head. Major brown-field areas have already been redeveloped into high-profile office, retail and residential developments.

**Initiative:** The city is continually increasing the number of sites for selective waste collection (including plastic, glass, metal and paper, but not organic waste). Charges are payable for municipal waste collection depending on the number of rubbish bins, in order to encourage recycling. Awareness campaigns are widespread.



Residential retrofitting cuts energy consumption and emissions

Budapest's largest apartment building in the Third District, built some 30 years ago and comprising 886 apartments, will be retrofitted by the end of 2009 at a cost of Ft1.2 billion (€4.5 million). The building's heating and hot water was originally supplied by the district-heating company, Fotav. The project involves the use of renewable energy sources, as the building will be fitted with solar cells to provide hot water. Fotav will continue to provide heating, but will do so through a modernised heating centre in the building. The building will receive a new insulation layer and windows will be replaced, while the apartments have already been equipped with meters to regulate heating individually. The combined effect of these improvements is expected to be a 50% reduction in the building's energy consumption. The district municipality will cover 40% of the project's costs (drawing in part on EU funds), with the central government budget providing another 33%.



reduction from 2005 levels in energy use by public institutions as well as by households by 2013, which will have a positive impact on the city's CO<sub>2</sub> emissions. The reduction will be achieved by means of energy audits of public buildings, and by retrofitting homes.

**Energy:** Budapest ranks 25th in the index for energy, owing to high energy consumption per head, low renewable-energy use as a proportion of total energy consumed, and relatively high

transport company calculates that around 60% of its passengers are transported using electric-powered vehicles.

**Initiative:** Budapest won the EU's 2008 European Mobility Week Award. It was judged to have done most to raise public awareness of air pollution from traffic and to promote cleaner alternatives.

**Water:** Budapest ranks 18th in the index for water. Consumption per head is moderate,

**Air quality:** Budapest ranks 22nd in the air quality category. Air quality is monitored by 11 stationary units across the city, and is mainly affected by vehicle traffic, which is responsible for 70-90% of emissions other than sulphur dioxide.

**Initiative:** Budapest is gradually improving its public transport vehicle fleet in order to reduce emissions by purchasing new buses or replacing engines, as well as installing particle filters in diesel-fuelled buses.

**Environmental governance:** Budapest ranks a favourable joint 13th for environmental governance, behind only Warsaw among east European cities. It has a detailed environmental programme that sets guidelines for environmental policy and targets in each area for 2013.

**Initiative:** Budapest is a member of the Covenant of Mayors, whose signatories pledge to produce and follow a sustainable-energy action plan to go beyond EU energy policy objectives.



# Copenhagen\_Denmark



## Select city data

Population:	504,000
GDP per head, PPP:	€ 43,640
CO <sub>2</sub> emissions per head:	5.38 tonnes
Energy consumption per head:	80.63 gigajoules*
Percentage of renewable energy consumed by the city:	18.76 %
Total percentage of citizens walking, cycling or taking public transport to work:	68 %
Annual water consumption per head:	147 m <sup>3</sup>
Share of waste recycled:	23.61 %

\* Estimate

The City of Copenhagen is small by European standards, being home to just over 500,000 people, or around one-tenth of Denmark's population. Copenhagen is the country's main business and financial centre, and is also one of western Europe's leading locations for international company headquarters and distribution centres. Copenhagen achieves the highest ranking in the European Green City Index, with a score of 87.31 out of 100. The city performs well in all eight categories of the index, and is ranked joint first in the environmental governance subcategory. Successive governments at both national and municipal level have strongly supported the promotion of sustainable development.

**CO<sub>2</sub> emissions:** Copenhagen is ranked fourth for carbon dioxide (CO<sub>2</sub>) emissions, thanks to good scores in the CO<sub>2</sub> intensity and CO<sub>2</sub> reduction strategy subcategories. The city's primary

fuel sources are coal, oil and natural gas. A drive to improve energy efficiency has contributed to a significant fall in emissions over the past decade or so. The city now produces about 5.4 tonnes of CO<sub>2</sub> emissions per head per year, slightly above the index average.

**Initiative:** The city's 2009 climate change plan includes a target to reduce CO<sub>2</sub> emissions by a further 20% by 2015 relative to their 2005 levels. The plan also sets an ambitious long-term goal for the city to become carbon neutral by 2025, which, if achieved, would make it the first large carbon-neutral city in Europe.

**Energy:** Copenhagen is ranked in second place for energy. Denmark's energy policy has sought to reduce the country's dependence on coal and oil in favour of natural gas and renewable energy sources. Renewable energy sources play an increasingly important role in the country,

accounting for 17% of total energy consumption in 2008 and for 27% of electricity consumption. **Initiative:** The national government's climate change strategy aims to raise the share of renewable energy to 30% of total consumption by 2025.

**Buildings:** Copenhagen is ranked fourth in the buildings category. Danish buildings are among the most energy-efficient in the world, despite the ageing housing stock. The annual energy consumption of residential buildings, at 554 megajoules per square metre, is the lowest of the 30 cities in the survey, being marginally better than that of Berlin. Almost all buildings in the Danish capital are connected to the district heating system.

**Initiative:** The Copenhagen municipality aims to achieve 10% of its CO<sub>2</sub> reductions through construction and renovation projects. The municipality intends to upgrade all municipal buildings to ensure compliance with the highest energy-efficiency standards.



**Transport:** Copenhagen is ranked third in the transport category. The city has an extensive public transport system — including a metro system, a suburban railway and bus networks — with the result that virtually all residents live within 350 metres of public transport services. Copenhagen is also famous for the ease with which its residents can cycle in the city.

**Initiative:** Copenhagen has set itself the objective of becoming the "world's best cycle city", and aims to raise the share of the capital's inhabitants who regularly use a bicycle to get to their place of work or education from 36% currently to 50% by 2015.

**Water:** Ranked in joint fifth place in the water category, along with Zurich, Copenhagen's score is dragged down by high levels of water consumption which, at 147 cubic metres per inhabitant per year, is almost three times that of

the best-scoring cities in this subcategory. However, Copenhagen claimed joint top spot for water system leakages, wastewater treatment and water efficiency.

**Initiative:** The municipality has a target to reduce household water consumption from 114 litres per person per day in 2007 to 100 litres per person in 2012. The city council spends around Dkr2 million (€270,000) each year on water-saving initiatives.

**Waste and land use:** Copenhagen ranks seventh for waste and land use. However, the city is placed joint first for its green land use policies, thanks to the ongoing redevelopment of brownfield sites and the widespread availability of green spaces (almost 80% of residents in the municipality of Copenhagen live within 300 metres of a park or recreation area). Some 55% of all waste is recycled, although the proportion for household waste is lower, at 24%.

**Initiative:** The vast majority (80%) of new developments during the current decade have

been on brownfield sites, including the redevelopment of the harbour front. The municipality actively seeks to use urban development as a tool to minimise transport requirements and energy consumption.

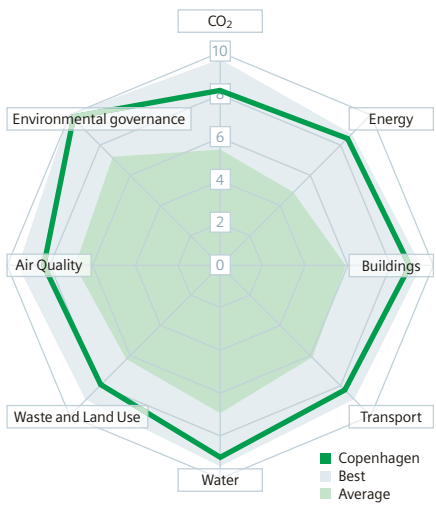
**Air quality:** Copenhagen is ranked fifth for air quality, with a score that is broadly similar to those of several other north European cities. The great bulk of air pollutants measured in Copenhagen come from traffic.

**Environmental governance:** Copenhagen is ranked joint first for environmental governance. The municipality has recently taken steps to ensure integrated environmental management across all of its departments, appointing environmental co-ordinators for each administrative unit, who meet regularly to exchange experiences. There is already a dedicated team within the city council to which citizens can direct their complaints or concerns on environmental matters.



## Carbon-neutral neighbourhoods

In partnership with energy companies, architects, construction firms and other interested parties, the municipality has launched two flagship urban development projects to create "carbon-neutral neighbourhoods", characterised by low-energy buildings, sustainable energy networks and environmentally friendly transport. One such development is in the Amager Faelled district, south of central Copenhagen, where it is expected that some 300,000 square metres of residential and commercial buildings will be built. Before a final development plan for the area is adopted in 2012, the city authorities will conduct an analysis of the technologies required to ensure that the district's energy supply, buildings, transport and waste management systems can be operated on a carbon-neutral basis. Another major new urban development will take place at Nordhavn, a 200-hectare site situated at the northernmost part of the city's docks. Following a public consultation, an international competition was launched in 2008 to elicit plans, with the winning proposal developed into a comprehensive plan during 2009-10. It is envisaged that a first phase of development will begin in 2011, with a second phase scheduled for 2018.





# Dublin\_Ireland



## Select city data

Population:	1.2 million
GDP per head, PPP:	€ 39,560
CO <sub>2</sub> emissions per head:	9.72 tonnes
Energy consumption per head:	156.46 gigajoules
Percentage of renewable energy consumed by the city:	5.11 %
Total percentage of citizens walking, cycling or taking public transport to work:	33 %
Annual water consumption per head:	127.95m <sup>3</sup>
Share of waste recycled:	28 %

Dublin is the capital of the Republic of Ireland, and is home to around 1.2 million of the country's 4.2 million citizens. The country's largest city, is also its commercial capital. The city's primary activities are in the services sector, including professional, administrative and financial services, as well as information technology.

Dublin is ranked 21st overall in the European Green City Index, with a score of 53.98 out of 100. Its results are strong in the air quality category, where it ranks fourth overall, but poor showings in other categories, including buildings and carbon dioxide (CO<sub>2</sub>) emissions, pull down its overall score. The city stands to benefit from various nationally driven environmental proposals, but progress is likely to be impeded by

the severe impact of the global economic slowdown.

**CO<sub>2</sub> emissions:** Dublin ranks 19th for CO<sub>2</sub> emissions; the city produces 9.72 tonnes of CO<sub>2</sub> per head annually, nearly twice the 30-city average of 5.2 tonnes. Its score is bolstered by a strong performance on CO<sub>2</sub> emissions per unit of GDP, which, at about 88 grams per euro, is far better than the average of 356 grams. But Dublin's result is further hindered by the absence of a formal CO<sub>2</sub>-reduction target, although a plan is currently being formulated.

**Initiative:** Dublin's climate change strategy document outlines a plan to meet a targeted 20-30% reduction in greenhouse gas emissions by 2020 (against a recommended base year of

1990, although this has yet to be confirmed for the city), as part of its membership of the Covenant of Mayors.

**Energy :** Dublin ranks 18th in the energy category, largely because of its poor performance in the energy consumption subcategory. The vast bulk of Ireland's electricity comes from fossil fuels, such as peat, coal, oil and gas, and each inhabitant of Dublin consumes 156 gigajoules per year, compared with a 30-city average of around 81 gigajoules.

**Initiative:** The city council aims to reduce its own energy usage by 3% per year, resulting in a total reduction of 33% by 2020. It is also working to reduce energy consumption by the city's social housing through the promotion of solar energy.

**Buildings:** Dublin ranks 24th in the buildings category. Much of the older housing stock in Dublin was not built with energy conservation as an objective. Dublin's housing action plan notes that residential and commercial buildings account for 55% of the city's total greenhouse gas emissions.

**Initiative:** The Greener Homes Scheme was launched in 2006. It provides €47 million between 2006 and 2011, and aims to give grant assistance to homeowners intending to install renewable-energy heating systems in either new or existing homes.

**Transport:** Dublin is ranked last in the transport category — its worst performance. Both the length of its public transport network and the extent of its cycle lanes are well below the index average. Accordingly, less than 20% of people take public transport to work, about one-half of the index average of 42%; nearly 61% use private cars.

**Initiative:** The Bike to Work scheme started 2008. It allows employers to purchase a bicycle,

via salary sacrifice, for employees at a cost of up to €1,000 tax-free. The scheme has attracted widespread participation.

**Water:** Dublin is ranked joint 16th in the water category, along with Stockholm. The city's residents each consume about 128 cubic metres of water per year, substantially above the index average of 105 cubic metres. The local river, the Liffey, and various tributaries are classified as either "moderately" or "seriously" polluted by the Irish Environmental Protection Agency.

**Initiative:** Dublin City Council engages in media activities to encourage water conservation. Further information is made available through websites such as [www.taptips.ie](http://www.taptips.ie).

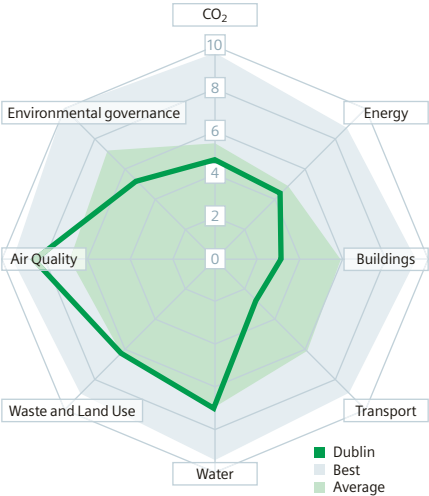
**Waste and land use:** Dublin is ranked 13th for waste and land use, helped by a strong score in the waste recycling and reuse subcategory. About 28% of waste is recycled, above the 30-city average of nearly 18%. However, Dublin is hindered by a poor score for municipal waste production: it creates 656 kg of waste per inhabitant per year, well above the average of 511 kg (excluding industrial waste).

**Initiative:** The construction of a waste-to-energy incinerator at Poolbeg was finally approved in 2008. When completed, it will burn 600,000 tonnes of household waste per year, making it one of the largest such facilities in Europe.

**Air quality:** Dublin ranks fourth for air quality. This is its best score in the index, and is achieved despite concerns on the part of Dublin city council about certain emissions, such as particulate matter. Because of changes in national legislation in the late 1980s, including the elimination of leaded petrol and a ban on coal, Dublin's air quality has improved dramatically in the past two decades. One concern is the backyard burning of household waste, which contributes 50% of Ireland's dioxin emissions.

### Transport21

Transport21, a flagship Irish transport project, was launched in 2006 and involves projected expenditure of €34 billion to upgrade roads, trains and buses across the country to 2015. The project should have a significant positive impact on Dublin's transport infrastructure. In Dublin the scheme proposes to expand the LUAS (the light rail system) and to create two new metro lines. The Metro North project, which would link Dublin Airport/Swords to the city centre, is under consideration by the Railway Procurement Agency (RPA). This is a public-private partnership initiative, and the RPA will begin to contribute funding only after the first passengers have been carried. Costs between €2.4 billion and €5 billion have been identified, and the expected completion date has been revised to 2014, with the tender being awarded in 2010. In addition to these larger projects, the government has begun to encourage alternative travel methods, such as cycling, and also aims to encourage the use of electric vehicles, with a goal of 10% of all vehicles on the market being electric by 2020.



**Environmental governance:** Dublin is ranked joint 21st for environmental governance, with Athens. Dublin city council's plans are outlined in its Climate Change Strategy 2008-12, which sets out the city's core objectives in terms of combating rising CO<sub>2</sub> emissions. The document focuses on energy, planning, transport, waste management and biodiversity.



# Helsinki\_Finland



## Select city data

Population:	569,000
GDP per head, PPP:	€ 52,832
CO <sub>2</sub> emissions per head:	6.01 tonnes
Energy consumption per head:	88.62 gigajoules
Percentage of renewable energy consumed by the city:	3.51 %
Total percentage of citizens walking, cycling or taking public transport to work:	44.7 %
Annual water consumption per head:	76.29 m <sup>3</sup>
Share of waste recycled:	57.61 %

With a population of 570,000, the Finnish capital, Helsinki, has an economy dominated by the services sector, with a particularly high concentration of jobs in information technology and the public sector. The Helsinki Metropolitan Area consists of four municipalities, Helsinki, Vantaa, Espoo and Kauniainen, the total population of which is around 1 million. This area accounts for one-third of Finland's GDP and is accordingly wealthy: its inhabitants' average annual income is the second-highest among the cities reviewed in this study, after that of Oslo. Helsinki ranks in seventh place in the European Green City Index, with a score of 79.29 out of 100. Helsinki is ranked fourth among the Nordic cities, largely because of its relatively high carbon dioxide (CO<sub>2</sub>) emissions and energy consumption, even though the city is a leader in energy efficiency.

