US and Canada Green City Index

Assessing the environmental performance of 27 major US and Canadian cities

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

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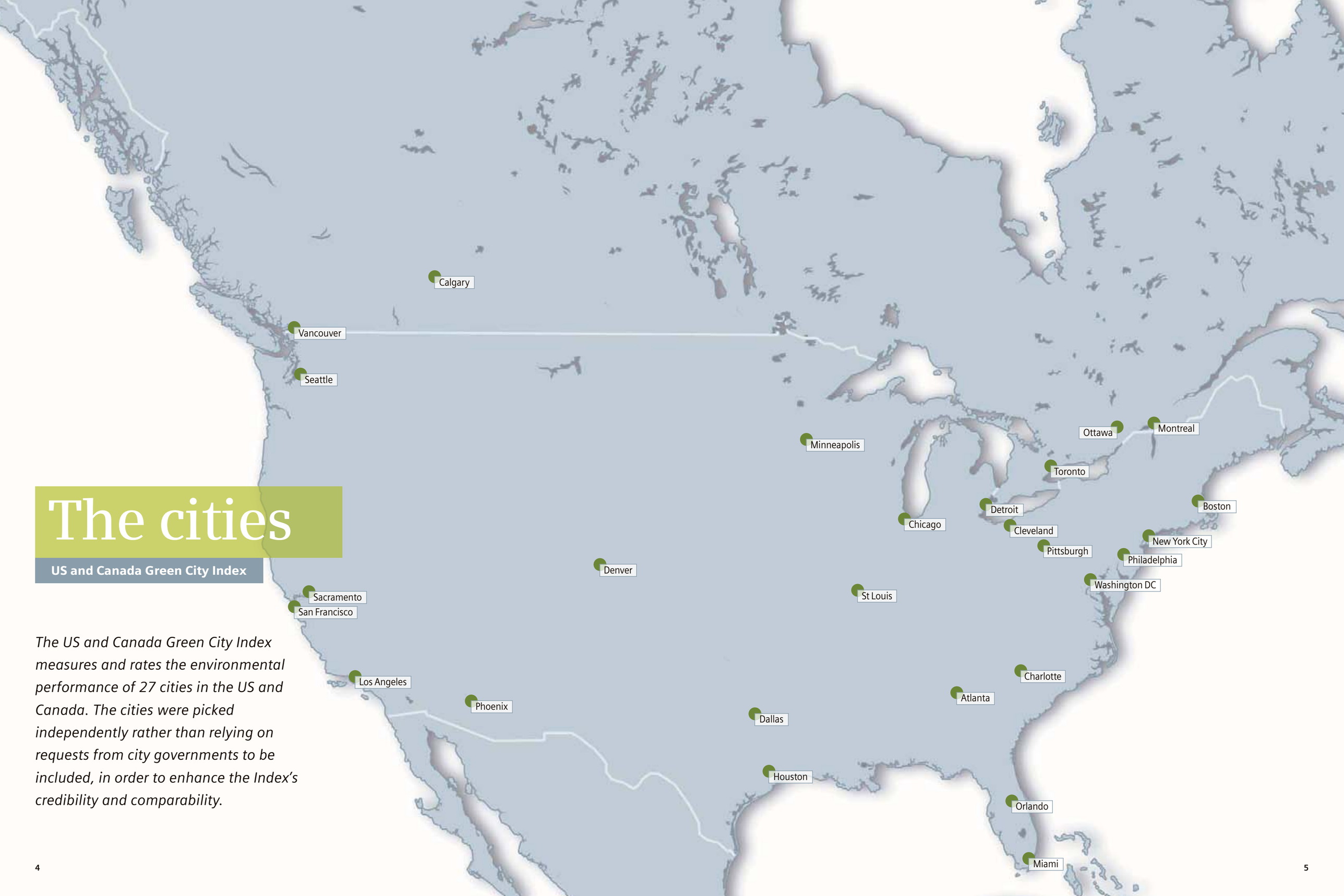
The US and Canada Green City Index measures and rates the environmental performance of 27 cities in the US and Canada. The cities were picked independently rather than relying on requests from city governments to be included, in order to enhance the Index's credibility and comparability.



Expert advisory panel

US and Canada Green City Index

A panel of global experts in urban environmental sustainability advised the Economist Intelligence Unit in developing the methodology for the US and Canada Green City Index. The EIU would like to thank the members of the panel for their time and valuable insight.

Don Chen
Senior Program Officer
Ford Foundation

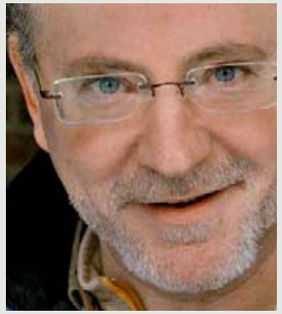
Since joining the Ford Foundation in 2008 Don Chen has worked on reforming the rules that shape municipal and regional growth by pursuing integrated approaches to affordable housing, public transportation, land use and community planning. His grant making at the Ford Foundation supports institutions working to reduce poverty and provide economic opportunities for low-income people through equitable development in US metropolitan areas. Previously, Mr Chen was the founding executive director and CEO of Smart Growth America, where he led efforts to create the National Vacant Properties Campaign and the Transportation for America Campaign. He was a founding board co-chairman of the Environmental Leadership Program, and served on the boards of West Harlem Environmental Action and Grist magazine.

Gareth Doherty
Lecturer
Harvard University
Graduate School of Design

Gareth Doherty currently teaches landscape architecture, and urban planning and design at the Harvard University Graduate School of Design (GSD). Together with Mohsen Mostafavi he edited Ecological Urbanism, published by Lars Müller Publishers in 2010. Mr Doherty is also a founding editor of New Geographies, a journal edited by doctoral candidates at Harvard GSD. He received a doctor of design degree from Harvard University, and a masters of liberal arts and certificate in urban design from the University of Pennsylvania. Mr Doherty's recent research has focused on paradoxes of green in arid urban environments.

Andreas Georgoulias
Co-founder and researcher
Zofnass Program for Sustainable Infrastructure, Harvard University

Andreas Georgoulias is a lecturer and a founding member of the Zofnass Program for Sustainable Infrastructure at the Harvard University Graduate School of Design. His research focuses on large-scale sustainable developments and infrastructures. Dr Georgoulias has worked in design and construction management with Obermeyer, Hochtief and the US General Service Administration, and in infrastructure financing with HVB/UniCredit. Recently, he has been a consultant for new city developments in Saudi Arabia and Pakistan, and he conducts research on sustainable urban economics for the Gulf Encyclopedia of Sustainable Urbanism for Qatar Foundation.



Mark Alan Hughes
Distinguished Senior Fellow
University of Pennsylvania
School of Design

Mark Alan Hughes is a distinguished senior fellow of the TC Chan Center for Building Simulation and Energy Studies. He is also associate director for Policy, Markets and Behavior at the US Department of Energy's Energy Efficient Buildings Hub at the Philadelphia Navy Yard. Additionally, Mr Hughes is a faculty fellow of the Penn Institute for Urban Research, a senior fellow of the Wharton School's Initiative for Global Environmental Leadership, and a distinguished scholar in residence at Penn's Robert A. Fox Leadership Program. Previously he served as chief policy adviser to Philadelphia Mayor Michael Nutter and was the founding director of sustainability for the city.

Rich Kassel
Senior Attorney
Air and Energy Program, Natural Resources Defense Council (NRDC)

For two decades Rich Kassel has been a leading advocate for city, state and federal programs that have reduced pollution from US vehicles. In the 1990s his Dump Dirty Diesels Campaign brought greater public awareness to the diesel pollution problem in US cities. Through his work to develop New York City Transit's clean-fuel bus program, he helped create a model for low-emission transit fleets that has been replicated in cities worldwide. Most recently, he has worked closely with the administration of New York Mayor Michael Bloomberg to develop and implement the transportation and air quality components of PlaNYC 2030, New York City's sustainability plan.

Tom Wright
Executive Director
Regional Plan Association (RPA)

Tom Wright is the executive director of Regional Plan Association and a visiting lecturer in public policy at Princeton University Woodrow Wilson School of Public and International Affairs. He lectures widely on growth management and regional planning, and supervised production of the Draft Vision Plan for the City of Newark (2006), the New Jersey State Development and Redevelopment Plan (2001), and A Region at Risk: The Third Regional Plan for the New York–New Jersey–Connecticut Metropolitan Area (1996). He has taught at the Columbia University Graduate School of Architecture, Planning and Preservation, the Lincoln Institute of Land Policy, and the New Jersey Institute of Technology School of Architecture.

Rae Zimmerman
Professor of Planning and Public Administration
New York University's Robert F. Wagner Graduate School of Public Service

Professor Rae Zimmerman has directed the Institute for Civil Infrastructure Systems at NYU's Wagner School since 1998. Her academic and professional experience focuses on urban area problems from the perspectives of infrastructure, sustainability, climate change, the environment, natural hazards and security. She has authored or co-authored over 100 articles and book chapters in these areas. She is a fellow of the American Association for the Advancement of Science, and past president and fellow of the Society for Risk Analysis. Her advisory appointments have been with numerous agencies, including the US Environmental Protection Agency, the National Research Council and the National Science Foundation.

Introduction

US and Canada Green City Index

US and Canadian cities: laboratories for an urban future

The United States and Canada, already largely urban, are becoming ever more so. According to the United Nations Population Division, 82% of Americans and 81% of Canadians lived in cities in 2010 and these proportions are set to continue rising, reaching 90% for the US and 88% for Canada by 2050. This is not a new phenomenon. As early as 1955, two-thirds of the populations of both countries lived in cities. Urbanization, though, has now reached a stage where rural America has begun to shrink. In absolute terms, the rural US population dropped by 12% in the last 20 years and the UN predicts it will decline another 14% in the next two decades, even as the overall national population rises. A similar trend is expected to emerge in Canada around 2020.

Not surprisingly, the two countries' cities play a fundamental role in national life and help to perpetually redefine what it means to be American or Canadian. Cities are cultural and intellectual centers. They drive economic activity. And they are the main recipients of new ideas from immigrants, the vast majority of whom settle in cities when they arrive. Cities are ideal laboratories for innovative responses to their countries' challenges, including environmental issues. It is well known that city life can exacerbate problems such as harmful greenhouse gas emissions or urban sprawl, but increasingly cities are also generating unique solutions to these challenges through effective local policies.

The US and Canada Green City Index, a research project conducted by the Economist Intelligence Unit, sponsored by Siemens, seeks to measure and assess the environmental performance of 27 major US and Canadian cities across a range of criteria. This report presents the key findings and highlights from the Index, and is intended to provide stakeholders with a unique tool to help cities in the region learn from each other in order to better address the common environmental challenges they face.

The report is divided into five parts. First, it examines the overall key findings. Second, it examines the key findings from the nine individual categories in the Index: CO_2, energy, land use, buildings, transport, water, waste, air and environmental governance. Third, the report presents a variety of leading best-practice ideas from across the US and Canada. Fourth, it gives a detailed description of the methodology used to create the Index. Finally, an in-depth profile for each city outlines its particular strengths, challenges and ongoing environmental initiatives. These profiles rightly constitute the bulk of the report because the aim of the study is to share valuable experience.

A unique Index

The 27 cities selected for the US and Canada Green City Index were chosen with a view to representing a number of the most populous metropolitan areas in the United States and Canada. The cities were picked independently rather than relying on requests from city governments to be included, in order to enhance the Index's credibility and comparability.

The methodology, described in detail in a separate section in this report, has been developed by the Economist Intelligence Unit in cooperation with Siemens. It relies on the expertise of both organizations, a panel of outside urbanization experts, and the experience from producing the European Green City Index in 2009, as well as the Latin American Green City Index in 2010 and the Asian Green City Index in 2011. One of the great strengths of the US and Canada Green City Index is the breadth of information it uses. For every city 31 individual indicators are evaluated, often based on multiple data points. Value also comes from how the Index is presented: each city is assessed in nine categories and ranked against the others to indicate its relative position. The process is transparent, consistent and replicable, and is designed to reveal sources of best practice.

Results

US and Canada Green City Index

Overall

	City	Score
1	San Francisco	83.8
2	Vancouver	81.3
3	New York City	79.2
4	Seattle	79.1
5	Denver	73.5
6	Boston	72.6
7	Los Angeles	72.5
8	Washington DC	71.4
9	Toronto	68.4
10	Minneapolis	67.7
11	Chicago	66.9
12	Ottawa	66.8
13	Philadelphia	66.7
14	Calgary	64.8
15	Sacramento	63.7
16	Houston	62.6
17	Dallas	62.3
18	Orlando	61.1
19	Montreal	59.8
20	Charlotte	59.0
21	Atlanta	57.8
22	Miami	57.3
23	Pittsburgh	56.6
24	Phoenix	55.4
25	Cleveland	39.7
26	St Louis	35.1
27	Detroit	28.4

CO_2

	City	Score
1	Vancouver	91.4
2	Miami	90.1
3	New York City	89.4
4	Los Angeles	86.5
5	Ottawa	86.0
6	Seattle	84.7
7	Toronto	81.6
8	San Francisco	81.1
9	Washington DC	80.8
10	Montreal	80.1
11	Boston	79.0
12	Philadelphia	78.4
13	Dallas	77.5
14	Denver	76.0
15	Calgary	75.4
16	Sacramento	67.6
17	Phoenix	66.3
18	Charlotte	59.8
19	Chicago	58.5
20	Atlanta	57.0
21	Orlando	52.2
22	Detroit	43.8
23	Minneapolis	40.2
24	Pittsburgh	38.8
25	Houston	32.1
26	St Louis	10.9
27	Cleveland	1.2

Energy

	City	Score
1	Denver	86.0
2	Boston	82.4
3	San Francisco	81.1
4	Vancouver	80.1
= 5	Los Angeles	77.8
= 5	Toronto	77.8
7	Minneapolis	76.5
8	Chicago	75.9
9	Phoenix	72.9
10	Philadelphia	72.5
11	Houston	71.0
12	Seattle	69.8
13	Washington DC	69.4
14	Cleveland	68.0
15	Pittsburgh	67.6
16	Dallas	65.8
17	Orlando	64.2
18	Calgary	62.5
19	Miami	61.5
20	Ottawa	56.9
21	Charlotte	55.7
22	New York City	53.8
23	St Louis	50.2
24	Sacramento	49.0
25	Atlanta	44.8
26	Montreal	33.8
27	Detroit	27.3

Land use

	City	Score
1	New York City	93.0
2	Minneapolis	80.1
3	Ottawa	75.0
4	Boston	74.9
5	Vancouver	74.1
6	Washington DC	69.9
7	Philadelphia	67.7
8	San Francisco	66.6
9	Charlotte	64.6
10	Miami	59.2
11	Calgary	57.8
12	Montreal	57.7
13	Houston	56.8
14	Seattle	56.2
15	Chicago	56.0
16	Orlando	54.5
17	Toronto	54.3
18	Denver	53.3
19	Pittsburgh	50.7
20	Phoenix	49.6
21	Los Angeles	45.3
22	Sacramento	44.4
23	Dallas	43.1
24	St Louis	38.0
25	Atlanta	36.7
26	Detroit	35.8
27	Cleveland	28.1

Buildings

	City	Score
1	Seattle	98.2
2	San Francisco	85.6
3	Washington DC	79.3
4	Pittsburgh	78.5
5	Vancouver	77.2
6	Denver	68.8
7	New York City	68.7
8	Atlanta	66.7
9	Houston	66.4
10	Boston	62.1
11	Calgary	56.0
12	Los Angeles	53.5
13	Toronto	53.4
14	Chicago	51.3
15	Dallas	49.6
16	Orlando	42.3
17	Sacramento	41.7
18	Minneapolis	37.0
19	Montreal	36.4
20	St Louis	33.8
21	Philadelphia	29.5
22	Ottawa	28.2
= 23	Miami	26.7
= 23	Phoenix	26.7
25	Charlotte	26.2
26	Detroit	18.1
27	Cleveland	16.7

Transport

	City	Score
1	New York City	76.6
2	San Francisco	67.0
3	Vancouver	66.6
4	Montreal	65.3
5	Ottawa	65.1
6	Chicago	64.7
7	Minneapolis	63.9
8	Denver	60.7
9	Seattle	59.8
10	Sacramento	56.0
11	Dallas	54.4
12	Houston	53.6
13	Washington DC	52.0
= 14	Miami	51.2
= 14	Pittsburgh	51.2
16	Calgary	50.8
17	Boston	50.2
18	Orlando	49.4
19	Cleveland	47.9
20	Atlanta	47.6
21	Philadelphia	47.2
22	Toronto	47.1
23	St Louis	44.4
24	Los Angeles	42.9
25	Charlotte	40.8
26	Phoenix	38.0
27	Detroit	37.5

Water

	City	Score
1	Calgary	94.1
2	Boston	91.8
3	New York City	88.8
4	Minneapolis	88.2
5	San Francisco	87.4
6	Vancouver	86.6
7	Denver	85.6
8	Ottawa	84.9
9	Charlotte	84.8
10	Toronto	83.5
11	Seattle	83.3
12	Chicago	82.2
13	Los Angeles	81.7
14	Orlando	81.0
15	Houston	80.5
16	Dallas	78.7
17	Miami	78.2
18	Phoenix	77.4
19	St Louis	77.0
20	Sacramento	76.3
21	Atlanta	71.7
22	Pittsburgh	71.6
23	Philadelphia	70.4
24	Washington DC	67.3
25	Cleveland	56.1
26	Montreal	47.2
27	Detroit	38.8

Waste

	City	Score
1	San Francisco	100.0
2	Seattle	83.1
3	Los Angeles	81.9
4	Toronto	78.6
5	Minneapolis	72.6
6	Sacramento	72.2
7	Vancouver	69.0
8	Ottawa	66.2
9	Montreal	63.7
10	Houston	59.5
11	Calgary	58.8
12	Orlando	58.0
13	Philadelphia	57.6
14	Chicago	55.2
15	Boston	54.7
16	New York City	53.1
17	Denver	51.9
18	Washington DC	44.8
19	Dallas	41.8
20	Charlotte	40.9
21	Phoenix	40.5
22	Atlanta	29.6
23	Miami	28.4
24	St Louis	26.6
25	Pittsburgh	25.5
26	Cleveland	22.2
27	Detroit	0.0

Air

	City	Score
1	Vancouver	95.1
2	San Francisco	91.9
3	New York City	89.2
4	Sacramento	89.1
5	Los Angeles	88.7
6	Philadelphia	82.9
7	Seattle	80.5
8	Montreal	79.5
9	Toronto	79.2
10	Denver	79.0
11	Washington DC	78.9
12	Atlanta	78.2
13	Ottawa	76.7
14	Boston	74.3
15	Chicago	70.3
16	Charlotte	69.5
17	Dallas	67.4
18	Orlando	66.4
19	Phoenix	65.2
20	Cleveland	60.0
21	Miami	57.8
22	Minneapolis	57.0
23	Calgary	50.8
24	Houston	49.3
25	Pittsburgh	40.1
26	Detroit	37.4
27	St Louis	29.5

Environmental governance

	City	Score
= 1	Denver	100.0
= 1	New York City	100.0
= 1	Washington DC	100.0
4	Seattle	96.7
= 5	Houston	94.4
= 5	Los Angeles	94.4
= 5	Philadelphia	94.4
= 8	Minneapolis	93.3
= 8	San Francisco	93.3
10	Vancouver	91.1
11	Charlotte	88.9
= 12	Atlanta	87.8
= 12	Chicago	87.8
14	Pittsburgh	85.6
15	Boston	84.4
= 16	Dallas	82.2
= 16	Orlando	82.2
= 18	Calgary	76.7
= 18	Sacramento	76.7
20	Montreal	74.4
= 21	Miami	62.2
= 21	Ottawa	62.2
= 21	Phoenix	62.2
24	Toronto	60.0
25	Cleveland	56.7
26	Detroit	16.7
27	St Louis	5.6

Overall key findings

US and Canada Green City Index

While there is a correlation between wealth and environmental performance, it is weaker in the US and Canada than in Europe and Asia

There is a correlation between how cities perform in the US and Canada Green City Index and their income (as measured by GDP per capita), just as there was in the European and Asian Green City Indexes. Wealthier cities can afford better projects – environmental or otherwise. They are also more able to deploy well-financed departments with relevant expertise to introduce and monitor appropriate environmental policies. In the US, for example, municipal governments are able to set their own environmental priorities and budgets, and consequently wealthier cities are able to devote more resources to environmental topics. "A lot of environmental performance in the US is based on the individual actions of cities rather than a centrally regulated and monitored system," says Andreas Georgoulias, a lecturer in the Department of Architecture at the Harvard University Graduate School of Design. A stronger local economy, therefore, enables cities to embark on projects and make environmental investments with higher costs and longer time horizons.

However, the link between income and overall Index scores is weaker in the US and Canada than it was in either Europe or Asia. Relatively low-income Vancouver, for example, places second overall, suggesting that other factors have a significant influence on the results. What might these factors be? There are a couple of possibilities.

First, there are differences in environmental priorities between US and Canadian cities. Canadians are more aligned with Europeans when it comes to carbon emissions and energy use. They are more willing than Americans to invest in emissions reductions and energy efficiency. On the other hand US cities prioritize different environmental areas like water and air quality.

A second important factor is that, in the US, environmental ambition is often wrapped up with other public policy goals such as economic development and poverty alleviation, especially in lower-income cities. As Mark Hughes, distinguished senior fellow at the PennDesign and TC Chan Center of the University of Pennsylvania, explains, urban planners and policymakers see environmental sustainability as part of a more cohesive attempt to address a range of problems. He presents the example of Philadelphia, which despite its high poverty rate does better than some more affluent cities in the Index in areas such as land use and environmental governance. In Philadelphia, he says, "sustainability is about poverty reduction not carbon reduction." Across the US, he argues, "there are high- and low-income constituencies for sustainability." In other words, this connection between sustainability and development means that lower-income cities will address environmental issues as part of a larger strategy to tackle poverty.

US cities – a more integrated development approach and active policy can improve performance

In the US, cities on both coasts, such as San Francisco, New York, Seattle and Boston, rank at the top. Part of this is economic: these are also some of the wealthiest cities. The strength of the east coast cities, however, tells an important story about how local governments have successfully integrated environmental programs into broader development strategies to simultaneously revitalize their economies and make urban areas more livable. Dr Hughes recalls that west coast cities used to have significantly better environmental records than those in the north-east. Cities like San Francisco, Seattle and Portland, influenced by the US conservationist movement, which was born in the American west, were more concerned about the impact that urban growth had on the surrounding environment. The Sierra Club, one of the largest environmental organizations in the US, was founded in San Francisco in the 19th century, and the roots of Portland's comprehensive land use policy can be traced to the start of the last century.

In the past decade, however, eastern and north-eastern cities have begun to address sustainability problems more vigorously. The catalyst has not been merely concern for the environment. Confronted with the long-term decline in the manufacturing economy, cities have introduced sustainability efforts in an attempt to increase their competitive advantage, thereby attracting jobs and stimulating economic growth. In particular, older cities have tried to revitalize urban infrastructure dating back well over a century, such as narrow streets, compact lots, and vertical commercial and residential buildings. Once viewed as unpleasant constraints on development, these are now regarded as the building blocks of a more sustainable urban environment – decreasing the cost of energy and transportation for businesses and citizens residing in the city.

The Index results illustrate how effective these integrated approaches can be: cities from both coasts have converged – a remarkable feat of catch-up for the easterners. There remain some differences in emphasis. New York and Boston, for example, now do particularly well on land use, which is a weaker area for west coast cities. West coast cities in contrast are trailblazers in recycling. Overall, though, the results are very similar.

This is more than just history – it suggests a way ahead for some of those cities ranked low in the Index. Cleveland, St. Louis and Detroit share things in common beyond geographic proximity. These cities have seen their traditional sources of economic growth decline in recent decades, and have been confronted with formidable challenges, including population loss and shrinking city budgets. As with the high performers in the Index, environmental issues are just one part of a mix of sometimes difficult hurdles. The experience of their peers suggests, however, that the solution will likely need to be a holistic one that includes a consideration of sustainability as an integral element from the beginning, rather than as something to be considered once the economy is back on track.

US and Canadian cities lead on water infrastructure, recycling and harnessing the private sector

Environmental problems in US and Canadian cities are well-documented: greenhouse gas emissions are high by any standard and urban sprawl remains a challenge. However, US and Canadian cities excel in several areas. Water infrastructure, recycling levels and environmental governance mechanisms are comparable to the best cities the Green City Indexes have evaluated around the world. For example, the average leakage rate, 13%, is lower than in any other continent and 26% of waste is recycled, compared with 28% for the 15 richest cities in Europe.

Americans and Canadians are also innovating in the area of urban sustainability, as the exemplar projects show. For Americans in particular, though, with their long tradition of private sector and non-governmental organization (NGO) activity, this innovation is not always through government institutions. For example, the Clinton Foundation – an American NGO – recently joined forces with C40 Cities, an organization of large global cities committed to combating climate change. Similarly, Dr Georgoulias of Harvard points to the Leadership in Energy and Environmental Design (LEED) building standards, which were created by the US Green Buildings Council – a non-profit organization that has a large number of corporate members from the building industry. He notes that such initiatives, which can take place without top-down central organization, might be particularly useful examples for those in "developing countries where a central administration is either not very strong in driving individual action or would like to encourage private institutions to deliver some of the environmental leadership."

In addition, as illustrated in the individual city portraits later in this report, many US and Canadian cities operate dedicated sustainability departments within the municipal governments, and even slightly outperform European cities on their commitments to international environmental covenants and regularly publishing environmental reports (see also "Category Findings" on page 20).

Canadian cities in the Index outperform the US when wealth is taken into account

Canadian cities have a reputation for being more environmentally conscious than US cities, but a first glance at the Index tells a different story. Vancouver, which is one of five Canadian cities in the Index, places second overall, but the other four are clustered around the middle of the ranking. If wealth is taken into account, however, all of the Canadian cities punch well above their weight. Despite an average per capita GDP $7,000 lower than the average of the 22 US cities in the Index, Canadian cities rank nine to ten places higher than they would be expected to given their lower income. One factor in Canadian cities' strong performance could be their robust environmental policies. Canadian cities have higher policy scores on average – at 78 points out of 100 overall, compared with 70 for American cities, which demonstrates the commitment they have made to improving environmental performance. Another factor could be cultural differences in attitudes towards willingness to accept environmental regulations, but here it is important to avoid over-simplification.

Canadians certainly have a long history of environmental activism – Greenpeace was born in Vancouver in 1970 – but the modern environmental movement in the US, especially in the west, also grew up in the 1960s and both countries have conservation movements reaching back over a century.

Category findings

US and Canada Green City Index

CO_2

Active CO_2 emissions reduction policies have helped cities in the US and Canada Green City Index fall below national emissions levels. However there is still significant room for improvement, particularly among US cities.

➔ On average, residents of all Index cities emit 14.5 metric tons of carbon dioxide per capita annually. The difference between US and Canadian cities is large, with the former emitting 16 metric tons per person and the latter only about half that much, at 8.1 metric tons.

➔ The emissions figures for the US cities may be slightly high as the best available and comparable city data comes from 2002, while the Canadian numbers are from 2008. Between 2002 and 2008, however, national per capita carbon emissions in the US fell by just 3%, so the urban emissions figures are not likely to have dropped significantly, with few exceptions.

➔ These emission figures in both the US and Canada are on average higher than in Europe or Asia. In the European Green City Index the average was 5.2 metric tons per capita and for the Asian Green City Index it was 4.6. In the latter, the Chinese cities, the largest emitters, averaged 7.6 metric tons of carbon emissions.

➔ The emissions from the Index cities do, however, outperform national averages calculated by the World Bank. US per capita emissions in 2002 were 19.8 metric tons (19.3 in 2007), compared to 16 metric tons in the 22 US cities in the Index (in 2002). Canada's national 2007 figure was 16.9 – more than twice the 8.1 metric ton-average of its Index cities. Some cities, such as Vancouver, at 4.2 metric tons, or New York, at 8.6 metric tons, are well below national averages.

➔ In terms of carbon emissions per unit of economic output, US and Canadian urban areas are more in line with their international peers, producing 296 metric tons per $1 million of GDP (200 on average in Canada, 319 in the US). The average of the 30 cities in the European Green City Index was 260 metric tons. However it is important to compare like with like: all of the US and Canada Index cities fit into the top half of Europe's income scale. For the 15 wealthier cities in Europe (with an average income of about $63,000), emissions per $1 million of GDP are 75 metric tons, again, far below US and Canada figures.

➔ On the policy side, 26 of the 27 US and Canada Index cities measure carbon dioxide emissions to some extent, and 21 out of 27 have set a carbon reduction target seperate to any national target.

Energy

Energy is another challenge for many US and Canada Index cities. Electricity use is high even when taking into account the underlying level of economic activity.

➔ Most cities have only partial or even no policies to promote the use of green energy in homes or businesses through subsides or tax breaks. Projects to increase locally produced energy are also typically underdeveloped. Only three cities – Denver, Orlando and Toronto – score full marks in these areas.

➔ US and Canada Index cities lag behind the European cities in the same income range. A majority of the high-income European cities had implemented all of the green energy policies evaluated in the Index.

➔ On average, US and Canada Index cities consume 52 gigajoules of electricity per person, although this covers a huge range, from 10 gigajoules to 152 gigajoules. This average is significantly higher than the 7.2 gigajoules consumed per person in the Latin American Green City Index, which is the only other Green City Index with comparable figures for electricity use. Part of the difference comes from the higher level of economic development in the US and Canada.

➔ When looking at economic efficiency of electricity use, US and Canadian cities do relatively better, using an average of 332 gigajoules per $1 million of GDP, while the Latin American average is 761 gigajoules. In this case, though, the Canadian cities consume a considerably higher 581 gigajoules per $1 million of GDP, whereas the US cities consume an average of 277 gigajoules per $1 million of GDP.

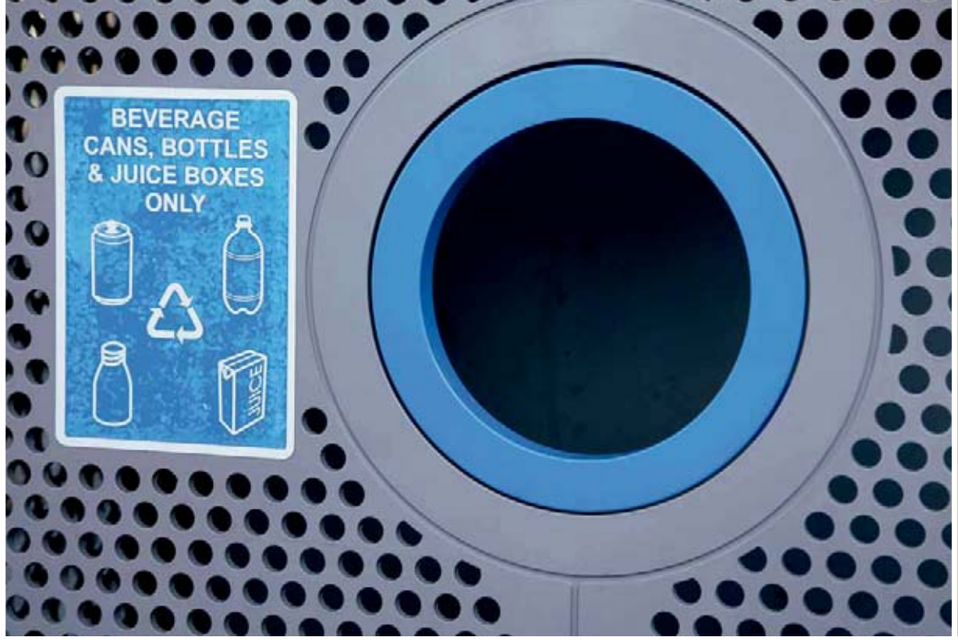
➔ A lack of data on the proportion of renewable energy used by cities and on overall energy consumption makes it difficult to present a more comprehensive picture of energy use.

Land use

US and Canada Index cities have large amounts of green space – although often this is combined with low population density. Consistent with this, they tend to have good policies on parks and trees but are less active in containing urban sprawl.

➔ On average 12% of the area of Index cities is green space.

➔ Some cities are able to mix higher density with maintaining parkland: New York and San Francisco are the two highest density cities, but 20% and 17% of their areas are green spaces, respectively. More often, though, low-density



cities tend to have more space for parks and other green areas.

➔ The average density for Index cities is 8,100 people per square mile, which is about 2.5 times less than for the Asian cities, at 21,100 people per square mile, and is also less than in Latin America (11,700) and in Europe (10,100).

➔ All but one city has at least some policy to sustain and improve the quantity and quality of green space, and two thirds have active tree planting programs. The latter can be quite large: MillionTreesNYC seeks to plant and care for a million trees over the next decade.

➔ Only 11 cities, however, get full marks for measures to prevent urban sprawl. In 2011 the Commission for Environmental Cooperation – a Canada-US-Mexico joint government body – identified growth in urban land area as a leading environmental issue deserving greater attention.

Buildings

Most cities are encouraging residents to have more energy efficient buildings, but are not requiring energy audits in which buildings are inspected for energy usage. Moreover, widespread regulations on the energy efficiency of new structures are not leading to a large number of Leadership in Energy and Environmental Design (LEED)-certified buildings.

➔ All but a handful of cities provide residents with energy efficiency education and incentives to retrofit, as did European cities with comparable incomes.

➔ All but four cities regulate energy consumption for new buildings.

➔ Less common in the US and Canada, however, are comprehensive requirements for energy audits: just three Index cities require such audits.

➔ On average, the Index cities have 6.4 LEED-certified buildings per 100,000 inhabitants. This figure varies drastically between cities, however, with as many as 18.3 per 100,000 inhabitants in Atlanta while some Index cities have constructed fewer than one LEED-certified building per 100,000 people since 2000, when the certification was introduced.

➔ The lack of energy consumption data for buildings makes more comprehensive comparisons of performance difficult.

Transport

Policies to promote green transportation are widespread in US and Canada Index cities, but these have little effect in practice. Although many US cities have ambitious goals to expand public transport, strained city budgets have prevented them from investing sufficiently in these infrastructure projects. Both US and Canadian cities also face a cultural battle, with most citizens seeing no need to get out of their cars.

➔ All but three cities provide at least some support for the use of public transport, and all but one encourage the public to use green means of getting around, as well as providing green public transport vehicles. The presence of most of these policies is as widespread as in the wealthier cities of Europe.

➔ Even more common than in Europe are incentives for efficient car use (all but two cities have such incentives) and road traffic management measures (all but one have them).

➔ Infrastructure is another story: US and Canada Index cities on average have only 1.1 miles of public transport network for every square mile of area, which is about a third of the 3.1 miles of European cities of the same wealth. This, however, conceals a national difference: in Canada, the average figure is 2.5 miles of public transport network per square mile, compared with just 0.7 miles per square mile in the US. This seems to be the result of choice rather than income: GDP per capita has no correlation with the size of public transport networks.

➔ Fewer people on average commute by car to work in the Canadian Index cities, at 74%, compared with those in the US, at 90%. In global terms, however, both figures are remarkably high. In the European cities with a similar level of wealth, an average of 43% of commuters drive. In poorer European cities, where cars are less affordable, this share is even lower.

➔ Residents in high-density cities are less inclined to drive than those in more sprawling, lower-density cities: seven of the eight high-density cities in the Index have higher shares of commuters travelling to work by public transport, foot or bike than the Index average.

➔ Culture has a role to play, too. Residents of both countries are very attached to the independence their cars give. And there is little need for residents to shift to public transport when the overall average commuting time is just under half an hour (27 minutes in the US and 35 minutes in Canada).

Water

US and Canadian cities have efficient water infrastructure and robust policies regarding water conservation. Nevertheless, their water consumption is far higher than in Asia, Latin America or Europe.

➔ Residents of Index cities use an average of 155 gallons of water per person per day, although the range is very wide, with the best performer, New York, at 69 gallons per person per day, consuming less than one quarter of the Index city with the highest water consumption.

➔ The overall average is about twice as high as in other parts of the world. In the European Index it was 76 gallons, for Asia it was 73 and for Latin America 70, indicating that even the best cities in the USA and Canada are only average internationally.

➔ There is a strong correlation between higher GDP per capita and lower water consumption. This is not only a result of being able to afford a better infrastructure, as the link between GDP and lower leakage is much weaker.

➔ Although water stress is not a universal issue, according to the Commission for Environmental Cooperation it affects 10% of the Canadian population and 40% of US residents, especially in the US southwest, suggesting that greater attention to consumption may become necessary.

➔ The high usage figures do not arise from a lack of attention to water: all cities monitor their water quality to some degree and nearly all promote lower use.

➔ On the infrastructure side, the average leakage rate is just 13%, which beats even the wealthy cities of Europe, at 16%.

➔ Only four of 27 cities do not recycle water to some extent – compared with 21 of 30 European cities that do not recycle water, including nine of the 15 wealthiest. The vast majority treats wastewater before discharging it.

Waste

Index cities have robust waste policies and do very well in terms of recycling when compared with global figures.

➔ Nine out of 27 cities get full marks in all waste policy areas and only one city scores no points.

➔ The vast majority has at least some version of selective disposal mechanisms and sustainable waste management practices. The proportion is similar to the European cities of similar income.

➔ On average 26% of waste is recycled in all cities in the Index, compared with 28% in the wealthier European cities.

➔ Two cities, San Francisco, at 77%, and Los Angeles, at 62%, recycle a higher amount of waste than any city in the European or German Green City Index except one, Leipzig, at 81%. Two other cities recycle over half of their waste – Vancouver, at 55%, and Seattle, at 51%.

➔ Although all European cities of similar income have comprehensive waste reduction strategies, only 14 of 27 US and Canada Index cities do, suggesting that waste reduction has not received as much priority in North America as it has in Europe. However, inconsistencies in the way different cities measure waste generation make it impossible to do meaningful comparisons. It is therefore unclear how well Index cities reduce waste.

➔ Whether or not they reduce waste, however, US and Canada Index cities certainly recycle.