**CO<sub>2</sub> emissions:** Helsinki ranks 11th in the index for CO<sub>2</sub> emissions, as a result of its relatively high

emissions per head of 6 tonnes, well above the 30-city average of 5 tonnes. This results from the city's high need for heating in buildings and its rising electricity consumption. **Initiative:** Helsinki's first, and the world's largest, heat pump plant, Katri Vala, was completed in 2006. The plant uses heat pumps and produces both district heat and cooling, significantly reducing Helsinki's CO<sub>2</sub> emissions.

**Energy:** Helsinki ranks 19th for energy, which is its weakest category in the index. At around 89 gigajoules per year, energy consumption per head is high (the 30-city average is 81 gigajoules), largely because of the city's cold climate and its high standard of living. **Initiative:** Helsinki Energy, which is municipally owned, is to build two large offshore wind-power parks with a generating capacity of 500-1,000 mw.

**Buildings:** Helsinki does well in the buildings category, ranking fifth as a result of its energy-efficient building standards and incentives and the below-average energy consumption of its residential buildings (at 683 megajoules per square metre in 2007, compared with the 30-city average of 909 megajoules). **Initiative:** Eko-Viikki is an ecological suburb located 8 km from the centre of Helsinki. Eko-Viikki was the first ecological neighbourhood to be built in Finland, and in 2010 the area is expected to support 6,000 jobs and to provide homes for 13,000 people.

**Transport:** Helsinki ranks ninth in the transport category. Its public transport network is the shortest in Europe. However, the city ranks first with regard to the length of its cycling network, and is a leader in green transport promotion.

houses, the municipally owned Helsinki Water is not particularly active in promoting water saving. **Initiative:** In order to improve the state of the Gulf of Finland (one of the most polluted parts of the Baltic Sea) and the entire Baltic Sea, Helsinki is actively participating in international co-operation projects such as wastewater treatment in St Petersburg, Russia.

**Waste and land use:** Helsinki ranks third in the waste and land use category, in large part because of its high level of waste recycling and reuse, and also thanks to its waste-reduction policies. New construction takes place on brownfield sites rather than green areas, so that expansion into green areas is now minimal. **Initiative:** The construction of a gas engine power plant in the area of Ammassuo, which is intended to recover landfill gases and will predominantly produce electricity, began in 2009. The plant is due to open in 2010.

**Air quality:** Helsinki ranks third for air quality. The city's air quality has improved substantially in recent decades as a result of the introduction of district heating and, more recently (from 1991), with the replacement of coal by natural gas as a fuel for energy production. **Initiative:** Helsinki Energy has invested in sev-

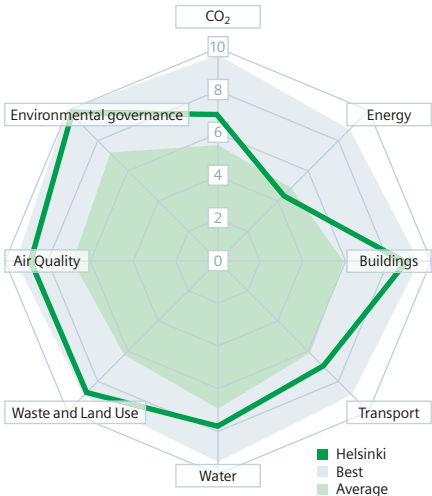


**Initiative:** An extension of the Helsinki metro system to the city of Espoo received official approval in September 2006 and will be completed by 2013 at the earliest. **Water:** Helsinki is ranked 11th in the water category, largely because of its limited water-efficiency policies. Although the city encourages the installation of water meters in individual

eral wind-energy plants in Finland, in order to raise its share of renewables and move away from the use of fossil fuels, which adversely affects the air quality of the city. **Environmental governance:** Helsinki is ranked joint first (with three other cities) for environmental governance. Its Sustainability Strategy and Action plan 2002-10 made Helsinki the

### Low2No

In March 2009 Sitra, the Finnish Innovation Fund, and the City of Helsinki launched an international competition for the construction of a sustainable and innovative block in the western harbour area of Helsinki. The Low2No competition seeks comprehensive solutions to the problems of low- or zero-carbon and energy-efficient building design. The competition aims to show that national and international targets for reductions in CO<sub>2</sub> emissions and improvements in energy efficiency can be reached and surpassed, at the same time producing an economically sustainable and architecturally high-quality environment. Some 74 entries were received, and five were selected for the final round, with a winner announced in September 2009. In the long-term, Sitra and the City of Helsinki hope that the competition process will help in the implementation of an innovative sustainable urban development solution in Helsinki, in developing a sustainable-development framework applicable to other contexts, and in spurring innovation in the field of energy efficiency and sustainable development.





# Istanbul\_Turkey



## Select city data

Population:	12.6 million
GDP per head, PPP:	€ 14,615
CO <sub>2</sub> emissions per head:	3.25 tonnes*
Energy consumption per head:	36.15 gigajoules*
Percentage of renewable energy consumed by the city:	5.12 %
Total percentage of citizens walking, cycling or taking public transport to work:	54.02 %*
Annual water consumption per head:	68.63 m <sup>3</sup>
Share of waste recycled:	3.12 %

\* Estimate



Istanbul is Turkey's biggest industrial centre, employing around one in five of the country's industrial workforce. Local industry varies widely, from textiles and chemicals to vehicles and food and beverages. By population, Istanbul is the largest city in Europe. Population growth has been far more rapid than elsewhere in Europe: the city's population has risen by at least 400% since 1970. As of 2008 the population was officially 12.6 million, largely as a result of migration from rural areas. Istanbul is ranked 25th in the European Green City Index, with a score of 45.20 out of 100. Many of its problems have greater similarities with those faced by cities in

the developing world than with the other European cities considered in this study. The city scores best on energy, thanks to its low level of consumption per head.

**CO<sub>2</sub> emissions:** Although Istanbul ranks only 16th overall for carbon dioxide (CO<sub>2</sub>) emissions, it scores strongly on CO<sub>2</sub> emissions per head, ranking second in this subcategory. However, this is largely because of the city's low level of car ownership per head and low per-head energy consumption.

**Initiative:** Scientists in Istanbul have been conducting research on how to meet the European

Commission's proposal to limit CO<sub>2</sub> emissions by passenger cars to 120 grams per kilometre by the end of 2012. They have produced new engine models that can reduce CO<sub>2</sub> emissions by up to 19%.

**Energy:** Istanbul performs well in the energy category, ranking 11th overall and first in the energy consumption subcategory. Istanbul's energy consumption per head is estimated at 36 gigajoules, less than one-half of the 30 city average of 81 gigajoules.

**Initiative:** A new renewable-energy bill is expected to be passed later in 2009, offering generous electricity contract guarantees for new hydro, wind, geothermal and solar power projects.

**Buildings:** Istanbul ranks poorly, in 28th place, in the buildings category. The majority of Istanbul's buildings date from the 1960s onwards and have been poorly constructed, with little thought given to energy efficiency. Some new buildings are being constructed with attempts at energy efficiency, but there are no universal standards in place.

**Initiative:** Discussions have begun about the possibility of issuing buildings with "energy deeds" that would identify the efficiency of their energy use.

km; and the possible development of plans for a further 293 km under discussion.

**Water:** Although Istanbul ranks only 23rd for water, it performs well with regard to water consumption per head, coming seventh overall in this subcategory and first among cities with high average temperatures.

**Initiative:** The city's municipal water company, ISKI, plans the construction of seven new biological treatment plants capable of processing 70,000 cubic metres per day, to supply a storage facility holding treated water for use in industry and horticulture.

**Waste and land use:** Istanbul ranks 25th in the waste and land use category, largely because of the small amount of green space in the city — at only 6.4 square metres per person — and its poor record on recycling and waste management. Most recycling is still conducted on an informal basis by impoverished communities living adjacent to landfill sites.

**Initiative:** In its 2007 strategic plan, Istanbul's municipality announced that it aimed to increase the percentage of packaging materials recycled from 15% in 2006 to 61% by 2011.

**Air quality:** Istanbul ranks 23rd for air quality,

Public participation in environmental debates is not encouraged, and there has been little effort to educate people or raise awareness of environmental issues.

**Initiative:** The municipality of Istanbul is implementing a new regulation plan in the period to 2010 that aims to institute a "preservation and development" balance. The plan acknowledges the effect of metropolitan settlement on the environment.



## Landfill methane power

Two of Istanbul's landfill waste sites have been adapted to allow methane produced from buried waste to be used by commercial power plants. One site currently powers both a 7.5 mw and a 7 mw plant, which is already in the process of being expanded to 14.3 mw. Two further plants with capacities of 4 mw and 1 mw are under construction, and others are expected to be built in the future as new landfill sites are developed with power production as part of the design criteria. These sites generate methane-rich landfill gas as organic solid waste gradually breaks down. To prevent uncontrolled venting of the gas, it is extracted via a network of pipes, processed and fed into engines to generate an alternative supply of electricity. Altogether, these four sites will be able to produce enough energy to support the requirements of around 100,000 households in Istanbul. As a result, the sites have attracted attention as one of the largest waste-to-energy projects in the world.



# Kiev\_Ukraine



## Select city data

Population:	2.7 million
GDP per head, PPP:	€ 4,943*
CO <sub>2</sub> emissions per head:	4.1 tonnes
Energy consumption per head:	87.16 gigajoules
Percentage of renewable energy consumed by the city:	0.47 %
Total percentage of citizens walking, cycling or taking public transport to work:	88.95 %*
Annual water consumption per head:	265.56 m <sup>3</sup>
Share of waste recycled:	0

\* Estimate

Kiev, the capital of Ukraine, is the country's largest city and an important industrial centre, with a population of some 2.7 million. Key sectors include heavy industry, such as engineering, chemicals and building materials, as well as consumer industries, such as food processing and textiles. Growing economic prosperity in recent years has contributed to strong growth in car ownership, with a related increase in congestion and emissions. Extremely low average temperatures in the winter require high levels of heating.

Kiev ranks 30th in the European Green City Index, with a score of 32.33 out of 100. In addition to the legacy of the Soviet Union, which paid scant attention to environmental issues, Kiev's low ranking also reflects its position as the poorest of the cities covered in the index.

**CO<sub>2</sub> emissions:** Kiev is ranked 30th in the category for carbon dioxide (CO<sub>2</sub>) emissions. The city

actually scores better than the 30-city average in terms of CO<sub>2</sub> emissions per head (at 4.1 tonnes, compared with the average of 5 tonnes), putting it in 11th place for this subcategory. However, this is outweighed by joint-lowest rankings for both CO<sub>2</sub> intensity and policies for reducing emissions.

**Initiative:** One of the key aims of the Kiev City traffic-management project, backed by the European Bank for Reconstruction and Development (EBRD), is to reduce congestion on the city's roads, which in turn will help to reduce CO<sub>2</sub> emissions.

**Energy:** Kiev is ranked 30th in the energy category. Reflecting highly inefficient energy consumption, Kiev ranks joint 26th in terms of energy intensity, although it performs somewhat better in terms of energy consumption per head.

**Initiative:** Kiev Hydroelectric Power Station is part of the Hydropower Rehabilitation Project

that is being implemented with financial support from the World Bank, which envisages increasing the output of the Dnipro Hydropower Cascade by around 500 gwh, the equivalent of constructing a major new hydropower plant.

**Buildings:** Kiev is ranked 30th in the buildings category. At 1,838 megajoules per square metre, the energy consumption of Kiev's residential buildings is the highest of any city surveyed and more than twice the 30-city average of 909 megajoules.

**Initiative:** Plans are being made at national level to improve the energy efficiency of buildings, in co-operation with the EU and the EBRD.

**Transport:** Kiev is ranked joint 19th in the transport category — its best result, tying with Paris, Vilnius and Zagreb — chiefly because of its

environmental project in the Kiev city administration's environmental programme to 2011.

**Waste and land use:** Kiev ranks 30th for waste and land use. It is estimated that Kiev produced almost 600 kg of municipal waste per inhabitant in 2007, making it the 26th-largest producer of waste on this measure. Chaotic construction planning practices have in recent years led to the disappearance of many of the city's green areas.

**Initiative:** In order to decrease the burden on the main landfill site, the city administration plans to create stations for processing plant waste in 2008-11.

**Air quality:** Kiev is ranked 30th for air quality. The city's industry is energy-intensive and insufficiently equipped with emission-reduction technology. While emissions from stationary



## Revitalising Kiev's traffic management

In October 2008 the EBRD announced the provision, under the Kiev City traffic-management project, of a €15 million loan to Kiev's municipal traffic-management agency. The loan will be used to create an information technology-based integrated traffic-management system in line with international best practice, to "manage traffic more effectively, improve air quality through lower congestion levels, and improve road safety". The EBRD has already committed substantial resources to improving Kiev's transport infrastructure, including a €100 million loan to the city's two municipal transport companies to buy new buses, trolleybuses and metro trains in 2007. One aspect of the city's transport plans has attracted criticism, however: a non-governmental organisation has argued that the construction of a new road tunnel under the Dnieper river is a "step towards private car-oriented development of the city's transportation". The project was approved by the city council in 2008, with funds expected to be provided by private investors under a public-private partnership (PPP). As part of the Kiev City traffic-management project, the EBRD is providing €200,000 for PPP structuring and a pre-feasibility study of the tunnel project. However, the financing of the project, which is estimated to cost up to US\$1 billion, is now looking even more difficult in the light of the current economic crisis.



# Lisbon\_Portugal



## Select city data

Population:	2 million
GDP per head, PPP:	€ 24,896
CO <sub>2</sub> emissions per head:	7.47 tonnes
Energy consumption per head:	48.65 gigajoules
Percentage of renewable energy consumed by the city:	9.69 %
Total percentage of citizens walking, cycling or taking public transport to work:	66 %
Annual water consumption per head:	87.12 m <sup>3</sup>
Share of waste recycled:	7.11 %

As Portugal's capital, Lisbon is home to 20% of the country's population and almost one-third of economic activity. Almost 80% of the city's workforce is employed in the services sector. Lisbon hosts most of Portugal's public administration services, as well as its financial and legal activities, telecommunications and consulting services.

Lisbon ranks 18th in the index, with a score of 57.25 out of 100. It's relatively strong results for energy and buildings do not sufficiently compensate for poor transport, air, water, land use and waste policies. Governance problems reduce the city's capacity to implement its policies. Moreover, Lisbon does not score well when compared with other middle-income, hot-climate cities. However, Lisbon surpasses these cities in its efforts to improve.

**CO<sub>2</sub> Emissions:** Lisbon ranks 22nd for carbon dioxide (CO<sub>2</sub>) emissions. In 2007 it produced 7.5 tonnes of CO<sub>2</sub> per inhabitant, well above the average of 5.2 tonnes. This is largely due to the high volume of vehicles entering Lisbon as a result of inadequate public transport.

**Initiative:** While the city does not have a specific CO<sub>2</sub> emission-reduction target, its general energy-reduction targets will help to cut its emissions.

**Energy:** Lisbon ranks ninth for energy. At about 49 gigajoules per head per year, consumption is the third-lowest in the index and is well below the average of 81 gigajoules. The percentage of renewable energy consumed by the city was almost 10% in 2006, the seventh-best score in the index.

**Initiative:** In December 2008 Lisbon approved a strategy that aims to achieve an overall reduction in energy consumption of nearly 9% between 2009 and 2013. Energy supply has been targeted by national policies, which encourage renewable sources, such as wind power.

**Buildings:** Lisbon ranks 11th for buildings. The average age of its buildings is about 35 years, and only recently have construction standards focused more heavily on energy efficiency. The city is now at the top of the table for energy efficiency standards for buildings, although it is let down by poor incentives to promote such policies.

**Initiative:** Legislation enacted in 2009 makes it compulsory for all new buildings, as well as those subject to renovation and all buildings being let or sold, to have an energy efficiency certificate valid for ten years.

**Transport:** Lisbon ranks 25th for transport, mainly because about one in three people use their own vehicles to commute, according to 2003 data. Cycle lanes are almost non-existent

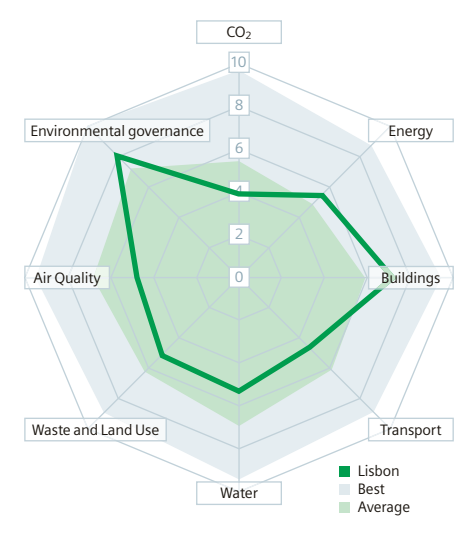


expected to be achieved by 2010. The leakage problem is tackled in the 2008 Strategy for Energy and the Environment, which has set a target of a 15.6% reduction in leakages by 2013. The document also targets a 7.8% reduction in water consumption.

**Waste and land use:** Lisbon ranks 22nd for waste and land use, largely because of inadequate policies regarding municipal waste production and reduction, waste recycling and reuse, and land use. The city scores below the west European average for the percentage of

12th for environmental governance, and is placed third among middle-income cities. This is thanks to environmentally sustainable action plans, such as the 2008 Strategy for Energy and the Environment, and to the city's openness to public participation in the discussion of plans. However, this strategy is not comprehensive, as it focuses only on water, energy and waste.

**Initiative:** In February 2009 Lisbon signed the Covenant of Mayors, a commitment assumed by 400 cities globally to reduce CO<sub>2</sub> emissions by 20% by 2020.



because of the hilly topography of the city. Public transport (consisting of railways, the metro and buses) is used by 44% of the population, a figure that is slightly higher than average, but electric trams constitute only a small part of the city's public transport network and just 5% of the bus fleet runs on natural gas. Hybrid buses will be introduced by 2010-11.

**Initiative:** Initiatives under way focus on the expansion of the metro system into suburban areas, in an attempt to reduce the number of cars entering the city. Car-pooling for public-sector employees, organised by the municipality, is currently a pilot project.

**Water:** Lisbon ranks 24th for water, while other middle-income cities with hot climates fare better. Although the city is ranked 16th for water consumption, at 87 cubic metres of water per head each year (below the average of 105 litres), qualitative aspects of water management are not as positive. Lisbon performs especially poorly on water system leakages, with a leakage rate of almost 46%.

**Initiative:** Full treatment of wastewater is

because of the hilly topography of the city. Public transport (consisting of railways, the metro and buses) is used by 44% of the population, a figure that is slightly higher than average, but electric trams constitute only a small part of the city's public transport network and just 5% of the bus fleet runs on natural gas. Hybrid buses will be introduced by 2010-11.

**Initiative:** The city's Strategy for Energy and the Environment sets targets for a reduction of 10% by 2013 in demand for non-recyclable materials and for an increase of 29% in selective waste collection.

**Air quality:** Lisbon ranks 24th for air quality, because of high levels of nitrogen dioxide and particulate matter. Clean-air policies and reducing road traffic have not been priorities, and this has contributed to the deterioration in air quality. More positively, the city has relatively low sulphur dioxide and ozone emissions, since there is little industrial production in the area.

**Initiative:** Policies to promote the use of renewable sources of energy and reduce energy consumption are expected to lead to an improvement in air quality in the city.

**Environmental governance:** Lisbon ranks

## Electric vehicles

As part of the national government's policy of developing electric mobility, a pilot programme started in Lisbon in March 2008 to install electric vehicle charging points. The project aims to reduce CO<sub>2</sub> emissions and oil consumption by encouraging the take-up of electric vehicles. The intention is to set up some 1,300 charging stations nationally by 2011, many of them in Lisbon. The charging stations already in place in Lisbon were previously reserved for city services, but are now available for use by all owners of electric vehicles. The city plans to expand this network significantly, with the aim of having 100 charging points in place by the end of 2009, 300 by the end of 2010 and 700 by the end of 2011. The government has also granted significant tax benefits to buyers of electric cars.



# Ljubljana\_slovenia



1,653 megajoules per square metre per year, well above the index average of 909 megajoules. Ljubljana has no specific standards relating to the upgrading of older buildings, although efficiency standards do exist for new buildings.

**Initiative:** The city hopes to reduce the use of energy in public buildings by 15% by 2013 compared with the level in 2004. It also plans to increase the availability of renewable energy sources in general.

**Transport:** Ljubljana ranks in 13th place in the transport category. Although the city does relatively well in transport when compared to other categories, it is still set back to some degree by the

**Waste and land use:** Ljubljana is ranked 18th in the waste and land use category, bolstered by a strong score for municipal waste production, where it comes joint sixth overall. The city's inhabitants produce about 441 kg of waste per year, well below the 30-city average of 511 kg. However, Ljubljana performs poorly on recycling, which pulls down its overall score. A new waste-management site, to help to raise the share of recycled waste, is currently being built.

**Initiative:** Ljubljana introduced a lottery in late 2008 to encourage recycling. It involves a fortnightly draw in which a household or office recycling bin is randomly selected, with a cash prize awarded if it contains the correct type of waste.



## Select city data

Population:	271,000
GDP per head, PPP:	€ 25,830
CO <sub>2</sub> emissions per head:	3.41 tonnes
Energy consumption per head:	105.87 gigajoules
Percentage of renewable energy consumed by the city:	0.21 %
Total percentage of citizens walking, cycling or taking public transport to work:	36.4 %
Annual water consumption per head:	84.31 m <sup>3</sup>
Share of waste recycled:	4.05 %

The city of Ljubljana is Slovenia's capital and the hub of the country's political, economic and financial activities. With 24.5% of Slovenia's population, in 2006 Ljubljana contributed 36.1% of national GDP.

Ljubljana ranks 19th place in the European Green City Index, with a score of 56.39 out of 100. Its score is adversely affected by poor performances in the water, energy and buildings categories. These reflect Ljubljana's antiquated water and sewage network; its scant use of renewable sources of energy; and the poor quality of insulation of its buildings.

**CO<sub>2</sub> emissions:** Ljubljana ranks 14th for CO<sub>2</sub> emissions, among its better results, and is the third-greenest city in terms of direct emissions per head (at 3.4 tonnes per year), being outperformed only by Oslo and Istanbul. Although its emissions are low compared with those of bigger cities, the amount of CO<sub>2</sub> produced by the city's traffic increased by 73% in 1989-2004, reflecting greatly increased use of private transport.

**Initiative:** Ljubljana does not have an official

CO<sub>2</sub>-reduction policy, but has pledged to draw up such a strategy during 2009 as part of its membership of the Covenant of Mayors. This strategy would aim to reduce CO<sub>2</sub> emissions by at least 20% by 2020.

**Energy:** Ljubljana is ranked just 27th for energy, mainly because of its high energy consumption and low use of renewable energy. At national level oil products account for 34% of energy consumption, coal for 22%, nuclear power for 20%, natural gas for 14% and renewable sources for 10%.

**Initiative:** In early 2009 Ljubljana built its first solar power generating unit, which will provide enough energy for 25 households.

There are plans to install additional solar panels on the roofs of several buildings from 2010 onwards.

**Buildings:** Ljubljana ranks 19th in the buildings category, as the energy consumption of most buildings in the city is relatively high. The city scores particularly poorly for energy consumption by residential buildings: it uses an estimated

relatively low usage of non-car transport. Although the city has a vast bus network, buses move slowly because of the general lack of dedicated bus lanes.

As a consequence, the number of bus passengers has been decreasing steadily for the past 15 years, and commuters tend to use their own cars for reasons of speed and comfort.

**Initiative:** In 2007 Ljubljana closed a large part of its city centre to traffic, and plans to introduce further pedestrian areas during 2009.

**Water:** Ljubljana ranks 27th in the water category. This is mainly owing to poor scores for water system leakages and the proportion of dwellings connected to the sewage system, as the city's per-head water consumption level is below the average (at 84 cubic metres per year, compared with a 30-city average of 105 cubic metres).

**Initiative:** The city authorities are planning a further increase in the number of wastewater connections in the next few years, along with repairs to the existing system in order to improve the water supply and reduce pollution.

**Air quality:** Ljubljana ranks 14th for air quality. It performs particularly well on sulphur dioxide emissions, with lower levels than many larger, wealthier cities.

So far Ljubljana has been unsuccessful in reducing traffic volumes in the city centre, and this contributes to high volumes of particulate matter, although overall pollution levels are about average.

**Initiative:** The opening of the Sentvid tunnel in 2008 has made it possible for motorists driving from the seaside to the north of Slovenia to bypass Ljubljana, thus reducing traffic and related air pollution.

**Environmental governance:** Ljubljana ranks joint 15th with London in the environmental governance category, mainly thanks to a high score in the green management subcategory. Over the past decade Ljubljana has paid ever more attention to green policies, and has recently suggested plans to design a sustainable energy action plan and to set a target for the reduction of CO<sub>2</sub> emissions, as well as subscribing to the Covenant of Mayors.

## Cycle sightseeing

From April to October, the main cycling season in Ljubljana, there are 80 bicycles available to the public for hire from eight locations in the city centre. Charges are €1 for two hours or €5 for a day, but hire is free of charge for anyone with a Ljubljana tourist card. The scheme is targeted primarily at tourists rather than local residents. Accordingly, most of the bicycles are rented during the peak tourist season from July to August. As an indication of the popularity of the scheme, at one location bicycles were hired out more than 400 times for two-hour periods in July alone, and around one-half of that number were used for full-day rental. The city authorities are planning to increase the network of locations and the number of bicycles in the scheme.



# London\_United Kingdom



## Select city data

Population:	7.6 million
GDP per head, PPP:	€ 44,890
CO <sub>2</sub> emissions per head:	5.84 tonnes
Energy consumption per head:	77.96 gigajoules
Percentage of renewable energy consumed by the city:	1.20 %*
Total percentage of citizens walking, cycling or taking public transport to work:	63 %
Annual water consumption per head:	57.59 m <sup>3</sup>
Share of waste recycled:	20 %

\*Estimate

London is the UK's largest city and its capital. It has also come to be recognised as a global centre for financial and professional services, as well as a major tourist destination. The city has a population of 7.6 million and is the headquarters for more than one-half of the UK's largest companies, as well as being a hub for multinational companies establishing a foothold in the European market.

London is ranked 11th overall in the European Green City Index, with a score of 71.56 out of 100. The city has been actively promoting its efforts on climate change, with a range of initiatives and plans that target various aspects of the environment.

**CO<sub>2</sub> emissions:** London ranks tenth overall in the category for carbon dioxide (CO<sub>2</sub>) emissions. Its inhabitants were each responsible for an average of 5.8 tonnes of CO<sub>2</sub> emissions in 2006, slightly above the 30-city average of 5.2 tonnes. However, the city has significant reduction targets in place, and is therefore ranked seventh for the ambition and credibility of its CO<sub>2</sub>-reduction strategy. The draft London Climate Change

Adaptation Strategy, published in 2008, aims to reduce London's emissions by 60% from their 1990 levels by 2025.

**Initiative:** In September 2009 ten boroughs were chosen to be low-carbon zones, and will receive funding to help meet a targeted 20% reduction in emissions by 2012.

**Energy:** London is ranked tenth in the energy category, with annual energy consumption per head almost equal to the 30-city average, at about 78 gigajoules. At just 1.2%, the city's use of renewable energy as a proportion of total energy consumption is well below the average of about 7%.

**Initiative:** London aims to generate enough energy from renewable sources to power the equivalent of 100,000 homes by 2010.

**Buildings:** London is ranked tenth in the buildings category, a position that is boosted by its strong performance on energy-efficient building incentives, many of which originate at national level.

Energy consumption per square metre in

residential homes is slightly higher than average and well above that in a number of cities with colder climates, such as Berlin and Copenhagen. However, new building standards are higher, and significant efforts are being made to retrofit older buildings.

**Initiative:** New homes will have to meet Level 3 of the Code for Sustainable Homes by 2010 and Level 6 by 2016. The code sets minimum standards for energy and water usage levels, on a scale of 1-6, helping to rate the sustainability of new homes.



**Initiative:** Thames Water has a £6.5 billion investment programme planned for 2010-15, which plans to cut system leakages by nearly one-fifth. By 2010 it aims to have reduced leakage rates to 690 megalitres per day, from 850 megalitres in 2003.

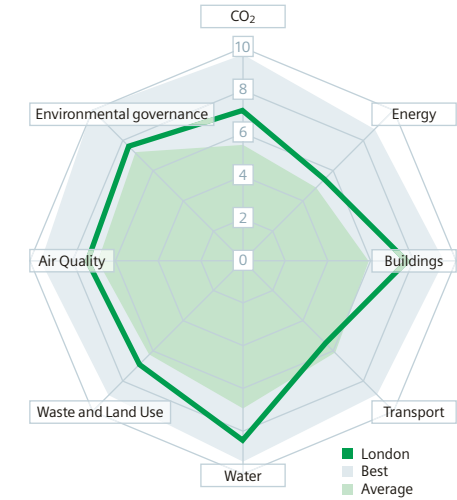
**Waste and land use:** London ranks 11th in the waste and land use category. It produces 558 kg of municipal waste per inhabitant per year, compared with a 30-city average of 511 kg. About one-half of this waste is currently managed



tory of energy use and greenhouse gas emissions in 2004-05.

The fact that some authority is devolved to the city's 33 boroughs and some is concentrated at national government level causes difficulties in terms of co-ordination on environmental governance.

**Initiative:** London's 2012 Olympic Games have been touted as the first sustainable Olympics. Commitments include using at least 20% local renewable energy sources and operating a zero-landfill policy on waste during the games.



## London's Array of power

One of London's key energy ambitions is the London Array, a planned 1,000 mw offshore wind-turbine project in the Thames estuary. When completed, it will be the largest offshore wind farm in the world, occupying 233 square km. The project will supply enough power for 750,000 homes — about one-quarter of the homes in the Greater London area — and will save 1.9 million tonnes of CO<sub>2</sub> emissions each year. The project will cost an estimated £2.2 billion, and aims to contribute as much as 10% to the UK's renewable-energy targets, with London becoming a major consumer of such energy. It is hoped that the array will start supplying electricity to the national grid by 2012, although 2013 is a more likely date for completion of the first phase, following initial planning and financing delays.



# Madrid\_Spain



## Select city data

Population:	6.1 million
GDP per head, PPP:	€ 25,012
CO <sub>2</sub> emissions per head:	4.08 tonnes
Energy consumption per head:	80.28 gigajoules
Percentage of renewable energy consumed by the city:	2.78 %
Total percentage of citizens walking, cycling or taking public transport to work:	54 %
Annual water consumption per head:	71.37 m <sup>3</sup>
Share of waste recycled:	9.88 %

Spain’s capital, Madrid, covers 0.12% of the nation’s territory but is home to 7% of the total population. The city’s economy is dominated by the services sector and is Spain’s financial, administrative and transport nerve-centre. Madrid accounts for around one-tenth of Spain’s GDP. In terms of average annual income, Madrid is at the lower end of the scale among west European cities but ranks above all east European cities.

Madrid ranks 12th overall in the European Green City Index, with a score of 67.08 out of 100. Among larger cities Madrid occupies a middle ranking, below Berlin, Paris and London but above Rome, Athens and Istanbul. Its ranking is buoyed by good performances in carbon dioxide (CO<sub>2</sub>) emissions and water. While sustainable development is newer to Madrid than to many of its west European neighbours, the city has set ambitious targets to catch up.

**CO<sub>2</sub> emissions:** Madrid does relatively well in this category, ranking ninth for CO<sub>2</sub> emissions, in large part because of its ambitious CO<sub>2</sub> emis-



sions-reduction strategy. Emissions per head, at 4 tonnes per year (2004), are below the 30-city average of approximately 5 tonnes per year. Road transport accounts for just under one-half of all CO<sub>2</sub> emissions, followed by residential homes and then the commercial and industrial sectors.