Air

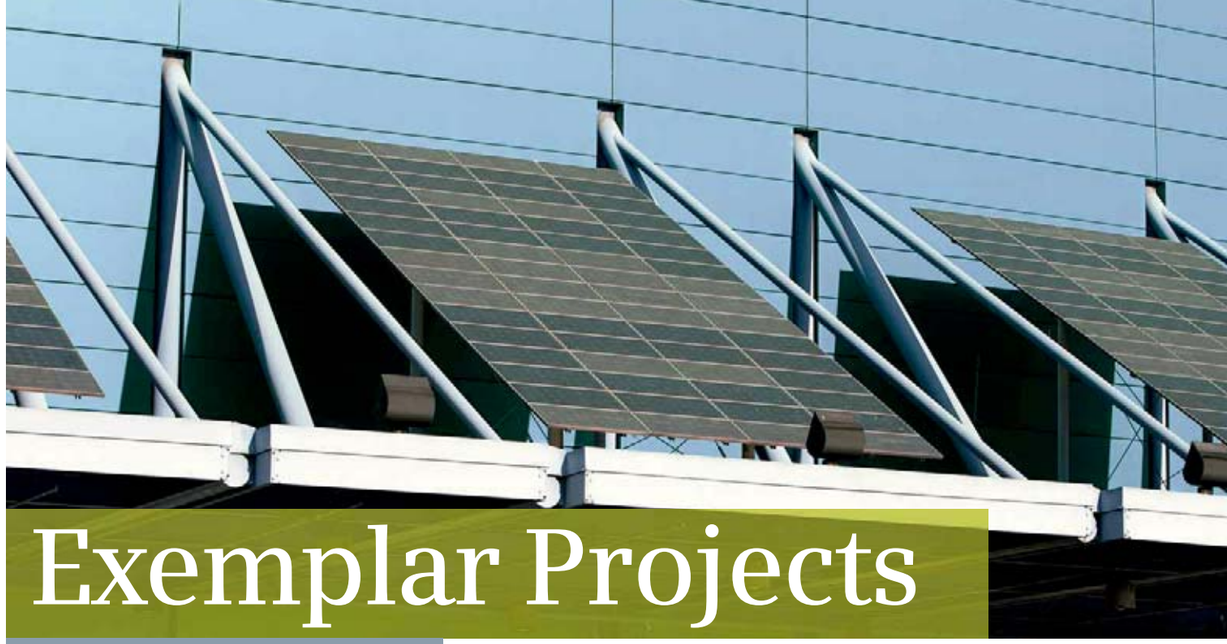
Air quality is an area of strong policy focus in Index cities, and denser cities have had some success in reducing particulate matter and nitrogen oxides emissions.

➔ All but three cities have some form of air quality policy and 20 Index cities even score full marks for this measure.

➔ Air quality targets, on the other hand, are slightly less widespread: only 12 out of 27 cities score full marks for this indicator.
➔ Nevertheless, denser cities are able to make an impact, whether through robust policies or less reliance on automotives: nitrogen oxides and particulate matter emissions decline noticeably with density.

Environmental governance

In their efforts to manage environmental governance, US and Canada Index cities are comparable to those of the high-income European cities. This, along with other areas of strong policy, suggests that environmental performance in the US and Canada Index cities should improve.
➔ The vast majority of cities have environmental strategies – at least to some degree. In particular, every city has some type of environmental contact point, all but one have an environmental authority, and all but two have an environmental plan endorsed by the mayor.
➔ Conducting a baseline review and setting targets across all environmental fields were the weakest areas for these cities, but even here, 11 had done a comprehensive baseline review and 14 had set targets in every area.
➔ Cities in the US and Canada Index demonstrate very similar records on urban environmental governance as the 15 European Green City Index cities in the same income range. The policies covered in the environmental governance category are about as likely to have been adopted by US and Canadian cities as they are by high-income European cities. Some policies are slightly more common in Europe, such as city-level commitments to international environmental covenants; others are adopted a bit more frequently in North America – for example the publication of annual or biennial environmental reports.



Exemplar Projects

US and Canada Green City Index

Energy and CO_2

Los Angeles: A comprehensive approach to renewables

Los Angeles already performs well on CO_2 emissions and energy consumption, with some of the lowest rates for both among the 27 cities in the US and Canada Green City Index. It is not, however, resting on its laurels. Instead, Los Angeles is taking a comprehensive approach to alternative energy generation. Unlike many cities in the US and Canada, the municipality directly owns the local power utility, the Los Angeles Department of Water and Power (LADWP). Through this body, the city is aggressively seeking to change its power mix. By 2020 the LADWP plans to eliminate its use of coal, which currently accounts for roughly 40% of power generation, and to have 40% of electricity come from renewables. By the end of 2010 it had already achieved half the target, with 20% of the city's power coming from renewable sources owing to projects like the 120-megawatt Pine Trees facility, America's largest municipally-owned wind farm.
Overall, 47% of the city's renewable power comes from wind, 30% from hydro, 22% from geothermal and 1% from solar. Not all of this was generated in the city, however. The LADWP purchases substantial wind energy from the Milford Wind farm in Utah and geothermal energy from Mexican utilities.
Although the LADWP understandably takes a leading role on renewable energy, other departments are helping too. The Hyperion Wastewater Treatment Plant, the main sewage treatment facility run by the Department of Public Works, will soon begin capturing natural gas in order to generate 70% to 80% of its own electricity needs. Meanwhile, the smaller Tillman Wastewater Treatment Plant has had nearly 26,000 square feet of solar panels installed. The department is a partner in a unique pilot scheme, the Terminal Island Renewable Energy (TIRE) project, which injects biosolids – currently about 25% of the city's total – deep into the earth and collects methane emissions.

Ideas from other cities

Chicago and Excelon, a major power generator, partnered to build Excelon City Solar, the largest urban solar plant in the US. Opened in 2010 and spread across a 41-acre brownfield site that had been vacant for over three decades, the plant now produces 10 megawatts of power, cutting 14,000 tons of greenhouse gas emissions annually and creating several hundred local jobs.
Enwave Corporation, owned in part by the city of **Toronto**, turned an energy problem into a sustainability opportunity. When the city had to move its water-intake pipe deeper into Lake Ontario, the water was too cold to be treated for consumption. Enwave used the cold water to provide air conditioning to downtown offices, saving 61 megawatts of energy annually. Moreover, this process raised the water temperature to a level sufficient for drinking-water treatment – thus eliminating the original problem.
In 2005 **Seattle's** mayor launched the "Kyoto Challenge" encouraging American cities to meet the Kyoto Protocol's greenhouse gas reduction targets. Since then, more than 1,000 mayors have followed Seattle's lead, signing the US Mayors Climate Protection Agreement, which includes a commitment to meet or beat the Kyoto emission targets to cut greenhouse gas emissions 7% below 1990 levels by 2012.

Land use

The million-tree strategy in NYC

New York City, already the Index leader in land use thanks to its high density and high proportion of green space, is seeking to vastly expand its urban forest. MillionTreesNYC, part of PlaNYC – a joint public-private partnership under the leadership of the city's long term planning unit – is in the middle of a ten-year project which, as the name suggests, aims to plant and care for a million trees inside the five boroughs. Since 2007, 430,000 trees have already been planted.

The scope of the project is impressive but so is the strategic thinking behind it. For example, consider the target to plant 220,000 "street trees", defined as any tree growing on a public right of way. This is a highly ambitious target based on a major 2006 tree census, which found that 220,000 was the absolute maximum number of new trees that could fit in the remaining space on city streets. In addition, the city has focused on street tree planting in six designated Trees for Public Health neighborhoods. These were chosen because they have low existing tree stocks and high hospital admission rates for asthma for children under five years old. Program officials are also experimenting with innovative ways of keeping trees healthy, and are conducting research on past urban reforestation projects.

Ideas from other cities

Washington DC has launched the CapitalSpace partnership to unify green-space management across various levels of government. It is taking a holistic approach that concentrates on six themes: creating a greenway to link parks, improving public schoolyards, enhancing urban natural areas, improving playing fields, enhancing center city parks and transforming small parks into public spaces.

In 2008 **San Francisco** City Hall hosted an exhibition Victory Garden to encourage vegetable growing within the city. The garden produced over 100 pounds of food a week that was donated to food banks.

In 2008 **Vancouver**, one of the Index cities with the highest density, adopted its own EcoDensity Charter, which focuses on reducing sprawl through relevant planning decisions.

New York is not the only city trying to plant a million trees: **Houston's** program, among other features, encourages companies to give their employees trees for planting as presents during the holiday season.

The city of **Denver** and other partners are beginning consultations on the South Platte River Area-wide and Brownfields Plan. Rather than focus on individual sites, this regeneration project will first consider the needs of the entire 2,000-acre corridor and then identify catalyst projects to help spark broad regeneration.

Detroit Greenmap is a web page produced by Sustainable Detroit – a non-governmental organization – that shows users the location of sustainability-oriented business, organizations, recreation centers, green spaces and citizen groups.

Buildings

Community power works in Seattle

Seattle recently launched its ambitious Community Power Works program. It aims to retrofit about 15% of buildings in central and southeast Seattle, including 2,000 homes, 75 apartment buildings, 120 small businesses (particularly restaurants, stores and cold-storage facilities), 25 large commercial buildings, and four hospitals. The goal is that each retrofit will lead to energy savings of 15% to 45% for individual buildings, and in total reduce carbon emissions by 70,000 metric tons. Although funded partly by a federal grant of $20 million, in addition to $120 million in local money, participating property owners will be required to contribute. The plan, however, will provide loans, rebates and financing that let people pay for the retrofits over time rather than up front. Specialists will advise property owners on the upgrades most appropriate for their buildings.

Another goal in Seattle is to create about 2,000 well paid, green jobs. Companies participating in the Community Power Works program will have to meet or exceed standards for labor wage, working conditions and training.

Ideas from other cities

In 2010 **Philadelphia** created the RetroFIT Philly Coolest Block contest, a public-private partnership between the city and a private chemical company. Seventy-four blocks competed to reduce energy expenses in order to win cool roofs (made of material that reflects sunlight), air sealing and insulation upgrades. Meanwhile, from September 2011 Lincoln Financial Field, the city's football stadium, will be self-sufficient for power, relying on 80 wind turbines, 2,500 solar panels and a 7.6-megawatt co-generation plant.

Pittsburgh has instituted a Density Bonus that allows new buildings to be 20% taller and have 20% more floor space than normal for their zone, if they are Leadership in Energy and Environmental Design (LEED)-certified.

With the encouragement of the City of **Denver**, its Botanic Gardens, Colorado State University and other groups have identified a range of plant species suitable to create green roofs (roofs covered in vegetation to absorb CO_2 and prevent stormwater run-off) in a semi-arid climate. Some of the city's notable public buildings now have green roofs, including the US Environmental Protection Agency building, the Central Library and the Museum of Modern Art.

Transport

Denver: From T-Rex to Fastracks – an integrated mobility concept

Denver has been investing heavily in mass transportation. In the early part of the last decade it completed the $1.67 billion Inter-modal Transport Expansion Program (T-REX); about half the money went toward widening two major highways – I-25 and I-225 – which were almost permanently clogged during daylight hours. This, however, was no mere highway extension. The highways themselves received intelligent transportation systems that relay information to drivers and control access at onramps. Most of the remaining funds went toward a 19.1 mile extension of the city's light transit system, more than doubling its existing network. Several of the new rail stations were constructed with park-and-ride facilities, and all had links to the city's bicycle network. The project also expanded bus services, and bridges were built across the highways for pedestrians and cyclists. The project was completed between 2001 and 2006, on time and slightly under budget. Over 35,000 people per weekday use the new rail line and local buses have seen increased ridership as well.

Recently the city embarked on a project that makes T-REX look small. Fastracks is a $6.7 billion program that aims, by 2017, to add 122 miles of light rail – more than triple the existing 35 miles. This will add six new lines as well as extensions to the existing three lines. The plan also includes an extension of the bus network and 18 miles of bus rapid transit lanes. According to the American Public Transportation Association, it is the biggest public transportation project since Washington DC broke ground on its Metro system in the early 1970s. When completed, Denver expects to boast one of the five longest rail systems in the country.

Ideas from other cities

Montreal introduced Canada's first self-service bike rental network, BIXI – a word derived from the combination of BIcycle and taXI – in 2009. It is currently North America's biggest bike sharing scheme, with approximately 5,000 bicycles and 400 docking stations. After 3.3 million trips in 2010, only 1% of bikes were lost or stolen. The program has been introduced in Toronto and is likely to expand to Vancouver, Minneapolis, Washington DC, and even London.

New York's Green Light for Midtown program created expanded pedestrian plazas in Herald Square and Times Square, and rearranged traffic patterns with a view to reducing congestion and improving pedestrian safety in the Midtown area. The results are impressive: there were 63% fewer injuries to motorists and passengers, and 35% fewer pedestrian injuries.

For the last five years, **Minneapolis** has been converting all its High Occupancy Vehicle (HOV) lanes to High Occupancy Toll (HOT) lanes. These remain free of charge for vehicles with more than one person in them, but when the lanes are underused, allow cars with single drivers to drive in them for a fee. The exact amount of the toll depends on conditions and is updated every three minutes.

In 2011 **Los Angeles** unveiled its Electric Vehicle Pilot Program. To encourage the purchase and use of electric cars, the city is offering rebates of up to $2,000 for the first 1,000 applicants to defray the costs of electric vehicle home chargers and installation. City officials say they hope to expand the rebate program to provide between 3,000 and 5,000 home chargers in the near future.

Sacramento spent $110,000 in late 2010 to equip 184 city-owned vehicles with GPS-enabled fleet telematics technology – an integrated use of telecommunications and informatics. By relaying information about these vehicles to a central point, the city is able to increase the efficiency of driving routes, reduce trip distances, decrease idling, improve vehicle operational efficiency and reduce emissions. Sacramento is planning to install the technology on several hundred vehicles over the next four years and expects its total five-year investment of $2.6 million to lead to savings of $800,000 per year.

Water

Cutting water consumption in Calgary

Since 2003 **Calgary** has been implementing its 30-in-30 policy of reducing per capita water consumption by 30% over 30 years in order to keep total demand steady as the population grows. As part of the plan, it has made water meters mandatory. In 2010 Calgary's water utility began installing them in 53,000 unmetered homes – out of about 280,000 total residences. The city expects to install about 10,000 per year, finishing the project in 2014, and the impact is likely to be substantial. Local studies show that the introduction of a meter reduces the average household's water consumption by around 60%. Although the meters are now compulsory, the city is trying to win people over rather than use regulatory force to have them installed. In particular, it is focusing on customer service. Residents can book an installation appointment online anywhere from the next week to months in advance. They can also leave feedback and score the installation team. Between November 2010 and March 2011, the reviews all rated the service as four or five out of five. Finally, the meters even help households save money. Installation is free and on average in 2009 metered households paid C$41.89 per month, compared with C$50 per month for those still on the flat rate.

Ideas from other cities

Phoenix is letting nature help with its wastewater treatment and gets an award-winning wetland in return. A portion of wastewater from the city's 91st Avenue Wastewater Treatment Plant is discharged into the manmade wetlands of the Tres Rios park. The flora and fauna of the wetlands help further clean the already treated effluent; the water also sustains diverse animal and plant life, including 143 species of birds. The original 25 acres of the park is currently being expanded to nearly 400.

Washington DC is having success with a plan that helps both waste reduction and water quality. The Skip the Bag, Save the River program helps fund the Anacostia Watershed Trash Reduction Plan, an effort to clean up one of the most polluted rivers on the East Coast. City residents pay a five-cent charge for every disposable bag received from stores, 80% of which goes to river cleanup efforts. As of October 2010 the number of bags given out by Washington merchants had declined by 80% and the number found littering the Anacostia River by 66%.

Since 2006 **Houston** has been using 20 SolarBees at Lake Houston, one of its drinking-water sources. These energy efficient solar-powered aeration mixers oxygenate the water to help prevent algal blooms, which cause an unpleasant odor and taste. The low-cost solution has produced reductions in energy costs of 28% and chemical costs of 78% compared with previous methods of reducing the blooms.

Waste

San Francisco recycling: Popular laws have dramatic effects

In 2009 **San Francisco** recycled 72% of its waste, already far ahead of any city in the US and Canada Green City Index, thanks to a proactive policy stance. San Francisco had long recycled a wide range of different materials, and had charged residents and businesses on a pay-as-you-throw basis for non-recyclable garbage, which encouraged waste reduction. San Francisco wanted to meet a longstanding goal to recycle 75% of waste by 2010. Officials also wanted to reduce the amount of compostable material in the city's waste, which made up more than a third of the total material discarded by city residents.

Unlike many cities in the US, San Francisco put mandates in place to achieve its recycling goals. In 2009 the city required residents and business owners to separate recyclable materials from waste using special curbside containers. At the same time, the city mandated a similar separation of compostable material, the first such regulation in the US. The impact was significant: total recycling went up to 77% and composting, meanwhile, rose from 400 tons a day before the law went into effect to 600 tons each day in the year following the ordinance. This is not the first time San Francisco has used regulation to address waste issues. In 2007 the city prohibited major grocery and pharmacy chain stores from giving out plastic shopping bags. The city estimates that the law has reduced its plastic bag waste overall by 15% to 20%, or roughly five million bags per month.

The politics of such restrictions are not always easy. In the run-up to the recycling law, there was some concern over the proposed maximum fine of $1,000 for individuals, so it was reduced to $100. For the most part, though, the law seems to be very popular. The city was surprised by how many people began sorting compostables well before it came into effect, and by December 2010 not a single individual or business had required a fine for non-compliance, which is monitored by city officials.

Ideas from other cities

The tailgate party is a traditional part of enjoying a football game, and in **Pittsburgh** the Pennsylvania Resources Council – a local non-profit organization – and the Alcoa Foundation are using it as an opportunity to promote recycling. At the last three Steelers home games and into the playoffs, the Let's Tackle Recycling Program provided the opportunity for tailgaters to recycle their trash and learn about the benefits of recycling. The scheme was very popular and in five games diverted eight tons of trash from landfills.

In **Montreal**, the Direction de l'environnement et du développement durable, working with the Conférence régionale des élus de Montréal, has created an online database of waste materials to serve as a virtual warehouse for artists who might want to use them.

Houston, in cooperation with a local non-governmental organization, has created Houston Mulch – a brand of compost created from green debris in the city. Available citywide since 2009, its environmental benefit in terms of lowering CO_2 emissions is the equivalent of keeping around 10,800 cars off the road.

Portland – leading by example

Portland, located in the Pacific Northwest US state of Oregon, is a recognized environmental leader, and consistently performs well in numerous environmental and quality-of-life rankings. As early as the 1970s city planners began to take proactive steps to contain urban sprawl, and safeguard the city's surrounding forests and farmland against population growth. Since then, Portland has implemented a range of programs that have ensured its status as a model of sustainable urban development. The nation's first car-sharing program was founded there and has since expanded to cities across the country. A bicycle-friendly city, Portland has over 300 miles of bikeways. And in 2005, the Christian Science Monitor called the city, "the new capital of the ecohouse movement."

Portland was not included in the US and Canada Green City Index because it fell outside the selection criteria, yet because of the city's environmental track record it provides many examples of best-practice leadership that can serve as models to other US and Canadian cities. Here are three of the best:

→ **LEED leader:** Portland has 18.4 Leadership in Energy and Environmental Design (LEED)-certified buildings for every 100,000 people living in the city, which is slightly more than any city in the Index. It has mandatory LEED standards for city-owned buildings and offers incentives for LEED-certified private construction projects. One of the city's flagship LEED-certified buildings is the Rose Garden Arena, which is home to the National Basketball Association's Trail Blazers. It received an LEED gold rating in 2010.

→ **Containing sprawl:** Portland is a pioneer in smart growth policies to contain sprawl, dating back to a state mandated policy in 1973 to limit urban areas. By law, all municipalities in the state were required to define their urban boundaries and restrict development outside the city limit. Portland established its boundary in 1979 and over the following decade the city's population density increased 50%. Today city zoning decisions are based on minimum density requirements and proximity to mass transit, and the city has policies in place to encourage walking and cycling in the city center rather than driving. With around 22,000 people commuting to work each day by bicycle along the city's 324 miles of bike lanes, Portland boasts the highest share of bicycle commuters of any large US city.

→ **Reducing waste and promoting recycling:** Portland has ambitious waste management and recycling goals, including strong incentives. As a result, the recycling rate compares with the best US cities in the Index, at 61%. The city's goal is to reduce total solid waste by 25% by 2030 by working with non-profits and other city organizations to encourage businesses and residents to purchase durable, repairable and reusable goods, and to increase the amount they recycle. In addition, the city is looking to improve its long-standing recycling program by providing weekly curbside collection of food waste and recycling, and shifting standard residential garbage collection to every other week. Officials are also exploring the possibility of making residential recycling mandatory.

Methodology

US and Canada Green City Index

The Index measures the environmental performance of 27 major cities in the US and Canada and their commitment to reducing their future environmental impacts. The methodology behind it was developed by the Economist Intelligence Unit (EIU) in cooperation with Siemens. It builds on the work of the Green City Index series (Europe, Latin America, Asia and Germany) and aims to closely follow the structure of previous indices. However, the Index has been adapted to accommodate variations in data quality and availability in the US and Canada, and environmental challenges specific to the region. An independent panel of urban sustainability experts provided important insights in the construction of the Index.

The 27 cities selected for the US and Canada Green City Index were chosen with a view to representing a number of the most populous metropolitan areas in the United States and Canada. The Index scores cities across nine categories – CO_2, energy, land use, buildings, transport, water, waste, air quality and environmental governance – and is composed of 31 indicators. Sixteen of the Index's 31 indicators are derived from quantitative measurements – e.g., a city's CO_2 emissions, electricity consumption, prevalence of public transport and levels of air pollutants. The remaining 15 indicators are qualitative assessments of cities' environmental policies, aspirations and ambitions – e.g., a city's commitment to consuming energy produced from green and local sources, the extent to which it promotes the usage of public transport and makes efforts to reduce road traffic, the ambitiousness of its waste reduction and water management policies, and the stringency of its environmental strategy.

The goal of the study is to allow key stakeholder groups, such as city authorities, policymakers, infrastructure providers, environmental non-governmental organizations, urban sustainability experts and citizens, to compare how their city performs against other cities, both overall and within each of the nine categories.

Clusters

In order to conduct a deeper analysis of city trends, the 27 cities in the Index were clustered into a series of groups, defined by the size of the population, population density, area, income, temperature and share of industry. For each of the six measures, three bands were created by calculating the mean of the relevant data for the 27 cities and then calculating 0.5 standard deviation above and below the mean. Cities with a data point less than 0.5 standard deviation below the mean in a given category were assigned to the low band, cities with a data point between 0.5 standard deviation below the mean and 0.5 standard deviation above the mean were assigned to the medium band, and cities with a data point greater than 0.5 standard deviation above the mean were assigned to the high band (see graphic above).

	Low	Medium	High
Population	< 515,505 people	515,505 – 2,177,633 people	> 2,177,633 people
Population density	< 5,276 people per square mile	5,276 – 10,937 people per square mile	> 10,937 people per square mile
Area	< 97.6 square miles	97.6 – 324.2 square miles	> 324.2 square miles
Income	< $41,960 in GDP per capita	$41,960 – $49,991 in GDP per capita	> $49,991 in GDP per capita
Temperature	< 50.1 degrees Fahrenheit	50.1 – 60.9 degrees Fahrenheit	> 60.9 degrees Fahrenheit

Regarding the share of industry, cities were defined as "goods intensive" if employment in the goods sector was more than 15.8% of total employment (labor force in the goods sector as a percentage of total labor force was used for Canadian cities); they were defined as "services intensive" if employment in the services sector was more than 88.1% of total employment (labor force in the services sector as a percentage of total labor force was used for Canadian cities).

Data sources

A team of in-house and external contributors from the EIU collected data for the Index in late 2010. Wherever possible, the EIU used publicly available data from official sources. Data sources for US cities included the US Census Bureau, the US Environmental Protection Agency, the US Geological Survey, the National Oceanic and Atmospheric Administration, the Trust for Public Land, Purdue University's Vulcan Project, and the National Transport Database. For Canadian cities sources included Statistics Canada, Environment Canada and the Conference Board of Canada. When data was not available from national sources, it was collected from city agencies and authorities. National sources were favored over city sources given that data obtained from national sources is measured in a consistent manner across the cities included in the Index. Particular attention was given to the geographical level at which the data was collected, and efforts were made to collect data consistently across the 27 US and Canadian cities in the Index for each of the 31 indicators. In practice, this sometimes involved choosing city-level data or metropolitan-area data depending on the geographical area at which the data was more commonly available for the range of cities covered in the Index.

The EIU made every effort to integrate the most recent data. When uncertainties arose regarding the accuracy of individual data points, the agency or city official from which the data was sourced was contacted to confirm. The main exception to the rule of using the most recent data is for CO_2 emissions for US cities. Here the EIU chose 2002 Vulcan Project data over data available from city agencies because it ensures that CO_2 emissions are measured consistently for all US cities in the Index. In the several instances in which gaps in the data existed, the EIU produced estimates by scaling down data from larger geographical areas.

For the purposes of comparability across US and Canadian cities, the EIU converted all metric unit data from Canadian sources to units typically used in the US. The exception to this is for CO_2 emissions, which were measured in metric tons in their original source, Purdue University's Vulcan Project.

Despite all of these steps, the EIU cannot rule out having occasionally missed an alternative reliable public source or more recent figures.

Indicators

For the 16 quantitative indicators in the Index, the EIU first "normalized" the data points representing each quantitative indicator on a scale of 0 to 10, where the high benchmark was set by the best-performing city for each indicator and the low benchmark was set by the worst-performing city for the given indicator. The best-performing city for each indicator was assigned a score of 10, while the worst-performing city for each indicator was assigned a score of 0. Remaining cities were assigned a score between 0 and 10 according to their distance from the high benchmark.

Qualitative indicators were scored by analysts of the Economist Intelligence Unit with expertise in the city in question, based on objective scoring criteria that considered concrete environmental actions, strategies and targets set by cities. Except in one case, qualitative indicators are composed of two or more sub-indicators. The qualitative sub-indicators were scored on a scale of one to three, with three points assigned to cities that met or exceeded the criteria established in the Index, two points assigned to cities that partially met the criteria, and one point assigned to cities that showed no progress toward meeting the criteria. The independent expert panel provided input into the criteria assigned to each indicator. After the sub-indicators were scored, they were bundled into a single qualitative indicator and rescored on a composite scale of 0 to 10.

Index construction

The Index is a composite of all underlying indicators. To create the category scores, each indicator was aggregated according to an assigned weighting. In several cases, when indicators represented similar measures of environmental performance, they were bundled together and assigned the weight of a single indicator before the category score was calculated. The category scores were then rebased on a scale of zero to 100. Finally, to build the overall score for the 27 cities, each of the nine category scores were assigned an equal weighting (that is, multiplied by 11.1%) and summed to arrive at a final score on a scale of zero to 100. The decision to assign equal weighting to the category scores reflects feedback from the expert panel and research on measuring environmental sustainability.

List of categories, indicators and their weighting in the US and Canada Green City Index

Category	Indicator	Type	Weighting	Description	Normalization technique
CO_2	CO_2 emissions per unit of GDP	Quantitative	33%	Total CO_2 emissions, in metric tons per US$m of GDP.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	CO_2 emissions per person	Quantitative	33%	Total CO_2 emissions, in metric tons per person.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	CO_2 reduction strategy	Qualitative	33%	Assessment of the ambitiousness of greenhouse gas emissions reduction strategy as well as of the rigor of the city's CO_2 reduction target and emissions measurements.	Scored by EIU analysts on a scale of 0 to 10.
Energy	Electricity consumption per unit of GDP	Quantitative	33%	Total electricity consumption, in GJ per US$m of GDP.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Electricity consumption per person	Quantitative	33%	Total electricity consumption, in GJ per person.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Clean and efficient energy policies	Qualitative	33%	Measure of a city's commitment to promoting green energies, developing green energy projects and increasing the amount of locally produced energy.	Scored by EIU analysts on a scale of 0 to 10.
Land use	Green spaces	Quantitative	25%	Sum of all public parks, recreation areas, greenways, waterways and other protected areas accessible to the public, as a percentage of total city area.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Population density	Quantitative	25%	Number of inhabitants per square mile.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Green land use policies	Qualitative	25%	Assessment of a city's efforts to sustain and improve the quantity and quality (for example, proximity and usability) of green spaces, and its tree planting policy.	Scored by EIU analysts on a scale of 0 to 10.
	Urban sprawl	Qualitative	25%	Assessment of how rigorously a city promotes containment of urban sprawl and reuse of brownfield areas.	Scored by EIU analysts on a scale of 0 to 10.
Buildings	Number of LEED-certified buildings	Quantitative	33%	Number of LEED-certified buildings (silver, gold or platinum) per 100,000 persons.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Energy efficient building standards	Qualitative	33%	Assessment of whether a city requires energy audits and whether energy consumption regulations require that new buildings satisfy energy efficiency standards.	Scored by EIU analysts on a scale of 0 to 10.
	Energy efficient building incentives	Qualitative	33%	Assessment of a city's incentives for retrofitting buildings to improve energy efficiency and how widely it promotes energy efficiency in homes and offices.	Scored by EIU analysts on a scale of 0 to 10.
Transport	Share of workers travelling by public transit, bicycle, or foot	Quantitative	20%	Percent of workers travelling to work by public transit, bicycle, or foot.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Public transport supply	Quantitative	20%	Evaluation of availability of public transport, including length of public transport network.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Average commute time from residence to work	Quantitative	20%	Average commute time from residence to work, in minutes.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Green transport promotion	Qualitative	20%	Assessment of how extensively the city promotes public transport and offers incentives for less carbon-intensive travel.	Scored by EIU analysts on a scale of 0 to 10.
	Congestion reduction policies	Qualitative	20%	Assessment of a city's efforts to reduce congestion.	Scored by EIU analysts on a scale of 0 to 10.
Water	Water consumption per capita	Quantitative	25%	Total water consumption, in gallons per person per day.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Water system leakages	Quantitative	25%	Share of non-revenue public water leakages.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Water quality policy	Qualitative	25%	Assessment of the level and quality of a city's main water sources.	Scored by EIU analysts on a scale of 0 to 10.
	Stormwater management policy	Qualitative	25%	Indication of whether a city has a stormwater management plan.	Scored by EIU analysts on a scale of 0 to 10.
Waste	Percent of municipal solid waste recycled	Quantitative	50%	Percentage of municipal solid waste recycled.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Waste reduction policies	Qualitative	50%	Assessment of measures to reduce waste and make waste disposal more sustainable.	Scored by EIU analysts on a scale of 0 to 10.
Air	Nitrogen oxides emissions	Quantitative	25%	NO_X emissions per annum, in lb per person.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Sulphur dioxide emissions	Quantitative	25%	SO_2 emissions per annum, in lb per person.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	PM_{10} emissions	Quantitative	25%	PM_{10} emissions per annum, in lb per person.	Scored on a scale of 0 to 10 based on min/max of data for all cities.
	Clean air policy	Qualitative	25%	Measure of a city's efforts to reduce air pollution.	Scored by EIU analysts on a scale of 0 to 10.
Environ-mental gover-nance	Green action plan	Qualitative	33%	Measure of the rigor of a city's green action plan.	Scored by EIU analysts on a scale of 0 to 10.
	Green management	Qualitative	33%	Measure of the extensiveness of environmental management undertaken by the city.	Scored by EIU analysts on a scale of 0 to 10.
	Public participation in green policy	Qualitative	33%	Measure of the city's efforts to involve the public in monitoring its environmental performance.	Scored by EIU analysts on a scale of 0 to 10.

Atlanta

US and Canada Green City Index

Atlanta, the capital of the southeastern state of Georgia, is a regional economic hub, with one of the highest concentrations of Fortune 500 companies in the US. The city has in particular attracted several high-tech start-up companies, which has led some to call it the Silicon Valley of the South. As a result, Atlanta's economy is services intensive, although manufacturing maintains a strong presence. The Coca-Cola Company, for example, has its headquarters there. With a GDP per capita of around $42,200, Atlanta has the 16th highest income in the US and Canada Green City Index. Data for the Index for Atlanta is based on a mix of statistics covering the city boundary, with a population of 540,000, and the wider metropolitan area, which has a population of 5.5 million.

Atlanta is ranked 21st overall in the Index. Its strongest category performance is in buildings, at eighth, bolstered by having the highest percentage of Leadership in Energy and Environmental Design (LEED)-certified buildings in the Index. Although the city places 21st in the water category, mainly because of a high leakage rate, it has strong policies to reduce water consumption. Atlanta is in the bottom half of the Index for CO_2, energy, land use, waste and transport, so there is still room for improvement in these categories, particularly for controlling sprawl and recycling. The city's mayor, Kasim Reed, is leading efforts to improve sustainability and has announced a goal for Atlanta to become one of the most sustainable cities in the US, in part by securing grants for a wide range of environmental projects.

CO_2: 20th, 57 points

Atlanta performs well for its overall CO_2 reduction strategy, gaining some of the best marks in the Index for setting targets and monitoring, but high carbon emissions drag down the overall performance. The city emits 21 metric tons of CO_2 per person, above the Index average of 15 metric tons. It releases 390 metric tons of CO_2 for every $1 million of GDP, higher than the Index average of 296 metric tons, and also the highest amount among services-intensive cities. A large manufacturing base, despite a high reliance on services, helps explain Atlanta's relatively high CO_2 emissions per unit of GDP. Since 2002, when the CO_2 data for all US cities in this Index was collected, Atlanta has ramped up efforts to reduce its carbon footprint (see "green initiatives" below).

Green initiatives: Atlanta signed the US Conference of Mayors Climate Protection Agreement in 2006. Signatories pledge to reduce carbon emissions 7% below 1990 levels by 2012. To help meet that target, Atlanta has embarked on a "sustainability program" to reduce greenhouse gas (GHG) emissions in municipal buildings. Assisted by state and federal funding, city authorities say the program, which started in February 2008, had cut municipal GHG emissions 13% by October 2010. Atlanta has also completed a citywide inventory of non-municipal sources of GHG emissions, which will provide the basis of a "Community Climate Action Plan", although the specific plans and targets have yet to be set.

Energy: 25th, 44.8 points

Atlanta consumes the most electricity in the Index on a per capita basis, at 152 gigajoules per person, much higher than the average of 52 gigajoules. Atlanta's electricity consumption per $1 million of GDP, at 357 gigajoules, is also higher than the Index average of 332 gigajoules. There are some mitigating circumstances, however. The city's relatively low population, combined with the numerous and energy demanding companies operating there, has driven up the per capita figure. Atlanta scores better on policy areas. For example, through a mixture of tax incentives and subsidies, the city promotes green energy for both homes and businesses.

Green initiatives: Atlanta's "Em-Powered to Change" program, started in February 2011, is designed to increase city-employee awareness about energy conservation. The goal is to reduce energy consumption 20% in city facilities over the next five years. In another initiative, Atlanta announced a partnership with a private automobile manufacturer in October 2010 and will be developing an electric vehicle charging network for the first delivery of electric vehicles, expected during 2011.

Land use: 25th, 36.7 points

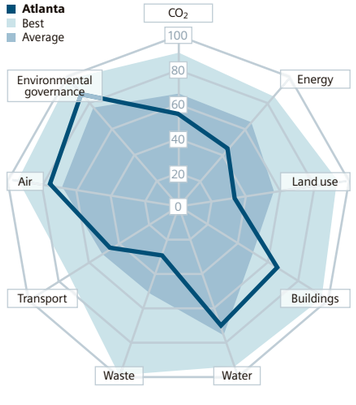
Less than 5% of Atlanta's administrative area is given over to green space, versus an Index average of 12%. The city performs well for proactive measures on tree planting and brownfield regeneration, but there are still policy challenges in order to overcome a historical legacy of city planning that did not put a priority on green space. For example, Atlanta is one of only a few cities in the Index that does not have any measures in place to protect existing green space from building development. There are plans to increase Atlanta's green space by 40% through Atlanta Beltline (see "green initiatives" below) but city authorities concede it will take many years before that target is achieved.

Green initiatives: Atlanta Beltline, a $2.8 billion urban redevelopment project launched in 2006 by city authorities in partnership with private companies, aims to convert a 22-mile railroad corridor into an integrated network of parks, trails and public transit. Atlanta Beltline will eventually connect 45 neighborhoods around Atlanta's downtown. The project, which has no fixed timeframe for completion, includes the redevelopment of 1,100 brownfield acres.

Buildings: Eighth, 66.7 points

This is Atlanta's highest category placing, and the city's score is boosted by having the highest proportion of LEED-certified buildings in the Index in relation to population, at 18.3 per 100,000 people. Strict energy efficiency regulation for new buildings has increased the pace of LEED certification, but so too has the city's LEED commitment on municipal buildings (see "green initiatives" below). Atlanta's overall buildings performance would have been even better were it not for the fact that the city does not require energy audits from property owners, and is relatively weak, by Index standards, in providing incentives to retrofit buildings. Public information on how to decrease energy consumption in offices and homes is also not as readily available in Atlanta as it is in the majority of Index cities.

Green initiatives: Atlanta passed an ordinance in 2003 requiring any new construction of city facilities and city-funded projects, as well as renovations, to be silver LEED-certified. Renovation work has included Atlanta's international airport, which is on track for silver LEED certification in 2012. In the same year the ordinance was passed, Atlanta installed a 3,000-square-foot garden on the city hall roof to reduce energy consumption and improve stormwater management. The city's sustainability program (see reference in "green initiatives" for CO_2) reportedly reduced city hall energy consumption by a quarter between February 2008 and October 2010.



Background indicators

Total population [1]	540,000
Administrative area (miles^2) [1]	131
GDP per person (real) (US$) [2]	42,200
Temperature (24-hour average, annual) (°F) [1]	62
Goods employment (%) [2]	11
Services employment (%) [2]	89

Geographical basis: 1) City, 2) MSA

Transport: 20th, 47.6 points

Atlanta scores well for its efforts to promote green transport, but is marked down for relatively weak congestion policies. Its public transport network is relatively short compared to other cities in the Index, at 0.2 miles per square mile, compared with the Index average of 1.1 miles per square mile. The share of Atlanta's workers taking public transport, riding bikes or walking, at 5%, is much lower than the 13% Index average. A common feature of low population density cities, of which Atlanta is one, is low take-up among workers of greener forms of transport. Municipal authorities have recognized the challenges and in 2009 created the city's first-ever comprehensive transportation plan (see "green initiatives" below).