**Initiative:** As part of the Sustainable Use of Energy and Climate Change Prevention Plan for the City of Madrid 2008, the city has a target of a 14% reduction in CO<sub>2</sub> emissions by 2012, compared with the level of emissions in 2004.

**Energy:** Madrid ranks 12th for energy con-

sumption, with energy consumed per head marginally lower than the 30-city average of 81 gigajoules. Energy consumption is centred mainly on electric power, oil-based fuels and natural gas. Renewables account for less than 3% of total energy consumed; however, solar power use in particular is expected to increase considerably. The use of coal has fallen substantially.

**Initiative:** Madrid’s Climate Change Prevention Plan includes a target of a 20% reduction in fossil fuel use by 2020 compared with the 2004 level.

**Buildings:** Madrid ranks 17th for buildings. Its average annual energy consumption in residential buildings, at 614 megajoules per square metre in 2007, is lower than the index average of 909 megajoules. However, the city’s overall rank is not as strong as it could be, mainly because of its lack of high-level energy efficiency standards, although solar panels are now required in all new buildings.

**Initiative:** The city has a target of issuing energy certifications for 30% of new constructions by 2012. Its long-term target is to make energy certification mandatory.

**Transport:** Madrid ranks 15th for transport. The proportion of people walking or cycling to work (14%) is under the 30-city average (21%),



while the proportion of those taking public transport to work is about average, at 40%. Still, Madrid is well connected, with an extensive and growing metro system and a high-speed train network that is extending its reach. Madrid hopes to reduce motorised, and particularly private, transport use. It has a number of ambitious targets, such as increasing the use of biofuels to 10% of the total by 2012 and lowering private transport use by 10% by 2012 and by 20% by 2020.

**Water:** Madrid ranks seventh for water, its best performance in the index, mainly due to its

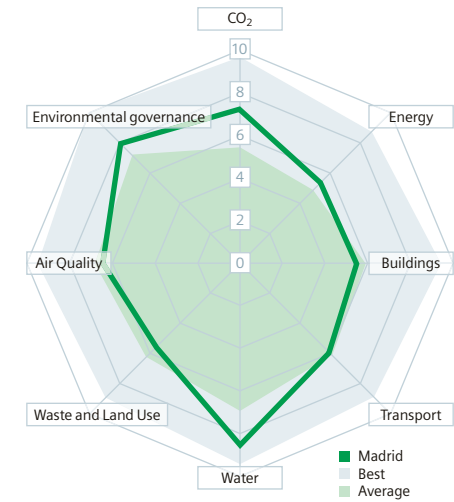
strong water-efficiency and water-treatment policies. Residents consume an average of 71 cubic metres per head per year, below the 30-city average of 105 cubic metres. Water leakages are also substantially lower than average. Madrid, like most of Spain, is subject to uncertain water resources because of high temperatures and low rainfall.

**Initiative:** Madrid’s water-treatment and water-reuse plan for 2005-10 involves the improvement of existing water-treatment systems and the reuse of purified effluents and sludge for agricultural purposes.

**Waste and land use:** Madrid ranks 19th for waste and land use. Just 10% of solid waste is recycled, lower than the index average of 18%. Around 40% of waste is sent to landfill. Municipal waste per head, at 551 kg per year, is above the average of 511 kg. The waste sector has reduced its emissions in the past decade by installing degasification systems and recovering biogas from landfill. Madrid’s green surface area makes up 43% of the city’s total area, including the city’s urban parks, gardens and forested areas, and there are measures in place to protect them. However, a decade-long construction boom has contributed to a significant amount of sprawl.

**Initiative:** The City of Madrid aims to recover all

**Environmental governance:** In 13th place in the environmental governance category, Madrid ties with Budapest. Sustainable development is relatively new to Madrid, but it has set itself an ambitious range of targets. Its recent Sustainable Use of Energy and Climate Change Prevention Plan for the City of Madrid was approved by Madrid’s government in June 2008. While citizens are not usually involved in any initial city planning, there is occasional participation later in the process.



## Regenerating the Manzanares river

The Manzanares River Project, Madrid’s main urban-regeneration project, is under way to transform the banks of the capital’s river. Water flow in the river, which runs to the west and south of the city centre, will be improved and more public spaces will be created, helping to stabilise the river’s ecosystem. Nine new pedestrian walkways over the river will link some of Madrid’s poorer neighbourhoods and will give a boost to a run-down area. The land reclamation along the river was made possible by the construction of a new and controversial motorway, the M-30, which has rerouted traffic. The area will be planted with 25,000 trees, include 42 km of pedestrian paths and 32 km of cycling tracks, and will provide a riverside beach, new children’s playgrounds and quiet areas designed to attract elderly visitors. The project began in 2008, and will cost an estimated €250 million. The first phase will be completed by 2011.



# Oslo\_Norway



## Select city data

Population:	549,000
GDP per head, PPP:	€ 59,467
CO <sub>2</sub> emissions per head:	2.19 tonnes
Energy consumption per head:	94.78 gigajoules
Percentage of renewable energy consumed by the city:	64.8 %
Total percentage of citizens walking, cycling or taking public transport to work:	57 %
Annual water consumption per head:	172 m <sup>3</sup>
Share of waste recycled:	26.6 %

Norway’s capital, Oslo, is a relatively small city, and with fewer than 550,000 inhabitants it is home to just 12% of the country’s population. The city contributes about 17% of Norway’s GDP but one-quarter of its tax revenue. Accordingly, it is a wealthy place: as of 2008, its GDP per head was the highest in Europe. Business services provided one-fifth of Oslo’s gross value added (GVA) in 2006. The wholesale and retail trade (which accounts for 14.5% of GVA) and the financial sector (nearly 11%) are also strong. By contrast, the city’s manufacturing sector is small, accounting for less than 7% of GVA, and this is a boon to Oslo’s environment. However, the population is growing by some 2% per year, faster than any of the other Nordic capitals.

Oslo is ranked third overall in the European Green City Index, with a score of 83.98 out of 100. It is also the best-performing city in terms of carbon dioxide (CO<sub>2</sub>) emissions, largely because of the use of hydroelectricity to power rail-based public transport.

**CO<sub>2</sub> emissions:** Oslo’s top ranking for CO<sub>2</sub> emissions is the result of its use of renewable and alternative energy sources for public transport and its reduction of landfill emissions. The focus on transport has had a significant impact, as pollution from private and public transport combined accounts for one-half of the city’s CO<sub>2</sub> emissions.

**Initiative:** From 2009, rather than allowing gas from its sewage plant to burn off and release its

12,000 tonnes of CO<sub>2</sub> a year, Oslo plans to harness one-half of it and convert it into bio-methane to run 80 of the city’s public buses.

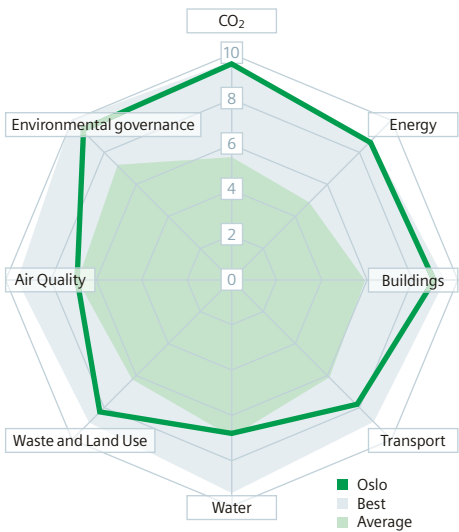
**Energy:** Oslo is ranked first in the energy category, despite ranking joint 24th with Zurich in the energy consumption subcategory. This is because the city receives full marks for its renewable-energy consumption and its clean and efficient energy policies, and also because of its number-two ranking in the energy intensity subcategory.

**Initiative:** Oslo has adopted an energy action plan to improve energy efficiency and replace fossil fuels with renewable sources, and to reduce greenhouse gas emissions from municipal buildings by 95% by 2030.

city’s low rate of residential water metering. Daily use of water per head fell from 208 litres in 1997 to 172 litres in 2007; by contrast, Amsterdam, the top-scoring city in this category, consumes just 53 litres per person per day.

**Initiative:** The new Oset water treatment plant uses coagulation and filtration as the first hygienic barrier in water treatment. The second hygienic treatment is UV disinfection with a trace residue of chlorination being retained.

**Waste and land use:** Oslo ranks sixth in the waste and land use category, surpassing other high-income cities, such as Copenhagen and Stockholm. The city’s position is bolstered by its policies on green land use and waste reduction, but is held back by lower rankings for waste



**Buildings:** Oslo is ranked third overall in the buildings category. The city is ranked sixth in the subcategory for energy consumption of residential buildings. Energy-efficient building standards are also strong, with the city ranking in joint fourth place in that subcategory.

**Initiative:** Following a city council ruling, energy efficiency assessments are being carried out on existing municipal buildings, with energy management of buildings being part of local certifications.

**Transport:** Oslo is ranked fifth overall in the transport category, behind several other high-income, small cities. While the city does well on green transport promotion and congestion-reduction policies, it performs relatively poorly in terms of the size of its non-car networks and use of non-car transport.

**Initiative:** Buses running on fossil fuels will be replaced by vehicles using biofuels and bio-gas — the latter consisting of methane generated from the city’s wet organic waste in a system that is to be introduced in 2011.

**Water:** Oslo is ranked a relatively poor 20th in the water category, reflecting its high water consumption, a fairly high leakage rate and the

recycling and reuse and for municipal waste reduction.

**Initiative:** The Marka forested hill area to the north and east of Oslo encircles part of the city. The part of Marka owned by the city has been certified with a local “Living Forest” standard.

**Air quality:** Oslo ranks only 15th in the index for overall air quality, primarily because of its poor performance on nitrogen dioxide. Its middling performance on particulate matter results from pollution in the winter months resulting from wood-burning stoves and temperature inversions.

**Initiative:** Since 2005 the city council has implemented schemes including a charge on studded tyres (which produce road dust and particulate matter), grants to replace old wood-burning stoves, an increase in the use of environmentally friendly public transport, and training for bus drivers in eco-friendly techniques.

**Environmental governance:** Oslo is rated joint fifth with Warsaw for environmental governance. Oslo’s environmental planning is co-ordinated by the city council, which is both the city and the county authority for Oslo.

## Powered by leftovers

In 2009 the Waste to Energy Agency awarded contracts to build a biogas facility at Klemetsrud that will transform food waste into biogas and bio-fertiliser, producing about 6 million cubic metres of biogas annually, which when upgraded to fuel is equivalent to about 4 million litres of diesel. The facility will be able to receive about 50,000 tonnes of food waste a year, with the possibility of extending this to 80,000 tonnes. Together with biogas from the wastewater treatment plant, it will guarantee a steady stream of biogas for the operation of vehicles, including 230 buses that are currently being adapted to use this fuel. Production of biogas from Klemetsrud will begin once a system for the separation of household organic waste is under way by 2011. The renewable-energy and wastewater project known as EGE 2010, of which Klemetsrud forms a part, has a budget of Nkr2.3 billion (about €264 million).



# Paris\_France



## Select city data

Population:	11.7 million
GDP per head, PPP:	€ 34,941
CO <sub>2</sub> emissions per head:	5.04 tonnes*
Energy consumption per head:	96.65 gigajoules
Percentage of renewable energy consumed by the city:	2.3 %*
Total percentage of citizens walking, cycling or taking public transport to work:	40.4 %
Annual water consumption per head:	109.5 m <sup>3</sup>
Share of waste recycled:	19 %

\*Estimate

Paris is an important crossroads between Germany, Belgium, Luxembourg and the UK, principally because of its location and a high-speed train network. The Paris metropolitan area and the greater Paris region (Ile-de-France) together form the most densely populated part of France, with nearly 12 million inhabitants. The underlying statistics and indicators used in the index are based on this greater area except where otherwise indicated<sup>1</sup>. It is the second-largest city in the European Green City Index after Istanbul. The economy is shifting steadily

towards services, including finance and information technology, but Paris remains an important manufacturing zone.

Paris ranks tenth overall in the index, scoring 73.21 out of 100, second only to Berlin within the group of large cities. Its environmental performance is particularly strong in the carbon dioxide (CO<sub>2</sub>) emissions, buildings, water and governance categories.

**CO<sub>2</sub> emissions:** Paris is ranked sixth for CO<sub>2</sub> emissions, a strong performance considering

the city's high density of inhabitants and activities. Its CO<sub>2</sub> emissions, estimated at 5 tonnes per inhabitant in 2006, are almost identical to the 30-city average but are better than those of other big capitals, such as London and Berlin.

**Initiative:** Aéroports de Paris (ADP), which runs Paris' airports, has launched an inter-company car-sharing network, initially targeting the 63,000 employees of ADP and the local Orly-Rungis centre.

**Energy:** Paris ranks 16th in the energy category. Nuclear-generated power now accounts for more than 40% of France's total consumption, making the country one of the world's biggest producers of nuclear energy. But Paris is hampered by a low proportion of renewables in its energy supply.

**Initiative:** A recently launched pilot project, ZAC Pajol, has as one of its aims the construction of the largest urban solar power generation structure in France by 2013.

**Buildings:** Paris ranks seventh overall in the buildings category, one of its strongest perfor-

for use of non-car transport. The main reason for its relatively poor performance is that although an extensive network of cycle lanes exists, the proportion of people walking or cycling to work stands at just 0.2%, far below the average of 20.9%.

**Initiative:** In 2007 the city's administration launched a bicycle-sharing programme, Vélib, introducing 10,000 bicycles in 750 automated rental stations at affordable rates (the first 30 minutes of use are free). In less than two years these numbers have doubled, and the system is now the largest of its kind in the world.

**Water:** Paris ranks ninth in the water category overall. However, it scores worse than other large cities in the index, such as London, partly because water prices are 25% lower than in Germany and 20% lower than in the UK, thereby encouraging overconsumption.

**Initiative:** The municipality's environmental department has launched Ecogestes (Environmental Gestures), an educational campaign aimed at citizens that shows how to reduce water consumption by means of simple daily measures via a series of videos.

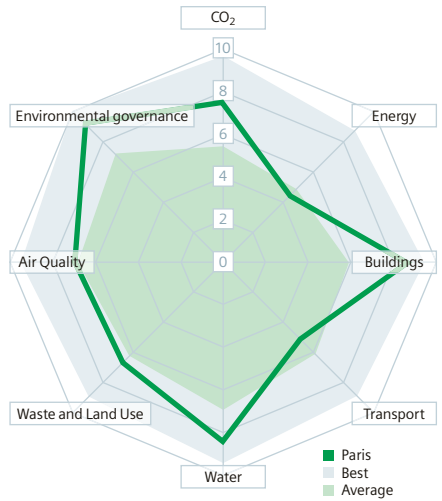
**Air quality:** Paris ranks 13th for air quality. Levels of air pollution in the city, which is mainly caused by transport, heating and industry, still exceed the limits set by some national and European regulations.

**Initiative:** The city's administration is addressing the problem of air pollution through a number of measures, aimed mainly at reducing traffic intensity through the development of public transport in the suburbs and the promotion of green transport, such as the use of electric cars, cycling and walking.

**Environmental governance:** Paris ranks in joint seventh place with Vienna in the environmental governance category. This is the best score in this category among the group of large cities.

A new project to define a vision for 2030 for the city was presented in 2009 by the French government (see highlight project).

**Initiative:** The city has developed the Local Town Planning Plan and the Paris Transport Plan, and has recently launched the city's climate plan.

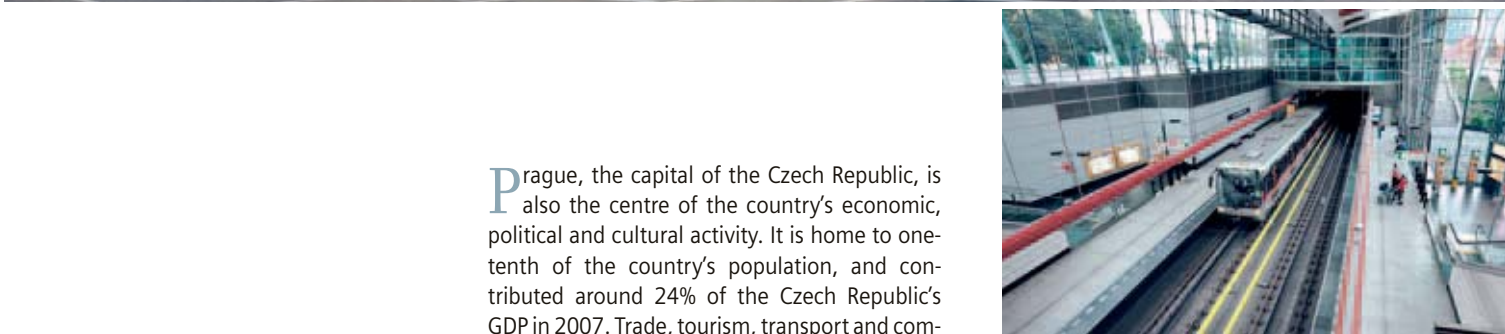


## Le Grand Paris

Proposed by the French authorities, Le Grand Paris is an ambitious urbanisation scheme with the aim of developing the city of Paris and its surrounding suburbs. The scheme's objective is to transform Paris through the pursuit of an innovative and environmentally friendly urbanisation strategy over the next two decades. Key to this strategy is the full incorporation and integration of the Ile-de-France suburban area into the metropolis through enhanced transport and infrastructure links, to bring the city's size into line with that of other major capitals. One notable aspect would be an automatic metro system for Ile-de-France, linking new towns and airports, which is expected to cost some €20 billion. Currently ten separate projects, led by architects but conceived by teams including engineers, sociologists and philosophers, have been submitted for examination. This undertaking adheres to an ethic of sustainable development, with the aim of eliminating social exclusion. Architectural projects undertaken in this context are also intended as a contribution to French cultural heritage.



# Prague\_Czech Republic



## Select city data

Population:	1.2 million
GDP per head, PPP:	€ 25,023
CO <sub>2</sub> emissions per head:	8.05 tonnes
Energy consumption per head:	67.19 gigajoules
Percentage of renewable energy consumed by the city:	1.02 %*
Total percentage of citizens walking, cycling or taking public transport to work:	67 %
Annual water consumption per head:	84.61 m <sup>3</sup>
Share of waste recycled:	13.77 %

\*Estimate

Prague, the capital of the Czech Republic, is also the centre of the country's economic, political and cultural activity. It is home to one-tenth of the country's population, and contributed around 24% of the Czech Republic's GDP in 2007. Trade, tourism, transport and communications together made up one-third of Prague's GDP in that year, while industry contributed only 13%, less than one-half of the national average share of 32.6%, in one of the EU's most industrialised economies. During the past 20 years of economic transition, Prague has seen a structural shift away from production and towards business-related services, and a number of multinational firms have their European headquarters in the city.

Prague is ranked 24th overall in the European Green City Index, with a score of 49.78 out of 100. The city performs best in the categories of water and of waste and land use, ranking in the top half of the index for these categories.

**CO<sub>2</sub> emissions:** Prague is ranked 25th for carbon dioxide (CO<sub>2</sub>) emissions, with around 8 tonnes of emissions per head per year (including other greenhouse gas emissions, as the city's CO<sub>2</sub> data are not published separately) — above the index average of about 5.2 tonnes. Prague's CO<sub>2</sub> intensity is also well above average.

**Initiative:** To cut transport-related CO<sub>2</sub> emissions in the city, Prague is investing heavily in the construction of inner and outer ring roads.

**Energy:** Prague ranks 24th in the energy cate-

gory, with a score similar to that of several other post-communist capitals. Prague is powered by combined heat and power (CHP) stations fuelled primarily by coal and gas, but is also supplied with nuclear power and some hydroelectricity.

**Initiative:** Prague has gradually increased spending to subsidise the replacement of fossil-fuel-based energy sources with cleaner and/or renewable sources, with the help of EU funds. The primary focus is on shifting fuel use by residents away from coal and towards natural gas, or on connecting them to the city's central heating system.

**Buildings:** Prague ranks 26th in the category for buildings, and has one of the highest residential energy consumption levels of any city in the index (at 1,163 megajoules per square metre, compared with an average of 909 megajoules). New national standards aim to cut energy consumption in newly constructed buildings, but incentives for more efficient construction are currently limited.

extension of the Green Line, and the construction of a new Blue Line, scheduled for completion by 2020.

**Water:** Prague ranks in tenth place in the water category — its best rating in any category in the index. The city consumes around 85 cubic metres of water per person per year, a figure well below the 30-city average of 105 cubic metres.

**Initiative:** A new sewage-treatment plant is planned for the city, although construction has been delayed because of flooding and issues relating to the absorption of EU funds.

**Waste and land use:** Prague is ranked in 14th place in the waste and land use category; the city produces 480 kg of waste per head each year, below the average of 511 kg. Recycling has improved significantly thanks to a system adopted in 1998, involving widely distributed recycling boxes and various campaigns supported by public funds.

**Initiative:** New legislation is in the pipeline that would oblige all municipalities to provide citizens with the infrastructure required to recycle basic items such as paper, glass and plastics. Fees for waste disposal are expected to be levied according to the volume of waste created, and fees for the dumping of waste are likely to increase in order to boost recycling.

**Air quality:** Prague ranks only 20th for air quality. However, emissions have fallen by more than 70% during the past 20 years, thanks to the concerted efforts that have been made to reduce pollution in the country as the Czech Republic's economic transition has gathered momentum.

**Initiative:** The city set out air quality targets to be attained by 2010 in a strategy document released in 2000. However, it seems unlikely that these will be met.

**Environmental governance:** Prague ranks 27th in the category for environmental governance. Green policies remain secondary to other concerns for the city. The quality and breadth of environmental information provided varies widely depending on the topic, and information is not always readily available.



**Initiative:** In May 2009 the Czech government launched a nationwide programme to retrofit buildings, with a €1 billion budget financed by the sale of CO<sub>2</sub> emission permits to Japan.

**Transport:** Prague, which continues to pursue a car-friendly approach, is ranked 26th overall in the transport category. Traffic levels have increased threefold during the country's economic transition since 1991, and the limited efforts made to contain or reduce traffic are the primary reason for Prague's relatively poor score in this category.

**Initiative:** The subway rail system has been gradually extended, with the number of stations increasing from 33 to 58 in the past two decades. Two major upgrades are under way: the



## Boom time for ferries

Favourable regulation and pricing policies have revived a traditional mode of public transport, in the form of the small passenger ferries that cross the Vltava river in Prague. There are now 12 ferries serving the city, five of them launched during the past four years, reflecting strong demand for this enjoyable and flexible method of travel. In 2008 some 350,000 passengers crossed the river this way. People use the ferries as a regular route to work from areas that are poorly served by conventional means of transport. The interests of the individual ferrymen have been promoted via municipal policy, as the ferries are subsidised by the city and are treated as part of the public transport network. Passengers may buy tickets directly; use a transfer ticket from trains, the subway system or trams; use travel passes; or buy tickets via mobile phone. A frequent schedule has also helped to establish ferries as a reliable way to get around the city — some make as many as 300 trips per day during busy periods.



# Riga\_Latvia



## Select city data

Population:	717,000
GDP per head, PPP:	€ 18,538
CO <sub>2</sub> emissions per head:	3.98 tonnes
Energy consumption per head:	69.18 gigajoules
Percentage of renewable energy consumed by the city:	7.09 %
Total percentage of citizens walking, cycling or taking public transport to work:	73.4 %
Annual water consumption per head:	90.11 m <sup>3</sup>
Share of waste recycled:	8 %

Riga is home to some 717,000 people, around one-third of Latvia's population, and accounts for over one-half of the country's GDP. The city has a significant industrial base, with manufacturing accounting for around 8.5% of the city's GDP in 2006 and construction for a similar proportion. The main subsectors are food-processing, pharmaceuticals, timber and furniture, textiles, communications equipment, and printing and publishing. Services account for the bulk of GDP, and financial services and real estate have played a growing role in recent

years, while tourist numbers have risen significantly since Latvia's accession to the EU in 2004. Riga ranks in the middle of the European Green City Index, in 15th place, with a score of 59.57 out of 100. However, its performance is better than that of most cities in the index with similar levels of prosperity, and it is one of the highest-ranked east European cities, behind only Vilnius.

**CO<sub>2</sub> emissions:** Riga ranks 15th for carbon dioxide (CO<sub>2</sub>) emissions. It has the second-best score among east European cities in this category,

**Initiative:** Pilot projects have been developed for the construction of energy-efficient ("passive") housing. Average heat loss from such homes is 15 kwh per square metre per year, compared with the average for housing in Riga of 231 kwh. Technical plans for the homes have been completed.

**Transport:** Riga ranks in 14th place in the transport category. It scores well for use of non-car transport — around two-thirds of the population use public transport to get to work, while

**Initiative:** The city council has developed a household waste management plan for 2006-12 that aims to increase waste sorting and raise the proportion of waste that is recycled.

**Air quality:** Riga performs well on air quality, ranking seventh, placing it second-highest among the low-income cities, after Vilnius. This reflects the absence of a heavy-industrial base and the closure of Soviet-era facilities.

**Initiative:** In 2009 the city council hopes to draw up a second air-improvement action plan

ry, behind only Ljubljana. At slightly less than 4 tonnes per head, annual CO<sub>2</sub> emissions are significantly below the 30-city average of 5.2 tonnes.

**Initiative:** The city is aiming to achieve the EU-mandated national target for CO<sub>2</sub> emissions. Emissions are expected to be some 40% lower than the 1990 level by 2010, although it is not yet clear how close to this target the city is.

**Energy:** Riga ranks 22nd in the energy category. Gas accounted for the bulk of the city's energy consumption in 2004, at over 62%, while oil accounted for just under 30%, renewables made up about 7% and the remainder, a tiny fraction, was accounted for by coal.

**Initiative:** Over 6,500 automatic heat substations have been installed in residential buildings, allowing the supply of heat to be regulated and permitting a reduction of up to 30% in heat consumption.

**Buildings:** Riga is ranked 18th in the buildings category. The city's building stock is relatively old and in many cases energy-inefficient, particularly with regard to heat insulation. However, the city's poor score is largely the result of limited policy initiatives in this area.

another 6% walk or cycle. The public transport system is fairly extensive, and electric-powered trolleybuses and trams make up over one-half of the public transport vehicle fleet.

**Initiative:** Two key initiatives are currently under way to reduce car use. The first is to extend the network of cycle lanes, while the second is to establish a park-and-ride service on the outskirts of the city once certain highways have been extended to the ring road.

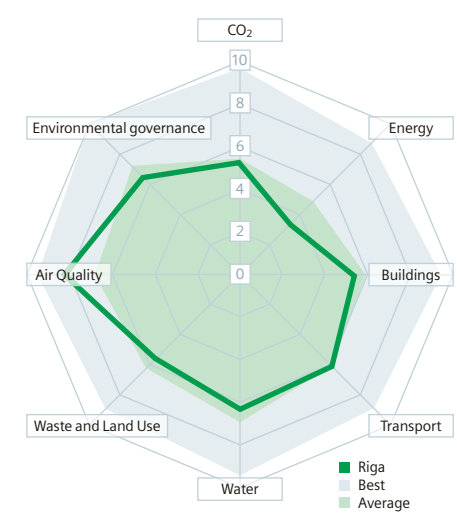
**Water:** Riga is ranked 21st in the category for water. Annual consumption per head of about 90 cubic metres is below the 30-city average of 105, while system leakages are about average. Furthermore, the widespread use of water meters helps to promote lower water usage.

**Initiative:** Riga Water has been carrying out a longer-term programme to improve the use of ground water, in order to bring the quality of the city's drinking water up to EU standards.

**Waste and land use:** Riga ranks 20th for waste and land use. Recycling facilities are not extensive, and no major public-awareness campaigns to encourage a reduction in waste creation have been undertaken. Moreover, land-use policies are not particularly comprehensive.

for 2010-14, but this depends on sufficient funds being made available.

**Environmental governance:** Riga's performance on environmental governance is mixed, and the city therefore ranks 19th. Although environmental concerns have tended to feature in the city's policies, commitment to high standards of environmental governance throughout the city administration has not been consistent.



## Powering on: renovating Riga's power plants

Two large Soviet-era combined heat and power plants in Riga district have been renovated by the national power company, Latvenergo, with the backing of the city council. The first, TEC-1, opened in 2005, while the first unit of the second, TEC-2, opened in May 2009. There are plans to add another unit to TEC-2 by 2012, reducing Latvia's electricity import requirement. The plants generate both heat and electricity — a more environmentally efficient approach than generating each separately. They account for around 30% of Latvenergo's total electricity generation and 70% of the heat supplied to Riga's heating system. The renovation of the plants has led to a considerable fall in harmful emissions. The reconstructed plants have switched from the use of oil to the more environmentally efficient gas, and generate up to three times more electricity per heating unit thanks to greater efficiencies. Latvenergo is also undertaking upgrading work on TEC-2, with the aim of halving the plant's CO<sub>2</sub> emissions by 2011.



# Rome\_Italy



## Select city data

Population:	4 million
GDP per head, PPP:	€ 27,910
CO <sub>2</sub> emissions per head:	3.5 tonnes*
Energy consumption per head:	84.57 gigajoules
Percentage of renewable energy consumed by the city:	18.69 %*
Total percentage of citizens walking, cycling or taking public transport to work:	44 %*
Annual water consumption per head:	87.03 m <sup>3</sup>
Share of waste recycled:	19.5 %

\*Estimate

Rome, Italy's capital, with its historic monuments and the Vatican City, is one of the most visited cities in Europe, attracting over 20 million travellers every year. Its population of about 4 million makes it the fifth most populous city in the European Green City Index. Tourism, public administration, media, information and communications technology and banking are all important businesses in the city. Rome is also the headquarters of many of Italy's biggest companies. In 2007 Rome contributed 6.5% of the country's GDP.

Rome ranks in the middle of the index, in 14th place overall, with a score of 62.58 out of 100. Despite the absence of heavy industry, Rome suffers from problems such as pollution and traffic congestion, which are largely the result of the original structure of the city and of its climate, although they also stem from limited environmental governance.

**CO<sub>2</sub> emissions:** Rome ranks seventh for carbon dioxide (CO<sub>2</sub>) emissions. This good performance is thanks to its low CO<sub>2</sub> emissions per capita,

estimated at 3.5 tonnes per inhabitant per year, compared with an average for the 30 cities of about 5 tonnes. Rome's CO<sub>2</sub> intensity is also well below average.

**Initiative:** The Roma per Kyoto initiative, co-founded by the European Community, sets guidelines for the reduction of Rome's CO<sub>2</sub> emissions.

**Energy:** Rome is ranked in seventh place in the energy category — the highest ranking of any large city in this category. Nearly 19% of Rome's energy is supplied from renewable sources, mainly solar thermal and photovoltaic. This places the city fourth in the renewable energy consumption subcategory.

**Initiative:** At national level, the government has promoted the use of photovoltaic technology since 2005. So far Rome has installed about 5,090 kw of solar power generation capacity.

**Buildings:** Rome ranks 15th in the buildings category, in part because of its weak energy-efficiency standards. Rome's many ancient

city. So far there have been just 3,000 subscribers. An integrated mobility plan has also gotten underway.

**Water:** Rome ranks 19th overall in the water category. This is partly because of water system leakages: about 40% of water is lost during distribution, a worse performance than the 30 city average of about 23%. In terms of water consumption the city does better, with 87 cubic metres consumed per head in 2007, below the 30-city average of 105 cubic metres.

**Initiative:** National legislation implemented in Rome has enforced the use of rainwater and grey-water systems for new buildings.

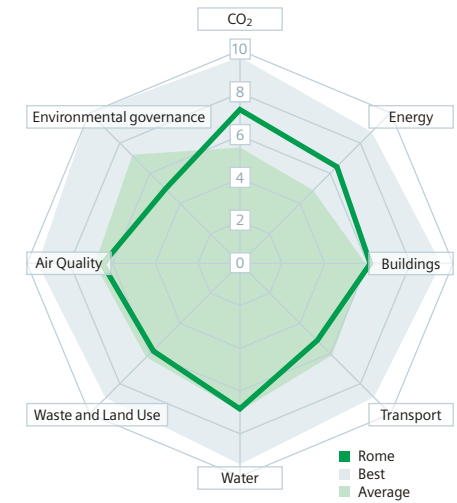
**Waste and land use:** Rome ranks 17th overall in the waste and land use category, hindered mainly by a poor score for municipal waste production. However, 19.5% of waste was recycled in 2008, a level similar to that in other large capitals, such as London and Paris, and higher than that in many other middle-income cities.