Green initiatives: Connect Atlanta, a wide-reaching transportation plan through to 2030, aims to expand its rapid transit network to put 500,000 residents within a 10-minute walk of rapid transit, up from the 70,000 residents who have that access level today. The plan, announced in 2009, also aims to extend bike access to green space from 1,000 acres to 3,400 acres.

Water: 21st, 71.7 points

Although Atlanta turns in a middling performance in this category in general, the city does exceptionally well in limiting water usage. Water consumption per capita is 122 gallons per day, which is below the Index average of 155 gallons. Despite being both a high temperature and a service intensive city, Atlanta has much lower water consumption per capita than other cities with the same profile, including many that are in the mid-temperature range. Strong policies, which include the promotion of lower water usage (see "green initiatives" below), have helped. But the performance on water consumption is weakened by Atlanta's water distribution system. Nearly a third of the water passing through Atlanta's system is lost to leakages, compared with the Index average of 13%, due to aging infrastructure.

Green initiatives: Atlanta offers rebates of up to $100 to replace older inefficient toilets with low-flow models. The program, running since the beginning of 2008, has led to the replacement of more than 3,700 toilets, and nearly 22 million gallons of water have been saved. The city also launched a toilet rebate program in October 2010, targeting 108,000 apartments built prior to 1992, when water efficiency standards were upgraded.

Waste: 22nd, 29.6 points

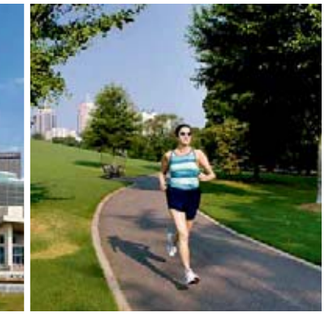
The city has one of the lowest proportions of recycled municipal waste in the Index, at 7%, compared with the Index average of 26%. In addition, it has one of the lowest rates among other cities with incomes in the middle range. One reason is that the city has only recently begun to introduce recycling initiatives (see "green initiatives" below). And on waste policy, Atlanta has made only moderate efforts to reduce waste creation. Local waste management practices, such as composting and the conversion of waste by-products to energy, are also relatively underdeveloped.

Green initiatives: Atlanta has been running a pilot recycling program to incentivize householders to set aside recyclable waste since November 2009. The scheme, Rewards for Collecting all Recyclables Together (ReCART), involves 10,000 households. Each household is provided with recycling carts retrofitted with an ID tag, which is scanned for weight information and collection frequency. Households are then awarded points according to the weight of recyclables they put aside, which are allocated to their recycling account. The reward points can then be redeemed with local vendors. The first phase of ReCART will last for up to three years. A decision will then be made if it is viable for citywide expansion.

Air: 12th, 78.2 points

Atlanta performs best for sulfur dioxide emissions, which at 12 lb per person per year are well below the Index average of 22 lb. Nitrogen oxides and particulate matter emissions are slightly above the averages. A robust set of polices, including targets, has no doubt helped Atlanta's air quality. It is also a low-density city with a high-services economy, and other cities in the Index with this profile also have lower sulfur dioxide and nitrogen dioxide emissions.

Green initiatives: The municipal government runs various schemes to reduce traffic and improve air quality, in partnership with statewide and local groups. One example is a commuter rewards program, which provides cash incentives for using greener forms of transport. More than 70,000 commuters across Georgia have signed up to the scheme. The city also conducts outreach events, including "Walk Day" and "Give Your Car the Day Off", as well as subsidizing public transit fares for public employees.



Environmental governance: 12th, 87.8 points

The city turns in a strong performance for overall green management. It has a dedicated environmental authority, gives public access to information on the city's environmental performance and policies, and has made environmental commitments at an international level. The carbon emission reduction targets of the US Conference of Mayors Climate Protection Agreement, which Atlanta signed up to in 2006, are in line with the Kyoto Protocol. However, the city does not produce any regular environmental reports, either annually or biannually, to monitor and evaluate policy implementation.

Green initiatives: Atlanta established the Mayor's Office of Sustainability in February 2008. As well as embarking on a series of sustainability initiatives, which has focused on municipal operations, the division has secured state and federal grants totaling $28 million to help fund environmental improvements. A sustainability sub-cabinet, tasked with improving coordination among government offices and tracking greenhouse gas emissions, held its inaugural meeting in February 2011.

Quantitative indicators

Category	Indicator	Average	Atlanta	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**390.1**	2002	MSA	Purdue University - The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**21.2**	2002	MSA	Purdue University - The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.36**	2009	City	Mayor's Office of Sustainability; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**152.4**	2009	City	Mayor's Office of Sustainability; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**4.6**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**4,129.2**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**18.3**	2010	City	US Green Building Council	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**5.3**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**36.8**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**2.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**30.1**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**7.1**	2009	City	Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**121.9**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**31.4**	2009	City	Mayor's Office of Sustainability	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**70**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**32**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**12**	2005	County	EPA; US Census Bureau	Using county population

Boston

US and Canada Green City Index

Background indicators

Total population [1)]	650,000
Administrative area (miles^2) [1)]	48
GDP per person (real) (US$) [2)]	57,100
Temperature (24-hour average, annual) (°F) [1)]	52
Goods employment (%) [2)]	11
Services employment (%) [2)]	89

Geographical basis: 1) City, 2) MSA

Boston is the capital of the US state of Massachusetts and the largest city in the New England region. With a population of just 650,000 people, Boston is smaller than the average North American city in the US and Canada Green City Index, although its metropolitan area extends into neighboring Rhode Island and New Hampshire, and has a population of 4.6 million. In the Index, a mix of city and metropolitan data is used. Historically a center of shipping and manufacturing, Boston's economy has largely shifted to services. Today finance, insurance and research centered on the area's acclaimed universities drive the economy. Boston has also recently become one of the leading centers for high-tech firms in the US. The success of these industries helps give Boston the fourth highest income in the Index – with a GDP per person of $57,100. Boston is also one of the oldest cities in the Index, contributing to a more compact downtown that facilitates the city's environmental efforts.

Boston ranks sixth overall in the Index. It scores best in the energy and water categories, placing second in each. These scores are driven by high marks in electricity consumption per unit of GDP, strong green energy policies and low water consumption. Additionally, among the cities with small administrative areas, Boston places second in land use, demonstrating that the city's policies to efficiently use the little land available have been effective. Perhaps the biggest factor contributing to Boston's high overall ranking is that the city ranks below 15th in only one category, transport, in which it falls to 17th. While excelling in a few categories, Boston's overall strength lies in its well-rounded environmental policies.

CO_2: 11th, 79 points

Boston has slightly better than average marks in CO_2 emissions. This is both on a per capita basis, at 12 metric tons per person compared with an Index average of 15 metric tons, and emissions per $1 million of GDP, at 199 metric tons, versus the average of 296 metric tons. Boston's carbon levels benefit from consuming less electricity than many other cities in the Index, as well as a relatively low level of coal consumption. Instead, emissions from petroleum consumption – both by road transport and, unusually for US and Canadian cities, from electricity generation – are the main drivers of Boston's carbon output. On a policy level, Boston's greenhouse gas reduction strategy is considered average compared to other North American cities, but its strong record on green energy projects (see "energy" category below) is likely to contribute to lowering CO_2 emissions.

Green initiatives: In 2010 Boston's Community Advisory Committee launched the campaign, Sparking Boston's Climate Revolution, to identify ways for the city to reduce greenhouse gas (GHG) emissions. The plan's main recommendations are for Boston to lower its GHG emissions by 25% by 2020 from 1990 levels; immediately start incorporating the projected effects of climate change in all planning and review processes for municipal and private projects; develop a comprehensive public engagement effort; use climate action opportunities to advance Boston's green economy and job goals; and ensure that climate action has clear public and private leadership and resources. Though its recommendations are non-binding, the city has already begun implementing the campaign into city policy.

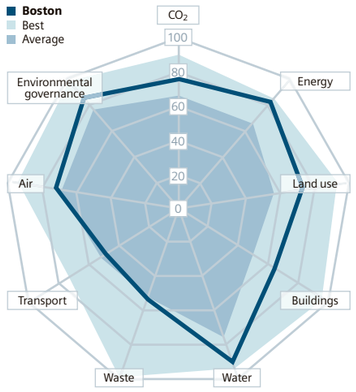
Energy: Second, 82.4 points

Boston receives its highest ranking in this category, along with the water category. The city consumes 41 gigajoules of electricity per person, compared with an Index average of 52 gigajoules, and just 100 gigajoules of electricity per $1 million of GDP, versus the Index average of 332 gigajoules. A major reason for Boston's success in this area is its comprehensive plans for promoting energy efficiency, which extend much further than for many other cities in the Index. Boston also excels in its policies for local and green energy projects. Led by recent solar projects (see "green initiatives" below), Boston is one of only five cities in the Index to receive the highest marks for both green energy projects and local energy production.

Green initiatives: In 2008 the city launched Solar Boston, a program to encourage the widespread adoption of solar energy. Details include easing permitting requirements, mapping feasible locations, and planning for purchasing, financing, and installing of solar technology. Through these efforts Boston increased its solar capacity to 3.1 megawatts in 2010, up from 1.8 megawatts in 2008. Its goal is to produce 25 megawatts from solar by 2015.

Land use: Fourth, 74.9 points

Boston's strong performance in this category is largely driven by its high population density, assuring the efficient use of the city's limited land. With 13,400 people per square mile, Boston has the third highest population density in the Index and well above the average of 8,100 people per square mile. Additionally, it has an above average percentage of green space, at 16% of the city's area, compared with the Index average of 12%. Boston has made strong efforts to promote green spaces over the years, highlighted by the so-called Emerald Necklace – a green network that links parks throughout the city. Boston also has been proactive about protecting its greenbelts from urban sprawl, focusing on "smart growth" that makes efficient use of the area's limited land.



Green initiatives: The Urban Wilds Initiative, initially created in 1976, seeks to protect city-owned urban green space and other natural areas from development and degradation. The initiative includes the Boston Youth Clean-up Corps, which provides clean-up and vegetation control, and has enlisted neighborhood and non-profit groups for similar activities. In cooperation with the state agency, the Massachusetts Department of Conservation and Recreation, the initiative has helped protect many acres of land from development and covers 36 unique regions within Boston.

Buildings: Tenth, 62.1 points

Boston is near the Index average for the number of buildings with Leadership in Energy and Environmental Design (LEED) certification, at 6.5 buildings per 100,000 people, compared to the average of 6.4. However, this number is likely to increase due to newly implemented zoning requirements (see "green initiatives" below). Meanwhile, although Boston offers rebates to homes and businesses for energy efficiency retrofits, the municipality does not require energy efficiency audits.

Green initiatives: In 2007 Boston was the first city in the US to mandate green standards in municipal zoning regulations, requiring that all large-scale building projects – generally meaning greater than 50,000 square feet – meet LEED standards, including minimum requirements for energy savings, water efficiency and CO_2 emissions reduction. In another initiative, Boston received $40 million in federal funds in 2009 to renovate public housing developments using green technology to increase energy efficiency. The first phase includes building 100 to 150 new housing units and a community center, which will include improved "building envelopes" (building shells that dramatically improve insulation to reduce heating and cooling costs), interiors designed to capture and store solar heat through specially designed windows and skylights, shading devices, and natural ventilation cooling.

Transport: 17th, 50.2 points

Although Boston's small administrative area contributes to a comparatively high rate of non-automobile commuting – 18% compared with the Index average of 13% – the city's public transport options are limited. The city has 0.3 miles of public transit per square mile compared with an Index average of 1.1, and has only 0.8 public transit vehicles available per square mile, well below the Index average of 9 public transport vehicles, and near the bottom of the Index. Meanwhile, Boston performs close to the Index averages for "annual vehicle revenue miles" (a measure of the availability of public transport), at 21 miles versus the average of 24 miles, and commute time, at 28 minutes compared to the average of 29 minutes. Boston's support for green public transit is also limited, although all city-owned vehicles must be hybrid or run on alternative fuels.

Green initiatives: Formed in 2007, the Boston Bikes initiative seeks to make Boston a world-class bicycling city by expanding bike lanes and offering new biking programs such as providing free breakfast at City Hall on Fridays to bicycle commuters. In 2011 the city is planning to establish a bike-sharing system that will have twice as many bicycles as Washington DC's program, which is currently the country's largest. Under the plan, Central Boston will be served by a network of 2,500 bikes and 290 stations with 3,750 docking spaces, with the potential to expand to a 5,000-bike system.

Water: Second, 91.8 points

Boston has its best showing in this category, along with the energy category, a performance largely driven by the city's low level of water consumption. At 74 gallons per person per day, Boston has the second lowest consumption rate of all the Index cities, behind New York, and less than half the Index average of 155 gallons. This low consumption rate is the product of concerted efforts and incentives to help residents reduce consumption (see "green initiatives" below). Boston's water leakage rate, at 9%, is also better than the Index average of 13%, suggesting that the city's proactive policies in this area have paid off as well.

Green initiatives: The statewide Massachusetts Water Authority provides state residents free water-efficiency kits, which include low-flow shower heads, low-flow faucet aerators and leak detection dye tablets. In 2008 the authority expanded its low-flow toilet retrofit rebate and pilot water audit projects, which offer $100 for rebates for residents to acquire more water-efficient home appliances. The city aims through these initiatives to help Boston meet its goal of keeping total water consumption below 300 million gallons per day. Since 2008 Boston has given grants to replace approximately 350 toilets per year, in addition to several water auditing pilot projects.

Waste: 15th, 54.7 points

Boston's recycling rate, at 20%, is below the Index average of 26%, and in addition, the city has only limited recycling options for industrial and hazardous waste. The city's performance in this category is improved though by a strong commitment to reducing waste. Efforts in this area have included changing the name and focus of the Department of Sanitation to the Department of Waste Reduction, and reducing the number of trash bins available per household.

Green initiatives: Boston's climate action plan recommends that the city switch to single-stream recycling (placing all recyclable materials in one bin to make recycling easier), establish mandatory recycling policies, charge a fee for trash pickup, and develop a year-round composting program. These recommendations are currently at the planning stages and have not been implemented.

Air: 14th, 74.3 points

Boston ranks better than average for the three major air pollutants evaluated in the Index – nitrogen oxides, particulate matter and sulfur dioxide. Boston's above average performance in air quality is largely the result of its dense population and service-oriented economy. Compared to cities with similar population densities, the city is third weakest. While Boston funds air quality improvement projects (see "green initiatives" below), it does not have any air quality targets.

Green initiatives: Since 2007 Boston has given out Community Climate Action and Air Quality Grants, which provide funding to neighborhoods, businesses, academics, and other groups for projects related to reducing air pollution emissions. The program is focused on small community projects designed to reduce greenhouse gas emissions and air pollution. Past awards have gone to youth workshops, door-to-door outreach programs, and alternative vehicles for community organizations. In another initiative, in 2010 Boston awarded nearly $100,000 to retrofit diesel vehicles to run on ultra-low sulfur diesel fuel. Businesses must commit to using only this cleaner fuel in vehicles that are awarded grants.

Environmental governance: 15th, 84.4 points

Boston's middling ranking in this category can be explained largely because the city's central environmental strategy was designed as a series of advisory policies rather than a full-scale action plan, and has only been accepted thus far as a recommendation. While the plan has the full support of the mayor and several recommendations have served as the basis for key policies and targets, the city council has not approved all of the strategy's ambitious measures. The strategy, however, was developed in coordination with local community leaders, giving the city high marks in the Index for transparency and public outreach. As a result of these efforts, the recommendations represent the collective wishes of a diverse group of stake-holders and emphasize city-community cooperation.

Green initiatives: Boston GreenFest is an annual festival, held since 2009, in which residents come together from across Greater Boston to display ideas and tips to make the city a more sustainable place to live. The festival works specifically with schools and is officially supported by the mayor.

Quantitative indicators

Category	Indicator	Average	Boston	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**198.6**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**12.2**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.10**	2009	City	City of Boston; US Census Bureau	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**40.6**	2009	City	City of Boston; US Census Bureau	Using MSA population
Land use	Green spaces as % of total area (%)	11.9	**16.3**	2008	City	Trust for Public Land; US Census Bureau	Using city population
	Population density (persons/miles^2)	8,106.8	**13,441.0**	2009	City	US Census Bureau	Using area of city in 2000
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**6.5**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**18.3**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.3**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**20.8**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**0.8**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**28.4**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**20.0**	2009	City	City of Boston Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**73.5**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**9.0**	2009	City	Mayor's Office of Sustainability	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**50**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**16**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**14**	2005	County	EPA; US Census Bureau	Using county population

Calgary

US and Canada Green City Index

Background indicators

Total population 1)	990,000
Administrative area (miles^2) 1)	280.5
GDP per person (real) (US$) 2)	50,200
Temperature (24-hour average, annual) (°F) 1)	39
Goods employment (%) 2)	24
Services employment (%) 2)	76

Geographical basis: 1) City, 2) CMA

Calgary is the largest city in the Canadian province of Alberta, and with 990,000 residents, it is also the largest city in western Canada. The metropolitan area is home to about 1.1 million people, and a combination of city and metropolitan area data are used for Calgary in the US and Canada Green City Index. Located about 400 miles (644 kilometers) south of the oil sands, one of the largest sources of petroleum in the world, the greater Calgary area is a major energy producer, and the oil and gas sector is the largest contributor to the city's GDP. Led by this industry, the city's per capita GDP of $50,200 ranks eighth overall in the Index. Calgary has the highest goods-oriented economy in the Index, also largely a result of the energy industry. In addition, the city is a major transportation center, home to the Canadian Pacific Railway and a hub for several airlines.

Calgary ranks 14th overall in the Index and fourth among Canadian cities. The city's strongest category by far is water, where it places first. It is among the top four cities in the Index for having low water consumption and leakages, in addition to having highly regarded water policies. Calgary ranks 11th or below in other categories, largely due to obstacles such as a low population density and cold winters that require high energy consumption – Calgary has the coldest average temperature in the Index. Compared to its peers though, Calgary fares well; among low density cities it places third overall, with high marks for CO_2 emissions and land use, and it places first in the buildings category when compared to other cold weather cities.

CO_2: 15th, 75.4 points

Calgary places slightly better than average for carbon emissions, both in terms of per capita and per unit of GDP. It emits 12.7 metric tons of CO_2 per person compared with the Index average of 14.5, and an estimated 253 metric tons of CO_2 per $1 million GDP, compared with the average of 296. Considering the dominant role of the oil and gas industry as well as a large reliance on coal in the electricity mix, Calgary does well to finish near the middle of the Index for both figures. This is the result of concerted efforts to reduce CO_2 emissions, which include a target of 20% reductions by 2020 based on 2005 levels.

Green initiatives: In October 2009 Calgary – along with 14 other global energy-producing cities such as Houston, Texas and Stavanger, Norway – signed the Calgary Climate Change Accord, pledging to reduce greenhouse gas emissions from city operations by 20% by 2020 and 80% by 2050 from 1990 levels. The plan focuses on increasing the use of renewable energy, capturing methane from landfills for energy production, greening the vehicle fleet, conserving energy and water in city buildings, and piloting innovative environmental technologies and practices. As of January 2009 Calgary had reduced greenhouse gas emissions from municipal operations by more than 34% over 1990 levels. The city expects to achieve a 63% reduction of total municipal greenhouse gas emissions by 2012 and to reduce emissions from electricity to zero.

Energy: 18th, 62.5 points

Calgary's result in this category reflects high electricity demand deriving from the city's goods-driven economy and cold temperatures. With usage at 620 gigajoules of electricity per $1 million GDP, Calgary consumes nearly double the Index average of 332. In per capita terms the city fares better, consuming 34 gigajoules per person compared with the average of 52. Meanwhile, Calgary is ramping up efforts to consume more green energy – including a mandate for city government electricity purchases to come from renewable sources – and expects to be the largest consumer of green electricity by percentage in North America by 2012.

Green initiatives: The Energy Management Office (EMO) is a joint initiative between Calgary and ENMAX, a local utility, to manage the city's energy use and stimulate the creation of new energy-related initiatives. Current EMO projects include the Calgary Downtown District Energy project that will provide co-generative heating for downtown municipal buildings, pilot projects for solar water heating and electricity for municipal buildings. Also, in 2005 Calgary was the first city in North America to install flat-lens energy efficient street lights, conserving enough electricity to power 3,000 homes and saving $1.7 million annually. Additionally, Calgary has retrofitted 170 intersections with LED lights, which use 80% less energy.

Land use: 11th, 57.8 points

Calgary's score in the land use category is hurt by its low population density, at 3,500 people per square mile (1,400 people per square kilometer), compared with the average of 8,100 (3,100). Calgary has made important strides to increase green space though; it has plans to add 11 new parks over the next three years and already has 15% green space compared with the average of 12%. Additionally, Calgary has made strong efforts to contain sprawl with an integrated land use and transportation plan (see "green initiatives" below).

Green initiatives: In 2009, as part of the overall Plan It Calgary development plan, which was launched in 2007, the city approved specific initiatives that aim to add dense residential and commercial centers along public transit corridors to encourage mass transit use. In 2001 Calgary initiated the BirthPlace Forest, an initiative to plant one tree for every baby born in the city. This was part of the larger Forever Green program, one of the largest greening initiatives in Calgary's history. The goal is to involve citizens in reducing Calgary's tree shortage by connecting population growth to tree growth, and offering subsidies to residents who plant trees. Since 2001 over 54,000 "birthplace trees" have been planted.

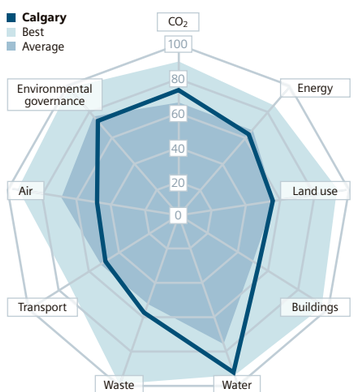
Buildings: 11th, 56 points

Calgary officials have placed recent emphasis on greening the city's buildings. To this end the city has reduced permit fees for buildings incorporating green design, and has required that all municipal buildings meet Leadership in Energy and Environmental Design (LEED) standards, the first Canadian city to do so. Nonetheless, Calgary's overall building score remains in the middle of the pack due to a current lack of LEED-certified buildings, at 3.2 LEED buildings per 100,000 people, compared with the Index average of 6.4.

Green initiatives: Energy performance contracting is an innovative partnership between the city and private enterprise to improve energy efficiency in buildings. Initiated in 2004, Calgary's program saves about 30,000 tons of greenhouse gas emissions annually through improvements to lighting systems, heating, ventilation and air conditioning equipment; building controls; and energy supply systems. The upgrades are provided at no net cost to the city, because the money from energy savings is used to repay the company that provides the improvements over a 10-year contract term.

Transport: 16th, 50.8 points

Calgary has just 0.2 miles of public transport per square mile of city territory (0.13 kilometers per square kilometer), well below the Index average of 1.1 miles (0.7 kilometers). Its score in transport is further hindered because its "annual vehicle revenue miles" (a measure of public transport supply) is the lowest in the Index, at an estimated 9 miles (14 kilometers) per person, well below the average of 24 miles (39 kilometers). However, Calgary was one of the first cities in North America to introduce a light rail system in 1981, and has made strong efforts to improve the system in recent years.



This includes introducing a wind-powered light rail (see "green initiatives" below) and doubling the length of the network since 2001. The city has also introduced carpooling initiatives and multiple bus-light-rail connections. As a result of these efforts, 22% of Calgary's workers commute by public transit, bicycle or foot, compared with an Index average of 13%.

Green initiatives: In 2001 Calgary initiated Ride the Wind, a program which powered its light rail transit entirely with wind-generated energy. This initiative gave Calgary the first wind-powered public transit system in North America and reduced greenhouse gas emissions by 26,000 tons annually. Furthermore, in 2005 Calgary started one of the first large pilots in western Canada to support city-owned biodiesel vehicles. The program has grown from supporting a single vehicle to a sustainable year-round program including 250 vehicles.

Water: First, 94.1 points

This is by far Calgary's strongest category in the Index. The city consumes 113 gallons (428 liters) of water per person per day compared with the Index average of 155 gallons (587 liters). Impressively, the city's water distribution leakage rate is just 4%, the third lowest rate in the Index and well below the average of 13%, which reflects the city's vigilance in continually monitoring the system. Additionally, with a high percentage of metered customers and strong wastewater management, the city is poised to remain at the top in the water category.

Green initiatives: In 2009 Calgary passed a law requiring water meters for all city residents by the end of 2014. Approximately 10,000 meters will be installed on a neighborhood-by-neighborhood basis between 2010 and 2014 to meet the target; by the start of 2011 over 80% of Calgary's homes already had water meters installed. Beyond 2014, Calgary aims to install peak and off-peak meters that allow for different water rates. Calgary's goal is to accommodate the water needs of an increasing population, while holding the amount of water it takes from local rivers at 2003 levels. The city is also active in supporting residents' efforts to reduce water consumption. Through its toilet rebate program the city distributed 7,188 low-flow toilets in 2010 alone.

Waste: 11th, 58.8 points

Calgary has a recycling rate that is below the Index average, weakening its performance in this category. The city recycles 14% of its municipal waste, compared with the average of 26%. However, officials have recognized the need to address this issue and the city is one of nine in the Index that receive full marks for policies related to waste reduction. Calgary is making efforts to increase composting, and has expanded its recycling program to increase the range of goods that are either recycled or sustainably disposed.

Green initiatives: Calgary's Landfill Gas Recovery and Utilization Project collects and treats methane to generate electricity. Calgary's three active landfills are the city's biggest source of greenhouse gas emissions. Turning the emissions into energy is the equivalent of taking 16,000 cars off the road, while generating about 11 million kilowatt hours of electricity, and recovering about 15 million kilowatt hours of heat energy, which is used to power the facilities. Furthermore, in 2006 Calgary set a goal to divert and recycle 80% of waste from landfills by 2020. As part of this initiative, the city has launched a pilot program that offers special rates to commercial customers to recycle concrete, brick, asphalt and selected metals.

Air: 23rd, 50.8 points

This is Calgary's weakest category performance. Although the city has made efforts to reduce pollution from automobiles – including an anti-idling law, mandating particulate matter filters for diesel fleets, and encouraging the use of biofuels – its goods-driven economy contributes to high levels of nitrogen oxides and sulfur dioxide pollution. Calgary emits 110 lb (50 kg) of nitrogen oxides per person, versus an average of 66 lb (30 kg), which is one of the highest levels in the Index. It emits 46 lb (21 kg) of sulfur dioxide per person, more than twice the Index average of 22 lb (10kg). The city's particulate matter emissions, though, are considerably better than the Index average, estimated at 13 lb (6 kg) per person, versus 25 lb (11 kg). Calgary is working at the provincial level to improve overall air quality, but has yet to set concrete municipal targets.

Green initiatives: The PM/O3 Management Plan is a collaborative effort involving the governments of Calgary and Alberta, as well as local businesses and NGOs. During 2010 activities included promoting air quality awareness, encouraging air quality research, and highlighting improved air quality as a way of attracting businesses. The plan's goal is to make the Calgary metropolitan area one of the best air quality regions in Canada.

Environmental governance: 18th, 76.7 points

Guided by the long-term plan imagineCALGARY (see "green initiatives" below), the city has in place strategies for improving its environment, which include targets and reporting, and receive strong political support. Calgary's environmental governance score is hindered, however, by the lack of central coordination of environmental efforts, and the city's transparency on environmental indicators also lags behind Index leaders.

Green initiatives: imagineCALGARY launched in January 2005 with the goal of producing a long-term urban sustainability plan for Calgary. Over 18,000 of Calgary's residents added their voice to the initiative, making it the largest community visioning process of its kind anywhere in the world. The city provided staff and resources to support over 150 active and committed stakeholders who were responsible for developing the plan, which includes goals to address a wide range of environmental aspirations.

Quantitative indicators

Category	Indicator	Average	Calgary	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**253.4**	2008	City	City of Calgary, Environment Canada, Statistics Canada	Using estimated city GDP
	CO_2 emissions per person (metric tons)	14.5	**12.7**	2008	City	City of Calgary, Environment Canada, Statistics Canada	Using city population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.62**	2006	City	City of Calgary	Using CMA GDP
	Electricity consumption per person (GJ)	52.2	**34.0**	2006	City	City of Calgary	Using city population
Land use	Green spaces as % of total area (%)	11.9	**15.0**	2006	City	City of Calgary	Using area of city in 2006
	Population density (persons/miles^2)	8,106.8	**3,522.9**	2006	City	Statistics Canada	Equivalent in metric units: 1,360 persons/km^2
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**3.2**	2010	City	CaGBC LEED Database	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**22.4**	2006	CMA	Statistics Canada	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2006	Metro-area	Calgary Transit	Using city area; Equivalent in metric units: 0.1 km/km^2
	Annual vehicle revenue miles (miles/person)	24.4	**8.7**	2010	Metro-area	Calgary Transit	Using CMA population; Equivalent in metric units: 14.1 km/person
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**3.0**	2010	Metro-area	Calgary Transit	Using city area; Equivalent in metric units: 1.1 vehicles/km^2
	Average commute time from residence to work (minutes)	28.9	**33.0**	2006	CMA	Statistics Canada	
Waste	Recycled municipal waste (%)	25.8	**13.5**	2009	City	Calgary Waste and Recycling Service Annual Report	
Water	Total water consumption per person per day (gallons)	155.1	**113.3**	2005	City	City of Calgary, Water Services	Using city population; Equivalent in metric units: 427.8 liters
	Water leakages in water distribution system (%)	12.8	**3.5**	2009	City	City of Calgary, Water Services	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**110**	2007	Metro-area	Calgary Region Airshed Zone	Equivalent in metric units: 50 kg
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**13**	2008	Mixed	Environment Canada; Statistics Canada	PM10 from non-industrial, mobile, and waste sources. Data point has been scaled down from provincial level by proportion of GDP represented by Calgary; Equivalent in metric units: 6 kg
	Sulfur dioxide emissions per annum (pounds/person)	22	**46**	2007	Metro-area	Calgary Region Airshed Zone	Equivalent in metric units: 21 kg

Charlotte

Charlotte, located in the southern state of North Carolina, is an important financial center and home to several of the US's largest banks. Charlotte also has a strong manufacturing base and, home to one of the leading energy companies in the country, is transforming itself into a hub for energy firms. The city is the third most prosperous in the US and Canada Green City Index, generating a GDP per capita of $57,700. Charlotte's 700,000 inhabitants occupy a space of 242 square miles, placing the city in the low population density bracket of the Index. Index data for Charlotte are based on a mix of statistics for the city and its wider metropolitan area, which has a population of 1.7 million. The city's environmental efforts are today underpinned to large degree by a $6.8 million Energy Efficiency and Conservation Block Grant, which the US Department of Energy awarded the city in 2009.

Charlotte ranks 20th overall in the Index. Its strongest categories are land use and water, largely because of robust policies in both areas. It places second in land use when measured against other cities with low population densities. The city's next best category is environmental governance, where it places 11th owing largely to its green action plan, which is one of the strongest in the Index. Across the other categories in the Index Charlotte places in the bottom half of cities. However, since the award of the federal energy grant in 2009 Charlotte has stepped up environmental efforts, suggesting that its overall rank may improve in coming years. Nevertheless, there are environmental weaknesses to address. Public transit supply in Charlotte is one of the lowest in the Index, for example, as is the proportion of municipal waste the city recycles.

Background indicators

Total population [1)]	700,000
Administrative area (miles^2) [1)]	242
GDP per person (real) (US$) [2)]	57,700
Temperature (24-hour average, annual) (°F) [1)]	61
Goods employment (%) [2)]	14
Services employment (%) [2)]	86

Geographical basis: 1) City, 2) MSA

CO_2: 18th, 59.8 points

Charlotte scores well for relatively low CO_2 emissions in relation to its economic output. At 192 metric tons for every $1 million of GDP, the city does much better than the Index average of 296 metric tons of CO_2. In per capita terms, Charlotte emits 14.5 metric tons of CO_2, on par with the 27-city average. Charlotte would be well served by strengthening its CO_2 reduction strategy. The city has not set any CO_2 reduction targets separate from national guidelines, and the city's strategy for reducing greenhouse gas emissions falls behind the Index leaders. However Charlotte has taken measures to reduce emissions from municipal facilities by improving energy efficiency (see "green initiatives" below).

Green initiatives: Charlotte's plans to cut greenhouse gas emissions from city operations, largely through energy efficiency improvements at municipal facilities, began in earnest following the award of the Energy Efficiency and Conservation Block Grant in 2009. At a cost of $1.4 million, taken from the energy grant, retrofits at the Charlotte Mecklenburg Utilities Office (home of the water utility) and Old City Hall are slated to begin in 2011, and are expected to reduce greenhouse gas emissions by 1,500 and 1,000 metric tons, respectively, each year.

Energy: 21st, 55.7 points

In per capita terms, Charlotte consumes an estimated 50.8 gigajoules of electricity, which is slightly better than the Index average of 52 gigajoules. However, like most goods-intensive cities, Charlotte has comparatively high electricity consumption relative to GDP. The city uses an estimated 355 gigajoules per $1 million of GDP, higher than the Index average of 332 gigajoules. While the city earns points for progress on developing its own green energy projects, Charlotte's score in this category is hindered by omissions in the area of clean and efficient policies. It is one of only five cities in the Index that do not promote the use of green energy for businesses and homes.

Green initiatives: In 2010 Charlotte launched the Neighborhood Energy Challenge. Seven neighborhoods were selected under the scheme and each was awarded $80,000 to improve energy efficiency on a community-wide basis. The city is assisting these communities in developing energy action plans; initiatives include home energy audits, installation of solar-powered lighting and conservation workshops.

Land use: Ninth, 64.6 points

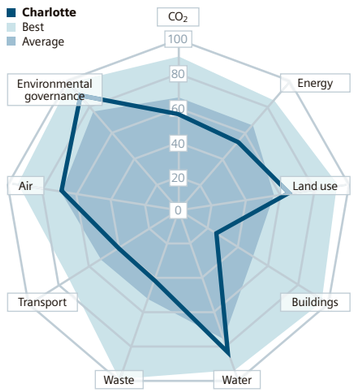
Together with water, Charlotte registers its highest rank in land use. Among low population density cities in the Index only Ottawa has a better overall performance in this category than Charlotte. The city scores particularly well on policy, which includes green space protection and the promotion of brownfield regeneration (see "green initiatives"). The proportion of green space in Charlotte, at 12%, is in line with the Index average.

Green initiatives: Charlotte has made brownfield redevelopment a high priority. The city runs two programs to aid brownfield revitalization efforts: first, it offers free assessments of brownfield property sites up to a cost of $40,000 to developers whose clean-up proposals have been approved; secondly, it offers matching funds of up to $20,000 to property owners or developers for the design and execution of clean-up activities. The city has targeted the Business Corridor Revitalization Area, which is home to more than 400 brownfield sites, including 100-acre rail yards, 45 dry cleaning operations and dozens of industrial properties.

Buildings: 25th, 26.2 points

Along with transport, this is Charlotte's weakest category in the Index. The city scores well for offering incentives and subsidies to improve energy efficiency (see "green initiatives" below); it has also prioritized energy efficiency at municipal facilities, suggesting its performance may improve in coming years. However, it has one of the lowest numbers of Leadership in Energy and Environmental Design (LEED)-certified buildings in the Index, with just 0.6 per 100,000 people, compared with the Index average of 6.4. The city's score is further weighed down by the relative weakness of its buildings policies: it is one of just four cities that do not require new buildings to meet energy efficiency standards.

Green initiatives: Of the $6.8 million federal energy efficiency grant awarded to Charlotte in 2009, the biggest slice – nearly $2.5 million – has been allocated to energy efficiency improvements at municipal buildings, including the Charlotte Mecklenburg Utilities Office and Old City Hall (see "green initiatives" under "CO_2"). Following an energy audit report, the city says energy usage at the Charlotte Mecklenburg Utilities Office can be cut by 35% and save $31,400 per year. A 46% energy reduction and annual savings of $22,600 are projected for the Old City Hall. Furthermore, the city has allocated $600,000 of grant money to support energy efficiency and weatherization improvements for low-income residents. Under this program the city provides eligible homeowners up to $6,000 for upgrade works. And as part of countywide legislation, property developers in Charlotte can receive a rebate of up to 25% of the building permit fee up to a maximum of $100,000 for LEED-certification projects.





Transport: 25th, 40.8 points

Charlotte records its lowest rank, along with buildings, in transport. The city is marked down for having the third shortest public transport network in the Index at just 0.09 miles per square mile of area, versus an Index average of 1.1 miles. As a result only about three of every 100 workers use public transit, bicycles or go by foot in Charlotte, which is, again, considerably lower than the Index average of 13%. However, officials have made efforts to expand the public transport network: in 2007 Charlotte unveiled its first light rail line, LYNX, which stretches 9.6 miles. It is the only city in the southeastern US that boasts a light rail system and Charlotte officials are drafting plans to expand the service. But there is still room for improvement: the city is one of four in the Index that lack central pedestrian zones and it has a mixed record on promoting public awareness of green forms of transport.

Green initiatives: Charlotte adopted a 25-year Transportation Action Plan (TAP) in 2006 to guide city transport projects and policy. The plan calls for a minimum of 65% of Charlotte residents to live within one-quarter of a mile of transit service; the implementation of a balanced and multi-modal transport system; and for the city to monitor and determine the adequacy of services for motorists, bicyclists and pedestrians at signalized intersections, among many other policies. In addition, 144 of the city fleet's 320 buses had been fitted with diesel particulate filters by the end of the city's 2009-10 fiscal year. This measure, coupled with the use of ultra-low-sulfur diesel in the entire city fleet, has cut emissions from city-owned vehicles by 90%.

Water: Ninth, 84.8 points

Charlotte registers its highest rank, along with land use, in the water category. Consuming 153 gallons per capita every day, Charlotte narrowly beats the Index average of 155 gallons. Of all the other high temperature cities in the Index (with average annual temperatures above 60°F) only Atlanta consumes less water per capita per day than Charlotte. Water efficiency and treatment policies are also strong. The city monitors water sources for quality and supply levels, and proactively encourages water conservation (see "green initiatives" below). The city also has a fairly efficient water distribution system by the standards of the Index, losing 11% of its supply to leaks against the Index average of 13%.

Green initiatives: The city offers homeowners free water audits, which include instructions on how to measure the amount of water consumed. When consumers return the audit forms they receive water conservation kits, including low-flow shower heads, faucet aerators and leak detection tablets. Twice a year the local utility hands out awards to homeowners and businesses that have taken measures to conserve water.