**Initiative:** The city has implemented a progres-

sive taxation system that is calculated as a function of the amount of waste collected to reduce the creation of waste since 2003.

approved in 2002, but it does not constitute a comprehensive environmental strategy. A change in local government in 2008 may result in revisions to current strategies, with higher priority given to environmental policies, such as an integrated mobility plan.

**Initiative:** The Roma Capitale plan, which has recently been finalised, enhances the autonomy of the city administration from the national framework.



## Countdown 2010

In February 2008 Rome signed up to Countdown 2010, a network of more than 600 partners and cities committed to tackling climate change and the loss of biodiversity. The original commitment started in 2001 at an EU summit in Gothenburg, while in 2002 the network agreed to work to reduce significantly the rate of loss of biodiversity by 2010. In joining this initiative, Rome plans to invest in the design of a pilot project focusing on sustainable buildings. The pilot buildings will aim to feature green roof coverings, solar thermal heating and high levels of both energy and water efficiency. In turn, they are intended to act as educational and awareness-raising centres within the city. The project will be developed by the environmental policies department of the Municipality of Rome and the research centre of La Sapienza university. Along with this, the city also aims to plant 500,000 trees in order to establish ecological corridors between its various parks.



# Sofia\_Bulgaria



## Select city data

Population:	1.2 million
GDP per head, PPP:	€ 12,954
CO <sub>2</sub> emissions per head:	4.32 tonnes*
Energy consumption per head:	80.71 gigajoules
Percentage of renewable energy consumed by the city:	1.39 %*
Total percentage of citizens walking, cycling or taking public transport to work:	75.4 %
Annual water consumption per head:	188.52 m <sup>3</sup>
Share of waste recycled:	0.02 %

\* Estimate

Bulgaria's capital city, Sofia, is the political and economic centre of the country. With about 1.2 million inhabitants, or around 16.5% of Bulgaria's population, Sofia contributed approximately 33% of the country's GDP in 2007. The population has risen noticeably since 2001, in contrast to the national demographic trend, as the city has flourished during the transition period, attracting more than 60% of Bulgaria's total foreign direct investment. Sofia's economic growth has also led to overcrowding on public transport and traffic congestion on the city's main roads.

Sofia ranks 29th in the European Green City Index, with a score of 36.85 out of 100. As in the cities of other post-communist countries, years of neglect and underinvestment have had a detrimental impact on Sofia's environment. The city is also located towards the bottom of the income scale in the index, a factor that appears to be correlated significantly with environmental performance.

**CO<sub>2</sub> emissions:** Sofia ranks 29th for carbon dioxide (CO<sub>2</sub>) emissions. Estimated annual emissions, at 4.3 tonnes per head, are comfortably



below the 30-city average of about 5.2 tonnes, but the city's intensity of CO<sub>2</sub> emissions (that is, the level of emissions per unit of GDP) is estimated to be far above average.

**Initiative:** The city's policy for controlling CO<sub>2</sub> emissions centres on improving public transport by expanding the network and gradually replacing older, more polluting buses.

**Energy:** In the energy category Sofia ranks 28th overall. Sofia has a large combined heat and power (CHP) plant and has made improvements to its district heating system, but the city's ener-

gy mix includes only a small proportion of renewable energy, at less than 1% of energy consumed. Furthermore, the city does not have policies of its own to encourage the use of green energy through low taxes or subsidies.

**Initiative:** The company responsible for water management in Sofia, Sofiyska Voda, has been working on the installation of three CHP plants to generate heat and electricity from the biogas produced during the decomposition of sewage sludge at the Kubratovo wastewater-treatment works. The company will then sell the electricity to the national electricity company.

**Buildings:** Sofia ranks 14th in the buildings category — much better than the city's performance in any other category, and below only Vilnius among low-income cities. Its relatively good score stems chiefly from the city authorities' decision to promote the retrofitting of housing to improve energy efficiency.

**Initiative:** Homeowners in Sofia are eligible for small loans to improve the energy efficiency of their homes, funded by the European Bank for Reconstruction and Development (EBRD) and the Kozloduy International Decommissioning Fund.



**Transport:** Sofia is ranked 27th in the transport category. Public transport is widely used: nearly two-thirds of the city's population commute to work on public transport, far ahead of the 30-city average of 42%.

**Initiative:** The city administration is beginning to upgrade the bus fleet, introducing newer, fuel-efficient buses. More than 100 buses have been converted to dual-fuel operation, while a few buses operate on biofuel blends.

**Water:** Sofia is ranked in last place in the water category. Water consumption per head is far

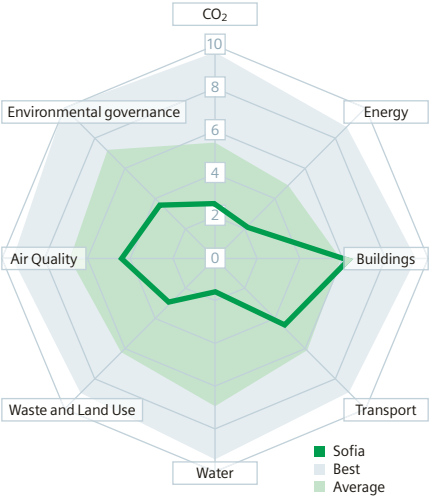
higher than the index average, while and the percentage of water leakage is three times the average. Furthermore, the percentage of dwellings connected to the sewage system, at 85%, is significantly below the 30-city average of 95%.

**Initiative:** There is an ongoing integrated water project being funded by the EU that will improve several aspects of Sofia's water system, including treatment of drinking water and wastewater.

**Waste and land use:** Sofia ranks 29th for waste and land use. Although estimated figures suggest that the amount of waste produced per head in the city is far below the 30-city average, waste disposal is a massive and ongoing problem. Sofia is close to green spaces in the surrounding mountains, but rapid development in recent years has encroached on green spaces within the city.

**Initiative:** A new regulation for the rehabilitation and development of Sofia's urban green spaces was approved in 2007.

**Air quality:** Sofia ranks 29th for air quality, mainly because of high levels of particulate matter and the city's lack of clean-air policies. Above-



## Rehabilitating Sofia's district heating

In June 2003 the World Bank approved a project to renovate the Sofia District Heating Company. The three objectives were to minimise heat losses, to rehabilitate the system to enable it to respond better to changing demand, and to gain environmental benefits through reductions in emissions and air pollution. Consultation with the public was carried out and an Environmental Management Plan (EMP) published before the work started in 2005; the project was finally completed in 2007. It involved extensive rehabilitation of the network of transmission pipes and the replacement of substations in order to reduce heat losses. In addition, the project mandated the installation of technology to allow for variable flow, meaning that consumers can automatically regulate their heat consumption. By 2007 the World Bank estimated that heat losses had been reduced by 10% in Sofia compared with 2002, that heat consumption by households had dropped by 30% and that carbon emissions had been reduced significantly. The funding needs of the project, estimated at US\$115 million, were met by loans from the World Bank (US\$27.2 million) and the EBRD as well as grants from the EU's PHARE programme and the Kozloduy International Decommissioning Fund, together with a contribution from the Sofia District Heating Company.



# Stockholm\_Sweden



from renewable sources. Around 80% of the population has access to district heating (combined heat and power), 80% of which is provided by renewable energy sources.

**Initiative:** Stockholm's long-term plan is to be fossil fuel-free by 2050. This means that emissions from energy use related to the heating of houses and commercial premises, vehicles and electricity use in the city will be reduced to a level near to zero by 2050.

**Buildings:** Stockholm ranks joint first in the buildings category, with Berlin. Like its Nordic neighbours, Sweden has been at the forefront of energy-efficient building standards, with the result that Stockholm achieves the maximum score for both building standards and incentives.

**Initiative:** Work has begun on the Stockholm Royal Seaport, a new city district that is being built in Stockholm's harbour area, which has three main environmental targets: by 2020 annual carbon emissions will be below 1.5 tonnes per person; by 2030 the seaport will be free of fossil fuels; and the seaport will be adaptable to future changes in climate.

**Water:** Stockholm ranks joint 16th in the water category, on account of its high water consumption and poor water-efficiency policies. Stockholm's residents consume almost 186 cubic metres of water per head per year, well above the 30-city average of 105 cubic metres.

**Initiative:** A strategic programme of water management was adopted by Stockholm city council in June 2006, setting standards for cleaner water and outlining methods by which this could be achieved.

**Waste and land use:** Stockholm ranks eighth for waste and land use. The fact that it does not do better in this category is attributable to its sizeable municipal waste production, which is above the European average. Stockholm has for many years protected its green spaces, and around 85% of the population live less than 300 metres from parks and green areas.

**Initiative:** The city's Waste Management Plan specifies that the collection and treatment of food waste should increase from the current level of around 4,500 tonnes per year to 18,000 tonnes during the period from 2008 to 2012.



## Stockholm's urban development showcase

Hammarby Sjostad is Stockholm's largest environmental project to date, and represents a high-profile case study in sustainable urban development. Started in 1990, the aim of the project was to redevelop an old and rundown industrial area into a highly energy-efficient and environmentally conscious neighbourhood. When completed in 2016, over 10,000 residential units will house some 25,000 people. The project incorporates a wide range of environmental goals and aspirations. Its buildings are around twice as energy-efficient as others in Stockholm. The project makes good use of wind, solar and hydro power, as well as other efficient technologies, including district heating and cooling. One of the project's goals is to base its entire heating-energy supply on either waste energy or renewables. From a transport perspective, the project aims for 80% of all journeys to be made using public transport or by walking or cycling. The area also features clean and efficient water and sewage systems; its water consumption target is 100 litres per head per day. Waste is collected by a vacuum suction system, which carries refuse to a central collection station. The project reuses local combustible waste in a combined heat and power plant, while biogas from a local wastewater facility is used for transport fuel.

### Select city data

Population:	795,000
GDP per head, PPP:	€ 39,415
CO <sub>2</sub> emissions per head:	3.62 tonnes
Energy consumption per head:	104.88 gigajoules
Percentage of renewable energy consumed by the city:	20.08 %
Total percentage of citizens walking, cycling or taking public transport to work:	93 %
Annual water consumption per head:	185.75 m <sup>3</sup>
Share of waste recycled:	31 %

Stockholm, the capital of Sweden, has a population of around 800,000, representing nearly one-tenth of the country's total population. The city's economy is dominated by the services sector, with a particularly high concentration of jobs in information technology, the healthcare industry and research. Stockholm is almost devoid of heavy industry, and this has helped to make it one of the world's cleanest cities.

Stockholm is ranked second in the European Green City Index, with a score of 86.65 out of 100. The city does particularly well in the areas of carbon dioxide (CO<sub>2</sub>) emissions, buildings, transport, air quality and environmental governance. It shares a number of characteristics with its Nordic neighbours, Copenhagen, Oslo and Helsinki (all of which rank highly in the index);

these include a plentiful supply of water, a lack of heavy industry and a long tradition of policies aimed at protecting the environment.

**CO<sub>2</sub> emissions:** Stockholm ranks second in the index for CO<sub>2</sub> emissions, behind Oslo, which, like Stockholm, has a heavily services-centred economy. Stockholm also benefits greatly from having practically no heavy industry.

**Initiative:** Stockholm plans to reduce its annual emissions to a maximum of 3 tonnes of CO<sub>2</sub> per head by the end of 2015.

**Energy:** Stockholm ranks fourth in the energy category. It has a strong green-energy profile: Over 60% of electricity consumed by the city and 20% of its overall energy consumption come

**Transport:** Stockholm ranks first in the transport category. A large proportion of people walk or cycle to work, and the cycle network is well developed.

Stockholm has the highest percentage of clean vehicles in Europe, and 75% of the city's public transport network runs on renewable energy.

**Initiative:** To reduce emissions, the Clean Vehicles in Stockholm initiative, which promotes hybrid and biofuel-powered vehicles, has the objective of reaching a market breakthrough level of 5% for clean vehicles. The initiative's goals are that by the end of 2010 all of the municipality's own vehicles will be clean and that 35% of new-car sales will be of clean vehicles.

**Air quality:** Stockholm is ranked second for air quality. The city's air quality has improved substantially in the past decade, with particulate matter standing at 16.7 micrograms per cubic metre in 2007, the lowest level in Europe.

**Initiative:** In 2008 construction started on the Northern Link, which will be a section of the peripheral route around the inner-city area and will form part of the E20 European highway.

**Environmental governance:** Stockholm ranks joint first in the environmental governance category, along with Brussels, Copenhagen and Helsinki. The city is currently implementing its sixth consecutive Stockholm Environment Programme (for 2008-11), which covers all the main environmental issues.





# Tallinn\_Estonia



## Select city data

Population:	398,000
GDP per head, PPP:	€ 26,580
CO <sub>2</sub> emissions per head:	6.8 tonnes*
Energy consumption per head:	89.56 gigajoules*
Percentage of renewable energy consumed by the city:	0.19% *
Total percentage of citizens walking, cycling or taking public transport to work:	61 %
Annual water consumption per head:	50.39 m <sup>3</sup>
Share of waste recycled:	31.4 %

\*Estimate

port of Tallinn is the largest in the Baltic states in terms of freight and passenger transit. The city's industrial sector encompasses light industry, food processing and textiles.

Tallinn ranks 23rd in the European Green City Index, with a score of 52.98 out of 100. The city performs best on air quality, water and transport. However, economic pressures have made it difficult for the city to prioritise environmental concerns.

**CO<sub>2</sub> emissions:** Tallinn ranks 26th in the category for carbon dioxide (CO<sub>2</sub>) emissions. The city produces 6.8 tonnes of CO<sub>2</sub> per head per year, above the 5 tonne average. This reflects Estonia's national pattern of energy use, with most power being generated from oil shale rather than greener alternatives.

**Initiative:** There are no sustained, targeted campaigns under way to reduce emissions, although the city does encourage sustainable transport.

**Energy:** Tallinn ranks 29th in the energy category. This is partly because of the lack of a clear sustainable-energy policy, and also because of the national structure of power generation,

the 1980s. Owing to a lack of investment, most of this housing is in dire need of maintenance and renovation.

**Initiative:** Estonia has a national government-led initiative, KredEx, which provides loans for renovation projects in apartment blocks that will improve efficiency by at least 20%, rising to 30% on larger buildings.

**Transport:** Tallinn is ranked joint tenth with Budapest in the transport category — one of its highest rankings in the index. As of 2008, 61% of inhabitants walked, cycled or took public transport to work.

This puts the city more or less on par with the overall average, but the distribution is weighted towards walking and cycling, which boosts its score.

**Initiative:** Tallinn is a member of the Civitas Mimosa project (along with Bologna, Funchal, Gdansk and Utrecht), which aims to promote the use of clean transport. It frequently runs publicity campaigns to promote public transport and discourage car use.

**Water:** Tallinn scores fairly highly in the water category, ranking 12th overall. However, the

ding ranking in the category for waste and land use, at 16th overall. It scores successfully in terms of waste recycling and reuse and waste-reduction policies, but does poorly on production of municipal waste.

**Initiative:** Since 2003 the city administration has been the main organiser of the periodic Tallinn Waste Conference, which aims to share experience and best practice in municipal waste management.

**Air quality:** Tallinn ranks sixth in the category for air quality, supported by levels of pollutants that are well below average: nitrogen dioxide levels are about one-third of the index average, while sulphur dioxide levels are about one-fifth of the average and levels of particulate matter stand at about one-half of the average.

**Initiative:** In conjunction with Civitas and EU initiatives for cleaner transport in cities, Tallinn is undertaking a study to improve the flow of public transport, which should assist in bringing about a reduction in vehicle-related emissions.

**Environmental governance:** Tallinn ranks 18th in the environmental governance cate-



## Tallinn's e-enabled transport

Working with Civitas, Tallinn city council is undertaking a project to increase the use of public transport by improving traffic flow and reducing journey times. The key aspect of the project is the aim of establishing a priority network for municipal bus transport. In accordance with Tallinn's tradition of e-innovation, buses are being fitted with priority signalling equipment that will inform traffic lights of their approach and facilitate a quick passage through junctions. Electronic displays in public transport and pre-recorded automatic stop-announcements are also being introduced, with a view to making the system more passenger-friendly and reducing the steep decline in public transport use in favour of private cars that has occurred in the past decade. Initial reports, from 2008, suggest that the decline has been halted, but further measures are planned to attempt to reverse it. For example, sensors in buses will carry out automatic passenger counting to optimise timetables according to fluctuations in passenger flow.



which is skewed towards coal- and oil shale-fired generation.