Waste: 20th, 40.9 points

The city scores well for its waste reduction strategy and good waste management practices, such as composting and converting local waste by-products to energy. However, Charlotte's rank in the waste category drops significantly due to its low recycling rate: the city recycles just 12% of its municipal waste versus an Index average of 26%. It is the weakest performance among high-income cities, although recent recycling programs (see "green initiatives" below) show intent to improve.

Green initiatives: Charlotte introduced single-stream recycling, in which all recyclable materials are placed into one bin and then separated by the waste company, in 2010. The same year, with federal funding, the city installed 15 new recycling containers in the uptown area to make daily recycling more convenient for pedestrians. To encourage use of the containers, two large private companies have run "Get Caught Green Handed" campaigns, where people using the bins are selected at random and given money or food vouchers of $25.

Air: 16th, 69.5 points

Charlotte's rank in the air category is bolstered by better than average rates of sulfur dioxide and nitrogen oxides emissions. The city releases 9 lb of sulfur dioxide into the atmosphere per person per year, considerably less than the Index average of 22 lb. Likewise, with nitrogen oxides emissions of 58 lb per person per year Charlotte beats the average of 66 lb. This relatively good performance has been helped by programs to improve air quality at both a city and county level (see "green initiatives" below). However, the city gets marked down for not setting any specific air quality targets and for having above-average particulate matter emissions.

Green initiatives: The Charlotte region Clean Air Works! program, launched in 2006, aims to improve air quality through encouraging vehicle sharing and non-automotive commuting. The initiative works with over 100 of the region's largest companies to educate employees on transport options; programs include "vanpooling" in which 15 commuters who live and work near each other can share one vehicle, and employers can also receive volume-purchase discounts for the public transport network. By 2010 the program had reportedly avoided 4.8 million vehicle miles and prevented 280,000 pounds of nitrogen oxides emissions. Initiatives to reduce nitrogen oxides emissions are also taken at a county level by the Mecklenburg County Air Quality department. In 2007 the department partnered with six nearby counties to launch a diesel engine replacement scheme called Grants to Replace Aging Diesel Engines (GRADE); the program was extended to 13 counties in 2010.

Environmental governance: 11th, 88.9 points

Charlotte scores well for its integrated environmental strategy, which contains explicit targets for each environmental issue and has been endorsed by the city administration. It also has a dedicated environmental authority, and produces regular reports that monitor and evaluate policy implementation. Despite involving citizens in environmental decision making, one weakness in Charlotte is that residents do not enjoy the same level of access to information on the city's environmental performance and policies as in other Index cities.

Green initiatives: For the first time in 2010, Charlotte appointed an energy and sustainability manager to oversee and implement programs run under the auspices of the federal Energy Efficiency and Conservation Block Grant. The grant supports 17 projects city-wide designed to reduce emissions and energy consumption, create new green jobs and increase the use of renewable technologies. In addition to managing the grant, the city sustainability manager is charged with advocating for environmental initiatives within the city's Environment Focus Area Plan and promoting best environmental practices.

Quantitative indicators

Category	Indicator	Average	Charlotte	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**191.6**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**14.5**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.36**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales; Scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**50.8**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**11.6**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**2,910.8**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**0.6**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**3.1**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.1**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**22.9**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**25.0**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**11.6**	2009	County	Mecklenburg County Land Use & Environmental Services Agency; US Census Bureau	Using county population
Water	Total water consumption per person per day (gallons)	155.1	**153.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**11.0**	2010	City	Mayor's Office of Sustainability	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**58**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**32**	2005	County	EPA; US Census Bureau	
	Sulfur dioxide emissions per annum (pounds/person)	22	**9**	2005	County	EPA; US Census Bureau	

Chicago

US and Canada Green City Index

Background indicators

Total population [1)]	2.9 million
Administrative area (miles^2) [1)]	227
GDP per person (real) (US$) [2)]	45,400
Temperature (24-hour average, annual) (°F) [1)]	49
Goods employment (%) [2)]	14
Services employment (%) [2)]	86

Geographical basis: 1) City, 2) MSA

With a population of 2.9 million, Chicago is the third largest city and the fifth most densely populated in the US and Canada Green City Index. Home to the headquarters of many businesses and a major financial center, Chicago is the economic engine of the US Midwest, with a GDP per capita of $45,400. In recent years the city has prioritized environmental issues, spearheaded by former Mayor Richard Daley, who gave strong public backing to Chicago's climate change action plan in 2008. However, Chicago's ageing infrastructure and land use constraints, among other factors, present the city with considerable environmental challenges. Nevertheless, the city's leadership and citizenry have demonstrated a commitment to long term improvements that are consistent with sustainable growth. The data for Chicago in the Index is based on a mix of statistics for the city and the wider metropolitan area, which has a population of 9.6 million.

Chicago ranks 11th overall in the Index. Its best performance is in the area of transport, where it ranks sixth. This is due to its robust public transit system, and policies that aim to expand and improve public transport options, encourage non-motorized forms of transit and reduce congestion. Chicago is in the top half of the Index in the categories of energy, water and environmental governance. Its weakest performance is in the CO_2 category, where it places 19th, due mainly to above average levels of carbon emissions.

CO_2: 19th, 58.5 points

Chicago's carbon emissions are higher than average, with per capita CO_2 emissions of 19.4 metric tons per person, compared with the Index average of 14.5. It is also well above the average for CO_2 emissions per unit of GDP, at 406 metric tons per $1 million, compared with the average of 296 metric tons. The city's carbon emissions are also the highest among the most densely populated cities in the Index. Officials have recognized the challenges and the city has enacted an impressive CO_2 reduction strategy, which includes adding four million square feet of green roofs. Like most US cities, however, Chicago does not oversee the privately owned utilities that supply the city's power, and therefore is likely to face challenges in significantly improving its performance in carbon emissions.

Green initiatives: The city has committed to a 25% reduction of CO_2 emissions below its 1990 greenhouse gas level by 2020. The long-range goal is an 80% reduction by 2050. To achieve this target, the city has identified 26 "mitigation" actions within the strategic areas of buildings, energy, transportation and waste. Chicago is using funding sources such as the state's Energy Efficiency Portfolio Standard, as well as other state and federal grants, to finance these measures.

Energy: Eighth, 75.9 points

The city's ranking in this category is bolstered by its per capita electricity consumption of 31 gigajoules, better than the Index average of 52 gigajoules. Chicago likewise outperforms the Index average for electricity consumption per unit of GDP, at 202 gigajoules per $1 million, compared with the average of 332 gigajoules. Chicago's performance in the energy category was improved by its leadership in the development of major green energy projects, intended to displace the city's fossil fuel dependence and increase overall energy security. The city believes that its proximity to some of the country's largest "wind potential" areas, along with the presence of at least 14 wind power companies located in Chicago, will lead to an increase in the city's share of renewable energy. Chicago has key support in this goal from the Illinois state government, which aims to switch to renewable sources for 25% of its statewide energy supply by 2025.

Green initiatives: In 2009 Chicago partnered with a private utility and a solar-panel manufacturer to develop the US's largest urban solar power plant at a former industrial site in Chicago's South Side. The $60 million project, completed in July 2010, includes more than 32,000 solar photovoltaic panels capable of generating enough electricity to power roughly 1,200 homes annually. The plant is expected to displace more than 14,000 tons of greenhouse gas emissions per year, the equivalent of removing 2,500 cars from city streets.

Land use: 15th, 56 points

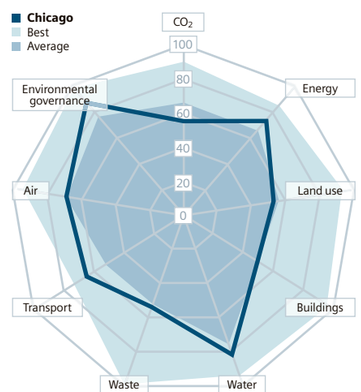
Chicago is the fifth most densely populated city in the Index, with 12,600 residents per square mile, compared with the Index average of 8,100. However, the city is marked down for a relative lack of green space, at 8% of the city's total area, compared with the Index average of 12%. The relative lack of green space in Chicago may be due in part to a historical divide between the city's more expansive industrialized areas – where there is room for park space but few people nearby to use it – and highly populated residential areas, where there is less available land. However, Chicago has enjoyed a measure of success in developing the 319-acre Millennium Park downtown and, as the Index shows, has a record of formulating robust policies in the area of brownfield regeneration and tree-planting.

Green initiatives: Aiming to improve performance in the area of land use, Chicago has been proactive in its efforts to promote revitalization of abandoned and idle land. The Chicago Brownfield Initiative was adopted in 1993 under the objective of simultaneously achieving environmental restoration, and creating jobs and tax revenues through redevelopment. The pilot phase of the initiative incorporated $2 million of capital, raised through municipal bonds. To date a total of 900 acres have been returned to productive use and the private sector has become increasingly engaged in this initiative.

Buildings: 14th, 51.3 points

Municipal officials have acknowledged major opportunities for improvement in this area, with buildings altogether responsible for 70% of Chicago's carbon emissions. Currently the city has 5.2 Leadership in Energy and Environmental Design (LEED)-certified buildings per 100,000 people, below the Index average of 6.4. However, Chicago has the highest percentage of LEED buildings among the Index's most highly populated cities, demonstrating a comparatively strong performance. With a mandate in place that city building projects must obtain at least LEED silver certification, the number of LEED buildings in Chicago will likely increase. The city also has stringent energy efficiency regulations and retrofitting incentives for residents.

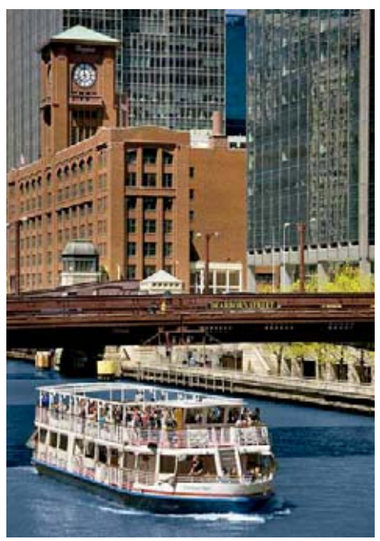
Green initiatives: The city of Chicago has undertaken several initiatives to improve the environmental performance of its buildings. One example, the Chicago Energy Conservation Code, approved in November 2008, requires new residential buildings as well as large-scale retrofits to meet energy efficient measures that exceed the Illinois Building Energy Code. The



code requires improved insulation of floors, roofs and walls, as well as the installation of energy efficient windows and mechanical systems. Another initiative, the Chicago Green Office Challenge, is a voluntary competition for property owners and business tenants who are set environmental targets over the course of a year. In the first round of the program, almost 150 participants competed and together reduced CO_2 emissions by 54,000 metric tons, the equivalent of removing 10,000 cars from Chicago streets. The second round of the competition began in early 2011.

Transport: Sixth, 64.7 points

This is Chicago's best category performance in the Index. The city's "annual vehicle revenue miles" (a measure of public transport supply), at 36 miles per person, is well above the Index average of 24 miles. Besieged by one of the highest levels of congestion in the US, the city is addressing the problem through some of the best policies on traffic management in the Index. Although Chicago has the most comprehensive public transit system in the Midwest, across the 27 cities in the Index the length of its public transport system, at 0.6 miles per square mile, fell below the average of 1.1 miles. However, the city has prioritized the expansion and improvement of public transport options, while encouraging non-motorized forms of transit.



Green initiatives: The most recent initiative to improve and diversify transportation options available to city residents is Bike 2015, a plan to increase the percentage of bicycle trips to 5% of journeys of less than five miles, and to reduce the number of bicycle injuries by 50% from current levels. Under Bike 2015, the municipal government will add 120 miles of on-street bikeways to Chicago's existing bike infrastructure, 35 miles of off-road bike paths, 11,000 bike racks, and a bike commuter station at the city's main downtown park equipped with 300 bike parking spaces, shower and locker facilities, and bike repair services. The city has also initiated a bike-and-ride scheme and a bus rapid transit pilot program.

Water: 12th, 82.2 points

Chicago has the lowest rate of water leakages in the Index, at 2%, well below the Index average of 13%, which reflects well on the city's ongoing leak detection and repair efforts. Chicago also performs well for the strength of its water supply monitoring policies, as well as programs to promote water conservation, and an effec-tive stormwater management plan. However, Chicago continues a difficult fight to eliminate altogether the discharge of untreated waste-water into area waterways, an inevitable byproduct of ageing water infrastructure.

Green initiatives: Currently, one-third of the total energy utilized by wastewater treatment plants operated by Chicago's Metropolitan Water Reclamation District comes from methane gas capture from sewage sludge. The District has also adopted an independently verified environmental management system governing the use of biosolids, which are the byproduct of wastewater treatment that can be used for agriculture and landscaping. The city has also installed a greywater recycling system in a new public housing project, added water-saving plumbing fixtures in city buildings, and instituted required water meters for industrial and commercial water users, for residential buildings with more than three units, and for new residential users.

Waste: 14th, 55.2 points

Despite the middling ranking in this category, Chicago's policies for waste reduction are among the best in the Index, including a comprehensive sustainable waste management and reduction program that includes convenient options for residents to dispose of household, recyclable and hazardous waste. Chicago continues to face the challenge of increasing its recycling rate, which at 8% is well below the Index average of 26%. This is also the lowest rate among the high-population cities in the Index.

Green initiatives: Although Chicago has a mixed record in successfully implementing a citywide recycling program, the city has been a leader in establishing a facility for the recycling of household chemicals. Funded by federal, state and city sources, the $3.8 million plant was constructed in 2005 on a brown-field site, and eventually earned an LEED gold certification.

Air: 15th, 70.3 points

While annual particulate matter and sulfur dioxide levels in Chicago are below the Index averages, nitrogen oxides emissions, at 68 lb per person year, are slightly above the average of 66 lb. Two of Chicago's major power plants are between 70 and 110 years old, and coal-fired, and generate a sizeable share of the city's pollution. Chicago has enacted policies to improve air quality, but has not implemented an air quality target. However, the city is expected to address this in its Air Quality Action Agenda, which it plans to launch by 2012.

Green initiatives: City officials are currently working with the Chicago Area Clean Cities coalition and the Metropolitan Mayors Caucus to promote the use of alternative fuels, such as compressed natural gas, propane and biodiesel, in city fleets. The city has also been building alternative fueling stations since 2003 using federal grants, and is developing a comprehensive training program to educate 2,800 fleet operators in the procurement and use of alternative fuels.

Environmental governance: 12th, 87.8 points

The city has an environmental department with strong political support and conducts rigorous environmental reporting. Indeed, many other US cities looked to the 2008 Chicago Climate Action Plan (see "green initiatives" below), one of the few of its kind released at the time, as a model for initiating similar plans. Although the city is marked down in the Index for a relative lack of public involvement in projects with environmental impacts and for a lack of specific environmental targets, the prospects for Chicago's continued dedication to improving environmental performance and strengthening environmental governance are favorable.

Green initiatives: In accordance with its commitment to improve environmental governance, the city has developed the Chicago Climate Action Plan, a comprehensive agenda that involves many stakeholders across the city and addresses the major environmental issues, establishes targets and performance indicators, and pledges to issue progress reports every two years. In addition, the city has websites with public information on the potential impacts of climate change and has started a campaign to enlist individual residents' support in addressing these issues.

Quantitative indicators

Category	Indicator	Average	Chicago	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**406.3**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**19.4**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.20**	2005	City	Mayor's Office of Sustainability; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**30.8**	2005	City	Mayor's Office of Sustainability; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**8.2**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**12,560.7**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**5.2**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**15.3**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.6**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**36.1**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**10.0**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**30.7**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**8.0**	2005	City	City of Chicago Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**144.8**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**2.0**	2009	City	City of Chicago Department of Water Management	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**68**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**14**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**14**	2005	County	EPA; US Census Bureau	Using county population

Cleveland

US and Canada Green City Index

Located on the shores of Lake Erie, Cleveland is one of the smaller cities in the US and Canada Green City Index in terms of population, at 430,000 people, and area, at 77 square miles. Cleveland's economy is more oriented towards industry compared with other cities in the Index, with nearly 16% of jobs generated in the goods sector. However, more than half of the city's manufacturing jobs vanished between 1950 and 1990, along with nearly half of the population, which left Cleveland with daunting economic challenges; currently it is in the lower half of the Index for income, with a per capita GDP of $41,400. Looking ahead, Cleveland hopes to make sweeping changes in its economy and environmental performance through the many programs being initiated at the municipal level. Although getting there will not be easy, Cleveland benefits from the support of Mayor Frank Jackson, who has made a strong public case for the relevance of climate action and sustainability. Most of the data for Cleveland came from the city and the wider metropolitan area, which has a population of 2.1 million.

Cleveland ranks 25th overall among the 27 cities in the Index, and performs best in the category of energy, where it ranks 14th. Because Cleveland, as well as the state of Ohio, has committed to renewable energy targets, prospects for its continued strong performance in this area are favorable. Cleveland has also introduced some innovative programs and policies to improve transportation and more generally address environmental performance. However, the city faces sizeable challenges in the areas of CO_2 emissions, land use, buildings and waste. Political will for environmental action is one encouraging aspect of the city's current planning strategy, and only the future will tell if it will succeed in leading to tangible improvements.

Background indicators

Total population [1]	430,000
Administrative area (miles^2) [1]	77
GDP per person (real) (US$) [2]	41,400
Temperature (24-hour average, annual) (°F) [1]	50
Goods employment (%) [2]	16
Services employment (%) [2]	84

Geographical basis: 1) City, 2) MSA

CO_2: 27th, 1.2 points

This category is one of Cleveland's weakest performances in the Index. Per capita CO_2 emissions are 29.1 metric tons per person, compared with the Index average of 14.5 metric tons, while CO_2 emitted per $1 million of GDP totals 721 metric tons, a dramatically higher figure than the Index average of 296. The area's three coal-fired power plants, as well as the region's economic orientation towards metal-related and other carbon-heavy manufacturing, are among the primary reasons behind Cleveland's large carbon footprint.

Green initiatives: Though it has not made a specific commitment to CO_2 reduction, the city has started to take action and is seeking to procure energy efficient LED streetlights and traffic lights from a local supplier. The municipal government hopes this initiative will reduce the city's carbon emissions by 25,000 tons each year. The city, along with local charitable foundations, runs the Cleveland Carbon Fund, which accepts donations from businesses and individuals, and then distributes grants for local projects that improve energy efficiency, water conservation and residential weatherization. One initial project will fund the installation of 10,000 compact fluorescent light bulbs in two Cleveland neighborhoods.

Energy: 14th, 68 points

Cleveland consumes the lowest level of electricity in the Index on a per capita basis, at an estimated 10 gigajoules annually, compared with the Index average 52 gigajoules. Electricity consumption per unit of GDP is also better than the Index average, at 247 gigajoules per $1 million,

compared with the Index average of 332 gigajoules. Both figures were estimated by scaling retail electricity sales down to the city level using population data, as local figures could not be obtained. Though Cleveland performs relatively well in the area of energy, state and local mandates requiring utilities to make energy efficiency improvements and increase the share of power generated from renewable energy sources are expected to have a positive impact on the city's energy profile.

Green initiatives: Cleveland has adopted an energy portfolio standard requiring Cleveland Public Power, one of the city's utilities, to use energy sources that are more efficient, cleaner or renewable to supply 15% of electricity by 2015, 20% by 2020 and 25% by 2025. In 2010, through a partnership with the non-profit organization First Suburbs Development Council, the city legally demarcated and contributed $100,000 to a new so-called special improvement district in the hopes of making energy efficient retrofits more affordable to residents. The initiative aims to increase resident-financed energy efficiency projects by providing low-cost financing to be repaid through tax assessments. This will, it is hoped, help residents cut utility costs while avoiding new debts. In late 2010 the Greater Cleveland Energy Alliance, a public-private partnership between the municipal government and ShoreBank Enterprise, a non-profit business development organization, received $150,000 to develop an energy efficiency retrofit program for commercial and residential customers.

Land use: 27th, 28.1 points

Green space comprises only 6% of the city's area, compared with the Index average of 12%. Cleveland's population density, at 5,600 people per square mile, is also below the average of 8,100. Although Cleveland faces a sprawl challenge familiar to other cities in North America, municipal officials have had a measure of success in revitalizing the downtown area. Between 1990 and 2000 Cleveland's downtown population increased by one-third.

Green initiatives: Using federal Environmental Protection Agency funding, the city established a brownfield redevelopment program in 2005. The program's goals include identifying sites for re-use, helping developers and businesses determine costs associated with redevelopment, maintaining green space, and converting vacant properties to uses that can contribute taxes to city revenues. Entities eligible for financial incentives include public and non-profit organizations, and businesses and developers with existing projects in Cleveland. All parties that contributed to the sites' contamination are ineligible to receive funds. As of 2008 the city had used $39 million in incentives, mostly low-interest loans and grants, to bring about $440 million in investments, while creating nearly 4,000 jobs, according to one regional newspaper.

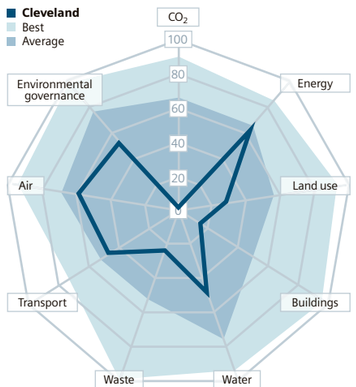
Buildings: 27th, 16.7 points

The city is placed in this rank because it has the lowest number of Leadership in Energy and Environmental Design (LEED)-certified buildings in the Index, and also lacks mandatory energy efficiency or auditing requirements. Cleveland's performance is no doubt affected by the fact that half of the city's housing units were built before World War II, a figure higher than in most other major cities in the US. However, though Cleveland faces real challenges in this area, the city's efforts to introduce green building standards (see "green initiatives" below) can be seen as an important starting point. Also, the fact that three Cleveland neighborhoods are trying to meet LEED neighborhood-development standards is a step forward.

Green initiatives: In 2007 the city introduced a green building standard. This requires projects receiving public funding or tax breaks to meet standards consistent with leading national green best practices such as the LEED silver certification. In addition, city officials have started conducting energy assessments of public facilities, such as water treatment plants, public utility buildings and City Hall, to identify opportunities to reduce carbon emissions and save money at the same time. The municipal government credits these efforts with over $110,000 in annual savings in its water division alone. Finally, the city provides information on its website on how to reduce energy and conserve water in buildings.

Transport: 19th, 47.9 points

Cleveland has a relatively large light rail system, and a recent extension connected the downtown to University Circle, a cultural center on the east side of the city. Overall, the city's supply of public transport measures 0.2 miles per square mile, which is well below the Index



average of 1.1. As a consequence, only 6% of workers currently travel by public transportation, bicycle or foot, compared with the Index average of 13%. According to a city report, part of the problem stems from the fact that Cleveland's streets and bridges are more conducive to automobile traffic than to cyclists or pedestrians. Despite these challenges, Cleveland has initiated policies and programs aimed at improving area transit, like park-and-ride schemes and carpooling lanes. Cleveland has also set a goal to develop a 190-mile network of trails and bike routes. However, the fact that the state of Ohio is one of the lowest investing states in the US for public transportation means that the city will have to work that much harder to find funding sources to facilitate significant improvements in this area.

Green initiatives: The city has announced an overarching strategy to provide more transportation options that will promote economic development and quality of life. Within this strategy are commitments to developing mass transit, encouraging mixed-use development incorporating commercial and residential activities, and promoting non-motorized transport. However, city officials have not issued specific targets or initiated any major programs to achieve these goals. Using federal and municipal funding, the city has committed to undertaking a study on bus rapid transit, but the timeline is unclear. Cleveland spent over $600,000 transforming part of a downtown parking garage into a station for bicycle parking, storage and repair, which is scheduled to open in 2011.

Water: 25th, 56.1 points

Water consumption in the city is not much higher than the Index average, at 165 gallons per person daily versus 155, but the 29% leakage rate in Cleveland's water distribution system is well above the Index average of 13%. Cleveland has faced challenges in improving its water system, especially in preventing sewer overflows during heavy storms, which is a problem for many other North American cities with aging infrastructure. However, the regional sewer district plans a $3 billion upgrade that will include building large underground holding tanks aimed at lessening the incidence of sewerage overflows.

Green initiatives: The city's water department announced plans in early 2011 to connect more than 425,000 water meters to homes and businesses. The project is expected to take three years to complete and to significantly reduce leaks and energy consumption, which have been persistent problems for the city.

Waste: 26th, 22.2 points

The city's recycling rate is only 9%, compared with the Index average of 26%. This figure was estimated by a city of Cleveland official, based on county-level waste figures. Improving waste management has been a challenge for the city, in part because it is administered at the county level. However, Cleveland's growing recycling program is a positive step (see "green initiatives" below).

Green initiatives: In late 2010 Cleveland rolled out a $2.5 million curbside recycling program, which provided 150,000 households with special bins that are equipped with computer chips connected to the city's computer system. The system allows officials to monitor household recycling by weighing the bin. In addition, the city's water department recycles at least 50% of the construction and demolition waste generated from capital improvement projects, a practice that other departments are expected to adopt shortly. Also, the city wants to build a $180 million waste-to-energy plant and the plans are currently being reviewed at state level.

Air: 20th, 60 points

Cleveland has higher than average nitrogen oxides levels, at 76 lb per person compared with the Index average of 66 lb, but its levels for sulfur dioxide and particulate matter are better than the Index averages. With many environmental challenges, air quality is not the city's most urgent priority, but implementing measures such as air quality targets could help Cleveland achieve a stronger performance in the future.

Green initiatives: In 2007 the city replaced 60 vehicles in the municipal fleet with diesel-electricity hybrid vehicles, and the city has an anti-idling policy for city vehicles and equipment, but the extent to which the policy is enforced is unclear.

Environmental governance: 25th, 56.7 points

Although Cleveland has not set environmental targets or committed to regular environmental reporting, the city has formulated a partial environmental strategy, set up a dedicated environmental authority, and initiated public awareness campaigns. In addition, Cleveland is assisted by the strong support of Mayor Frank Jackson, who in 2006 signed the US Mayors Climate Protection Agreement, acknowledging a commitment to try to reduce the city's carbon footprint.

Green initiatives: In 2005 Cleveland established an Office of Sustainability to help the city become more efficient, reduce consumption and waste generation, and use sustainability as an economic development tool. The department's website includes information about the various municipal efforts in different areas. In addition, the city organized "Sustainable Cleveland 2019" summits in 2009 and 2010, three-day, 700-participant events wherein residents weighed in on their vision for long-term sustainability planning and voted on priority issues. The third annual summit will take place in September 2011. Finally, Cleveland is one of only two US municipal signatories to the UN Global Compact (the other is Milwaukee), which includes three principles specifically related to improving the environment.

Quantitative indicators

Category	Indicator	Average	Cleveland	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**721.3**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**29.1**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.25**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**10.3**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**6.4**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**5,602.2**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**0.0**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**6.3**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**16.7**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.6**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**24.4**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**8.5**	2007	County	Cuyahoga County (Ohio) Solid Waste Management District	Residential waste only; Data point is for county
Water	Total water consumption per person per day (gallons)	155.1	**165.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**28.7**	2003	City	EPA	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**76**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**14**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**20**	2005	County	EPA; US Census Bureau	Using county population

Dallas

US and Canada Green City Index

Dallas is located in the southern state of Texas. Sprawling across 342 square miles, the city has one of the largest administrative areas in the US and Canada Green City Index. But with only 1.3 million inhabitants in the city limits, it has the Index's sixth lowest population density. The city's economy is dominated by banking and energy, and is also boosted by a large number of big-name telecom manufacturers setting up base there. It is among the mid-income cities in the Index, with a GDP per capita of $48,900. Like other southern cities, Dallas is relatively hot, which places demands on energy consumption, but the city is responding by making strides in adopting renewable energy and transferring its municipal fleet to alternative fuels. The statistics in the Index for Dallas are a mix of data for the city and the wider metropolitan area, which has a population of 6.4 million, and which is one of the largest metropolitan areas in the US.

Dallas ranks 17th overall in the Index. It achieves its highest rank, at 11th, in the transport category, largely thanks to long-standing efforts to make the city's fleet greener and other efforts to promote environmentally friendly transport. Dallas also scores relatively well in the CO_2 category, at 13th, picking up points for its efforts to curb carbon emissions. The city has signaled its intent to improve its overall green performance by putting in place a management framework that is designed to exceed environmental compliance requirements. The weakest areas for Dallas are land use, where it places 23rd, and waste, at 19th.

CO_2: 13th, 77.5 points

Low population density cities with hot climates tend to have higher than average CO_2 emissions per capita, but not Dallas. At 11.6 metric tons, the city's annual per capita CO_2 emissions are better than the Index average of 14.5 metric tons. When measured against economic output, the city registers the third-best performance among its mid-income peers: 191 metric tons for every $1 million of GDP, compared with the Index average of 296 metric tons. Strong policies have helped Dallas rein in carbon emissions.

Background indicators

Total population [1]	1.3 million
Administrative area (miles^2) [1]	342
GDP per person (real) (US$) [2]	48,900
Temperature (24-hour average, annual) (°F) [1]	67
Goods employment (%) [2]	15
Services employment (%) [2]	85

Geographical basis: 1) City, 2) MSA

The city scores well for monitoring emissions and setting a CO_2 reduction target separate from national guidelines (see "green initiatives" below). City authorities say that municipal operations account for only around 4% of the Dallas carbon footprint.

Green initiatives: Dallas signed up to the US Conference of Mayors Climate Protection Agreement in 2006, which commits the city to reducing greenhouse gas emissions 7% below 1990 levels by 2012. The same year, Dallas completed a baseline inventory of greenhouse gas emissions in 2005 comprising municipal and non-municipal sources. Dallas will complete another baseline inventory in 2011, which will be based on 2010 emissions. City authorities say they are on track to meet the 7% reduction target, primarily through energy conservation programs and the purchase of renewable energy.

Energy: 16th, 65.8 points

Dallas is second only to Houston as the largest municipal purchaser of renewable power in the US, with 40% of the city's electricity coming from clean sources, primarily wind, according to the federal Environmental Protection Agency (EPA). The city also has better than average electricity consumption figures. Dallas consumes an estimated 208 gigajoules of electricity per $1 million of GDP against an Index average of 332 gigajoules. The performance looks more impressive when taking into account that goods-intensive economies are generally less efficient than service-intensive ones. Although Dallas is not classed in the Index as goods-intensive, it falls just outside that bracket. Estimated electricity consumption per capita in Dallas is also slightly better than the Index average, at 50 gigajoules per person versus 52 gigajoules.

Green initiatives: Dallas has replaced incandescent bulbs with more energy-efficient LED traffic lights at intersections. The replacement program has resulted in annual savings of 14.5 million kilowatt hours, the equivalent of $1.45 million per year. Investment in solar energy projects is also underway, the most notable being a solar panel installation on the Dallas Convention Center.

Land use: 23rd, 43.1 points

Dallas registers its lowest rank in land use. A low population density works against the city, but its performance is also hindered by relatively weak policies. The city does not have any measures in place to protect green space from building development, for example. Nor is there a tree planting policy, although the city does at least supply citizens with trees to plant on public

property. Despite some policy oversights, Dallas has a reasonable amount of green space: 13% of its total administrative area is green against an Index average of 12%.

Green initiatives: An Urban Forest Advisory Committee, established in 2005, advises city officials and educates the public about the environmental importance of trees in an urban environment. In 2006 the city appointed a city forester to develop an urban forestry program. In another initiative, a citizen forestry scheme, started in 2007, trains residents in basic tree skills and encourages tree planting.

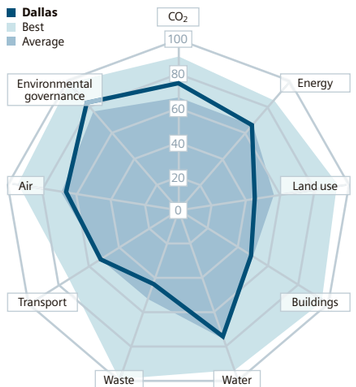
Buildings: 15th, 49.6 points

The city's middling score in the buildings category is one of the lowest among mid-income cities. Dallas's performance is dragged down primarily by a relative lack of strong policies: the city does not require energy audits and has only limited incentives for retrofits. The number of Leadership in Energy and Environmental Design (LEED)-certified buildings is also relatively low, at 4.3 per 100,000 people, versus the Index average of 6.4. However, the city has made progress on municipal buildings – Dallas has cut annual energy usage in its city buildings by almost 5% through retrofits between 2004 and 2009 (see "green initiatives" below). And in 2009 the city set out energy and conservation standards for residential and commercial construction, which help boost its performance.

Green initiatives: As part of the city's Green Building Program, started 2003, all new municipal buildings over 10,000 square feet have to meet LEED silver certification standards, and this was upgraded to gold in 2006. The city built 17 green buildings between 2003 and 2010, and had 26 others in the design and construction phases. Using $9.1 million of federal stimulus funding, the city is also retrofitting older municipal buildings to make them more energy efficient. The Dallas Convention Center has already been renovated, achieving silver LEED certification, and a new terminal at one of the city's two airports, Dallas Love Field, will be built to LEED silver standards.

Transport: 11th, 54.4 points

Dallas achieves its highest rank in transport. The city scores well for promoting green transport, which includes efforts to make the city fleet greener. Dallas is an Index pacesetter in converting city fleets to cleaner energy, purchasing its first alternative-fuelled vehicle in 1992. Ten years later Dallas became the first city in Texas to use biodiesel. Over 40% of the city's 2,000-vehicle fleet now operates on alternative fuel, either compressed natural gas, biodiesel, propane or hybrid gasoline-electric. Despite efforts to make transport cleaner, the city's score in this



category is constrained by a relatively short transport network. Dallas's public transport system measures 0.4 miles per square mile, compared with an Index average of 1.1 miles, although the city has plans under way to expand the system. Furthermore, Dallas has the lowest share in the Index of workers commuting by public transit, bicycle or foot in Dallas, at 3% compared with the average of 13%.

Green initiatives: Under the city's 2030 Transit System Plan, approved in 2006, transport infrastructure is being upgraded and expanded. By 2030 the plan's goals are: 43 miles added to the light rail system; 77 miles of enhanced bus service corridors; 20 miles of extra rapid-bus service corridors; and 116 miles of high occupancy vehicle lanes. Additionally, a streetcar project, funded by a $23 million federal grant, is in an environmental assessment phase. Under the proposed scheme, streetcars in downtown Dallas would link to light rail lines.

Water: 16th, 78.7 points

Dallas has a relatively efficient water distribution system, losing 9% of its supply to leaks compared with the Index average of 13%. Water-related policies are also robust. Main water sources are monitored for quality and supply levels, lower water usage is promoted and recycled water is used. However, high water consumption weighs down the city's score in this category – the second highest rate in the Index – at 219 gallons per person per day, versus the Index average of 155 gallons. High temperature cities like Dallas tend to consume more water than the Index average. City officials have recognized the problem and are making concerted efforts to bring consumption down (see "green initiatives" below).

Green initiatives: Through an extensive water conservation program, which includes "xeriscaping" (water-efficient landscaping that reduces the need for irrigation), Dallas reduced annual water consumption 14% between 2001 and 2009, equivalent to 98 billion gallons. The city is targeting a further reduction of 1.5% each year during 2010-2015. Dallas Water Utilities has been funneling treated wastewater to irrigate the golf links at Cedar Crest Golf Course since 2005, which had previously been irrigated using potable water. Nearly 82 million gallons of potable water were saved in 2005 alone by this initiative.

Waste: 19th, 41.8 points

Dallas's placement in this category is a reflection of its comparatively low recycling rate. The city recycles only 13% of its municipal waste, half the Index average of 26%. However this rate should improve in coming years as a result of programs currently underway (see "green initiatives" below). Through education and the introduction of single-stream recycling (in which all recyclables are placed in one large container), Dallas has already increased recycling from 9,700 tons in 2005 to 44,700 tons in 2010. The city's goal for recycling participation – 50% of households by 2011 – was exceeded a year early with a participation rate of 62%.

Green initiatives: The OneDAY Dallas program reduces garbage and recycling collections to one day per week, encouraging residents to separate recyclables from their trash into a single container. In addition, sales of recyclables added $2.2 million to the city's coffers in 2010 alone. In another initiative, the Recycle Naturally program offers free composting classes to residents and free composting bins to class participants. The Dallas Zoo, by recycling much of its waste for compost and mulch, has saved over $40,000 in dump fees and materials over the last ten years.

Air: 17th, 67.4 points

Dallas, like many cities in the state of Texas, suffers from poor air quality. In the Index only Houston, also in Texas, has higher annual emissions of particulate matter than Dallas. The city emits 80 lb of particulate matter per year, considerably more than the Index average of 25 lb. Cement production constitutes more than 40% of all point sources of air pollutant emissions in the Dallas-Fort Worth region, contributing significantly to the city's air quality problem. But like Houston, Dallas has put in place a robust set of policies to improve air quality (see "green initiatives" below).

Green initiatives: Dallas is part of the Sustainable Skylines initiative, a voluntary three-year pilot program to improve air quality in partnership with the EPA and state government. Some of the program's successes include facilitating the replacement of the city's old taxi fleet with cleaner, low-emitting vehicles, the construction of 30 LEED silver homes in partnership with Habitat for Humanity, a housing charity, and the distribution of energy efficiency and water conservation kits to Dallas residents. Due to its success, the Dallas pilot is now being used as a national model. Other measures to curb air pollutants include the banning of vehicles with a gross weight over 14,000 lb from idling for more than five minutes. In addition, a green cement purchasing policy was adopted in 2007, giving preference to dry kilns with lower nitrogen oxides emission levels.

Environmental governance: 16th, 82.2 points

Dallas scores well for having a dedicated environmental authority and producing regular reports on the city's environmental performance and policies. Environmental commitments have also been made at an international level. The carbon emission reduction targets of the US Conference of Mayors Climate Protection Agreement, which Dallas signed in 2006, are in line with the Kyoto protocol. The city's biggest shortcoming in this category, however, is a lack of citizen involvement in the decision-making process surrounding large projects with an environmental impact.