**Initiative:** Energy policy tends to be determined at national level, but Eesti Energia, an energy company, has opened a number of renewable energy plants in recent years.

**Buildings:** Tallinn ranks 29th overall in the buildings category, ahead of only one other city, Kiev. Although there was a housing construction boom in 2005-07, most of Tallinn's housing stock was built between the 1960s and

city's ranking in this category is skewed by its good result in the water consumption subcategory, where it ranks first of the 30 cities in the index, with the lowest consumption per head.

**Initiative:** An European Investment Bank co-funded project, to run until 2010, will provide a total of €82.5 million to add a further 142 km to the water supply and sewage network, as well as to carry out pipeline rehabilitation to prevent a deterioration in leakage indicators.

**Waste and land use:** Tallinn achieves a mid-

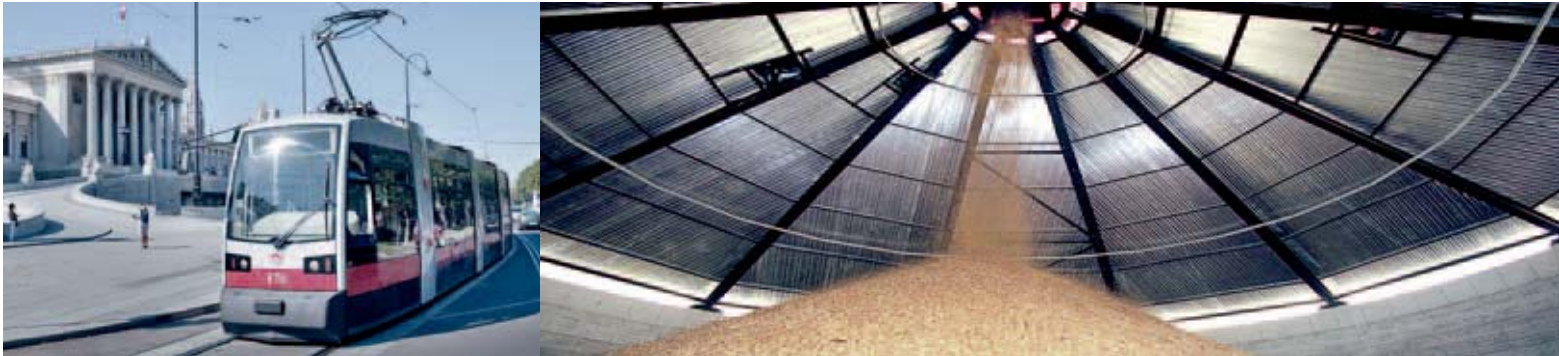
gory. The city would perform better if its Development Plan 2009-27 (its main strategic policy document) addressed environmental concerns more directly.

**Initiative:** Tallinn is a signatory to the directives set out in the Aalborg Commitments and the Covenant of Mayors.

The city council collaborates with a number of outside expert agencies, such as the Tallinn Technical University, to help with the collation of data in a number of areas, including air quality.



# Vienna\_Austria



### Select city data

Population:	1.67 million
GDP per head, PPP:	€ 35,239
CO <sub>2</sub> emissions per head:	5.19 tonnes
Energy consumption per head:	78.74 gigajoules
Percentage of renewable energy consumed by the city:	13.18 %
Total percentage of citizens walking, cycling or taking public transport to work:	68 %
Annual water consumption per head:	79.39 m <sup>3</sup>
Share of waste recycled:	33.35 %

Vienna, Austria’s capital, is an important economic and transport link between western and central Europe. With just one-fifth of the country’s population, in 2005 Vienna contributed around 27% of Austrian GDP. The backbone of Vienna’s economy is formed by small and medium-sized enterprises, which account for a staggering 98% of Vienna’s enterprises. The city has seen a structural shift from manufacturing to business-related services over the past decade.

Still, Vienna’s manufacturing industry accounted for around 16% of the city’s gross value added in 2007, with the primary exports being machin-

ery and vehicles, chemicals and plastics, and agricultural products. Financial services, insurance and tourism are also important industries in Vienna. Vienna ranks fourth overall in the European Green City Index, with a score of 83.34 out of 100, behind Copenhagen, Stockholm and Oslo. Vienna performs particularly well in the water category, and also scores highly for use and development of renewable energy.

**CO<sub>2</sub> emissions:** Vienna is ranked eighth for carbon dioxide (CO<sub>2</sub>) emissions. However, it comes first among medium-sized cities in this category. In 1999 the City of Vienna launched the Vienna

Climate Protection (KliP) programme, which aims to reduce the city’s annual CO<sub>2</sub> emissions by 2.6 million tonnes by 2010.

**Initiative:** To reduce transport-related emissions, which account for one-third of the city’s total CO<sub>2</sub> emissions, Vienna has encouraged the use of public transport by introducing shorter bus-service intervals, all-night bus services and an extensive network of cycle routes.

**Energy:** Vienna ranks third in the index for energy, in large part because of its long-standing active use and development of renewable energy sources. Renewable sources account for 13% of the energy used by the city, well above the 30-city average of 7%.

**Initiative:** The Urban Energy Efficiency Programme (SEP) outlines measures to enable the city’s annual rate of energy consumption growth to slow from 12% in 2003 to 7% by 2015 without any change in quality of life.

**Buildings:** Vienna ranks eighth in the buildings category, in part because of high residential energy consumption. Indeed, the largest single component of the city’s total energy consumption is energy use by private households, accounting for around one-third of all energy used.

have lower nitrogen oxide and carbon monoxide emissions than diesel engines.

**Water:** Vienna ranks second in the water category, in large part because of its water efficiency and treatment policies. Water is collected from mountain springs, and reaches the city without the use of pumps by exploiting the difference in altitude between the mountains and the city. The gravitational energy produced in the process is used to generate electricity.

**Initiative:** In 2005 Vienna extended its wastewater treatment plant to purify water before it is fed into the Danube channel.

**Waste and land use:** Vienna ranks fifth for waste and land use, a score that is largely underpinned by its green land use policies. The city has also attempted to reduce the use of landfill sites by thermally treating non-recyclable and bulky waste so that only inert materials need to be sent to landfill.

**Initiative:** The Vienna Repair Network consists of over 50 repair shops in the city, which customers are encouraged to visit rather than discarding faulty goods. Customers are given frequent-user cards entitling them to a discount on the fourth item that they have repaired.

joint seventh place with Paris in the environmental governance category.

Every two years the Department of Environmental Protection produces the Vienna Environmental Report, highlighting important recent developments and delineating a number of short-term goals.

### Europe’s biggest biomass burner

In October 2006 Europe’s largest biomass-fuelled power plant opened in Simmering, a district of Vienna. The construction and operation of the plant has been the responsibility of the Österreichische Bundesforste (Austrian Federal Forests), which manages and protects woodlands and forests in Austria, and Vienna’s public energy company, Wien Energie. The biomass plant is wood-fired, burning wood and wood waste (chips and pellets) to generate electricity. It processes around 200,000 tonnes of fresh wood and untreated waste wood annually. Relying on these renewable resources, the plant generates enough power to supply around 48,000 homes with electricity (involving consumption levels of around 23 mw) and 12,000 homes with heating (around 37 mw). The biomass power plant’s operation reduces CO<sub>2</sub> emissions in Vienna by around 144,000 tonnes per year. In supporting the construction and running of the Simmering power plant, the city of Vienna has helped to promote an highly efficient method of energy generation based on renewable resources, which reduces the city’s overall greenhouse gas emissions.

**Initiative:** Since 2006 an energy efficiency certificate has been obligatory for all new buildings. As of 2009, such a certificate is now also legally required for all purchases and rentals of houses, apartments and offices.

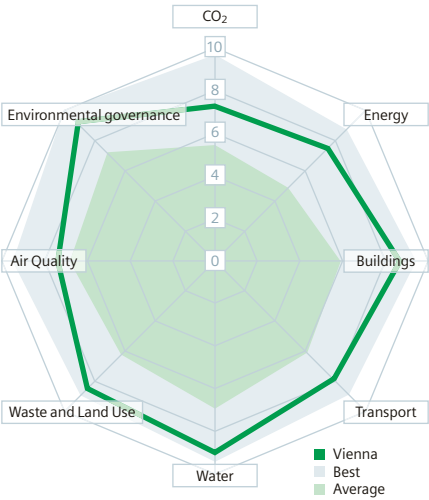
**Transport:** Vienna ranks fourth in the transport category, below three other high-income cities, Stockholm, Amsterdam and Copenhagen. The number of residents travelling by public transport and bicycle and on foot rose to 68% of the total population in 2006.

**Initiative:** All of Vienna’s buses operate using liquefied petroleum gas (LPG) engines, which

**Air quality:** Vienna is ranked tenth for air quality, partly because the city is affected by toxic emissions from the combustion of fossil fuels, vehicle traffic, and emissions from commerce and industry.

**Initiative:** The municipal Department of Environmental Protection launched the Urbane Luft Initiative Wien (Vienna Urban Air Initiative) in 2005. This programme seeks to obtain the advice of experts on how to reduce toxic emissions in the city, and in particular those of fine dust.

**Environmental governance:** Vienna ranks in





# Vilnius\_Lithuania



## Select city data

Population:	554,000
GDP per head, PPP:	€ 16,148
CO <sub>2</sub> emissions per head:	4.55 tonnes*
Energy consumption per head:	62.87 gigajoules*
Percentage of renewable energy consumed by the city:	1.53 %
Total percentage of citizens walking, cycling or taking public transport to work:	69.4 %
Annual water consumption per head:	64.36 m <sup>3</sup>
Share of waste recycled:	5 %

\*Estimate



The city of Vilnius, Lithuania’s capital, is home to 16% of the country’s population and, with 554,000 citizens, it is one of the smaller cities in the index. From an economic perspective, however, Vilnius contributed just under two-fifths of the country’s GDP in 2007 and accounts for around 19% of total employment in Lithuania. Although Vilnius provides just 16% of national industrial output, it has attracted more than two-thirds of total foreign direct investment in Lithuania. As well as increasing numbers of tourists, Vilnius has been a key destination for many migrants

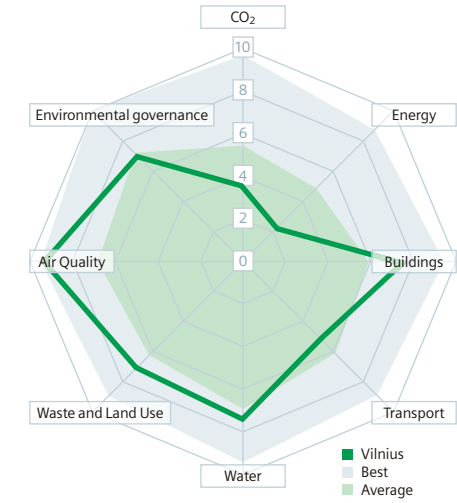
from other parts of Lithuania because of the employment opportunities that it offers. Vilnius ranks 13th in the overall index, with a score of 62.77 out of 100, making it the best-performing city in eastern Europe as well as among the low-income cities in the index. Vilnius ranks around the middle of most categories in the index, but performs exceptionally well on air quality, for which it is ranked in first place. **CO<sub>2</sub> emissions:** Vilnius performs relatively poorly in the category for carbon dioxide (CO<sub>2</sub>)

emissions, ranking 23rd. Emissions per head, at 4.6 tonnes per inhabitant per year, are below the 30-city average of about 5.2 tonnes. However, emission intensity is above the index average. **Initiative:** The city regularly runs campaigns, working with the World Health Organisation’s Healthy Cities project, to promote the use of cycling and public transport rather than cars. **Energy:** Vilnius ranks 26th in the energy category. This is a result of the city’s high energy consumption per unit of GDP, owing to both the energy-inefficiency of local industry and the relatively poor quality of the housing stock, which demands large amounts of energy for heating. **Initiative:** Vilnius hosts the largest biofuel-fired generating plant in Lithuania, which has been operational since late 2006 and accounts for about 10% of the municipality’s district heating. **Buildings:** Vilnius ranks 13th in the buildings category — the best result among low-income cities — thanks to the introduction of incentive schemes to promote the renovation of the housing stock to more energy-efficient standards. **Initiative:** The city offers tax breaks, grants and concessional loans to carry out housing renovation work to energy-efficient standards, as part of a scheme that has also been rolled out nationally. **Transport:** Vilnius is ranked joint 19th with



consumed around 64 cubic metres of water in 2007 — the sixth best result in the 30-city index (the average is 105 cubic metres). **Initiative:** The Vilnius Water Company is drawing on EU funds to improve its supply and treatment network. Besides pipe rehabilitation and extension of the network, the company has refurbished pumping stations and sewage treatment plants. **Waste and land use:** Vilnius ranks ninth in the waste and land use category, far above the other low-income cities in the index, and positioned just below Stockholm. City policies aim to increase the amount of urban green space and to limit urban sprawl, although they are not always effective. Only 5% of waste is recycled, with most destined for local landfill sites. **Initiative:** In 2005 the city municipality endorsed a new Waste Management Plan, which provides for the construction of a new 360,000 square metre landfill site with modern monitoring systems. **Air quality:** Vilnius ranks first for air quality, giving a significant boost to the city’s overall index ranking. The city has low levels of nitrogen dioxide, sulphur dioxide and particulate matter. Despite high and rising traffic levels, the city is helped by a lack of heavy industry, its small size and the presence of large areas of forest in the immediate vicinity.

**Initiative:** The city adopted an Environment Protection Policy in April 2004, and its Environment Protection Agency remains active in promoting more efficient waste management, sustainable transport policies and clean air campaigns.



## No sludge slouch

Vilnius Water, the city’s municipal water and wastewater company, launched a project in September 2008 to construct one of Europe’s most advanced sludge-treatment plants. The plant is intended to reduce sludge volumes and odours and to limit pollution of soil and groundwater. It will also reduce greenhouse gas emissions and use sludge-generated biogas to produce electricity and thermal power. When completed, the facility will bring sludge treatment in Vilnius into line with EU requirements. The scope of work includes sludge thickening, digestion, dewatering and low-temperature drying, while using the resulting biogas in a combined heat and power station. A thermal hydrolysis plant will ensure an odourless final bio-solids product, while significantly increasing biogas production and cutting the volume of the final product. The total cost of the project is LTL175 million (about €50 million), which is largely being financed by EU cohesion funds (providing 62% of the total). Vilnius city council and Vilnius Water Company will contribute the balance of the funds for the project, at 20% and 18% of the total cost respectively. Construction is expected to take three years.



# Warsaw\_Poland



## Select city data

Population:	1.7 million
GDP per head, PPP:	€ 30,984
CO <sub>2</sub> emissions per head:	6.29 tonnes
Energy consumption per head:	49.81 gigajoules*
Percentage of renewable energy consumed by the city:	7.12 %*
Total percentage of citizens walking, cycling or taking public transport to work:	70 %
Annual water consumption per head:	180.84 m³
Share of waste recycled:	19.33 %

\*Estimate

As the capital of Poland, Warsaw is also the country's largest city, with a population of 1.7 million and an area of just over 500 square km. It is a vital economic centre for Poland. There were 324,282 companies registered in Warsaw at the end of 2008, accounting for some 13.5% of GDP. The most important sector is services, including trade and repair, transport and storage, accommodation and catering, financial services and real estate activities, which collectively accounted for about 84% of the city's economic activity in 2006. By contrast, industrial production and construction accounted for shares of just 11.7% and 4.1% respectively.

Warsaw ranks 16th overall in the European Green City Index. Its score of 59.04 out of 100 is supported by the city's strong economic reliance on services. Warsaw outperforms most other medium-sized cities in categories such as energy, buildings and air quality. Its best performance is

in the environmental governance category, where it is ranked in joint fifth place.

**CO<sub>2</sub> emissions:** Warsaw ranks 20th in the category for carbon dioxide (CO<sub>2</sub>) emissions. This is largely because 90% of the energy that it consumes is produced from coal, a fuel that generates high CO<sub>2</sub> emissions.