Green initiatives: Dallas uses an environmental management system (EMS), a management framework for setting environmental strategies, implementing plans and reviewing results. It spans 11 city departments and 85% of the city's 13,000 employees. In 2008 the Dallas EMS was awarded "ISO 14001:2004" certification, an international environmental standard that sets out criteria for organizations wishing to exceed environmental compliance requirements. A dedicated website launched in 2008 provides information on the city's green initiatives and accomplishments, and tips to help residents reduce their environmental footprint.

Quantitative indicators

Category	Indicator	Average	Dallas	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**190.6**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**11.6**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.21**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**50.4**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**13.4**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**3,799.8**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**4.3**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**3.0**	2009	MSA	US Census Bureau American Community Survey; US Census Bureau	
	Length of public transport (miles/miles^2)	1.1	**0.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**18.6**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.7**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**26.1**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**13.0**	2009	City	City of Dallas	
Water	Total water consumption per person per day (gallons)	155.1	**219.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**9.1**	2009	City	City of Dallas	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**54**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**80**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**14**	2005	County	EPA; US Census Bureau	Using county population

Denver

US and Canada Green City Index

Background indicators

Total population [1)]	610,000
Administrative area (miles^2) [1)]	153
GDP per person (real) (US$) [2)]	49,200
Temperature (24-hour average, annual) (°F) [1)]	50
Goods employment (%) [2)]	12
Services employment (%) [2)]	88

Geographical basis: 1) City, 2) MSA

Denver is the capital of the western US state of Colorado. Located in high plains at the edge of the Rocky Mountains, Denver earned the nickname the "Mile-High City" because of its elevation exactly one mile above sea level. With 610,000 residents living inside the city limits, Denver is considered a mid-population city in the US and Canada Green City Index. The larger metropolitan area is home to some 2.6 million people, and a combination of city and metro-level data are used in the Index. Local economic activity is dominated by transportation, telecommunications, aerospace and manufacturing. The city has a per capita GDP of $49,200, placing it at the top end of the mid-income group of cities in the Index.

Denver is ranked fifth overall in the Index. The city's strongest categories are energy and environmental governance, where it places first. Its clean and efficient energy policies are among the most robust in the Index, and its environmental governance performance is supported by its green action plan, green management and strong public participation. Denver also ranks among the leaders in most policy areas across the Index owing to the Greenprint Denver Office, established in 2007, which plans and coordinates citywide environmental programs. Denver places in the top ten in the buildings, water, transport and air categories, and is the top performer overall among mid-income cities in the Index.

CO_2: 14th, 76 points

Emissions per capita, at 13.2 metric tons of CO_2 per year, are below the Index average of 14.5 metric tons. And for every $1 million of GDP that Denver generates, it releases 231 metric tons of CO_2 into the atmosphere, versus an Index average of 296 metric tons. A recent report found that carbon emissions from power plants across Colorado declined by 47% between 2000 and 2010. The largest utility in the state also has plans to close or retrofit four coal-burning plants, which will have positive ramifications for communities across the state, including Denver. The city also scores well for measuring carbon emissions and for its greenhouse gas reduction strategy.

Green initiatives: One of the first recommendations of the Greenprint Denver Advisory Council in 2007 was to set more ambitious greenhouse gas reduction goals. Denver had a previous target of reducing per capita greenhouse gas emissions 10% below 1990 levels by 2012. Taking into account population growth, this per capita target would require an 18 million metric ton reduction of greenhouse gases (16% below 1990 levels). But the advisory council called for a more ambitious long-term goal of reducing absolute greenhouse emissions 25% from 1990 levels by 2020. The main greenhouse gas reduction areas identified by the advisory council were energy conservation, greater energy efficiency in buildings, renewable energy and carbon offsets.

Energy: First, 86 points

Along with environmental governance, this is Denver's strongest category in the Index. Electricity consumption per $1 million of GDP is 184 gigajoules, which is nearly half the Index average of 332 gigajoules. Electricity consumption per capita is 38 gigajoules, also below the Index average of 52 gigajoules. The city has taken a proactive approach on managing energy consumption, and is one of only three cities in the Index that scores full marks for clean and efficient energy policies, through its comprehensive Greenprint Denver plan (see "green initiatives" below). In 2010 the Greenprint Denver Office canvassed 15 neighborhoods around the city and implemented at least one "energy action" in 2,500 homes. Actions included measures to improve energy efficiency and reduce weatherrelated energy loss. Denver's energy performance also benefits from increasing the amount of locally produced energy, which only a few cities in the Index have managed to achieve. In addition, statewide legislation in Colorado requires that 30% of all electricity produced must come from renewable resources by 2020, and to help meet that target Denver is evaluating around 300 municipal buildings for solar power installations.

Green initiatives: The Greenprint Denver program includes several energy saving initiatives. In 2010 alone, 2,000 LED bulbs in 200 traffic signals were installed with estimated savings of almost $800,000 per year. The city is also in the process of installing solar PV cells with a combined capacity of four megawatts on city buildings and public schools, and has announced it will retrofit the central library for projected annual savings of $150,000 through reduced energy bills. Low-income households are also eligible for assistance to improve energy efficiency and the city also provides them with attic insulation assessments.

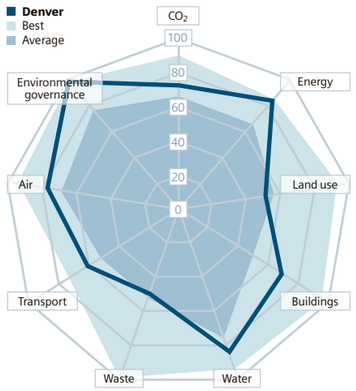
Land use: 18th, 53.3 points

This is Denver's weakest category. The city is marked down for having the smallest amount of green space in the Index as a proportion of its administrative area – just 3% versus the Index average of 12%. A relatively low population density of 4,000 people per square mile, compared with the average of 8,100 also works against Denver in land use. But the city scores well for its green land use policies and its measures to contain urban sprawl. These include subsidies to promote brownfield regeneration and the protection of its scarce green space from building development.

Green initiatives: Denver has been part of the US Environmental Protection Agency's Brownfields Program since October 2010. The program targets the 2,000-acre South Platte River area, which contains 33 brownfield sites, coal-fired power plants and railway corridors, and is home to about 88,000 of the city's low-income residents. With federal assistance the city is identifying and prioritizing brownfield cleanup projects, evaluating potential uses for properties, and, with site owners, conducting environmental assessments. Additionally, in 2006 Denver launched the "Mile High Million" with the goal of planting one million trees by 2025. The city reached a fifth of that target by March 2011.

Buildings: Sixth, 68.8 points

Denver's strong rank in this category is a reflection of policies aimed at improving the energy efficiency of buildings. The city offers incentives for building retrofits, and distributes information to offices and homes about ways to reduce energy consumption. Strict energy regulation for new buildings has also led to a rise in the number of Leadership in Energy and Environmental Design (LEED)-certified buildings. For every 100,000 people in Denver there are 10.2 LEED-certified buildings, many more than



the 6.4 Index average. The one blemish on Denver's buildings score is its failure to require energy audits, which would help to identify inefficiencies.

Green initiatives: As part of the Greenprint program Denver unveiled its first municipal green building policy: all current and future city buildings have to be LEED certified. To encourage solar power usage in municipal buildings, the city offers minimum 15-year leases to private companies to install, operate and maintain solar energy systems. In return for the lease, energy rates must be lower than those charged by utility companies. Solar systems have been installed in numerous city-owned buildings, the biggest of which is the two-megawatt array at Denver International Airport. A "green roof" installation program for municipal buildings, to cut down energy consumption, is also part of the Greenprint initiative.

Transport: Eighth, 60.7 points

The city's strong placement in transport is supported by its efforts to make the public transport fleet greener and encourage citizens to walk, cycle or take public transport. Congestion reduction policies are also strong. The city boasts

pedestrian-only zones and a well-developed traffic management system to ease traffic flow. The most significant weakness in this category is the lack of public transit supply, even after the city invested $1 billion on improving public transport infrastructure through the Inter-modal Transportation Expansion (T-REX) project, which was completed in 2006. The length of the Denver metropolitan area public transport network remains one of the shortest in the Index at just 0.1 miles per square mile, versus an Index average of 1.1 miles. And, likely a result of the public transport shortfall, Denver's share of workers using public transit, a bike or walking is also currently relatively low, at 7.4% versus an Index average of 13%.

Green initiatives: In 1993 Denver became the first US city to launch a Green Fleet program to prioritize fuel efficiency in its public transport fleet. The program, which city officials revised in 2000, calls for a reduction in carbon emissions and fuel expenditures through the adoption of strategies including the purchase of smaller vehicles, encouraging alternative modes of transport, minimizing total vehicle miles, and investing in vehicles that run on alternative fuels. In 2004 Denver launched a pilot program to test clean-burning B20 biodiesel in 60 of the city's vehicles. Today over 1,000 of the city's 3,500 vehicles run on biodiesel.

Water: Seventh, 85.6 points

Denver has one of the most efficient water distribution systems in the Index, losing a modest 5% of its supply to leaks against the Index average of 13%. Water efficiency and treatment policies are also strong. Main water sources are monitored for quality and supply levels, and measures are in place to lower water usage. Denver's one weakness in the water category is its relatively high consumption. Denver consumes 181 gallons of water per capita per day, which is one of the highest among mid-income cities and well above the Index average of 155 gallons.

Green initiatives: Denver's new water recycling plant on the South Platte River is the largest in Colorado and work is underway to expand treatment capacity to 45 million gallons a day. The facility supplies recycled water for non-potable uses, such as irrigation for lakes, parks, golf courses and wildlife preserves. And through new irrigations systems already in place, city authorities say they use 28% less water in parks than in 2001.

Waste: 17th, 51.9 points

This is one of Denver's weakest categories, despite the fact that it treats different types of waste, including recyclable, hazardous and industrial. The city also scores well for its waste reduction strategy and for reducing reliance on landfills in favor of more sustainable local waste management practices. Regardless of its efforts to improve recycling (see "green initiatives" below), Denver has one of the lowest recycling rates in the Index, at just 3%, versus the 27-city average of 26%, which restrains its score.

Green initiatives: In 2005 the city of Denver began a transition to a single-stream recycling system, which allows residents to place all recyclable materials into a single container. Sorting

of materials is then conducted at treatment facilities. The city saw a 61% increase in recycling rates in the first two years of the single-stream recycling program.

Air: Tenth, 79 points

Denver's performance in the air category is bolstered by having some of the strongest clean air policies in the Index. Air quality targets have been set and measures are in place to improve air quality, and they have had a positive effect. Denver's annual sulfur dioxide emissions, at 14 lb per person, fall well below the Index average of 22 lb. But there is still room for improvement. Both particulate matter and nitrogen oxides emissions are above the averages.

Green initiatives: Denver has an anti-idling ordinance limiting idling to five minutes and police have authority to ticket idling vehicles left unattended for any period. In addition, since 2003 the state of Colorado has operated a voluntary mobile vehicle emissions testing program, making it more convenient for motorists to get tested. Vans deployed with special laser-based technology examine vehicles as they drive by and alert drivers to whether they have passed or failed. Drivers who fail the test have the opportunity to retest at a traditional emissions testing facility.

Environmental governance: First, 100 points

Denver ties with New York and Washington DC in this category, earning full points. The performance is underpinned by the Greenprint Denver Office, Denver's coordinating body for environmental programs across different city agencies. Working alongside the Greenprint Denver Implementation Committee, which helps ensure green measures are integrated throughout city operations, Greenprint Denver is a best-practice model of environmental governance in the Index. A baseline review has been carried out, targets have been set, and evaluation reports are regularly published. There is also easy access to information on the city's environmental performance and policies, coupled with a central contact point for citizen complaints.

Green initiatives: Greenprint Denver enables public participation in environmental programs through a variety of initiatives, including Green Teams. Green Teams are community-based groups of friends, families and neighbors interested in learning about energy efficiency and carbon emissions reduction, and improving their local environment. The Greenprint Denver office considers these teams catalysts for greater community involvement and provides them with free income-qualified weatherization, subsidized home-energy audits, junk mail reduction, free CFL porch bulbs and trees for planting in neighborhoods. Greenprint's residential program managers work closely with Green Teams to set tangible goals and decide on the best outreach methods for expanding participation throughout the community, including door-to-door canvassing or neighborhood picnics.

Quantitative indicators

Category	Indicator	Average	Denver	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**231.3**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**13.2**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.18**	2009	City	Sustainability Department; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**37.9**	2009	City	Sustainability Department; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**3.2**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**3,989.2**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**10.2**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**7.4**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.1**	2009	Metro-area	National Transit Database; US Census Bureau	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**21.3**	2009	Metro-area	National Transit Database; US Census Bureau	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**0.6**	2009	Metro-area	National Transit Database; US Census Bureau	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**26.8**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**3.0**	2009	City	City of Denver Sustainability Department	
Water	Total water consumption per person per day (gallons)	155.1	**181.2**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**5.0**	2009	City	City of Denver Water Department	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**68**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**26**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**14**	2005	County	EPA; US Census Bureau	Using county population

Detroit

US and Canada Green City Index

With a population of 910,000, Detroit is one of the mid-sized cities in the US and Canada Green City Index. The population figure included in the Index is from 2009, but the 2010 US Census – which was not yet published upon finalization of the Index – showed a steep 25% decline, accelerating a decades-long trend. Traditionally a center of automobile manufacturing and home to the big-three automobile companies, General Motors, Ford and Chrysler, Detroit peaked in terms of population and economic strength in the 1950s. Since then, the city has seen its population shrink as residents moved to the suburbs or other cities and, in tandem with various shocks to the automobile industry, has had to restructure the local economy away from a reliance on auto manufacturing. Today, Detroit's per capita GDP stands at $40,300, below the Index average of $46,000. In 2007 roughly one-third of Detroit residents lived below the federal poverty level, the highest percentage among large US cities. In April 2008 the city announced a $300 million stimulus plan to create jobs and revitalize the diverse, and partially historic, downtown neighborhoods. As an important transportation hub with ports, highways and railways that connect Detroit with the region and Canada, Detroit may still find opportunities for revitalization, hopefully integrated with environmental excellence. Most of the data for Detroit came from the city and the wider metropolitan area, which has a population of 4.4 million.

Detroit ranks at the bottom of the Index, at 27th overall. The nine categories in the Index all highlight the challenges the city faces. Nevertheless, Detroit has taken some steps to transform itself from a "rust belt" into a "green belt", helped in no small part by the proactive stance of the former Michigan Governor, a staunch advocate for alternative energy and green economic development. The existence of state-level goals for renewable energy and energy efficiency may help shape, in some capacity, future policies and programming at the city level. Already, Detroit has taken action to improve the city's non-motorized transport infrastructure as well as the variety and quality of public spaces. These initiatives, which aim to improve quality of life as well as the city's environmental performance, are encouraging win-win strategies that will hopefully be replicated.

Background indicators

Total population [1)]	910,000
Administrative area (miles^2) [1)]	138
GDP per person (real) (US$) [2)]	40,300
Temperature (24-hour average, annual) (°F) [1)]	50
Goods employment (%) [2)]	14
Services employment (%) [2)]	86

Geographical basis: 1) City, 2) MSA

CO_2: 22nd, 43.8 points

CO_2 emissions per $1 million of GDP total 427 metric tons, well above the Index average of 296 metric tons. Per capita emissions are 17 metric tons per person, compared with the Index average of 14.5. Detroit's large carbon footprint is a factor of its heavy industrial activity, as well as the fact that the second largest coal-fired plant in the nation is located less than 50 miles away. Statewide standards for adopting renewable energy (see "green initiatives" in the energy category) will, hopefully, help reduce Detroit's CO_2 emissions.

Green initiatives: Although the Detroit municipal government has not committed to a reduction in CO_2 emissions, it is nevertheless affected by state-level policy initiatives. The state government conducted a greenhouse gas inventory in 1990, and again in 2002. In 2009 the Michigan Climate Action Council completed a climate action plan, which identifies 54 policy recommendations for reducing almost 1 billion metric tons of CO_2 equivalent, based on 1990 levels, between 2009 and 2025. The Council also established an annual reporting mechanism, beginning in 2012, to track performance and progress toward achieving the CO_2 emissions target.

Energy: 27th, 27.3 points

Electricity consumption per unit of GDP is an estimated 1,029 gigajoules per $1 million, compared with the Index average of 332 gigajoules, making Detroit's energy intensity the highest in the Index. Detroit's per capita electricity consumption is estimated at 87 gigajoules per person, compared with the Index average of 52. Both figures are estimated based on state retail electricity sales, scaled down to the city level using population data. Policies aimed at promoting energy efficiency and renewable energy, which Detroit has partially initiated, are a positive step towards improvement in this area.

Green initiatives: Although there are few city-level initiatives related to energy, the Michigan state government is promoting renewable energy and energy efficiency. In 2008 the state enacted a law requiring 10% of its energy to come from renewable sources by 2015. In 2010 one of Michigan's largest power suppliers, which serves southern Michigan and some of Detroit, announced that its supply of renewable power would reach 6% following power purchases from four new independent projects. Three of the four projects are in Michigan and Iowa and generate wind power; the other is in Texas and is a gas-to-electricity landfill.

Land use: 26th, 35.8 points

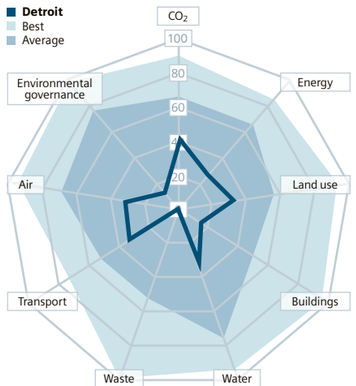
In terms of population density, Detroit has 6,600 people per square mile compared with the Index average of 8,100. Only 7% of Detroit's area comprises green space, compared with the Index average of 12%. In recent years the city has taken steps to revitalize certain areas, prevent further sprawl and increase the quality of life downtown, but Detroit currently lacks policies to sustain and improve the quality and quantity of green space. A private group of the state's largest employers has called on the municipal government to make changes (see "green initiatives" below).

Green initiatives: The main organization promoting revitalization initiatives is Business Leaders for Michigan. Comprising executives from the state's largest job providers and universities, in 2010 the entity issued a comprehensive "Turnaround Plan" for Detroit aimed primarily at economic development, but including urban revitalization as one of its goals. So far, the group has secured the city government's support for some of the plan's initiatives, but not those centered on combating urban sprawl.

Buildings: 26th, 18.1 points

Detroit has only 0.8 buildings per 100,000 people certified by Leadership in Energy and Environmental Design (LEED), compared with the Index average of 6.4. Several state-level initiatives (see "green initiatives" below) offer city officials opportunities to consider similar programs and additional funding at the city level.

Green initiatives: The state government has introduced a state and federally funded program providing low-income Michigan residents with free weatherization services aimed at saving families up to 25% in heating costs. The program also offers low-income homeowners a 10% energy efficiency home improvement tax credit on upgrades that meet federal Energy Star efficiency requirements. In addition, in 2009 a Detroit-based utility introduced proposals to increase its renewable energy and energy efficiency portfolio. No specific targets were announced.



Transport: 27th, 37.5 points

Detroit performs well in the Index for the length of its public transport network, which is 2.5 miles per square mile of metropolitan area, the fourth highest in the Index, and well above the Index average of 1.1 mile per square mile. This figure was estimated based on numbers from the national transit database. Detroit performs less favorably in other transit-related areas. For instance, whereas the Index average for the percentage of workers traveling by public transit, bicycle or foot is 13%, in Detroit it is only 4%. It is encouraging that the wider region is committing to a long-term plan that includes several hundred miles of walking and biking facilities.

Green initiatives: Detroit adopted a non-motorized transportation master plan in 2008, aimed at developing a more extensive network of urban bikeways and walkways, including 400 miles of new bike lanes. To date, the city has identified $86 million in private and government funding for projects, and has already added some lanes. Officials have not released a timeline for the project.

Water: 27th, 38.8 points

Per capita water consumption in Detroit is 172 gallons per person daily, compared with the Index average of 155. The Index average for water leakages as a percentage of the water distribution system is 13%, and in Detroit it is 16%. Detroit is one of only two cities in the Index that does not treat all of its wastewater, but it has begun to address some of the issues facing the city's water system by committing to a long-term plan to limit sewage overflows (see below "green initiatives"). Although Detroit is relatively weak on many of the policies evaluated in the Index, the city makes use of recycled water, a positive achievement to date.

Green initiatives: In response to a federal mandate, the Detroit Water and Sewerage Department is in the process of replacing an existing pump station with a retention basin that would eliminate untreated sewer overflow into the nearby Rouge River. The $154 million project began in the fall of 2007 and is slated for completion in 2011. To the extent they are "feasible, cost effective and beneficial", the city has pledged to incorporate "green infrastructure" upgrades, such as bioswales (special landscaping that filters silt and pollutants from stormwater), rain barrels, porous pavers that reduce runoff by allowing water to permeate into the subsoil, and green roofs.

Waste: 27th, 0 points

In the category of waste, Detroit ranks last in the Index. The city recycles almost none of its waste, a number estimated from state data, whereas the Index average for recycled waste is 26%. This estimate is based on data from 2006 however, and the city has made some progress rolling out residential recycling in recent years (see "green initiatives" below), suggesting that its performance has actually improved. Though the city has used an incinerator for most of its waste management in recent years, it recently shut down the facility following long-standing public opposition.

Green initiatives: In 2009 the city started a pilot program to introduce curbside recycling for 30,000 homes, or roughly 12% of the city's households, with plans to serve the entire city within five years. The program, expected to cost $3.8 million, will end Detroit's status as one of the country's largest cities without a recycling program. In 2009 a local utility offered Detroit residents $50 for their old freezers and refrigerators, and hauled them away for free.

Air: 26th, 37.4 points

Detroit performs better than the Index average in particulate emissions, which total 17 lb per person annually compared with the Index average of 25 lb per person. However, Detroit's sulfur dioxide emissions of 59 lb per person per year are notably higher than the Index average of 22 lb, and the city emits 93 lb of nitrogen oxides per person annually compared with the Index average of 66 lb. Over half of nitrogen oxides emissions are attributed to on-road vehicles, while over 70% of sulphur dioxide comes from electricity generation. Industrial processes also make up a significant share of Detroit's pollutants, making the city's transition from a "rust belt" to a "green belt" all the more urgent in terms of air quality.

Green initiatives: In the summer of 2007 the Southeast Michigan Council of Governments conducted a pilot program aimed at reducing emissions from high-polluting vehicles through increased public awareness and the use of remote sensing technology. The latter is an aerial traffic monitoring system that measures the number of cars and their position by means of the radiation they emit, and generates data that can be used in a number of ways. The results of this program and continued activities are unclear. The Council of Governments has information on its website on ways for the public to improve air quality through consumer habits and everyday behavior.

Environmental governance: 26th, 16.7 points

Though the city has a dedicated environmental authority, Detroit does not have an identifiable environmental strategy or environmental targets, and has not committed to regular reporting on its environmental performance. In order to reach the level of openness and public engagement that the Index's top performers have attained, Detroit might follow through with the commitment that its Office of Energy and Sustainability made in 2008, which was to formulate a baseline review based on input from a diverse cross-section of stakeholders (see "green initiatives" below).

Green initiatives: In late 2008 the city's mayor at the time, Ken Cockrel Jr, announced the creation of the Office of Energy and Sustainability, whose mission he identified as the collaboration of "city departments, business groups, non-profit organizations and other agencies to protect, enhance and promote sustainability, livability and energy efficiency in Detroit". The office is an extension of an earlier mayoral Green Task Force, created in 2007 to advise the city council and Detroit residents on green principles and practices. There are no websites with information about the status of present initiatives, but the Green Task Force issued a progress report in 2008. The document laid out general progress to date and goals, but did not include specific targets among its near-term objectives.

Quantitative indicators

Category	Indicator	Average	Detroit	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**426.8**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**17.0**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**1.03**	2009	City	Detroit Edison; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**86.9**	2010	City plus a portion of the metro-area	Detroit Edison	Using population served by Detroit Edison
Land use	Green spaces as % of total area (%)	11.9	**6.7**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**6,600.9**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**0.8**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**3.6**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**2.5**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**17.5**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**3.5**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**26.0**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**0.1**	2006	State data	BioCycle and Earth Engineering Center of Columbia University	
Water	Total water consumption per person per day (gallons)	155.1	**172.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**15.9**	2000	City	Detroit Water and Sewerage Department	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**93**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**17**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**59**	2005	County	EPA; US Census Bureau	Using county population

Houston

US and Canada Green City Index

Background indicators

Total population [1]	2.3 million
Administrative area (miles^2) [1]	579
GDP per person (real) (US$) [2]	48,000
Temperature (24-hour average, annual) (°F) [1]	69
Goods employment (%) [2]	20
Services employment (%) [2]	80

Geographical basis: 1) City, 2) MSA

Houston has the second largest administrative area in the US and Canada Green City Index, and with a population of 2.3 million, it is one of the least densely populated cities in the Index. Located in the southern region of Texas, Houston's hot climate opens up opportunities to harness solar power. But just as the climate can help Houston's environmental efforts, it can also hinder them through destructive tornados and hurricanes. The city's economy, which is goods intensive, generates a GDP per person of $48,000 and puts Houston into the mid-income bracket. The Index data for Houston is based on a mixture of statistics from the city and wider metropolitan area, which has a population of 5.9 million.

Houston ranks 16th overall in the Index. The city's highest category placing is in environmental governance, where it ranks joint fifth with Los Angeles and Philadelphia. In other categories, such as energy, land use, buildings, waste and transport, Houston ranks near the middle – yet still in the top half – of the Index. The city ranks near the bottom of the Index in two categories, CO_2 and air, mainly for high levels of emissions. Despite Houston's mid-table overall ranking, by doing relatively well at governance – coordinating green initiatives across multiple departments and informing citizens and businesses about ways to be more environmentally friendly – the city has the potential to boost its overall environmental performance in the future. Officials have also been successful in enlisting outside help. Federal and state funding has been drafted in for brownfield regeneration and for converting the city fleet to cleaner fuel, while the Clinton Climate Initiative, an international non-profit organization, has played a big part in Houston's drive to make municipal buildings more energy efficient.

CO_2: 25th, 32.1 points

CO_2 emissions in Houston are much higher than the Index averages, at 25.8 metric tons per person versus the average of 14.5, and 433 metric tons per $1 million of GDP, compared with the average of 296. Emissions tend to be higher in the Index in other hot, goods-intensive, and low-density cities, and Houston falls into all three categories. Although Houston's policymakers have some catching up to do with their Index peers in reducing CO_2 emissions, the city's profile does little to help them.

Green initiatives: Houston unveiled a Multi-Pollutant Emissions Reduction Plan in 2008, which includes a series of ongoing energy efficiency and renewable energy measures. Specific projects include municipal building retrofits, and the installation of a combined heat and power system at Houston's wastewater treatment facilities, which are responsible for over 30% of the city's energy usage. Completed work includes the retrofitting of the heating, ventilating and air conditioning systems at city airports.

Energy: 11th, 71 points

Houston's electricity consumption per capita is generally in line with the Index average, at an estimated 50 gigajoules per person versus the average of 52. Consumption per $1 million of GDP is higher than the average, at 404 gigajoules, compared with the average of 332. When income is taken into account, of the eight mid-income cities in the Index, only Toronto consumes more electricity per unit GDP than Houston, and only Atlanta consumes more electricity per capita. Conscious of the need to improve, Houston scores well for its clean and efficient energy policies. Through a mixture of tax incentives and subsidies, the city promotes green energy for both businesses and homes. Houston is also marked up for developing green energy projects, which include investment in solar power (see "green initiatives" below). According to the US Environmental Protection Agency (EPA), Houston overtook Dallas in 2009 as the largest municipal purchaser of renewable energy in the US.

Green initiatives: Houston is one of 12 US cities carrying "Solar America City" status; it received a $200,000 federal grant in 2008 that was matched by a private energy company. Houston has used the funds to develop solar infrastructure and has completed small-scale demonstration projects at several city facilities, including a 100-kilowatt solar system installed on the roof of the George R. Brown Convention Center. In 2010 Houston received a $1.3 million grant from the Texas state government to develop off-grid solar-powered generators for emergency use. In parallel with its solar-powered initiatives, Houston has almost completed the replacement of incandescent bulbs with more energy efficient and longer lasting LEDs at its traffic lights and pedestrian signals. As of March 2011 calculations from the city based on 300 signals showed that Houston will save 2.7 million kilowatt hours of energy and over $3.6 million a year. Savings from the entire project will be much higher once work on all the city's 2,450 signalized intersections is completed.

Land use: 13th, 56.8 points

Houston performs well for its measures to improve the quantity and quality of green space. An active tree planting policy is in place and, with the help of the EPA funding, brownfield regeneration is underway. The biggest policy oversight is the absence of any green space protection from building development, although Houston's proportion of green space, at 14%, is slightly higher than the Index average of 12%.

Green initiatives: Houston's Brownfields Redevelopment Program provides free environmental site assessments, funded by the EPA, to potential redevelopers. Twenty-four sites have been added to the program since 2005, the majority of which are to become park space. A 2007 regulation requires residential developers to create 1.8 acres of park space per 100 dwellings, or pay a fee of $700 per dwelling. Another initiative, the "Million Trees + Houston", a public-private initiative started in 2008, aims to plant one million trees in the Houston area over a five-year period.

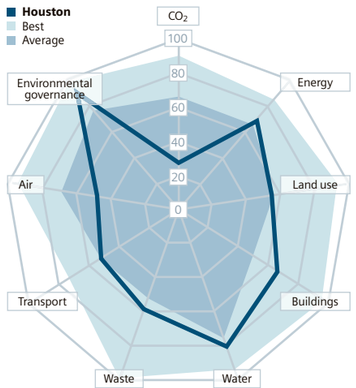
Buildings: Ninth, 66.4 points

New buildings in Houston have to comply with energy efficiency standards and incentives are available to make existing buildings greener through retrofits. Houston also offers information to homes and businesses about ways to reduce energy consumption. The city's main weakness is the relatively low number of Leadership in Energy and Environmental Design (LEED)-certified buildings in relation to population, at 4.3 per 100,000 people against an Index average of 6.4. LEED certification continues in the city, however. As of January 2010 the city reported that 28 buildings representing more than one million square feet of LEED projects were underway.

Green initiatives: In recent years Houston has invested heavily in improving energy efficiency of its buildings. In collaboration with the Clinton Climate Initiative, the city has a program to retrofit 7.1 million square feet of municipal building space in 262 buildings. Houston expects an average 30% reduction in energy usage from the retrofitted buildings, through measures such as lighting upgrades, HVAC efficiency improvements and the installation of energy management systems. Energy savings are guaranteed by the private sector partners that implement the retrofits. The funds saved from reduced energy use are used to finance energy upgrades and improvements. In September 2010 the City of Houston partnered with the ICLEI-Local Governments for Sustainability to launch the first annual Green Office Challenge. Through the challenge, the city will bring local, state and national sustainability experts together to provide training and resources to assist owners of office buildings, property managers and tenants to reduce water use, waste generation and energy consumption. Participants' successes and milestones will be measured throughout the challenge year, culminating in awards for progress. Reaching out to the same target group, the city launched an energy efficiency incentive program for commercial buildings in early 2011.

Transport: 12th, 53.6 points

The city performs well on green transport promotion, which has included heavy investment in the municipal fleet to make it more environmentally friendly (see "green initiatives"). But public transit is limited by Index standards, with two public transit vehicles available per square mile, compared with the Index average of nine per square mile, and a network that extends 0.2 miles per square mile, compared with the Index average of 1.1 miles. Houston's large



administrative area is certainly a limiting factor, as is the region's reliance on cars, which is similar to other highly populated, sprawling US cities.

Green initiatives: Houston is investing more than $4.1 billion to extend the current 7.5-mile urban light-rail system to 39 miles by 2014. The city has also replaced 50% of its passenger vehicles with gasoline-electric hybrids. And with the help of an EPA grant, 34 of the city's heavy-duty vehicles have been replaced with hybrid and clean-diesel vehicles. In addition, Houston has been working with private and non-profit partners to introduce electric vehicles and chargers in the city. One of the city's partners, for example, recently launched the first private investment in electric vehicle infrastructure, deploying over 150 charging stations throughout Houston.

Water: 15th, 80.5 points

Although Houston's water consumption, at 158 gallons per person per day, is near the Index average of 155 gallons, it fares better when compared with other high temperature cities in the Index. Out of this nine-city group, only two cities consume less water than Houston. Policy areas are also reasonably strong. Main water sources are monitored for quality and supply levels, and the city promotes lower water usage. The percentage of water lost to leakages in Houston's water distribution system, at 12%, is just under the Index average of 13%.

Green initiatives: The Houston Area Water Corporation and the US Geological Services partnered in 2006 to install 20 energy efficient solar-powered aeration mixers, known as "Solar Bees", at Lake Houston near the intake for the water treatment plant. The lake experiences seasonal algal blooms, which give an unpleasant taste and odor to the water. Instead of using chemicals as a costly short-term fix, the city installed the mixers to keep the waters oxygenated and support the lake's natural ecosystem. The low-cost solution produced 28% in energy cost avoidance through the use of solar power, and 78% in chemical cost savings. Through the installation of low-flow water faucets and toilets in municipal buildings, along with significant enhancements and controls for irrigation systems in the city's parks, Houston is saving over 13 million gallons of water annually.

Waste: Tenth, 59.5 points

Houston recycles only 15% of its municipal waste versus an Index average of 26%, although several initiatives are underway to boost the city's recycling performance (see "green initiatives" below). The city has facilities to treat different types of waste: recyclable, hazardous and industrial. It also performs well for reducing reliance on landfills and moving towards more sustainable local waste management practices. A measure of Houston's growing competence in waste management came in the wake of Hurricane Ike in 2008. Working alongside the Clinton Climate Initiative and Living Earth, a charity, the city managed to divert all of the 5.7 million cubic yards of debris tree material from landfills and burning.

Green initiatives: To encourage Houston's residents to set aside more recyclable waste, since 2008 the city has reduced heavy trash pickup from one-month to two-month intervals. In the intervening months it picks up only organic material, such as tree debris. The city also promotes "single-stream" recycling by giving residents 96-gallon recycling bins for all recyclables. The scheme covered 104,000 households as of January 2011. In addition the city, in cooperation with a local non-governmental organization, has created Houston Mulch – a brand of compost created from green debris in the city. Available citywide since 2009, its environmental benefit is the equivalent of keeping over 10,000 cars off the road.

Air: 24th, 49.3 points

Houston's emissions of sulfur dioxide and nitrogen oxides are much higher than Index averages. Its levels of particulate matter, at 93 lb per person, are the highest in the Index. But it is the wider region, not just Houston, which suffers from high amounts of air pollutants. The EPA has designated the surrounding area as a "severe ozone non-attainment region". The region has until 2019 to achieve compliance with the authority's national ambient air quality standards for ozone. Houston is responding well. The city has one of the most robust sets of clean air policies in the Index, setting air quality targets and putting policies in place to improve air quality. And the city, along with local private companies, is lobbying the Texas state government for more funds to help improve air quality. The city says the replacement of older fleet vehicles with ones running on cleaner diesel fuel, at a cost of $2 million, could reduce nitrogen oxides emissions by 200 lb per year.

Green initiatives: With EPA funding, Houston has set up a Mobile Ambient Air Monitoring Laboratory. The mobile lab, which city authorities claim is the first of its kind in the country, can be deployed throughout the Houston area to identify source emissions with near real-time reporting capabilities.

Environmental governance: Fifth, 94.4 points

A strong green action plan is in place, with environmental targets set after conducting a baseline review, and this helps give Houston its highest category ranking. The city publishes regular environmental reports and performs well for having a dedicated environmental authority. Houston is also a member of the C40 Cities Climate Leadership Group. One relative weakness is a lack of citizen involvement in the decision-making process of large projects that have an impact on the environment.

Green initiatives: An Environmental Coordinating Council was established in 2009 with the purpose of coordinating environmental work among all city departments. Specially trained staff, spread across different departments, coordinates all environment matters through the council. The council is also charged with communicating environmental issues to the public. The Environmental Standard, an e-newsletter launched in 2009, informs citizens about city environmental programs and gives advice about ways to improve the environment.

Quantitative indicators

Category	Indicator	Average	Houston	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**432.6**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**25.8**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.40**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**50.4**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**14.2**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**3,899.7**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**4.3**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**4.0**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**23.6**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**2.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**27.6**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**14.7**	2009	City	City of Houston General Services Department	Residential waste only
Water	Total water consumption per person per day (gallons)	155.1	**158.4**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**11.8**	2009	City	General Services Department, City of Houston	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**78**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**93**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**44**	2005	County	EPA; US Census Bureau	Using county population

Los Angeles

US and Canada Green City Index

Background indicators

Total population [1]	3.8 million
Administrative area (miles^2) [1]	469
GDP per person (real) (US$) [2]	47,200
Temperature (24-hour average, annual) (°F) [1]	63
Goods employment (%) [2]	14
Services employment (%) [2]	86

Geographical basis: 1) City, 2) MSA

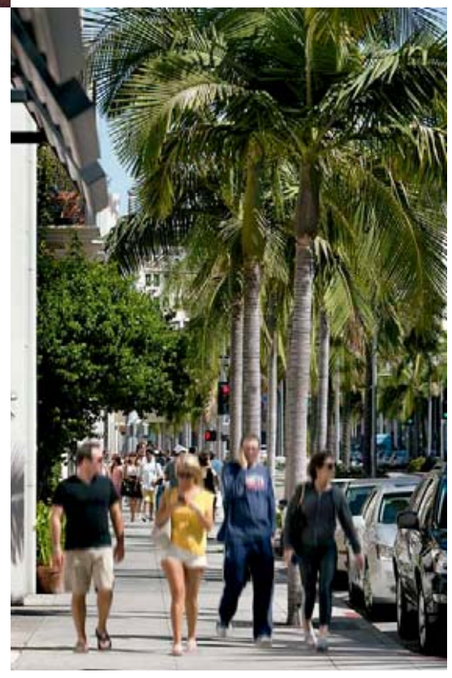
With 3.8 million residents, Los Angeles is the second most populous city in the US and Canada Green City Index. Its administrative area, totaling 468 square miles, is the fourth largest in the Index. The much larger metropolitan area, which spans across five counties, boasts a population of 12.9 million, making it the second biggest city in the US behind New York. Located on a hilly plain along the Pacific Ocean, Los Angeles has one of the world's busiest ports – the Long Beach and Los Angeles ports combined – which is a strong source of carbon emissions, as is the city's large manufacturing base. However the local economy is dominated by less-carbon-intensive industries, such as media production and financial services. With a GDP per capita of $47,200, the city falls in the mid-income bracket in the Index.

Los Angeles ranks seventh overall in the Index. Spearheading many of the city's green initiatives is the Los Angeles Department of Water and Power (LADWP), the local water and electricity utility. In CO_2 and energy, where Los Angeles performs particularly well, the city-owned utility has played a lead role in reducing energy consumption and cutting carbon emissions. Other categories where Los Angeles scores above average are waste and air. The city has one of the strongest records on municipal waste recycling in the Index and, despite its proximity to the Long Beach and Los Angeles ports, air quality is relatively high. Los Angeles is in the lower half of the Index in the land use and transport categories, but is showing intent to improve in both areas. It has put forward an innovative scheme to finance transport investment by using future tax revenue as collateral for federal borrowing. This may well become a model for other cities to copy if the scheme gains US government approval.

CO_2: Fourth, 86.5 points

CO_2 emissions per capita, at 8 metric tons, are below the Index average of 14.5. And for every $1 million of GDP the city generates, 162 metric tons of CO_2 are released, versus an Index average of 296 metric tons. For reasons of data availability and comparability, the CO_2 figures were taken from 2002 for all of the US cities in the Index, and in the meantime Los Angeles has made progress reducing its emissions and deserves credit for the green measures it has taken. Through a combination of energy efficiency initiatives and less reliance on electricity generation from fossil fuels (see "green initiatives" below) LADWP has cut CO_2 emissions by 2 million metric tons since 2005. The city also scores well on policy. Los Angeles monitors emissions and has a target to reduce CO_2 emissions 35% below 1990 levels by 2030.

Green initiatives: In 2007 the city unveiled the Los Angeles Climate Action Plan, which sets one of the most aggressive greenhouse gas reduction targets in the Index: 35% below 1990 levels by 2030. To achieve this goal, in 2008 the city established an implementation program called ClimateLA. Initiatives running under the auspices of ClimateLA include increasing renewable energy purchases, making the city fleet greener, retrofitting buildings, and offering rebates on energy efficient appliances. Additionally, Los Angeles has already met the Kyoto Protocol target by taking more than 6,000 city-owned diesel trucks off the road, purchasing a fifth of the city's energy from renewable sources, converting all city buses to alternative fuel and creating 35 new parks. Kyoto called for reducing greenhouse gas emissions 7% below 1990 levels by 2012; Los Angeles achieved that feat in 2008.



Energy: Fifth, 77.8 points

Los Angeles ties Toronto in the energy category. Electricity consumption in Los Angeles, both on a per capita basis and in relation to economic output, is about half the Index average. The city uses an estimated 169 gigajoules of electricity per $1 million of GDP, versus an Index average of 332 gigajoules. On a per capita basis Los Angeles consumes 27 gigajoules, considerably less than the Index average of 52 gigajoules per person. Energy saving programs undertaken by LADWP have helped (see "green initiatives" below) and the city scores well for green energy promotion. However, Los Angeles is marked down for not yet doing more to develop green energy projects and for its relatively slow progress in consuming more locally produced energy. Ambitious plans by LADWP to source more renewable energy look set to address this.

Green initiatives: LADWP generated 40% of its power from coal in 2009 but aims to be coal-free by 2020 with the help of renewable electricity generation. LADWP completed a 120-megawatt wind farm in 2009, at a cost of $500 million, which serves 56,000 households in Los Angeles. Energy efficiency initiatives undertaken by the utility company in the 12 months to March 2010, at a cost of $70 million, have resulted in energy savings of 300 gigawatt hours (nearly 1.1 million gigajoules). Measures include the distribution of compact fluorescent bulbs to households, installation of efficient lighting in small businesses, and a variety of household rebate programs to replace inefficient windows and appliances. The city also installed solar panels on the LA Convention Center, while nearly 26,000 square feet of solar panels are to be installed at the city's main wastewater treatment plant.

Land use: 21st, 45.3 points

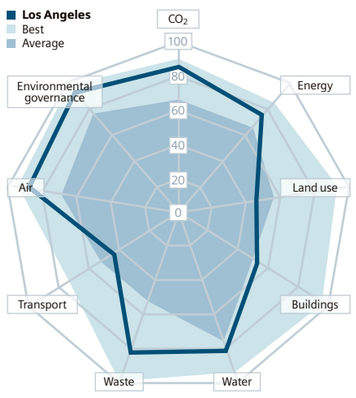
This is one of Los Angeles's weakest categories in the Index. Only 8% of the city's administrative area is green space, versus an Index average of 12%. Other high temperature cities in the Index also tend to have less green space, but more rigorous policies would help improve the city's performance. Incentives for brownfield regeneration are not yet as strong in Los Angeles as in other Index cities, although a future initiative is in the planning stages (see "green initiatives" below). The city's measures to contain urban sprawl are also relatively weak, but it does have an active tree planting policy.

Green initiatives: The city is planning a Clean-Tech Corridor to run alongside the Los Angeles River by regenerating brownfield sites. Through a variety of incentives, such as favorable ground leases and low interest loans, the aim is to fill the corridor with companies specializing in green technology development. A timetable for corridor completion is not yet available. Los Angeles's Million Trees initiative, begun in 2005, is a public-private partnership working to plant one million trees throughout the city. Nearly 300,000 trees have been planted so far and there is no timeline for when the city hopes to reach this target.

Buildings: 12th, 53.5 points

For every 100,000 people in Los Angeles there are only 1.9 Leadership in Energy and Environmental Design (LEED)-certified buildings, considerably fewer than the Index average of 6.4, even though LEED standards for municipal buildings are mandatory (see "green initiatives" below) and other incentives are in place. However, Los Angeles scores better in policy areas. New buildings have to comply with energy standards, and incentives are available for energy-saving retrofits. There are still some policy gaps: information on how to decrease energy consumption in offices and homes is not as readily available in Los Angeles as in other Index cities, for example.

Green initiatives: LEED certification for new municipal buildings has been mandatory in Los Angeles since 2002. Seven years later the Green Building Retrofit Ordinance was passed, which calls for municipal buildings built before 1978 (or occupying more than 7,500 square feet) to meet the silver LEED certification standard. The city plans 100 retrofits per year. Tax credit



incentives and fast-tracked building permits have been available to private property developers seeking silver LEED certification since 2008.

Transport: 24th, 42.9 points

Los Angeles, notorious for its complex web of highways and traffic-choked rush hours, registers its lowest rank in transport. Congestion reduction policies are comparatively weak and the city's overall public transit supply is one of the most limited in the Index. Of the five large-area cities covered in this Index, Los Angeles's public transport network, measuring 0.18 miles per square mile, is the shortest. City authorities are, however, keen to improve supply. Through an innovative funding arrangement with the US government they are aiming to fast-track an ambitious $40 billion transport investment program (see "green initiatives" below). In policy areas the city scores well for its efforts to make the city fleet greener.

Green initiatives: Los Angeles's voters approved a general half-cent local sales tax in 2008 to raise $40 billion over a 30-year period to fund public transport improvements. Under the city's subsequent 30/10 plan, awaiting approval from the US House of Representatives, the 30-year timetable is trimmed to ten years. The 30/10 plan is based on borrowing federal funds upfront, using future sales tax revenue as collateral. The city estimates the 12 transport projects included in the plan will increase transit boardings by 77 million and reduce vehicle miles traveled by 191 million. Furthermore, in 2011 the mayor's office, in conjunction with LADWP, unveiled the Electric Vehicle Pilot Program. To encourage the purchase and use of electric cars the city is offering rebates of up to $2,000 for the first 1,000 applicants to defray the costs of electric vehicle home chargers and installation. City officials say they hope to expand the rebate program to provide between 3,000 and 5,000 home chargers.

Water: 13th, 81.7 points

Los Angeles has one of the most efficient water distribution systems in the Index, losing just 5% of water supply to leaks, compared with a much higher 13% Index average. Among mid-income cities only Chicago and Denver boast more efficient water systems than Los Angeles. Policy areas are also strong. Main water sources are monitored for quality and supply levels, and water conservation is vigorously promoted (see "green initiatives" below). LADWP reports that its single-family residential customers used 24% less water in February 2011, on average, compared with the same month in 2007. Nonetheless, water consumption per capita, at 187 gallons per day, is considerably higher than the Index average of 155 gallons, but high water consumption is a common feature of high-temperature cities.

Green initiatives: A water fixtures ordinance introduced in 2009 mandates the installation of high-efficiency toilets and faucets in all new buildings. The city estimates this measure will save 20 billion gallons of water over a ten-year period. The LADWP also restructured its water rate system in 2009 to increase rates for heavy users. An update to the city's water conservation ordinance in 2010 restricted lawn watering when water levels are low. Cleaning sidewalks and washing cars during droughts is also prohibited unless an automatic shut-off nozzle is used.

Waste: Third, 81.9 points

Los Angeles records its highest rank in waste. The city already recycles 62% of its municipal waste, the second highest rate in the Index, and has set a target to increase that rate to 70% by 2015. Los Angeles also scores well on policy. It is marked up for its facilities to treat different types of waste (recyclable, hazardous and industrial) and for reducing reliance on landfills. Further measures to reduce waste creation could improve the city's ranking in this category even more.

Green initiatives: The Renew LA program, started in 2006, aims to divert more than 90% of the city's waste from landfills by 2025 and sets a long-term goal of zero waste. Aside from recycling, the city is developing waste-to-energy projects to achieve the 90% target and various technologies are under consideration. Renew LA calls for a waste-to-energy processing capacity of 14,500 tons per day by 2025.

Air: Fifth, 88.7 points

Los Angeles's strong rank in the air category is all the more impressive when measured against other large-area cities, which tend to place in the bottom half of the Index in this category. Annual per capita emissions of all the pollutants measured in the Index are well below average in Los Angeles. The city does particularly well in sulfur dioxide and particulate matter – the city ranks in the top five for both indicators. While it drops down to tenth for nitrogen oxides, Los Angeles's emissions of 55 pounds per person are still considerably lower than the Index average of 66 pounds. The city's impressive performance in this category can be attributed to a robust set of policies aimed at improving air quality over the past decade. Programs include the transition to vehicles running on alternative fuels and the implementation of an Automated Traffic Surveillance and Control System to reduce idling time, among others.

Green initiatives: The ports of Los Angeles and Long Beach account for 20% of toxic air emissions in the south coast air basin. Largely by replacing dirty-fuel trucks that service the ports with cleaner-fuel vehicles, the city aims to reduce emissions of particulate matter 45% below 2006 levels by the end of 2011. Nitrogen oxides and sulfur dioxide emissions in the port areas are targeted to fall 47% and 52%, respectively, over the same period. Los Angeles also provides electric power to berthed ships in harbor, eliminating the need for engine idling.

Environmental governance: Fifth, 94.4 points

Los Angeles ties Houston and Philadelphia in environmental governance. The city's score is bolstered by the presence of a dedicated environmental authority and the setting of environmental targets, after conducting a baseline review. Los Angeles also publishes regular environmental reports and involves citizens in the decision-making surrounding large projects that have an environmental impact. The city could improve its rank by providing citizens with a central contact point for environmental complaints and enquiries rather than directing all enquiries to the general city hotline.

Green initiatives: To ensure private sector participation in the city's environmental goals, in 2009 Los Angeles approved a Green Business Certification Program. The program, which is still in the planning phase but is expected to be rolled out by summer 2011, will provide businesses with information on how to adopt sustainability practices and award "certified green business" seals in order to help meet the city's environmental goals.

Quantitative indicators

Category	Indicator	Average	Los Angeles	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**162.0**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**8.0**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.17**	2009	Mixed	California Energy Commission; US Bureau of Economic Analysis	Scaled county level data to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**26.7**	2009	Mixed	California Energy Commission; US Census Bureau	Scaled county level data to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**7.9**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**8,207.6**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**1.9**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**9.7**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using city area
	Annual vehicle revenue miles (miles/person)	24.4	**14.1**	2009	Metro-area	National Transit Database	Using MSA population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**2.5**	2009	Metro-area	National Transit Database	Using city area
	Average commute time from residence to work (minutes)	28.9	**27.9**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**62.0**	2006	City	Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**187.0**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**5.3**	2009	City	Los Angeles Department of Water and Power	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**55**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**14**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**5**	2005	County	EPA; US Census Bureau	Using county population

Miami

US and Canada Green City Index

With only 35 square miles of area, Miami is the smallest city in the US and Canada Green City Index. However, because Miami has a rather large population, at 433,000, it is considered a high-population-density city in this study. The city has the eighth lowest GDP per capita in the Index, at $39,500, based on one of the most services-oriented economies among the 27 cities. Miami has developed considerably in recent years and officials predict that the city will add at least 50,000 residents by 2020. Despite this expansion, Miami has managed to preserve historical areas and also assist the state government in protecting the nearby Everglades wetlands. Nevertheless, because many of the services provided to Miami residents, including public transport, are administered by the Miami-Dade County government, city officials have not attained the same level of achievement or taken as active a role as their peers in initiating environmental programs and policies. The data for Miami came from the city and the wider metropolitan area, which has a population of 5.5 million.

Miami ranks 22nd overall in the Index. Its strongest performance is in the CO_2 category, where it ranks second, likely owing to the lack of industry in the area. Given the size of Miami and local leaders' sensitivity to using the city's land effectively, it is perhaps not surprising that Miami also performs well in the area of land use, where it places tenth. The city places in the bottom half of the Index in other categories. Waste remains a challenge – the city is one of three in the Index that have not implemented more sustainable local waste management practices, including composting and converting waste by-products to energy. Buildings also present opportunities for improvement. Despite the municipal government's limited role in some areas of decision-making, regarding for example transport, water treatment and air quality, Miami has demonstrated an awareness of environmental issues and intention to make improvements in the areas where it has capacity to act.

CO_2: Second, 90.1 points

CO_2 is Miami's best category performance. The city emits 166 metric tons of CO_2 per $1 million of GDP, compared with the Index average of 296. The city's per capita CO_2 emissions levels likewise outperform the Index average, at 9.3 metric tons per person compared with 14.5. These figures not only reflect the lack of industry in Miami, but also result from a utility sector that operates cleaner, newer power plants that have contributed to a reduction in greenhouse gas emissions from electricity in recent years.

Green initiatives: The city conducted a greenhouse gas emissions inventory in 2008 and set a target to reduce emissions by 25% from 2006 levels by 2020, and reduce government-related emissions 25% by 2015. The municipal government has announced plans to offer free compact fluorescent bulbs to city residents, retrofit outdoor city-owned lighting and perform energy audits on all large city government buildings, but has not yet rolled out these initiatives.

Energy: 19th, 61.5 points

Although ranked in the lower half of the Index in the energy category, Miami has the second best electricity consumption, on a per unit of GDP basis, among Index cities. It consumes only 75 gigajoules per $1 million of economic output, compared with the Index average of 332. This reveals the extent to which Miami is unburdened by the energy intensive impact of an industry-oriented economy. Per capita energy consumption, at 38 gigajoules per person, is also better than the Index average of 52. As the hottest city in the Index, most of Miami's energy is consumed by buildings as electricity, perhaps explaining why some of the city's green incentives in this area (see "green initiatives" in the buildings category, below) pertain to improving energy efficiency in buildings.

Green initiatives: As part of its 2008 MiPlan: City of Miami Climate Action Plan, Miami has committed to reducing its greenhouse gas output by 429,000 metric tons annually, mainly by using more renewable energy and more local sources of power (the latter help cut energy losses during transmission and delivery). While there aren't any major renewable projects in the city currently, the municipal government has installed four demonstration solar panels in the city hall building. It has also retrofitted the building's lighting to make it more energy efficient, which has led to a 9% increase in energy efficiency. The city uses approximately $2.8 million in federal Energy Efficiency and Conservation Block Grant funding to retrofit 16 municipal buildings to improve energy efficiency.

Land use: Tenth, 59.2 points

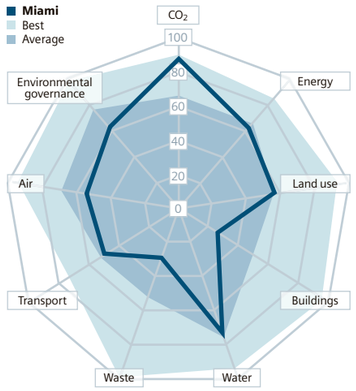
Although Miami's parks budget is relatively modest, the city has still managed to introduce several programs such as tree planting and green space improvement and expansion. These policies will, if effective, help Miami increase the amount of green space it has from its current 6% of total area, which is half the Index average of 12%. Miami performs well in terms of density, at 12,400 people per square mile compared with the Index average of 8,100, and is the only low-population city in the Index to be classified as a high-density city, owing to the small administrative area it covers.

Green initiatives: Miami has established a brownfield and land revitalization initiative, extending several financial and legal benefits to developers who clean up contaminated sites, including low-interest loans and tax credits on building materials. The county government also offers economic incentives for brownfield clean-up and development, including tax credits, low-interest loans, administrative-fee waivers and insurance. One of the main green initiatives is the Eastward Ho! Corridor, a 115-mile expanse of land stretching across three counties that contained more than 2,100 contaminated sites when the program began in 1995. To date, the partner governments have formulated community outreach strategies, initiated environmental assessments and secured over $190 million in investment to clean up more than 260 of the sites.

Buildings: 23rd, 26.7 points

The city has relatively few buildings certified by Leadership in Energy and Environmental Design (LEED), at only 0.9 per 100,000 people, compared with the Index average of 6.4. It also seems to lack a coherent set of policies aimed at addressing building performance, such as incentives to retrofit or mandatory energy auditing. Buildings are an area where Miami has room for improvement, though it will likely continue to face the challenge of limited resources and need to depend, at least in part, on county-level initiatives in this area. Given the large amount of development going on in Miami, beginning by addressing energy efficiency with developers may be the city's best bet for making progress in buildings.

Green initiatives: As part of the city's 2010 Miami 21 program, it started requiring all public



Background indicators

Total population [1]	433,000
Administrative area (miles^2) [1]	35
GDP per person (real) (US$) [2]	39,500
Temperature (24-hour average, annual) (°F) [1]	77
Goods employment (%) [2]	9
Services employment (%) [2]	91

Geographical basis: 1) City, 2) MSA

buildings over 5,000 square feet and other buildings over 50,000 square feet to comply with LEED silver requirements. This follows a 2008 ordinance requiring all city departments to only buy energy-consuming products that meet Energy Star energy efficiency requirements, a federal government standard. In 2008 the city also pledged to reduce emissions from buildings by 975,000 metric tons, or roughly 20% from 2006 levels, by 2020. There are several county and state-level rebates and tax credits available for homeowners and businesses for energy efficient retrofits for buildings. Also to facilitate energy efficiency improvements, Miami passed an ordinance allowing for expedited permitting for LEED silver-certified buildings. And in 2011 the city will start construction on its Miami Green building, which will serve as a green building resource center for the community, providing educational events and a showcase for green technologies.

Transport: 14th, 51.2 points

The city offers only 0.4 miles of public transport per square mile, compared with the Index average of 1.1 mile. Likewise, the number of public transport vehicles available per square mile, at about four, is below the Index average of nine vehicles. This reveals the extent to which Miami transport largely depends on personal automobiles, a fact that is reflected in high congestion levels. However, Miami still performs slightly better than the Index average for commute times, at 27 minutes compared with 29 minutes. Currently only 6% of Miami workers travel by public transit, bike or foot compared with the Index average of 13%. Still, compared with other high-temperature cities, which tend to have poor rates of public transport usage, Miami outperforms in terms of the percentage of residents that use public transit, and performs well against other low-population cities for public transit availability.

Green initiatives: Under its climate action plan, Miami has committed to reducing greenhouse gases associated with transport by 565,000 metric tons, or approximately 12% from 2007 levels, by 2020. To do this, the city aims to reduce the number of vehicle miles traveled, increase fuel efficiency and the use of alternative fuels, and promote alternative transportation. The city has eliminated high-occupancy vehicle (HOV) lanes on one major expressway and converted them into high-occupancy toll (HOT) lanes, which charge tolls for solo drivers at busy times. The city has used revenues from the HOT lanes to roll out bus rapid transit on a limited basis. After HOT lanes were initiated in 2008, bus ridership rose 30%. In October 2009 the city adopted its first "Bicycle Master Plan" to become more bicycle friendly. Additionally, Miami currently uses 10% biodiesel fuel for its non-emergency fleet and plans to increase this to 20%.

Water: 17th, 78.2 points

Miami has only 8% of leakages in its water distribution system, which compares favorably with the Index average of 13%. The region is prone to storms that can overwhelm the wastewater system and make sewer overflows difficult to avoid. Miami's direct authority in the area of water management is limited by the fact that the city has awarded Miami-Dade County responsibility in delivering water services to city residents. However, municipal officials have a record of strong policymaking in terms of effective water use, promoting water conservation and improving stormwater management. Miami's score in this category is constrained by high water consumption. The city consumes 173 gallons of water per person per day, considerably more than the Index average of 155 gallons.

Green initiatives: City officials approved a broad series of water-related goals in 2007, including better resource management, planning, conservation and pollution prevention, but it is unclear how much progress has been made. At the county level, since 2007 Miami-Dade County has had water-related regulations for new construction, including water-efficient landscaping and other conservation measures.

Waste: 23rd, 28.4 points

Miami's performance in this area is weighed down by a lower than average recycling rate and some weaknesses in waste management policies. The city recycles an estimated 18% of municipal waste, compared with the Index average of 26%. This estimate is based on Miami-Dade County statistics, because data for the city of Miami alone is not reported. While it has a curbside recycling program (see "green initiatives" below), Miami is one of three cities in the Index that does not yet appear to have taken substantial steps towards implementing more sustainable, non-landfill waste treatment such as composting or converting waste to energy, which weighs on its score.

Green initiatives: Miami has a curbside recycling program available to all single family homes and for apartment buildings with up to three residential units, or roughly 69,000 homes citywide, or about 42% of neighborhoods. The city's Solid Waste Department provides eligible homes with bins, in which residents can place all recyclable materials, regardless of type. Larger apartment blocks and all businesses in the city must contract private providers for recycling.

Air: 21st, 57.8 points

In terms of pollutants, the city ranks slightly better or on par with the Index averages, with 54 lb of nitrogen oxides per person annually versus the Index average of 66 lb, 18 lb per person versus the average of 25 lb for annual particulate matter emissions, and 22 lb per person annual sulfur dioxide emissions, equal to the average. The city's residents are highly dependent on automobiles, which affects pollution levels.

Green initiatives: The city does not have any specific programs to address air quality and compliance with federal Environmental Protection Agency regulations is administered by Miami-Dade County. The county government has some measures to combat air pollution, including restricting the sale and purchase of refrigerant products.

Environmental governance: 21st, 62.2 points

Due to the limited role that municipal government plays, Miami has not made as much progress as Index leaders on formulating environmental strategies and implementing policies aimed at improving environmental performance. However, the city has taken some steps by reporting its environmental performance publicly, establishing a dedicated environmental authority, and engaging and securing the support of the mayor. Going forward, the test for Miami will be how to creatively use its resources and administrative capabilities to effectively rally public support and achieve quantifiable improvements in environmental governance.

Green initiatives: Miami's municipal government established the Office of Sustainable Initiatives in 2007 to coordinate the city's environmental programs and improve environmental performance. Countywide, the Environmental Education Program of Miami-Dade County, founded in 1997, is a consortium of local non-profit organizations, government agencies and schools that provides training and workshops throughout the year, and publishes environmental information on its website.

Quantitative indicators

Category	Indicator	Average	Miami	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**165.8**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**9.3**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.08**	2006	City	City of Miami; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**37.9**	2006	City	City of Miami; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**6.3**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**12,375.3**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**0.9**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**5.9**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**21.8**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**4.5**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**26.7**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**18.0**	2009	County	Miami-Dade County Department of Solid Waste	
Water	Total water consumption per person per day (gallons)	155.1	**172.6**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**8.3**	2010	County	Miami-Dade County Water and Sewer Department	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**54**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**18**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**22**	2005	County	EPA; US Census Bureau	Using county population

Minneapolis

US and Canada Green City Index

Minneapolis is comparatively small both in terms of administrative area and population, spanning 54 square miles and with a population of only 390,000 residents. The city has a large manufacturing base and a number of the country's largest corporations are headquartered there. With a per capita GDP of $50,200, it is among the high-income cities in the US and Canada Green City Index. Minneapolis was one of the first cities in the US to incorporate environmental sustainability into city planning, which has encouraged other similarly sized cities in and outside of the region to follow suit. Often considered "one to watch" by environmentalists, prospects are good for continued environmental action in Minneapolis. The majority of data in the Index for Minneapolis are based on the metropolitan area, which has a population of 3.3 million. Minneapolis ranks 10th overall in the Index. Its strongest performance is in the land use category, where it places second, with almost one-fifth of its area given over to green space, and strong policies aimed at revitalization and public transit-focused development. Minneapolis also ranks in the top third of the Index in several other categories, including energy, water, waste, transport and environmental governance. The city has not only developed a comprehensive environmental strategy, but has also taken action to implement policies aimed at improving areas where it has direct municipal control, such as water, waste and transportation infrastructure. Minneapolis has a seemingly inconsistent performance in managing air pollution, but has already taken action to address these issues – persuading the local utility to undertake voluntary efficiency improvements, for one, which few other cities have been able to do.

Background indicators

Total population [1]	390,000
Administrative area (miles^2) [1]	54
GDP per person (real) (US$) [2]	50,200
Temperature (24-hour average, annual) (°F) [1]	45
Goods employment (%) [2]	14
Services employment (%) [2]	86

Geographical basis: 1) City, 2) MSA

CO_2: 23rd, 40.2 points

At 30 metric tons per person, Minneapolis's CO_2 emissions, generated from a variety of sources, including transport and the city's large manufacturing base, are the highest in the Index, and well above the Index average of 14.5 metric tons. Emissions per $1 million of GDP are similarly higher than average, at 543 metric tons, compared with the average of 296 metric tons. However, for reasons of data availability and comparability, the Index figures were taken from 2002 for all of the US cities in the Index, and in the meantime Minneapolis has benefitted from strong emissions policies. It has one of the best carbon emissions reduction strategies in the Index, and in 2005 the city persuaded the public utility to convert two large coal-fired power plants to natural-gas-fired combustion, lowering CO_2 and air pollution considerably. Figures released by the utility company show that CO_2 emissions at these plants dropped 13% between 2000 and 2006.

Green initiatives: In 2005 Minneapolis was one of the early cities to sign the US Mayors Climate Protection Agreement, which calls for cities to set a goal to reduce greenhouse gas emissions by 7% from their 1990 levels by 2012. In addition, the municipal government has committed to reducing its CO_2 emissions 17% by 2020, using 2006 as a baseline. To achieve this target, the city's climate change incentive program, which began in 2007, awards residents up to $10,000 for innovative and immediate energy-saving and cost-saving actions, such as building rooftop gardens or reducing energy in the home.

Energy: Seventh, 76.5 points

Minneapolis has the lowest electricity consumption per $1 million of GDP of all the Index cities, at 54 gigajoules, compared with the Index average of 332 gigajoules. The city also performs well in terms of electricity use per person, at 23 gigajoules, the second best figure in the Index, and well below the average of 52 gigajoules. Both figures are based on 2009 data. Minneapolis' strong performance in this area reveals the success of robust local initiatives to reduce energy consumption and increase efficiency. The city benefits as well from state-government-led initiatives, including a regulation requiring utilities operating in Minnesota to obtain 30% of their electricity from renewable resources by 2020. Minneapolis aims to do its part to support the statewide goal and has committed to increasing the city's share of renewable energy to 10% by 2014.

Green initiatives: In 2005 Minneapolis successfully lobbied the local public utility to transform two of its coal-fired power plants to natural gas. Completed in 2006, this project has been credited with reducing sulfur dioxide and nitrogen oxides emissions from power plants by over 90%. In another initiative, through a $2 million grant provided by the utility, the city built the largest urban solar array in the Midwest in November 2010. Comprising more than 2,600 solar panels atop the Minneapolis Convention Center, the project is expected to produce enough electricity to power the equivalent of approximately 85 homes, offsetting roughly 540 metric tons of CO_2 emissions.

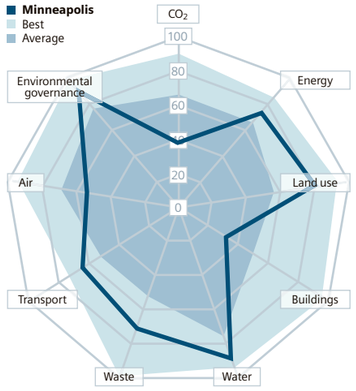
Land use: Second, 80.1 points

With residential use constituting over half of the city's area, Minneapolis has the third highest percentage of green space in the Index, at 20%, compared with the average of 12%, and it is by far the best performer among low-population Index cities. And despite its relatively small population and small area, Minneapolis's population density is among the mid-range for the Index, at 7,100 people per square mile, not far below the Index average of 8,100. The city's success with green space, as well as population density, is the result of proactive policies. It showed initiative early on with regard to brownfield revitalization, creating a task force in 1987 to respond to imminent neighborhood decline. More recently, in 2000 the city adopted a zoning code that encouraged high-density developments focused around public transportation.

Green initiatives: Since 1994 the city has cleaned up hundreds of brownfield sites while leveraging over $1 billion of private investment, according to its own reports. In addition, the city has introduced a more broadly defined Neighborhood Revitalization Program, created in order to improve residential areas, and bring residents and other stakeholders into the neighborhood planning process. By 2005 the city claimed it had spent $280 million on improving neighborhoods, and in a 2010 report set a further target to improve at least 100 sites by 2014, including beautification and landscaping efforts, neighborhood cleanups, and improvement of area pedestrian and bicycle paths.

Buildings: 18th, 37 points

Minneapolis performs close to the Index average when it comes to Leadership in Energy and Environmental Design (LEED)-certified buildings,



with 6.5 per 100,000 persons, compared with the average of 6.4. This figure has been helped by 2006 legislation mandating LEED certification (see "green initiatives" below). Room for improvement, however, remains. For example, Minneapolis does not require energy audits, and it only receives partial marks in the Index for energy efficiency standards in buildings or giving incentives for retrofits. The city has led by example though with small, but high-profile projects, such as installing a green roof on the historic City Hall and Courthouse building.

Green initiatives: In 2006 the city of Minneapolis required all new municipal buildings of 5,000 square feet or larger, as well as major renovations, to meet LEED silver-level requirements. The city also launched a project in 2010 to use more than $11.6 million in federal stimulus money to upgrade 725 single-family low-income housing units. The nature of the retrofits will be basic improvements, such as installing energy efficient appliances, boilers, water heaters and new thermostat-programming devices.

Transport: Seventh, 63.9 points

Minneapolis has the shortest commuting time of all the cities in the Index, at 24 minutes, compared with the Index average of 29 minutes. Although it is widely regarded as a bicycle friendly city, car reliance remains an issue. Only 8% of workers travel by public transit, bicycle or foot, compared with the index average of 13%. And, with only 0.5 miles of public transport per square mile, compared with the index average of 1.1, Minneapolis could improve its mass transit provision. Nevertheless, Minneapolis has made a strong commitment to alter residents' behavior by encouraging more public transit use and non-motorized transport. In recent years, the city has set a target to build 163 miles of new bike trails and has already nearly reached that goal; it also boasts a 12.3-mile light rail line that connects to the Minneapolis-St Paul International Airport, the Mall of America, Target Field and the Metrodome.

Green initiatives: The municipal government has initiated several programs to encourage residents to take greener forms of transport, including the Pedestrian Master Plan, Minneapolis Bicycle Program, Non-Motorized Transportation Pilot Program, and a bike sharing program. For these programs it has used local, state and federal funding, including a $21.5 million federal grant awarded to four communities nationwide. Some of the services these programs offer are enabling residents to purchase daily, monthly or yearly bicycle subscriptions from over 65 kiosks in downtown Minneapolis; utilizing bicycle lockers available downtown; and providing businesses and private buildings with bicycle racks, with the city paying half of the cost. Furthermore, over the past five years, the city has been converting all its High Occupancy Vehicle (HOV) lanes to High Occupancy Toll (HOT) lanes. These remain free of charge for HOVs but, when the lanes are underused, allow cars with single drivers to drive in them for a fee to reduce traffic congestion.

Water: Fourth, 88.2 points

Minneapolis is defined by the vast network of waterways – rivers, streams, lakes and wetlands – that surround it, and the city has a long history of taking initiative to improve its water management system. The city's history of proactive management and policies are demonstrated by consumption and leakage figures in the Index. It has a better than average per capita water consumption, at 124 gallons per person per day, versus the index average of 155. Minneapolis also performs better than the Index average for water leakages, at 6% compared with 13%.

Green initiatives: The city's main wastewater treatment facility is the largest in the state, and one of the largest in the country, treating more than three-quarters of the city's wastewater. Several improvements are planned through 2030, at an estimated cost of $3.8 billion, including upgrading to a $20 million processing system that will reduce air pollution and remove harmful chemicals such as mercury.

Waste: Fifth, 72.6 points

Minneapolis's recycling rate is better than the Index average, at 35% compared with 26%. The city has enacted several measures to encourage recycling and composting, including differential pricing based on how much waste is disposed. Minneapolis also claims to be the only city in the country to accept electronic waste from residents at no cost. To continue improving performance in this area, the city has formulated strong waste reduction policies, such as setting a target to increase recycling and compost volumes from 35% to 50% by 2013, with 10% coming from composting.

Green initiatives: Minneapolis has extended its recycling program to all municipal residents in dwellings with fewer than four units, which represents roughly 33% of the total municipal population, according to the city's recycling coordinator. The cost of the city's recycling program is covered by garbage collection fees.

Air: 22nd, 57 points

Pollutant levels in Minneapolis are much higher than the Index averages. Nitrogen oxides, at 126 lb per person, are the highest in the Index and almost double the Index average of 66 lb. However, as with CO_2 emissions, the city has strong policies in place to address the issue of pollution. Already, Minneapolis has demonstrated intentions to improve air quality by setting air quality targets consistent with the recommendations of the federal Environmental Protection Agency's Clean Air Scientific Advisory Committee and the state health guidelines. And municipal authorities have set a target to reduce all monitored air toxins to levels within the state health guidelines by 2015. According to a Minneapolis environmental report issued in 2010, in the five years since the US Census Bureau statistics used in the Index were recorded, air pollutant levels have declined, although they remain a challenge.

Green initiatives: In 2010 the city said it had reduced fuel use in its municipal fleet by 14,000 tons, increased the number of hybrid vehicles by 9%, and added 45 hybrid-electric buses to its fleet in 2008. This brought the total number of hybrid-electric buses to 67, roughly 8% of the fleet.

Environmental governance: Eighth, 93.3 points

Having decided early to take action on environmental issues, Minneapolis has carved out a niche for strong leadership, not only compared with other cities with similar demographics, but also compared with larger, wealthier cities. Although the city places eighth, its high score illustrates that Minneapolis is a leader in environmental governance. The city has a well-defined environmental strategy that includes specific targets; an annual reporting structure; a dedicated environmental authority; public aware-ness-raising campaigns; and a robust degree of citizen engagement and overall transparency.

Green initiatives: Minneapolis has established a Citizen's Environmental Advisory Committee to advise the city on its environmental and sustainability initiatives. The committee includes two citizens, two representatives from environmental advocacy groups, two environmental technical experts, two representatives from industry, and representatives from the Minneapolis School and Hennepin County boards. The committee discusses issues of environmental concern and makes recommendations to city officials on programs or actions that can be taken to improve Minneapolis's overall environmental performance.

Quantitative indicators

Category	Indicator	Average	Minneapolis	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**542.9**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**30.0**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.05**	2009	City	City of Minneapolis; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**23.3**	2009	City	City of Minneapolis; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**19.5**	2008	City	City of Minneapolis	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**7,136.6**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**6.5**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**7.9**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.5**	2009	Metro-area	National Transit Database	Using city area
	Annual vehicle revenue miles (miles/person)	24.4	**13.4**	2009	Metro-area	National Transit Database	Using MSA population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.5**	2009	Metro-area	National Transit Database	Using city area
	Average commute time from residence to work (minutes)	28.9	**24.3**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**34.9**	2009	City	Minneapolis Solid Waste and Recycling Department	Residential waste only
Water	Total water consumption per person per day (gallons)	155.1	**123.6**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**6.0**	2009	City	City of Minneapolis	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**126**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**36**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**34**	2005	County	EPA; US Census Bureau	Using county population

Montreal

Background indicators

Total population [1)]	1.6 million
Administrative area (miles^2) [1)]	141
GDP per person (real) (US$) [2)]	31,500
Temperature (24-hour average, annual) (°F) [1)]	43
Goods employment (%) [2)]	20
Services employment (%) [2)]	80

Geographical basis: 1) City, 2) CMA

Montreal is the largest city in the French-speaking province of Quebec, and with 1.6 million people it is the second largest city in Canada and the sixth largest city in the US and Canada Green City Index. Montreal's metropolitan area expands beyond the Island of Montreal to include 3.6 million people, and a mix of city and metropolitan area data are used for this Index. Although Montreal is the financial hub for Quebec, the city remains relatively industrial, boasting one of the largest inland ports in the world. In total, goods make up 20% of employment, the fourth largest percentage in the Index. Additionally, although Montreal is the economic capital of Quebec, Montreal's GDP per capita is the lowest in the Index at an estimated $31,500.

Montreal ranks 19th overall in the 27-city Index. The city's strongest category is transport, where it places fourth, a performance due mainly to having the second highest percentage of non-automobile commuters in the Index. Montreal's overall score is in part a result of its low income and limited funding for environmental initiatives. However, Montreal fares better compared with other low-income cities in the Index, ranking fifth out of 11 cities in this bracket. It is in the top half of the group of low-income cities for all but two categories, energy and water.

CO_2: Tenth, 80.1 points

The city has among the lowest per capita CO_2 emissions in the Index, at 8.5 metric tons per person compared with the Index average of 14.5 metric tons. Although Montreal belongs to the group of low temperature cities in this Index and requires more power for that reason, it derives almost all of its electricity from hydropower, which greatly reduces its carbon output. In terms of emissions per unit of GDP, though, Montreal's low income hurts its score. The city emits an estimated 268 metric tons of CO_2 per $1 million of GDP, but this is still slightly better than the Index average of 296. Montreal has made commitments to reduce emissions further (see "green initiatives" below).