**Initiative:** Warsaw's mayor joined the Covenant of Mayors earlier in 2009, thus committing the city to cutting CO<sub>2</sub> emissions by at least 20% by 2020.

**Energy:** Warsaw ranks 14th in the energy category. Nevertheless, energy consumption in Warsaw is low, estimated at just 49.8 gigajoules per head, far below the index average of about 81 gigajoules. This is why the city scores fourth in the energy consumption subcategory.

**Initiative:** A new, highly efficient 480 mw combined heat and power plant is being added to the existing Siewerki power plant in Warsaw, with the aim of cutting nitrogen oxide emissions substantially.

**Buildings:** Warsaw ranks 16th in the buildings category, and fourth of the middle-income cities reviewed in the study. Many older buildings have received or are receiving extra insulation, and green-building standards are therefore steadily improving.

**Initiative:** The Polish government runs a thermo-modernisation fund, which supports the upgrading of public-utility buildings to make them more energy-efficient. This has been implemented and marketed to relevant users in Warsaw.

**Transport:** Warsaw ranks just 24th in the transport category, as its score is dragged down by



the lack of municipal promotion of green transport and the absence of a clear congestion-reduction strategy. However, the city has a regular reliable public transport system, and the proportion of bus and tram passengers who use the system to commute to work is estimated to be nearly 70%.

**Initiative:** Warsaw has made efforts to integrate its transport-management systems and to optimise transport infrastructure, thereby cutting travel times in the city.

**Water:** Warsaw ranks a relatively low 25th in the water category, largely because of its high usage of water per head and a past record of poor water-efficiency and treatment policies. However, major investment is under way to modernise and develop water infrastructure.

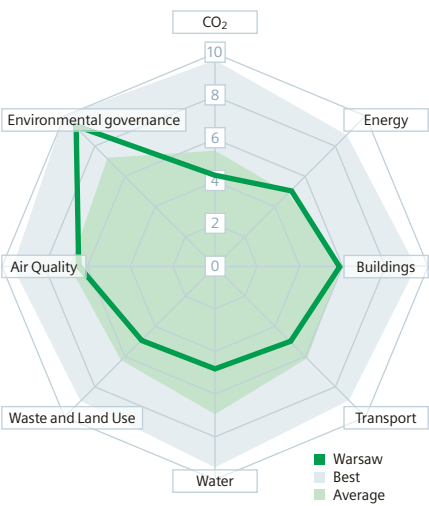
**Initiative:** Warsaw's water-supply and wastewater investment plan includes the further

enlargement of one of its water purification plants.

**Waste and land use:** Although Warsaw ranks below average for waste and land use, in 24th place, it has developed and continues to implement a comprehensive waste-disposal management plan. However, the city's score is brought down by its green land use policies.

**Initiative:** The city's Solid Communal Waste Utilisation Plant (ZUSOK) is a multi-purpose plant that sorts waste, recovers recyclable resources, thermally processes waste not suitable for recycling and composts the organic part of the waste. It also produces electricity.

**Air quality:** Warsaw ranks 19th for air quality. The index shows mixed results for the city, with good performances in the ozone and nitrogen dioxide subcategories (both of which are slightly



## Clean flush: modernising Warsaw's sewage systems

A major sewage system modernisation programme aims to reduce the pollution load originating from the left (west) bank of the Vistula river, while increasing existing treatment levels from the right (east) bank. The project supports Warsaw's efforts to comply with the EU directive on urban wastewater treatment, reducing the amount of pollutants draining into the Baltic Sea and promoting better water quality. The overall goal is to treat all wastewater to EU standards by the end of 2010. The total investment of €595 million, with €358 million coming from the EU Cohesion Fund, will modernise Warsaw's infrastructure and will also improve potable water supplies. One of the main areas of investment is in the city's wastewater treatment facilities. The left (western) side of Warsaw has a purification plant, Poludnie, built in 2005, which treats about 30% of wastewater from that side of the city. Expansion and modernisation of the plant is under way, and a new sewage-processing line is expected to be the first of its kind in the country. Sewage will be dried in the processing line and reused as either fertiliser of fuel for power generation, while biogas emitted during the process will be used for heating. The right (eastern) side of Warsaw has a purification plant, Czajka, which opened in 1991. Poland is now investing heavily to develop the plant further.



# Zagreb\_croatia



## Select city data

Population:	786,000
GDP per head, PPP:	€ 19,101
CO <sub>2</sub> emissions per head:	6.68 tonnes*
Energy consumption per head:	68.02 gigajoules
Percentage of renewable energy consumed by the city:	10.13 %
Total percentage of citizens walking, cycling or taking public transport to work:	62.9 %
Annual water consumption per head:	83.84 m <sup>3</sup>
Share of waste recycled:	11 %

\*Estimate

With 18% of Croatia’s population, Zagreb contributed just over one-third of the country’s GDP in 2005, accounting for more than one-quarter of national employment. The city has attracted more than 75% of Croatia’s total foreign direct investment, and nearly 25,000 companies, about one-third of the country’s total, operate there.

The main manufacturing industries in the city include food and beverage processing, electrical machinery, broadcasting and communications equipment, and chemicals.

Because of its employment opportunities, Zagreb has attracted many migrants from other parts of Croatia, leading to overcrowded public transport and traffic congestion on the city’s main roads.

Zagreb ranks 26th in the European Green City Index, with a score of 42.36 out of 100. Despite the absence of heavy industry in the city, years of neglect and underinvestment — a problem common to other post-communist countries — have had a detrimental impact on Zagreb’s environment.

**CO<sub>2</sub> emissions:** Zagreb ranks 27th for carbon dioxide (CO<sub>2</sub>) emissions, owing to the fact that emissions are significantly above the 30-city average (both per head and also per unit of GDP), despite the city’s having agreed a target for reductions in CO<sub>2</sub> emissions.

**Initiative:** Zagreb’s mayor signed a covenant in the European Parliament in February 2009, targeting a 20% reduction in the city’s CO<sub>2</sub> emissions by 2020.

**Energy:** Zagreb ranks 20th in the energy category. This is the city’s highest score in the index, and stems from its below-average energy consumption per head and its relatively high use of renewable energy, with more than one-half of electricity consumed being generated by hydropower.

**Initiative:** The city authorities have carried out a pilot project to replace public lighting on

Zagreb’s main streets with new, energy-efficient lamps, helping to cut energy use by 1 million kwh per year.

**Buildings:** Zagreb ranks 25th in the buildings category, despite the fact that the estimated energy consumption of its residential buildings per square metre is slightly below the index average.

There is a growing awareness of the need for energy-efficient buildings — especially as this is a topic in Croatia’s EU accession negotiations — but until now it has not been emphasised through the widespread use of energy-efficiency standards or incentives.

**Initiative:** A proposed new terminal building at Zagreb airport has been designed with walls made of low-emissivity glass to allow natural light in, and a wave-form roof that would collect rainwater for reuse as grey water.

**Transport:** Zagreb is ranked joint 19th with Kiev, Paris and Vilnius in the transport category. When considered in comparison with other low-income cities, it moves to joint second place.

A precise breakdown of the city’s modal split is not available, but the most recent data suggest that some 37% of inhabitants commute via public transport, slightly below the 30-city average.

**Initiative:** In 2007 Zagreb’s transport authority, ZET, began a four-year project to convert the city’s public transport to be powered by biofuels.

The first phase has seen over 100 buses running on biodiesel, reducing diesel usage by an estimate 10,000 tonnes per year.

**Water:** Zagreb is ranked 26th overall in the water category. The city consumed 65.9m cubic metres of water in 2007, which on a per-head basis is less than the average across the 30 cities reviewed.

However, water loss is high, at around 43% of total water distributed in the city.

**Initiative:** A pilot project in the Knezija area has

helped to reduce water loss by 25%. The city authorities now want to expand the project throughout Zagreb’s distribution system.

**Waste and land use:** Zagreb ranks poorly, at 27th, in the category for waste and land use. The city produced 382,037 tonnes of waste in 2007, the smallest amount among the industrial cities in the survey.

Although this is below the 30-city average, the level of recycling is low, with most municipal waste ending up in the Jakusevac landfill.

**Initiative:** Gas produced as a result of the decomposition process at Jakusevac is used to generate electricity at a small thermal power plant at the site, reducing gas emissions and producing energy.

**Air quality:** Zagreb ranks 26th for air quality. Although its nitrogen dioxide emissions are slightly below the 30-city average, emissions of ozone, particulate matter and sulphur dioxide are higher than average.

**Initiative:** A programme for the protection of air quality in Zagreb has recently been adopted. It has been received with approval by green agencies, although timelines are rather vague.

**Environmental governance:** Zagreb ranks just 26th in the environmental governance category. Environmental concerns were identified as high priorities in the Vision of Zagreb in the

## Cutting water pollution

Construction of Zagreb’s wastewater treatment plant was completed in September 2007. Previously, all sewage produced by the city’s inhabitants was discharged untreated into the Sava river, polluting not just the local environment but the wider Danube and Black Sea basin. The plant is one of the largest environmentally sustainable projects in Europe, and was built under a public-private partnership model. The total cost of the project exceeded €350 million, and was financed by the German Reconstruction Loan Corporation (KfW), the European Bank for Reconstruction and Development (EBRD) and a German consortium. By involving the private sector in this way, the EBRD and KfW hoped to ensure the most effective management of the project. The aim was gradually to bring the treatment of wastewater in Zagreb up to EU environmental standards. An important aspect of the project was to monitor progress carefully — including surface water quality (the river Sava), groundwater quality, sludge management and air emissions — to ensure that these environmental standards were being met.





# Zurich\_Switzerland



## Select city data

Population:	377,000
GDP per head, PPP:	€ 32,455
CO <sub>2</sub> emissions per head:	3.70 tonnes*
Energy consumption per head:	94.75 gigajoules
Percentage of renewable energy consumed by the city:	5.14 %*
Total percentage of citizens walking, cycling or taking public transport to work:	62 %
Annual water consumption per head:	114.84 m <sup>3</sup>
Share of waste recycled:	34 %

\*Estimate

Zurich is Switzerland’s most cosmopolitan city, with a population of nearly 400,000. The most important industry in the city is the financial services sector. Zurich also acts as a hub for the Swiss-German media, advertising and public-relations sector, while tourism and business travel bring in visitors. As a result of Switzerland’s federal structure, Zurich’s environ-

mental performance is regulated and influenced by the three levels of federal, cantonal and city regulations. Zurich ranks sixth overall in the index, with a score of 82.31 out of 100. It scores particularly well for carbon dioxide (CO<sub>2</sub>) emissions and waste and land use. Zurich’s main business activities, being service-oriented, have a relatively light environmental impact, putting the city in an advantageous position from which to tackle environmental issues.

**CO<sub>2</sub> emissions:** Zurich ranks in third place for CO<sub>2</sub> emissions, with its estimated annual emissions per inhabitant standing at a comparatively low 3.7 tonnes (the sixth-lowest level among all cities), compared with a 30-city average of 5 tonnes. Its CO<sub>2</sub> emissions per unit of GDP stand at 25.5 grams per euro of GDP. The city’s policy action on CO<sub>2</sub> emissions reduction is relatively limited, as this aim is pursued at a national level, where the federal government has agreed to reduce carbon emissions by 10% from the 1990 level.

**Initiative:** Zurich’s electricity company, EWZ, builds, runs and finances the energy supply of third parties, as a form of “energy contracting”. In comparison with conventional installations, the newly built or renovated installations have reduced CO<sub>2</sub> emissions by 11,900 tonnes per year as of 2009.

**Energy:** Zurich ranks sixth for energy. The city scores best of all 30 cities in the index for its energy consumption per unit of GDP: at 0.7 megajoules per euro, this is far below the average of about 5 megajoules. However, Zurich has a high level of energy use per head, at 95 gigajoules per inhabitant (the average is about 81 gigajoules). The city’s energy sources include oil products, nuclear and hydroelectric power.

**Initiative:** Recognising the high energy consumption of buildings, Zurich has introduced energy-coaching facilities, with the aim of promoting competent renovation and construction of buildings to reduce energy use.

**Buildings:** Zurich ranks ninth for buildings. The city’s climate is cooler than most, meaning that buildings are required to have insulation to prevent energy losses. There are fiscal incentives to renovate old buildings to improve their energy efficiency, and these are provided at city, cantonal and federal level. The energy consumption of Zurich’s residential buildings, at 729 megajoules per square metre, is better than the index average of 909 megajoules.

**Initiative:** The “Seven-mile steps for environmentally friendly and energy-saving building” programme aims to renovate city administration buildings in conformity with the low-energy-consumption Minergie standard, which will result in buildings consuming only one-half of the energy that other buildings in the country use. About 90% of new buildings now comply with this standard.

**Transport:** Zurich ranks sixth for transport. There is a well-connected public transport net-



work, and Zurich boasts the best non-car transport network of all 30 cities. But private car use is nonetheless heavy, especially outside the city centre. The city is working to reduce the incidence and impact of this, but regulatory incentives are fairly light. The share of people taking public transport to work stands at around 44%, with another 19% walking or cycling.

**Initiative:** Zurich is seeking to take heavy traffic out of the city, and the opening in 2009 of the western bypass motorway has been a significant step.

**Water:** The city ranks in joint fifth place for water, with Copenhagen. Zurich scores full marks for water treatment and water efficiency, and has a level of water consumption per head of 115 cubic metres per year, only slightly above the average of 105 cubic metres. Leakage rates, at 12%, are well below the average of 23%.

**Initiative:** To guard against the danger of flooding, city officials are drawing up a risk map of the

city identifying the areas that are most susceptible to flooding and reinforcing protection there.

**Waste and land use:** Zurich ranks in second place. Waste production per head is below average (at 406 kg per inhabitant, compared with an average of 511 kg), and recycling rates are well above average (at 34%, compared with 18%). The city scores full marks for waste-reduction policies and green land use.

**Initiative:** The city is investing heavily in district-heating technology, based in part on waste-to-energy technology, with a number of new furnaces having been built and connected to the network in 2007-08. The operators of these facilities have formed an association to leverage buying power and synergies. They burn 870,000 tonnes of rubbish annually.

**Air quality:** Zurich ranks ninth for air quality. It is held back in particular by its ozone, nitrogen dioxide and sulphur dioxide emissions, although



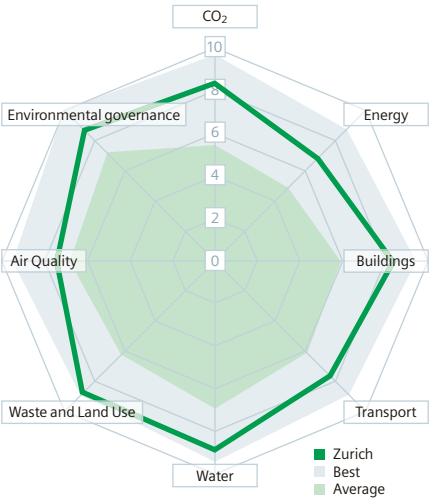
## Watt’s the story

In November 2008 the city’s electorate voted to embed the 2,000-Watt Society in city legislation, working towards energy use of 2,000 watts per person per year, compared with the current 6,000 watts. This requires a long-term reorientation towards lower energy use, a significant reduction of CO<sub>2</sub> and other pollutant emissions and a higher uptake of renewable energies. It sets the tone for current and upcoming programmes related to the environment; for example, EnergieVision 2020 is a stepping stone towards the ultimate goal of a 2,000-watt society. This sub-project focuses on the energy efficiency of buildings, renewable energies and electricity.

levels of particulate matter are low. Zurich suffers as a result of its location on the flat land adjacent to the Alpine massif, where smog ceilings can build up. Transport is one of the main local air polluters.

**Initiative:** With regard to traffic-generated air pollution, Zurich’s administration is leading by example with its vehicle fleet. All new diesel-fuelled buses are required to have particle filters, with older vehicles being retrofitted with filters. Diesel-powered machines at building sites are also required to have particle filters.

**Environmental governance:** Zurich ranks 11th for environmental governance. The city is publicly committed to an ambitious environmental programme, which is embodied by the Masterplan Environment strategy paper. The approval by popular referendum of a plan to embed the 2,000-Watt Society programme into city legislation suggests that the city government’s environmental drive is supported by the population.





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