Green initiatives: As part of the Municipal Leaders Summit on Climate Change held in December 2005 in Montreal, the city agreed to reduce greenhouse gas emissions by 30% by 2020 from 1990 levels. As a first step in this direction, in 2007 Montreal adopted a plan to reduce greenhouse gas emissions by 20% by 2012. Specific measures include reducing dependence on cars by encouraging public transit and bicycling alternatives, reducing greenhouse gas emissions from buildings, and public awareness campaigns on climate change targeted at residents and employees.

Energy: 26th, 33.8 points

Montreal's rank in this category is driven in part by per capita electricity consumption of 68 gigajoules per person compared with the Index average of 52 gigajoules, but primarily by electricity consumption per unit of GDP, which at 956 gigajoules per $1 million of GDP is nearly three times the average of 332 gigajoules. Montreal is the second coldest city in the Index, resulting in high energy usage during winter months. The city's energy policies also have room for improvement. It does not appear to have incentives in place to encourage local energy production, for example; however, with 97% of electricity for the city and surrounding province supplied by renewable hydropower, there is less reason for Montreal to establish its own programs. On the other hand, Montreal runs a clean energy program and pilot projects in solar and geothermal power (see "green initiatives" below).

Green initiatives: Fonds Energie is a $3 million city-run investment program to finance energy efficiency and clean energy projects in municipal districts. Eight projects, including energy efficiency retrofits and clean energy heating systems, have received $2 million in backing since 2008. The projects have combined to eliminate the equivalent of nearly 800 tons of CO_2, and the program has won a national award for municipal climate change and poverty reduction programs. Montreal has begun pilot projects to implement solar and geothermal energy in municipal buildings. These projects aim to establish standard specifications to allow the city to increase the use of renewable energy on municipal property. Montreal promises to complete at least one renewable energy project annually for the next three years in city buildings.

Land use: 12th, 57.7 points

Like other island cities such as New York and Vancouver, Montreal has a favorable population density, with 11,500 people per square mile (4,400 people per square kilometer) compared with the average of 8,100 people per square mile (3,100 people per square kilometer). Montreal also has a considerable share of green space, at 19% compared with the Index average of 12%, placing it among the top five cities in this indicator. Despite these statistics, Montreal's land use policies are less developed than those of most of its peers in the Index. While it is seeking to increase its amount of green space (see "green initiatives" below), the city is one of only five that does not have a tree-planting policy.

Green initiatives: In 2010 the city set a goal to increase the percentage of green space from about 19% to 25% by 2025. As part of this goal, Montreal has created 10 "ecoterritories", special zones of protection for natural areas. It is also creating promenades through the city's most densely populated sections and reassessing potential threats to green space such as plant infestations resulting from warming temperatures. Another initiative, Revi-Sols, is a brownfield rehabilitation program that helps property owners and developers pay to clean up sites by contributing up to half of the costs. Since 1998 the program has subsidized clean-ups for 132 development projects in Montreal, covering nearly 509 acres.

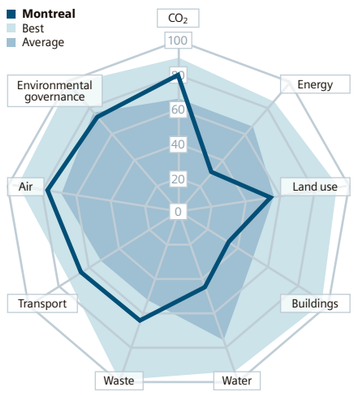
Buildings: 19th, 36.4 points

Montreal has 1.7 buildings per 100,000 people certified by Leadership in Energy and Environmental Design (LEED) compared with the Index average of 6.4, although a recent law (see "green initiatives" below) is likely to lead to increases in LEED certification for both new and renovated buildings. Montreal has limited authority in mandating energy efficiency audits or regulations, but the provincial government runs buildings-related programs, such as offering up to $1 million in financial incentives for companies that improve the energy efficiency of their buildings.

Green initiatives: From 2010 Montreal has required LEED gold certification for all new public buildings of more than 500 square meters and LEED silver certification for all major renovations to public buildings. To be certified, buildings must meet minimum requirements for energy savings, water efficiency, CO_2 emissions reduction and improved indoor environmental quality.

Transport: Fourth, 65.3 points

Transport is Montreal's strongest category. Montreal's public transit system in general is one of the best in the Index. It has the sixth longest system, at 2.1 miles per square mile (1.3 kilometers per square kilometer), compared with the Index average of 1.1 miles (0.7 kilometers), and the city has 18 public vehicles available per square mile (7 vehicles per square kilometer), double the average of nine vehicles per square mile



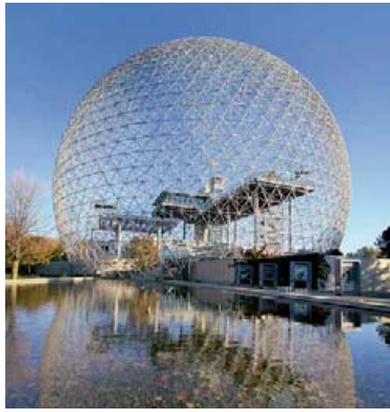
(3.5 vehicles per square kilometer). While the city's average commute time is longer than normal due to long commutes from elsewhere in the metropolitan area onto the island, the city's high population density ensures efficient transport once in the city of Montreal. The city's high score is also driven by having the second highest share of non-automobile commuters – 29% of workers commute by public transit, bicycle, or on foot, more than double the Index average of 13%.

Green initiatives: Montreal introduced Canada's first self-service bicycle rental network, BIXI, in 2009. With 5,000 bicycles and 400 docking stations, it is currently the largest bicycle share program in North America. Also, Montreal created a transportation master plan in 2008 as part of a wider strategy to address sustainability. The plan aims to implement 21 initiatives by 2018, including a downtown tramway system, upgrades and extensions to the subway, a rail line to the airport, a bus rapid transit system and priority bus lanes, doubling the length of the city's bicycle paths, and improving walkability in the downtown. Finally, Montreal is buying high-fuel-efficiency diesel buses as well as hybrid buses, and plans to have an entirely electric bus fleet by 2025.

Water: 26th, 47.2 points

Montreal has both the highest water distribution leakage rate, at 35% compared with the Index average of 13%, and the highest per capita water consumption, at 293 gallons (1,110 liters), compared with the average of 155 gallons (587 liters). The two statistics are linked. One major cause of Montreal's high water consumption figure is leakage and that means nearly half of the water is not actually "consumed." The city promotes water conservation, but until the city's aging pipes are replaced, it will continue to produce high rates of leaks and, correspondingly, consumption.

Green initiatives: In 2002 Montreal began installing water meters at all businesses and public institutions such as schools and hospitals, and aims to have installed 30,000 meters by 2013. Though meters are not required for residences, the city is raising public awareness of water conservation in homes, including sending teams of students to deliver door-to-door water conservation messages. In 2008 Montreal passed a bylaw requiring a permit for industrial facilities to dispose of wastewater into the city's treatment system. In 2008 more than 760,000 cubic meters of wastewater was properly treated and discharged into the sewer system – 40% more than in 2007.



Waste: Ninth, 63.7 points

The city is above average in recycling, with a 34% recycling rate compared with the Index average of 26%, driven by extensive recycling facilities available to the public, including separate facilities for hazardous materials such as batteries or paint. Montreal also has a comprehensive waste reduction plan (see "green initiatives" below) and is making efforts to convert waste to energy, although these programs are still in the pilot stage.

Green initiatives: Montreal has a comprehensive plan to increase the amount of total waste recovered through recycling and composting from 31% in 2008 to 80% by 2019. The city's commitments include banning single-use water bottles in municipal buildings, replacing plastics used in city food banks, offering organic waste collection to all residents, and building new composting centers. In another initiative, in 2008 Montreal put together a database of waste materials that can be converted into works of art and began connecting donors with artists. To highlight these efforts, the city has hosted eco-designer bazaars in which eco-designers can sell and demonstrate works of art made from these materials.

Air: Eighth, 79.5 points

The city ranks slightly better than the averages for the three pollutants evaluated in the Index. It emits an estimated 57 lb (26 kg) of nitrogen oxides per person, compared with the Index average of 66 lb (30 kg); 18 lb (8 kg) of particulate matter per person, compared with the average of 25 lb (11 kg); and 10 lb (5kg) of sulfur dioxide per person, compared with the Index average of 22 lb (10 kg). While these figures are estimates, one of Montreal's chief efforts recently has been to improve measurement of air pollutants, ensuring greater accuracy in the coming years and helping improve both residential and commercial pollution.

Green initiatives: In 2008 Montreal authorities adopted an action plan aiming to counter pollution caused by wood heating, a major source of residential air pollution in the city. The plan contained new regulations on burning and a public awareness campaign.

Environmental governance: 20th, 74.4 points

Although the city has a strong environmental strategy complete with ambitious targets and fully backed by the mayor, it is less open about reporting its environmental statistics. However, the city has run programs in the past to raise general awareness of environmental issues among city residents.

Green initiatives: Montreal's Community Sustainable Development Plan 2010-2015 was developed in collaboration with over 180 partner organizations, including civil society. The plan calls for the reduction of greenhouse gas emissions, the responsible management of natural resources, the adoption of sustainable development practices in industry, business and institutions, and the protection of biodiversity and green spaces. Additionally, Montreal offers training to help citizens better manage their household waste, and informational sessions on climate change for organizations involved in environmental protection. City officials have also taught college-level courses on environmental issues, and city employees have trained almost 1,000 students and food handlers on sustainable practices.

Quantitative indicators

Category	Indicator	Average	Montreal	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**268.5**	2006	City	City of Montreal	Using estimated city GDP
	CO_2 emissions per person (metric tons)	14.5	**8.5**	2003	City	City of Montreal	Using city population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.96**	2009	City	City of Montreal	Using CMA GDP
	Electricity consumption per person (GJ)	52.2	**67.6**	2009	City	City of Montreal	Using city population
Land use	Green spaces as % of total area (%)	11.9	**18.5**	2006	City	City of Montreal	Using area of city in 2006
	Population density (persons/miles^2)	8,106.8	**11,496.1**	2006	City	Statistics Canada	Equivalent in metric units: 4,439 persons/km^2
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**1.7**	2010	City	CaGBC LEED Database	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**28.8**	2006	CMA	Statistics Canada	
	Length of public transport (miles/miles^2)	1.1	**2.1**	2009	Metro-area	Société de Transport de Montréal	Using city area; Equivalent in metric units: 1.3 km/km^2
	Annual vehicle revenue miles (miles/person)	24.4	**24.3**	2010	Metro-area	Société de Transport de Montréal	Using CMA population; Equivalent in metric units: 39.1 km/person
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**18.0**	2010	Metro-area	Société de Transport de Montréal	Using city area; Equivalent in metric units: 7.0 vehicles/km^2
	Average commute time from residence to work (minutes)	28.9	**38.0**	2005	CMA	Statistics Canada	
Waste	Recycled municipal waste (%)	25.8	**34.0**	2009	City	City of Montreal	
Water	Total water consumption per person per day (gallons)	155.1	**293.1**	2010	City	City of Montreal	Using city population; Equivalent in metric units: 1,109.5 liters
	Water leakages in water distribution system (%)	12.8	**35.0**	2009	City	City of Montreal, Division of Public Affairs	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**57**	2009	City	Environment Canada, Statistics Canada	NO_x from non-industrial, mobile, and waste sources. Data point has been scaled-down from provincial level by proportion of GDP represented by Montreal; Equivalent in metric units: 26 kg
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**18**	2008	City	Environment Canada, Statistics Canada	PM10 from non-industrial, mobile, and waste sources. Data point has been scaled-down from provincial level by proportion of GDP represented by Montreal; Equivalent in metric units: 8 kg
	Sulfur dioxide emissions per annum (pounds/person)	22	**10**	2008	City	Environment Canada, Statistics Canada	SO_x from non-industrial, mobile, and waste sources. Data point has been scaled-down from provincial level by proportion of GDP represented by Montreal; Equivalent in metric units: 5 kg

New York City

US and Canada Green City Index

Background indicators

Total population [1]	8.4 million
Administrative area (miles^2) [1]	303
GDP per person (real) (US$) [2]	56,900
Temperature (24-hour average, annual) (°F) [1]	55
Goods employment (%) [2]	9
Services employment (%) [2]	91

Geographical basis: 1) City, 2) MSA

New York City is the largest city in the US, and with 8.4 million residents in the city proper it is by far the largest in the US and Canada Green City Index. Indeed, with some 19 million people in the metropolitan area, New York is one of the most populous cities in the world, although this analysis is largely based on city indicators. The city is the economic powerhouse of North America and boasts a GDP per person of $56,900. A global financial and business capital, New York's economy is 91% service based. In addition to the dominant role that finance and insurance play in the local economy, the city is also a major hub for media and the arts. New York's population and wealth make it unique within this Index, as does its population density – four of the city's five boroughs are on islands, constraining its lateral growth.

New York ranks third overall in the Index. It is the top ranking city in land use, transport and environmental governance, and finishes third in the CO_2 and air categories. In particular, New York has by far the highest population density and percentage of workers commuting by public transport, bicycle, or by foot, while also producing top performances in several air and water indicators. While the city's high rankings stem in part from its enormous population, which produce favorable per capita scores, New York also fares well in comparison to other large cities in the Index. Measured against large cities, New York ranks first in every category except for waste and energy. Additionally, New York has one of the highest percentages of green space, belying its population density.

CO_2: Third, 89.4 points

New York ranks well both in terms of CO_2 emissions per capita and CO_2 emissions per unit of GDP. With emissions of 145 metric tons of CO_2 per $1 million of GDP, the city has the second lowest levels in the Index and is well below the Index average of 296 metric tons. Likewise, New York's per capita emissions are 8.6 metric tons versus the Index average of 14.5. The city's strong CO_2 performance is a reflection of its efficient transportation network and a comparatively low use of coal in its energy mix. New York's CO_2 score is expected to improve further in the coming years as the city has set ambitious targets for emissions reductions (see "green initiatives" below) and the city's greenhouse gas reduction plan is rated as one of the best in the Index.

Green initiatives: Launched in 2007, New York's Long-Term Plan to Reduce Energy Consumption and Greenhouse Gas Emissions mandates a 30% greenhouse gas reduction for municipal facilities and operations by 2017 from 2006 levels. Around 50% of the reductions will come from efficiencies in buildings, 32% from improved power generation and 18% from transportation. The city has allocated $280 million for the plan, and has begun more than 200 projects, 80 of which have been completed. A further 118 projects currently in the pipeline will save the city an additional $29 million a year and reduce annual greenhouse gas emissions by an estimated 117,000 megatons of CO_2 equivalent.

Energy: 22nd, 53.8 points

This is New York's weakest category in the Index. The city consumes 500 gigajoules of electricity per $1 million of GDP, compared with an Index average of 332. On a per capita basis the city uses 65 gigajoules per person, once again more than the overall average of 52 gigajoules. New York's higher than average levels of consumption come despite high population density and an abundance of tall buildings, which tend to be more efficient (indeed, New York ranks seventh in the buildings category). Nonetheless, New York's thriving economy requires considerable energy, especially its vast financial services sector, which is one of the most energy intensive service industries. And although the city plans to offer tax incentives for solar power, and is piloting wave power and waste-to-energy projects, large-scale green and local energy projects so far remain limited.

Green initiatives: New York is conducting feasibility studies and streamlining permitting procedures for cogeneration – the use of a heat engine or a power station to simultaneously generate both electricity and useful heat – and has planned a 15-megawatt cogeneration plant. Additionally, New York is creating an online "solar map" that will enable residents to evaluate the potential for solar power production on the buildings in which they live and work.

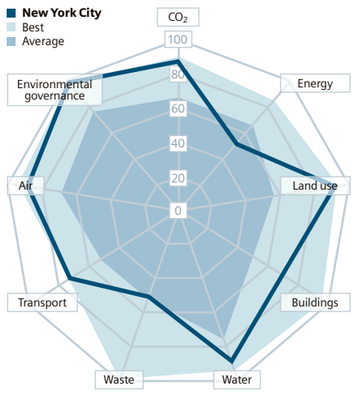
Land use: First, 93 points

Along with transport, this is New York's strongest category. New York is the most densely populated city in the Index, with 27,700 people per square mile, more than three times the average of 8,100 people. Yet, despite such a high population density, the city has also managed to maintain and develop green space – most notably Central Park, but also several other parks and coastlines throughout the five boroughs. With 20% of the city's area considered green space, New York ranks second overall, well above the Index average of 12%. As the city has shifted away from industrial production it has been active in promoting brownfield development, and New York's land use policies are among the best in the Index.

Green initiatives: The Million Trees Program created in 2007 aims to plant 1 million trees by 2017. New York is currently ahead of its goal, having planted an average of 19,000 street trees each of the past three years and planting in total over 430,000 trees in parks, open spaces and private backyards. Additionally, in 2010 New York created the Green Property Certification Program to do for brownfields what Leadership in Energy and Environmental Design (LEED) has done for green buildings. Certification under the program provides tangible evidence of the brownfield clean-up and can help developers market the environmental quality of their properties, much in the way that LEED has become a key selling point for buildings.

Buildings: Seventh, 68.7 points

New York's comparatively strong showing in the buildings category is a reflection of ambitious policies. New York, for example, is one of just three cities in the Index that requires energy



efficiency audits. It also mandates that new buildings meet energy efficiency standards, and offers incentives for energy efficiency retrofits, including targeted incentives for businesses. New York's buildings score is weighed down, however, by a low percentage of LEED-certified buildings. In an instance where the city's large population hurts its per capita indicators, New York has just 1.1 LEED certified buildings per 100,000 people, well below the average of 6.4.

Green initiatives: In December 2009 New York approved the Greener, Greater Buildings laws, the most comprehensive set of efficiency regulations in the US, which aim to reduce energy costs by $700 million annually by 2030. Together these measures ensure that the city's energy code applies to all public and private construction projects, require annual energy efficiency benchmarking, and mandate a set of cost-effective energy efficiency upgrades and evaluations of the city's largest buildings.

Transport: First, 76.6 points

New York's domination of this category is a result of the extensive subway and bus networks that span the city's five boroughs. The network measures 1.8 miles per square mile of city territory, well above the Index mean of 1.1 miles. High population density encourages walking and biking as well. Indeed, New York ranks first overall in the number of workers walking, biking or taking public transport to work – 37% of New Yorkers commute by means other than private car, a full eight percentage points above the second highest city, Montreal, and well above the Index average of 13%. New York also has the highest number of "annual vehicle revenue miles" (a measure of public transport supply), with 68 miles per person compared with an Index average of just 24. The city has the second highest number of public transport vehicles per square mile, at 45 vehicles, compared with the Index average of nine. Furthermore, New York's green transit efforts include the largest hybrid-electric bus fleet in the world, with 855 hybrid buses as of 2009.

Green initiatives: Green Light for Midtown, a pilot project launched in May 2009 that has now been made permanent, created expanded pedestrian plazas in Herald Square and Times Square. Overall, the program produced a 63% reduction in injuries to motorists, a 35% reduction in pedestrian injuries and a 7% improvement in taxi speeds. New York has also doubled the number of bicycle lanes in the city in the last three years and met its goal of building 200 miles of bicycle lanes ahead of schedule in 2009. In the last year, the city has seen bicycle commuting increase 26%.

Water: Third, 88.8 points

New York's strong placement in this category is driven by the city's low level of water consumption, at just 69 gallons of water per person per day, less than half the Index average of 155 gallons. The city's water policies have effectively curbed consumption levels, and these include incentives for installing low-flow appliances and discount water rates for buildings that use recycled water. New York's water leakage rate is 14%, just above the Index average of 13%, mainly due to an aging network, with some water mains more than 100 years old.

Green initiatives: As of 2010 the Department of Environmental Protection, which provides water services in New York, had installed over 278,000 automated meters and expects to install a total of 834,000 by January 2012. As a result of metering and water conservation promotion, New York's water consumption rate is now at its lowest in 50 years.

Waste: 16th, 53.1 points

This is one of New York's weaker categories. The city's score is bolstered by a better than average recycling rate, at 30%, compared to the Index average of 26%. Where the city lags, however, is in policies related to sustainable waste management. New York relies primarily on awareness campaigns rather than direct incentives for waste reduction.

Green initiatives: The Apartment Building Recycling Initiative allows tenants to volunteer to increase recycling in their building. Residents who volunteer for the program receive a site visit from staff who offer personalized recycling tips, as well as free materials to encourage all residents to recycle more.

Air: Third, 89.2 points

New York's placement in the air category is a reflection of low per capita emissions in all pollutants measured in the Index. New York emits 29 lb of nitrogen oxides per person each year, considerably less than the average of 66 lb, placing it at the top of the Index. Likewise, New York ranks first, along with Vancouver, with particulate matter emissions of 6 lb per person, well below the Index average of 25 lb. Sulfur dioxide emissions of 10 lb per person each year also come in below the 22 lb Index mean. While the city's service-based economy and low automobile usage are major contributors to the comparatively low levels of air pollution, policy efforts have also contributed to improved air quality. Indeed, New York aims to have the best air quality of any big city in the US.

Green initiatives: New York has sought to mandate the use of cleaner taxis and offer tax breaks to fuel-efficient taxis. While courts have blocked the city from introducing these measures thus far, in anticipation of future requirements almost 25% of the city's 13,200 yellow cabs have converted to hybrid or clean diesel vehicles, giving New York the largest fleet of clean vehicle taxis in the country. Additionally, in 2010 New York unveiled a comprehensive agreement that will cut harmful pollution from the Port of New York and New Jersey by launching a $28 million truck replacement program.

Environmental governance: First, 100 points

New York tops the Index in environmental governance, along with Washington and Denver. There is strong support from the top the mayor, Michael Bloomberg, is a driving force behind the C40 Cities Climate Leadership Group. New York's environmental strategy, international commitments and customized environmental awareness campaigns are all considered among the best in the Index. Furthermore, the city has four separate environmental departments that are responsible for driving policy on a vast range of environmental issues.

Green initiatives: In addition to generally strong environmental oversight at city level, New York is developing customized environmental awareness campaigns tailored to specific sectors of the public, including the press, schoolchildren and those in the building trades. The city is also focusing on schools. New York established its first "green" public school in 2008 and has plans to build more. The school is equipped with a computerized heating and cooling system, and natural lighting, to conserve electricity. Meanwhile, students are educated on the merits of conserving energy and participate in conservation projects. Finally, the New York state Green Schools Challenge provides extra funding to schools, including those in New York City, that are developing programs to improve waste reduction, reuse, recycling and composting.

Quantitative indicators

Category	Indicator	Average	New York	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**145.0**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**8.6**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.50**	2009	City	City of New York; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**64.7**	2009	City	City of New York; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**19.7**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**27,666.8**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**1.1**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**37.2**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**1.8**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**68.5**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**44.9**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**34.6**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**30.4**	2006	City	City of New York	
Water	Total water consumption per person per day (gallons)	155.1	**69.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**14.2**	2009	City	City of New York	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**29**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**6**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**10**	2005	County	EPA; US Census Bureau	Using county population

Orlando

US and Canada Green City Index

Background indicators

Total population [1)]	240,000
Administrative area (miles^2) [1)]	93
GDP per person (real) (US$) [2)]	41,800
Temperature (24-hour average, annual) (°F) [1)]	73
Goods employment (%) [2)]	10
Services employment (%) [2)]	90

Geographical basis: 1) City, 2) MSA

Orlando is located in the southern US state of Florida. Home to several of the country's largest theme parks and resorts, Orlando's thriving tourism sector dominates local economic activity. Additionally, it is home to one of the country's biggest convention centers, attracting large numbers of business visitors each year. High tech, aviation and aerospace, and film and television production also contribute significantly to the city's economy, and many engineering and manufacturing firms have set up base there. Orlando has a GDP per capita of $41,800, which places it at the upper end of the low-income group of cities in the US and Canada Green City Index. The city is the smallest in population terms, with just 240,000 residents. Data included in the Index, however, are based on a mix of statistics for the city and wider metropolitan area, which has a far greater population of 2.1 million. Orlando boasts the third highest average temperature in the Index, placing strains on energy demand, because of air conditioning in the summer months.

Orlando ranks 18th overall in the Index. The city's highest ranking is in the waste category, where it places 12th thanks to a better than average recycling rate. Although Orlando's performance is near the middle of the table in all main categories aside from CO_2, where it is 21st, the city can claim a number of environmental strengths. Orlando has one of the strongest sets of policies for clean and efficient energy in the Index, and boasts a relatively high number of Leadership in Energy and Environmental Design (LEED)-certified buildings in relation to its population. It is also one of the most adept cities among other low-income peers at recycling municipal waste. The city's transport score is bolstered by the lead it is taking on the installation of battery-charging stations for electric vehicles. But Orlando still has room for improvement. The city would benefit from expanding its public transport network and strengthening policies to curb carbon emissions.

CO_2: 21st, 52.2 points

The city emits 254 metric tons of CO_2 per $1 million of GDP, which is more than 40 metric tons below the Index average of 296. Orlando's CO_2 emissions per capita, at 13.5 metric tons, are also narrowly better than the Index average of 14.5 metric tons. Despite better-than-average CO_2 emissions, policy omissions weigh on Orlando's score. The city is one of just five in the Index that have failed to set any of their own targets to reduce city-wide CO_2 emissions, and its strategy for reducing greenhouse gas emissions falls behind the more ambitious ones in Index: Orlando's commitments on greenhouse emissions are in line with long-term national targets only (see "green initiatives" below), whereas many cities have set separate targets.

Green initiatives: Orlando, in line with national targets, has committed to making all city operations greenhouse gas-neutral by 2030 and to reducing total greenhouse gas emissions (municipal and non-municipal) 80% from 1990 levels by 2050. To achieve these goals the city began transitioning its automotive fleet to bio-diesel, flex-fuel and hybrids. By 2009 one-third of the fleet was running on cleaner fuels. By the same year every stoplight and pedestrian signal in the city was converted from incandescent bulbs to more energy efficient LEDs.

Energy: 17th, 64.2 points

Orlando consumes 118 gigajoules of electricity per capita, more than double the overall average and one of the highest rates in the Index. This is due in part to the demand for residential heating and cooling, which is a challenge for the whole state. A recent US Energy Information Agency report found that residential electricity demand in Florida is among the highest in the country because of widespread use of air conditioning in the summer and home heating during the winter. The city does better on electricity consumption per $1 million GDP, which, at 319 gigajoules, is slightly better than the Index average of 332.

Orlando also scores the highest marks, along with Denver and Toronto, for clean and efficient energy policies. The city promotes green energy, has embarked on green energy projects (see "green initiatives" below), and has increased the amount of locally-produced energy as a proportion of its overall energy consumption.

Green initiatives: Orlando is one of 25 US cities carrying "Solar America City" status, entitling it to federal funding of $200,000 to develop solar power infrastructure. Orlando intends to install 11 megawatts of solar energy by 2011, increasing to 15 megawatts by 2015. The installation of LEDs at road signals (see "green initiatives" under "CO_2" above) is saving the city more than $25,000 a month through lower energy consumption.

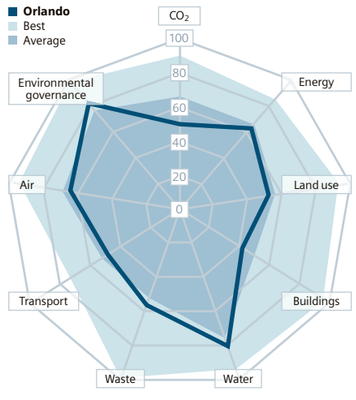
Land use: 16th, 54.5 points

Orlando's proportion of green space, at just under 5% of its administrative area, is one of the smallest in the Index. Decades of rapid population growth resulted in urban sprawl in the already small confines of the city limits. Orlando officials appear to have recognized the problem and are now making some concerted policy efforts. The city is actively improving the quantity, proximity and usability of green space, and measures are in place to protect existing green space from building development. With state help, Orlando also promotes brownfield regeneration (see "green initiatives" below).

Green initiatives: With assistance from the Florida Department of Environmental Protection, Orlando has designated several brownfield sites for regeneration. A number of areas have already been revitalized, including a new events center in downtown Orlando and a performing arts complex located on a 34-acre brownfield area. Additionally, the city has an active tree-planting policy and has replaced the estimated 10,000 trees lost to hurricane damage in 2004. Orlando set a goal in 2010 to increase tree canopy coverage to 40% by spring 2011, up from the 25-35% estimated canopy coverage in the city when the goal was set.

Buildings: 16th, 42.3 points

Low-income cities generally score lower in the buildings category, particularly in policy areas, and Orlando is no exception. Energy efficiency regulation for new buildings is not as strict as in many other Index cities, and Orlando could do more to inform residents and businesses about ways to decrease energy consumption. The city has, however, increased efforts to retrofit low-income and high-energy households through subsidies (see "green initiatives" below). The number of LEED-certified buildings in Orlando is 9.3 per 100,000 people, which is one of the highest ratios among low-income cities and well



above the Index average of 6.4. The strong performance on this indicator is a reflection of the priority the city has given to making its buildings more sustainable: since 2007 the city has constructed all new municipal buildings to meet LEED standards and says it is drafting a new buildings code that will establish standards for green homes.

Green initiatives: In 2010 Orange County launched its Homeowner Energy Efficiency Program (OCHEEP!). Backed by nearly $700,000 in federal funds, OCHEEP! provides homeowners subsidies of up to $1,000 for energy efficiency upgrades. To be eligible, applicants must first gather ten or more people together for free workshops. The workshops are intended to change energy usage habits and cover a range of topics from common reasons for energy waste in homes to new technologies. Upon completion of the workshop homeowners are required to hire a certified energy rater, who tests the energy efficiency of a property and creates a customized plan to improve performance in each home. After implementing the rater's suggestions, OCHEEP! participants receive rebates of $300 for the energy audits and up to $700 for up-grade work.

Transport: 18th, 49.4 points

Orlando's rank in this category is a reflection of the city's underdeveloped public transport network. On a per square mile basis, the Orlando metropolitan area has both the shortest public transport network, at just 0.001 miles per square mile, and lowest vehicle availability, at 0.2 vehicles per square mile, in the Index. However, the city has ambitious plans to expand its bus rapid transit network and commuter rail links (see "green initiatives" below). Additionally, Orlando and Florida state authorities are building a 61-mile rail transit line to improve commuter links across four counties. Service is expected to begin in 2013. But the city will need to boost worker enthusiasm for greener forms of transport. Only around 3% of workers use public transit, bicycles or go by foot in Orlando, which is well below the Index average of 13%. Where Orlando scores well is for policies to reduce congestion and its efforts to make the city fleet greener.

Green initiatives: Orlando is part of ChargePoint America, a US government-backed program to roll out electric vehicle infrastructure nationwide. Under the scheme, which the city joined in June 2010, up to 500 charging stations will be installed around Orange County by the end of 2011. The city also aims to increase usage of its bus rapid transit system from just over 4,000 daily passengers today to 20,000 by 2030. Although plans haven't been finalized, it's expected the city will extend the free service from its current 1.5-mile stretch in downtown Orlando to 3.6 miles. The city has said it will likely have to introduce a passenger fee between $0.25 and $1.50 per ride.

Water: 14th, 81 points

This is one of Orlando's strongest placements in the Index. The city gains points for its relatively efficient water distribution system. It loses 10% of supply to leaks against an Index average of 13%. Water efficiency and treatment policies are also strong. Main water sources are monitored for quality and supply levels, and measures are in place to lower water usage. One weakness is relatively high water consumption. Orlando consumes 193 gallons of water per capita per day. This is well in excess of the Index average of 155 gallons, but high temperature cities, like Orlando, do tend to consume more water than average.

Green initiatives: To encourage water conservation, the city offers rebates as credit on water bills to residents who install cisterns to collect and reuse rainwater. The rebate is $0.10 per gallon up to $1,000 and cistern storage capacity ranges from 200 gallons to 10,000 gallons. Additionally, during summer months watering days are limited to two per week per household. Household numbers, odd or even, determine which days they can water.

Waste: 12th, 58 points

Orlando records its highest placement in the waste category. The city recycles 38% of its municipal waste versus a much lower 26% Index average. The performance looks even more impressive when taking into account that low income and low population density cities generally score below average on this indicator, and unlike many cities, Orlando has not yet fully rolled out a single-stream recycling program. Nonetheless, relatively strong policies have helped. Orlando picks up points for installing facilities to treat different types of waste (recyclable, hazardous and industrial) and for adopting good waste management practices, such as composting and converting waste by-products to energy. One policy oversight is the absence of any measures to reduce waste creation.

Green initiatives: Orlando's Solid Waste Management Division provides single-stream recycling service to businesses in certain areas of the city. To encourage company participation, collection fees for recycling bins are approximately 43% cheaper than for standard waste bins.

Air: 18th, 66.4 points

Orlando's annual emissions of particulate matter, sulfur dioxide and nitrogen oxides are each in line with Index averages. Like other services-intensive cities with low population densities, Orlando records higher emissions of both particulate matter and nitrogen oxides than the Index frontrunners. The city does comparatively better on sulfur dioxide emissions, but Orlando is one of three cities in this Index that has not adopted proactive policies to improve air quality, which weighs on its score.

Green initiatives: With federal funding, Orange County's Air Quality Management division oversaw the retrofitting of nearly 400 school buses in 2007 and 2008. Buses were fitted with diesel oxidation catalysts to reduce the amount of carbon monoxide and particulate matter being emitted into the atmosphere.

Environmental governance: 16th, 82.2 points

Orlando ties with Dallas in the environmental governance category. The city scores well for actively involving residents in environmental programs and seeking public input on projects that have an environmental impact. Orlando holds regular public hearings to give residents the opportunity to participate in policy implementation. Furthermore, Orlando and Orange County produce regular reports on environmental progress. Areas for improvement include the need for a more comprehensive baseline review and setting more explicit targets for each environmental issue.

Green initiatives: In 2007 the city convened an internal "green team" comprising staff representatives from across municipal departments. The team's mandate was to draft a comprehensive plan to transform Orlando into an environmentally-friendly city. As a result, in mid-2007 Orlando unveiled its environmental action agenda: Green Works Orlando. The plan includes actions to conserve local natural resources; invest in green building and vehicles; foster alternative transport options; increase the amount of trees and green spaces in the city; provide residents the tools and information they need to become more environmentally responsible; and encourage community participation in environmental projects. Green Works Orlando remains the pillar of local environmental action today.

Quantitative indicators

Category	Indicator	Average	Orlando	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**254.4**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**13.5**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.32**	2010	City	Orlando Utilities Commission; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**117.7**	2010	City	Orlando Utilities Commission; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**4.9**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**2,536.1**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**9.3**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**3.2**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.001**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**12.6**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**27.0**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**38.0**	2009	City	City of Orlando	
Water	Total water consumption per person per day (gallons)	155.1	**193.4**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**10.0**	2009	City	Orlando Utilities Commission	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**62**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**26**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**20**	2005	County	EPA; US Census Bureau	Using county population

Ottawa

US and Canada Green City Index

The capital of Canada, Ottawa is by far the largest city in terms of area in the US and Canada Green City Index. Sprawling over 1,100 square miles (2,800 square kilometers), it is nearly double the size of the second largest city, Houston, and more than five times the Index average of 211 square miles (546 square kilometers). This vast area is home to just a mid-range population of 810,000, giving Ottawa the lowest population density among the 27 cities in the Index. Ottawa's metropolitan area, with a population of 1.1 million, spills into neighboring province Quebec, and a mix of city and metropolitan data are used in the Index. The city's low population density and extreme climate are principal strains on its environment. Ottawa's economy, dominated by services, is based primarily on housing the federal government. And although it is one of Canada's high-tech hubs, its per capita GDP of $38,500 is one of the lowest in the Index.

Ottawa ranks 12th overall in the Index and third among the five Canadian cities. Ottawa's best performance is in the area of land use, where it places third. The city limits encompass numerous semi-rural areas, which combine to give it the highest percentage of green space in the Index. Ottawa also fares well in the CO_2 and transport categories, placing fifth in both. Its per capita CO_2 emissions are among the lowest in the Index while the city also boasts one of the highest percentages of workers commuting by public transport, on foot or bicycle. As noted, many of the environmental challenges Ottawa faces are the result of its low population density. However, compared to other cities with low population densities, Ottawa fares well; it places second in this group, while scoring first in CO_2, land use and transport.

CO_2: Fifth, 86 points

Ottawa's per capita CO_2 emissions of just 6.9 metric tons per person are the second lowest in the Index and well below the average of 14.5 metric tons. The city also performs relatively well in the area of CO_2 emissions per $1 million of GDP, at 197 metric tons, compared with the Index average of 296 metric tons. When measured against other cities with low population densities, Ottawa places first for carbon emissions overall. The city has taken proactive steps to improve its already strong performance in this category. Officials set a goal to reduce CO_2 emissions by 20% by 2012, compared to 1990 levels, and this is one of the earliest and more ambitious CO_2 reduction targets in the Index.

Green initiatives: In 2005 Ottawa's Air Quality and Climate Change Management Plan established targets for greenhouse gas reduction and outlined the types of measures that would, if fully implemented, achieve the plan's targets. The government pledged to reduce emissions from its own activities by 20% from 1990 levels by 2007, a goal the city met. As noted above, the city is now embarking on an effort to reduce emissions 20% by 2012. However, the challenges of continued population growth, lack of direct municipal control over such variables as building code standards, fossil fuel generation, and vehicle fuel efficiency, have put this target into question.

Energy: 20th, 56.9 points

Ottawa's performance in this category is bolstered by relatively low per capita electricity consumption of 34 gigajoules per person, compared with the Index average of 52 gigajoules. However, due to having a low per-capita GDP, Ottawa's electricity consumption per unit of GDP is comparatively high, weighing heavily on its ranking. The city consumes 626 gigajoules of electricity per $1 million, nearly twice the Index average of 332. Ottawa also lags in local energy production, although its plans to increase solar power in the coming years (see "green initiatives" below) will boost its performance in this area.

Green initiatives: In May 2010 Ottawa approved two solar parks on land near a municipal landfill. The two ground-mounted solar photovoltaic fields could harness enough solar energy to power 1,500 homes annually. The project is a partnership with a private green energy company that allows the firm to lease lands for the solar parks for 20 years. The private company will design, construct, operate and maintain both sites. Under the agreement, which is expected to begin in 2012, the city would receive a fixed payment of approximately $125,000 from the utility annually while the private company would enter into a feed-in tariff contract with the Ontario Power Authority and retain revenues for its power generation.

Land use: Third, 75 points

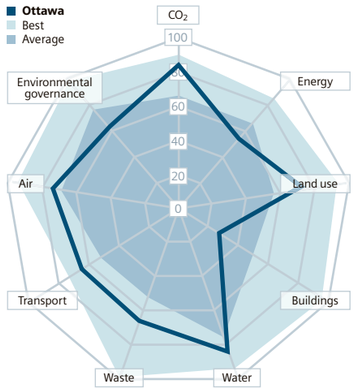
This is Ottawa's best category performance in the Index. As noted above, the city limits encompass an area that is five times larger than the average city in Index, creating both opportunities and challenges for land use policies. On one hand, Ottawa has by far the lowest population density in the Index, at 800 people per square mile (300 people per square kilometer), just one-tenth the Index average of 8,100 people per square mile (3,100 people per square kilometer). While this low population density leads to some urban sprawl, the city limits also encompass vast amounts of green space. One-fifth of the land within Ottawa's large city boundaries is green space, the highest percentage in the Index and well above the average of 12%. The city has protected this greenbelt for decades and has recently made an effort to transform these green spaces into woodlands, further improving its landscape.

Green initiatives: Ottawa's Green Acres Program provides landowners with advice and assistance in setting up a tree planting plan for their properties. Among the program's goals is to achieve 30% forest cover (up from 27%, currently) and to plant 100,000 trees between 2006 and 2011. In 2006 Green Acres planted 91,920 trees to create 45 hectares of new forest.

Buildings: 22nd, 28.2 points

Ottawa's score in the buildings category is weighed down by a shortage of Leadership in Energy and Environmental Design (LEED)-certified buildings. The city claims 1.7 LEED buildings per 100,000 people, well below the Index average of 6.4, but this could improve as regulations implemented in 2005 take full effect in the future (see "green initiatives" below). Nonetheless, the city does not appear to require energy efficiency audits, which further weighs on its overall buildings score. Ottawa is also one of just four cities in the Index that do not offer homeowners incentives to make retrofits to improve energy efficiency. However, it is currently exploring ways to offer tax breaks for homeowners to implement retrofits.

Green initiatives: As of 2005 all newly constructed buildings in Ottawa greater than 500 square meters must be designed, delivered and certified by the Canada Green Building Council as being LEED-Canada "Certified" at minimum. All newly constructed buildings



Background indicators

Total population [1]	810,000
Administrative area (miles^2) [1]	1,100
GDP per person (real) (US$) [2]	38,500
Temperature (24-hour average, annual) (°F) [1]	43
Goods employment (%) [2]	11
Services employment (%) [2]	89

Geographical basis: 1) City, 2) CMA

must also incorporate energy efficient features into the building design to meet the standards required by another program, the Commercial Building Incentive Program of 2006.

Transport: Fifth, 65.1 points

Ottawa's strong performance in transport reflects an extensive and widely embraced public transport system that links the metropolitan area. Ottawa boasts the third highest share of workers commuting by public transit, bicycle, or foot, at 28%, more than double the Index average of 13%. Compared with other low income cities in the Index, Ottawa has the second highest share of workers traveling by means other than private automobiles. The Ottawa metropolitan area also has the third longest public transit network in the Index, at 3.9 miles per square mile (2.4 kilometers per square kilometer), compared with an average of 1.1 miles per square mile (0.7 kilometers per square kilometer). This is a feat made more impressive by the city's vast total area. Ottawa's score is weighed down, however, by a low rate of public transit vehicles, coming in at just 0.8 vehicles per square mile (0.3 vehicles per square kilometer), compared with the average of nine vehicles per square mile (3.5 vehicles per square kilometer). Meanwhile, the city has been active in promoting public transit and alternative fuels (see "green initiatives" below), which ensure that Ottawa will remain one of the top cities for transport in North America.

Green initiatives: In 2004 Ottawa launched an ambitious plan for introducing alternative-fuel vehicles into its city fleet. By 2009 Ottawa had converted all of its nearly 250 buses to biodiesel fuel and over 1,000 total city-owned vehicles to electric/hybrids or ethanol biofuels. Furthermore, the Ottawa Traffic Master Plan aims to make public transit more affordable when compared to driving and better integrate transit with other modes of travel. The plan also calls for the implementation of new tracks and stations that improve transit's service wherever possible. The city has also started designing a light rail network, which is in early planning phases now and is expected to become fully operational by 2019.

Water: Eighth, 84.9 points

Ottawa's very low per capita water consumption, which is among the best in the Index, bolsters its performance in the water category. The city consumes just 75 gallons (284 liters) of water per person per day, less than half the Index average of 155 gallons (587 liters). Ottawa's water efficiency plan (see "green initiatives" below) has been effective and is expected to keep the city among the leaders in efficient water consumption. The city's rank in this category, however, is hindered by above average water leakages. Ottawa loses 15% of its water to system leakages, compared with the Index average of 13%. Furthermore, Ottawa is also one of only four cities that do not promote the use of recycled water, further hurting its performance.

Green initiatives: WaterWise, initially launched in 2005, is a comprehensive plan to improve water efficiency in Ottawa. The campaign focuses on public education, rebates on water efficient items, and assistance with the cost of water audits and fixture retrofits. In 2009 the city introduced a regulation to restrict water use through metering, and in 2013 the city plans to explore financial penalties for inefficient commercial and residential water use.

Waste: Eighth, 66.2 points

Political will has put Ottawa at the forefront of waste-to-energy programs in Canada (see "green initiatives" below), which supports the city's score in this category. Canada's capital also takes deliberate measures to reduce waste, and to this end, runs programs that advocate reduced packaging, reusing plastic goods and consuming fewer beverages from plastic bottles. Despite progressive policies, the city's recycling rate is nearly average for the Index: Ottawa recycles 25% of municipal waste, compared to the average of 26%.

Green initiatives: In 2008 Ottawa was the first municipality in Canada to permit the construction of a 100-ton per day commercial gasification demonstration facility. The 15-megawatt facility is set to begin construction in 2011, and will be capable of supplying electricity to approximately 15,000 households. Similar to systems in Europe, waste is converted into a higher form of gas called PlascoSyngas. The PlascoSyngas is further refined to remove all major air contaminants and used to fuel a combustion engine that produces steam to turn a turbine that produces energy.

Air: 13th, 76.7 points

Ottawa's air pollution levels vary greatly depending on the specific pollutant, leading to a middling rank in this category. Due to a comparatively low use of automobiles, the city has below average levels of particulate matter emissions at 14 lb (6 kg) per person, compared with the Index average of 25 (11 kg), and is close to the Index average in terms of nitrogen oxides emissions, at 66 lb (30 kg) per person per year. In large part due to cold weather, the city emits a far greater amount of sulfur dioxide than the Index average, at 36 lb (16 kg) per person versus 22 (10 kg). Ottawa recently piloted a unique air quality mapping project that has enabled the city to identify high-polluting and sensitive neighborhoods, and intends to use the results to implement a number of air quality initiatives and reduce its overall air pollution.

Green initiatives: Ottawa's Air Quality and Climate Change Challenge includes several recommendations aimed specifically at air quality improvement. In addition to transit, building and land use initiatives mentioned above, the plan includes implementation of smog control measures that discourage such activities as the use of single occupancy vehicles, and high consumption vehicles and appliances, as well as control of non-source emissions such as wood combustion and road dust.

Environmental governance: 21st, 62.2 points

Although Ottawa has an environmental strategy in place, the plan lacks baseline measurements for all categories. Ottawa's performance in this category is further hindered because it is less transparent in environmental issues than most cities in the Index, with environmental data not as readily available as in other cities. However, Ottawa's performance is boosted by strong public involvement in environmental matters. The environmental committee holds public events, including area tours, which demonstrate the effects of city life on the local environment. Furthermore, the committee reports directly to the city council on green issues, providing a forum for citizen action.

Green initiatives: In 2008 Ottawa, in partnership with the non-profit software company Zerofootprint, launched an information campaign that helps residents calculate their carbon footprints and adopt methods for reducing emissions. The program has a component geared specifically towards schools, where students can monitor their greenhouse gas emissions and teachers learn tips for ways to incorporate sustainability into the curriculum. Thus far, nearly 40,000 residents have registered with the program, with savings calculated at more than 26,000 tons of CO_2 emissions.

Quantitative indicators

Category	Indicator	Average	Ottawa	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**197.0**	2008	City	City of Ottawa, Planning and Growth Management Department	Using estimated city GDP
	CO_2 emissions per person (metric tons)	14.5	**6.9**	2008	City	City of Ottawa, Planning and Growth Management Department	
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.63**	2009	City	Hydro Ottawa	Using CMA GDP
	Electricity consumption per person (GJ)	52.2	**33.5**	2009	City	Hydro Ottawa	Using city population
Land use	Green spaces as % of total area (%)	11.9	**20.0**	2005	City	City of Ottawa	Using area of city in 2006
	Population density (persons/miles^2)	8,106.8	**757.1**	2006	City	Statistics Canada	Equivalent in metric units: 292 persons/km^2
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**1.7**	2010	City	CaGBC LEED Database	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**28.4**	2006	CMA	Statistics Canada	
	Length of public transport (miles/miles^2)	1.1	**3.9**	2009	Metro-area	City of Ottawa, communication with city official	Using city area; Equivalent in metric units: 2.4 km/km^2
	Annual vehicle revenue miles (miles/person)	24.4	**23.5**	2009	Metro-area	OC Transpo	Using MSA population; Equivalent in metric units: 37.9 km/person
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**0.8**	2009	Metro-area	OC Transpo	Using city area; Equivalent in metric units: 0.3 vehicles/km^2
	Average commute time from residence to work (minutes)	28.9	**32.5**	2005	CMA	Statistics Canada	
Waste	Recycled municipal waste (%)	25.8	**25.0**	2005	City	City of Ottawa	
Water	Total water consumption per person per day (gallons)	155.1	**75.0**	2010	City	City of Ottawa, communication with city official	Using city population; Equivalent in metric units: 283.9 liters
	Water leakages in water distribution system (%)	12.8	**14.5**	2010	City	City of Ottawa, communication with city official	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**66**	2004	City	City of Ottawa, Planning and Environment Committee	Using city population; Equivalent in metric units: 30 kg
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**14**	2004	City	City of Ottawa, Planning and Environment Committee	Using city population; Equivalent in metric units: 6 kg
	Sulfur dioxide emissions per annum (pounds/person)	22	**36**	2004	City	City of Ottawa, Planning and Environment Committee	Using city population; Equivalent in metric units: 16 kg

Philadelphia

US and Canada Green City Index

Background indicators

Total population [1)]	1.6 million
Administrative area (miles^2) [1)]	135
GDP per person (real) (US$) [2)]	46,200
Temperature (24-hour average, annual) (°F) [1)]	55
Goods employment (%) [2)]	12
Services employment (%) [2)]	88

Geographical basis: 1) City, 2) MSA

Philadelphia is the largest city in the state of Pennsylvania, with a population of 1.6 million. The metropolitan area, home to 6 million residents, flows into neighboring states New Jersey and Delaware, though city data are primarily used in the US and Canada Green City Index. Philadelphia, one of the oldest cities in the US and the home of the country's constitution. It hosts several important national monuments and attracts large numbers of tourists each year. The city has a broad-based economy that ranges from pharmaceuticals and financial services to shipping and manufacturing. Services account for about 88% of economic activity. Philadelphia's GDP per capita, at $46,200, places it among the mid-income cities in the Index.

Philadelphia ranks 13th overall in the Index. Its best rankings are in the categories of environmental governance, where it places fifth, and air quality, at sixth. These results are driven by the city's much lauded green action plan, strong public participation in environmental management, and low overall air pollution levels. Additionally, while it places seventh in land use, Philadelphia is first among middle-income cities in the land use category, a score driven by strong policies that are likely to positively influence the city's overall environmental performance in the coming years. Philadelphia's weakest ranking is in the water category, at 23rd, largely because it has one of the highest leakage rates in the Index.

CO_2: 12th, 78.4 points

Philadelphia's carbon emissions are slightly better than average both in terms of per capita emissions and per unit of GDP. With 11.3 metric tons of CO_2 emissions per person, the city emits less than the Index average of 14.5. With respect to economic output, Philadelphia emits 233 metric tons of CO_2 emissions per $1 million of GDP, again better than the overall average of 296 metric tons. For reasons of data availability and comparability, the CO_2 figures were taken from 2002 for all of the US cities in the Index, and according to city officials Philadelphia has in the meantime made progress reducing its emissions. Although a large percentage of Philadelphia's electricity is supplied by coal, the city's low overall electricity consumption (see "energy" section below) contributes to this better than average performance in carbon emissions. Still, city officials recognize room for improvement and have adopted an ambitious greenhouse gas reduction strategy (see "green initiatives" below) to reduce emissions by 20% by 2015, based on 1990 levels.

Green initiatives: In May 2009 the city introduced the Greenworks Philadelphia plan, which established its greenhouse gas emissions-reduction target. The city has been working to update an emissions inventory that will serve as a benchmarking tool for reduction goals. Officials are gathering information from local utility companies and calculating vehicle miles traveled to develop a citywide and regional greenhouse gas tracking and measurement system. The majority of Philadelphia's environmental programs fall under the umbrella of Green-

works and contribute to reducing the city's CO_2 emissions.

Energy: Tenth, 72.5 points

Better than average levels of electricity use boost Philadelphia's score in the energy category. The city consumes 28 gigajoules of electricity per person each year, versus the Index average of 52 gigajoules. Additionally, Philadelphia consumes just 154 gigajoules of electricity per $1 million of GDP, less than half the average of 332 gigajoules. When measured against other mid-income cities, Philadelphia has the best record for electricity consumption compared to economic output. Philadelphia's efforts at greening this consumption, however, are only just beginning. In 2009 the city set a goal to purchase and generate 20% of electricity from alternative energy sources, and in particular the city is planning to ramp up solar production (see "green initiatives" below). It has further plans for local geothermal and hydro production, but thus far these remain undeveloped.

Green initiatives: Philadelphia has plans for three large-scale solar installations, which together will provide enough electricity to power over 600 homes. By 2021 Philadelphia hopes to have solar generation capacity of over 57 megawatts, enough to power almost 9,000 homes.

Land use: Seventh, 67.7 points

This is one of Philadelphia's stronger categories. As one of the older cities in the Index, Philadelphia benefits from high population density that makes efficient use of its land – the city has 11,500 people per square mile compared with the Index average of 8,100. In terms of green space, Philadelphia is just above the average, with 13% of city territory classified as green space compared with the Index average of 12%. Philadelphia is working to improve this further (see "green initiatives" below), and has adopted policies to encourage tree planting and green-belt protection, including a series of greenways that connect parks and other green spaces throughout the Philadelphia metropolitan area.

Green initiatives: Green2015, launched by the city in 2010, aims to create new open space during ongoing neighborhood redevelopments and to make vacant lots green. In total, it plans to acquire and redevelop an additional 500 acres of green public space and to ultimately provide green space for the 202,000 residents who currently do not live within a ten-minute walk of a park. Additionally, in April 2010 the Department of Parks and Recreation launched Green Philly, Grow Philly with the goal of increasing tree coverage to 30% in all neighborhoods by 2025. As an immediate step, the city has revised its zoning code to allow public and private tree planting in additional areas, and performed a satellite assessment of the current urban tree canopy, with the goal of planting 300,000 trees by 2015.

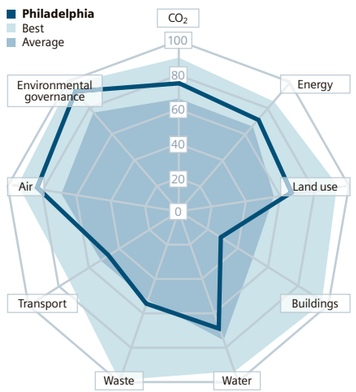
Buildings: 21st, 29.5 points

Philadelphia's placement in the buildings category is largely a reflection of slow policy implementation for energy efficiency standards in buildings. The city has implemented just one energy efficiency regulation – that new buildings use highly reflective roofing materials that meet or exceed Energy Star cool roof standards. City officials are in the process of drafting more comprehensive regulations, however. Although the city has implemented incentives for energy efficiency retrofits (see "green initiatives" below), it does not require energy efficiency audits. Furthermore, with just 2.5 Leadership in Energy and Environmental Design (LEED)-certified buildings per 100,000 people, Philadelphia ranks well below the Index average of 6.4.

Green initiatives: Philadelphia has set a goal to complete energy efficiency retrofits on 15% of its public housing by 2015. To highlight this goal, in 2010 the city held a neighborhood contest called the "RetroFIT Philly Coolest Block", a public-private partnership between the city and a private company, in which city blocks competed to see how much they could reduce energy expenses. Seventy-four blocks entered the contest to win cool roofs, air sealing and insulation upgrades. All told, these efforts aim to help Philadelphia meet its target of 100,000 houses retrofitted by 2015.

Transport: 21st, 47.2 points

Transport is another of Philadelphia's weaker



categories in the Index. The score is largely a reflection of a low number of public transport vehicles – the city has just three public vehicles per square mile compared with the Index average of nine. Similarly, Philadelphia has just 0.7 miles of public transit per square mile, versus the Index average of 1.1. The city places near the middle of the Index for the percentage of non-automobile commuters, at 14%, just above the average of 13%. Furthermore, Philadelphia's more ambitious projects to expand mass transport and implement car sharing and bicycle programs have yet to fully materialize, and remain instead future initiatives.

Green initiatives: In 2009 Philadelphia set a goal to reduce the number of miles residents drive annually by 10% by 2015 from a 2008 baseline of 6.4 million. The city government recently invested $191 million from the federal Recovery Act in improving subway tracks, and has secured funding for residential and commercial development along transit lines throughout the city that will encourage mass transit usage. In the next two to three years, Philadelphia plans to introduce new fare card technologies to make travel quicker and to expand its transit lines. In addition, to help reduce city government energy consumption, in 2009 Philadelphia created the largest municipal car sharing program in the US.

Water: 23rd, 70.4 points

This is Philadelphia's weakest placement in the Index, relative to other cities. While per capita water consumption in Philadelphia is better than average at 134 gallons per person per day, compared with the Index mean of 155 gallons, the city's score is hindered by an aging sewer system that has one of the highest percentages of leaks in the Index. At 27%, Philadelphia's leakage rate is more than double the Index average of 13%. The city has begun to implement new strategies for stormwater management to address not just large storms but the smaller, more frequent storms common in the area (see "green initiatives").

Green initiatives: Under the 2010 program "Green city, clean waters" Philadelphia has begun to strengthen its stormwater regulations and has approved stricter regulation for both new and existing drainage systems that will save over 1.3 billion gallons of water per year. In total, the city plans to invest $1.6 billion over the next 20 years to upgrade its stormwater infrastructure.

Waste: 13th, 57.6 points

Philadelphia's middling rank in this category comes despite recent efforts (see "green initiatives" below) to reduce waste and increase recycling. The city's recycling rate, as a result of these programs, is now 37%, well above the Index average of 26%. Meanwhile, Philadelphia has regulations in place regarding specific types of waste, such as hazardous or industrial, but admits that few residents or sanitation employees regularly follow the regulations. The city is weaker too, relative to other cities' efforts, in terms of taking steps to finding alternatives to landfills.

Green initiatives: In February 2010 the city government launched Philadelphia Recycling Rewards, an innovative partnership with the non-governmental organization RecycleBank. Under the program, residents receive points according to how much material they recycle, which they can redeem for discounts, gift cards, or charitable contributions at participating merchants and charities. Additionally, the city has added recycling facilities in commercial buildings, public spaces, at municipal events and at transit stations.

Air: Sixth, 82.9 points

One of Philadelphia's strongest categories, this performance is largely a reflection of the city's low levels of air pollution across the board, particularly for having the third lowest levels of particulate matter, at just 12 lb per person, compared with an Index average of 25. Additionally, Philadelphia emits 46 lb of nitrogen oxides per person, compared with an average of 66 lb, and 12 lb of sulfur dioxide, compared with the average of 22 lb. A combination of comprehensive air quality policies, including a wide-ranging program to retrofit diesel vehicles in Philadelphia's municipal fleet (see "green initiatives" below), and the city's largely service-based economy contribute to its good air quality.

Green initiatives: In 2009 Philadelphia began reducing the amount of high-polluting diesel used in the city. The main effort involved a retrofit of all city-owned diesel vehicles, including replacing existing filters and adding diesel oxidation catalyst equipment. As of 2010, 1,680 out of 2,400 diesel vehicles had been retrofitted. The city also replaced 70% of its police vehicles with more fuel-efficient vehicles, helping reduce overall gasoline consumption. Additionally, in 2009 the city government deployed 676 biodiesel vehicles, purchasing 906,497 gallons of biodiesel; Philadelphia hopes to expand the use of the fuel by 5% every year.

Environmental governance: Fifth, 94.4 points

Philadelphia ties with Houston and Los Angeles in the environmental governance category, with a strong score and its best placement in the Index. Led by its Greenworks initiative (see "green initiatives" below), Philadelphia has a comprehensive environmental strategy, including targets, reporting and baseline reviews, with support from the mayor. The city also has been active in involving citizens in its decisions, although its openness on environmental performance is more limited than leading cities such as New York and Washington DC.

Green initiatives: Greenworks, Philadelphia's sweeping environmental plan, encompasses the majority of the city's green programs – from energy reduction to park space to water management – and diverse stakeholders from throughout the city were involved in the plan's development. The Office of Sustainability spent a year researching municipal sustainability and publicly consulting with residents while it drafted the plan. The city also conducted surveys of energy and transportation use in the city, and held a number of community meetings and public hearings about proposed changes in advance of launching the plan. Finally, the city continues to review its progress on an annual basis and solicits public input on proposed changes.

Quantitative indicators

Category	Indicator	Average	Philadelphia	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**232.9**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**11.3**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.15**	2006	City	City of Philadelphia; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**27.5**	2006	City	City of Philadelphia; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**12.6**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**11,461.5**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**2.5**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**13.7**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.7**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**26.7**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**3.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**28.0**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**37.4**	2009	City	City of Philadelphia	
Water	Total water consumption per person per day (gallons)	155.1	**134.4**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**26.5**	2009	City	Philadelphia Water Department	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**46**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**12**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**12**	2005	County	EPA; US Census Bureau	Using county population

Phoenix

US and Canada Green City Index

Background indicators

Total population [1)]	1.6 million
Administrative area (miles^2) [1)]	474
GDP per person (real) (US$) [2)]	37,300
Temperature (24-hour average, annual) (°F) [1)]	74
Goods employment (%) [2)]	13
Services employment (%) [2)]	87

Geographical basis: 1) City, 2) MSA

Aptly nicknamed the "Valley of the Sun", Phoenix is a vast low-density city surrounded by mountains. The city has a population of 1.6 million, making it the seventh most populous in the US and Canada Green City Index. With a services-oriented economy, including a large contribution from tourism, Phoenix has been one of the US's fastest growing cities in the last ten years. Despite this growth, the city has a per capita GDP of $37,300, well below the Index average of $46,000 and the third lowest in the Index. Given its location in the Sonoran desert, which receives only three to 15 inches of rain per year, Phoenix is required to make efficient use of its surface water. Likewise, the high temperatures that discourage tall buildings have contributed, in part, to Phoenix's expanding municipal footprint. Most of the data for Phoenix came from a mix of figures covering the city and the wider metropolitan area, which has a population of 4.4 million.

Phoenix ranks 24th overall in the Index. Its best performance is in the energy category, where it ranks ninth. Phoenix has committed to adhering to the state mandate requiring that 15% of its energy come from renewable sources by 2025. Phoenix is middling in the categories of CO_2 and water, though still in the bottom tier of the Index. Transport and buildings remain challenging areas mainly owing to issues associated with its large area, heavy reliance on cars and a current lack of Leadership in Energy and Environmental Design (LEED)-certified buildings.

CO_2: 17th, 66.3 points

The amount of CO_2 emissions Phoenix produces per $1 million of GDP, at 190 metric tons, is much less than the Index average of 296, and indeed is the lowest rate among cities with a similarly low population density in the Index (below 5,000 inhabitants per square mile). This may be due, in part, to the fact that the city's economy is primarily services-oriented. Phoenix also performs favorably in per capita CO_2 emissions, which are, at 9.5 metric tons per person, well below the Index average of 14.5. In 2006 then governor of Arizona, Janet Napolitano, established a statewide goal to reduce Arizona's greenhouse gas emissions to year 2000 levels by 2020, and to 50% below 2000 levels by 2040.

Green initiatives: In 2005 Phoenix conducted its first inventory of CO_2 emissions from city operations, and at the same time set a target to reduce the city government's share of greenhouse gas emissions by 5% from 2005 levels by 2015. In addition, since 2000 the city's transportation department has been converting incandescent traffic signal bulbs to more efficient LED lights, capable of reducing energy use by up to 90%. By 2007 the city claimed that more than 9,000 LED lights had been installed in roughly 80% of traffic signals.

Energy: Ninth, 72.9 points

Energy is Phoenix's best category performance in the Index. The city's per capita electricity consumption is better than the average, at an estimated 42 gigajoules compared with an Index average of 52 gigajoules. However the city uses

an estimated 407 gigajoules per $1 million of GDP, which is more than the Index average of 332. Both of these numbers were estimated by scaling down state retail electricity figures from 2008 to the city level. The city has strong energy policies in place, receiving full marks, for example, for developing green energy projects. Also, in 2008 the City Council mandated that by 2025, 15% of energy used by the city should come from renewable sources, which is consistent with a target established by the Arizona state government.

Green initiatives: The city launched Energize Phoenix to transform a ten-mile stretch of the city's new light rail line (see "green initiatives" under "transport") into a Green Rail Corridor. With $25 million in federal funding, Phoenix is installing energy efficient air conditioners, water heaters and windows, as well as smart metering devices in homes and businesses along the corridor to help costumers reduce energy usage. Furthermore, officials have approved several small solar panel installations at fire stations, park restrooms, libraries, a solid waste transfer station and the Phoenix Convention Center. Also, the city's public works department plans to build a utility-scale solar plant in the city's only active landfill, anticipated to be the nation's first concentrated solar thermal system at a landfill. It will be capable of generating power to an estimated 50,000 homes, and is scheduled to be completed by the end of 2012.

Land use: 20th, 49.6 points

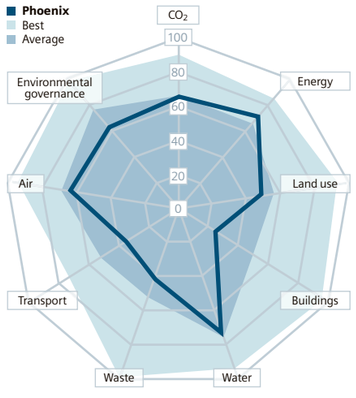
Phoenix has extensive nature preserves, and 14% of the city's area is dedicated to green space, compared with the Index average of 12%. However, the city is extremely spread out and not densely inhabited. Though Phoenix is the seventh most populous city in the Index, its massive area of 474 square miles makes it one of the least densely populated, at 3,400 people per square mile, compared with the Index average of 8,100. Despite the challenges Phoenix faces to discourage sprawl, the municipal government has enacted strong policies aimed at this goal. In the last few years more businesses and residents have begun returning downtown, and the state's largest university, Arizona State, has broken ground on a major new campus in Central Phoenix.

Green initiatives: Since 1998 Phoenix has operated a brownfield lands recycling program that provides assistance to city departments and the private sector to redevelop contaminated plots. Officials have used grants from a number of sources to stimulate more than $293 million in private investment. This money has been used to restore 21 sites totaling approximately 275 acres, according to city reports. In addition, in 1995 the city started offering financial incentives such as the waiving of sewer and water fees to occupants of housing units constructed in central areas, in order to discourage urban sprawl and congestion. This has resulted in 4,500 new, more central housing units.

Buildings: 23rd, 26.7 points

In recent years Phoenix has enacted energy efficiency building standards to improve new building performance. However, the city lacks the municipal-level incentives for retrofitting offered by many other cities in the Index. In addition, the city ranks far below the Index average for buildings certified by LEED, with fewer than one building per 100,000 persons, compared with the Index average of 6.4. However, having recently hosted the annual green expo of the US Green Building Council (the organization responsible for administering LEED standards and certification), Phoenix has demonstrated an intention to continue making progress in this area.

Green initiatives: Phoenix's building code, revised in 2006, has stringent energy-related measures for all new buildings, many of which surpass the widely accepted LEED standards. The city's code requires landscapes that reduce the use of heat-absorbing pavement, recycling 50% of construction waste from landfills, and a LEED professional to advise on all projects,



among many other mandates. Officials believe this code will lead to substantial water conservation (up to 50% through landscaping and 20% through improvements inside the buildings), as well as a 30% overall reduction in energy consumption. To help residents meet these standards, the city has established the Greening Homes and Businesses program, which advises on how to conduct energy and water audits, and offers subsidies for energy retrofits.

Transport: 26th, 38 points

Phoenix's rank in this category is not surprising given the challenges that such a large administrative area presents in terms of mass transit. Phoenix offers just 0.2 miles of public transport per square mile, compared with the Index average of 1.1 miles per square mile. As a consequence, only 5% of the city's workers commute by public transportation, bicycle or foot, compared with the Index average of 13%. Whereas other large, relatively car-dependent cities have had some success expanding public bus or bus rapid transit service, Phoenix's hot climate makes this option less viable. Most residents are not willing to endure waiting in the heat for public transit if they do not have to. In addition, Phoenix voters passed legislation in 2006 aimed at restricting municipal government spending on development of the city's mass transit system. Despite these challenges, Phoenix is determined to embark on a new course in upcoming years. City leaders hope that a major light rail project (see "green initiatives" below), which the city has spent several years and considerable capital getting approved and partially constructed, will get them there faster.

Green initiatives: In 2008 the city opened its first light rail network, initially covering 20 miles, with plans to extend it to 37 miles by 2025. A ten-mile stretch of the light rail line has been named the Green Rail Corridor (see "green initiatives" under "energy" above), along which Phoenix is carrying out a range of energy efficiency projects. In 2007 Phoenix announced $70 million in improvements, including roughly 16% more miles of service, more than 500 new sheltered bus stops and more than 120 new buses. A bus rapid transit service started in 2003 using existing freeway carpool lanes. Regarding cycling initiatives, as early as 1987 the city adopted a bikeway program that, in tandem with other city efforts, has resulted in adding over 520 miles of bike lanes, bike routes and multi-use trails, as well as special bicycle crossings in some city street intersections.

Water: 18th, 77.4 points

Phoenix performs favorably against the Index average in terms of the percentage of water leakages, at 7% compared with the average of 13%. However, its per capita water consumption of 217 gallons per person per day is much higher than the Index average of 155 gallons. The city has invested heavily throughout the years in water distribution and treatment facilities, and has been relatively successful in utilizing its limited water supply. According to a city water report, 90% of treated wastewater is recycled as potable drinking water, or used for agriculture or landscaping.

Green initiatives: Phoenix found a cost-effective and eco-friendly way to revitalize a 25-acre section of riverbank using wastewater. The city used local, state and federal funding to obtain a pump that diverts wastewater to the area, called Tres Rios. The first phase was finished in 2007, and Tres Rios is now home to diverse animal and plant life reintroduced in the area. Additional phases of the project, which comprises a total of 380 acres, are already under way supported by $36 million in federal funding.

Waste: 21st, 40.5 points

The percentage of recycled waste in Phoenix, at 11%, is well below the Index average of 26%. Though the city has tried to introduce a recycling program to most residents and has selective disposal mechanisms for different types of waste, sustainable waste management remains an area for improvement.

Green initiatives: In 1998 Phoenix was one of the first cities in the US to establish a single-stream recycling initiative (in which all recyclables are accepted in one container) and currently curbside recycling is offered at residential properties ranging from single family homes to buildings with up to 30 units. In another initiative, the city has conducted studies into the viability of deploying gas-to-electricity technologies in at least three area landfills. The municipal government plans to establish a methane-fueled power plant at one site with the eventual capacity to power an estimated 2,000 homes. Though construction was supposed to be completed by 2009, the project has been delayed repeatedly.

Air: 19th, 65.2 points

Despite its middling ranking in this category, Phoenix has the lowest levels of sulfur dioxide emissions in the Index, at 3 lb per person compared with the Index average of 22 lb. These comparatively low levels of sulfur dioxide emissions are likely owed, in part, to the state utility's voluntary efforts to reduce emissions at its power plants in recent years, as well as to Arizona's use of nuclear power. Phoenix has room for improvement in other pollutant categories, with particulate matter emissions at 37 lb per person, higher than the Index average of 25 lb. This is largely a result of the high volume of dry desert dust from construction sites and unpaved roads, which constituted over half of Phoenix's particulate emissions in 2005.

Green initiatives: The city has focused on dust reduction to improve air quality. Between 1999 and 2006, municipal officials spent more than $19 million to pave or treat over 330 miles of roads, procure street sweepers that kick up less dust, provide dust-reduction training to road maintenance staff and building contractors, and enforce standards prohibiting unpaved lots and off-roading. In 1994 the city began introducing alternative fuel vehicles into its fleet, and currently more than 3,000 vehicles operate on compressed natural gas, liquefied natural gas, biodiesel, and hybrid technology. Roughly 70% of the city's 480 public buses now run on liquefied natural gas.

Environmental governance: 21st, 62.2 points

Though municipal authorities have enacted several programs aimed at improving the city's environmental performance and have launched public awareness campaigns, the lack of environmental targets and vagueness of overall strategy remain areas for improvement. The city has taken steps to improve, however, introducing a municipal purchasing program that favors products and services that minimize environmental impact.

Green initiatives: The municipal government has an Office of Environmental Programs dedicated to coordinating city environmental programs, developing policies and regulations, and providing technical and regulatory assistance to city departments. In addition, the city is in the process of creating a comprehensive environmental plan called Plan Phoenix, and has made public participation an element of the process.

Quantitative indicators

Category	Indicator	Average	Phoenix	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**190.1**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**9.5**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.41**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales; Scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**41.6**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**13.8**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**3,362.1**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**0.9**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**5.0**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**15.9**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.3**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**25.6**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**11.0**	2008 –2009	City	City of Phoenix Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**217.3**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**6.6**	2010	City	Water Services, City of Phoenix	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**50**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**37**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**3**	2005	County	EPA; US Census Bureau	Using county population

Pittsburgh

US and Canada Green City Index

Background indicators

Total population [1]	310,000
Administrative area (miles^2) [1]	55
GDP per person (real) (US$) [2]	39,400
Temperature (24-hour average, annual) (°F) [1]	51
Goods employment (%) [2]	14
Services employment (%) [2]	86

Geographical basis: 1) City, 2) MSA

Pittsburgh, located in the northeastern US state of Pennsylvania, was once home to a thriving steel industry, but since its collapse in the 1980s lower-carbon industries began to dominate the local economy. Today companies in the finance, technology, services and healthcare sectors are major employers, though some legacy manufacturing remains. Pittsburgh is also emerging as an important hub for arts and culture. A GDP per capita of $39,400 places the city in the lower-income bracket in the US and Canada Green City Index. At 55 square miles, it also has one of the smallest administrative areas in the Index and has a relatively low population of 310,000. Data for Pittsburgh in the Index are based on a mix of statistics for the city and the Greater Pittsburgh Area, which has a population of 2.4 million. In 2010 the city hosted the United Nations World Environment Day, which helped bring sustainability issues to the forefront of public discourse.

Pittsburgh ranks 23rd overall in the Index. Although the city is in the lower half of the Index rankings for most categories, it has some notable strengths it can build on. In the buildings category, for example, largely through robust policies on Leadership in Energy and Environmental Design (LEED) certification, Pittsburgh achieves its highest category rank, fourth. Public transit supply is also relatively strong, as are the city's efforts on recycling. In addition, Pittsburgh appointed its first sustainability coordinator in 2009 (see "green initiatives" in "Environmental governance"), illustrating the city's commitment to improving its overall environmental performance.

CO_2: 24th, 38.8 points

Pittsburgh releases 645 metric tons of CO_2 for every $1 million of GDP, more than double the Index average of 296 metric tons. One caveat is that this is based on 2002 data, and Pittsburgh's economy has continued its shift from manufacturing to services in recent years, so this figure is likely to have decreased. On a per capita basis, Pittsburgh emits 24.6 metric tons of CO_2 against an Index average of 14.5 metric tons. Where Pittsburgh scores relatively well is on policy. The city has set a CO_2 reduction target separate from national guidelines, monitors emissions, and, by the standards of the Index, has a fairly ambitious greenhouse gas reduction strategy.

Green initiatives: The Pittsburgh Climate Action Plan, unveiled in 2008, set a target of reducing citywide greenhouse emissions 20% below 2003 levels by 2023. The Pittsburgh Climate Initiative, comprising a range of private organizations working alongside city staff, is in charge of implementing the plan. The initiative subsequently set a specific target for reducing municipal emissions 20% below 2003 levels by 2023. To meet these targets, the city outlined a series of emissions reduction initiatives, including replacing city information servers with newer more efficient models, and several programs aimed specifically at reducing energy consumption (see "green initiatives" under "Energy").

Energy: 15th, 67.6 points

A shift towards services has helped Pittsburgh lower its electricity consumption in relation to economic output. At 163 gigajoules per $1 million of GDP, Pittsburgh's electricity usage is less than half the Index average of 332. Of all the other low-income cities in the Index, only Miami fares better. On a per capita basis, Pittsburgh consumes 49 gigajoules, which is slightly lower than the Index average of 52 gigajoules. Despite below average electricity consumption, the city's score is weighed down by several policy omissions. Pittsburgh is one of only a few cities in the Index that do not promote green energy for businesses and homes, either through incentives or subsidies. And although it did receive federal funding in 2007 and 2008 to build solar power infrastructure (see "green initiatives" below) the city falls behind Index leaders on adopting green energy. However, Pittsburgh is marked up for increasing the amount of locally produced energy.

Green initiatives: Pittsburgh plans to replace incandescent bulbs in all of the city's 40,000 street lights with energy efficient LEDs. No timetable for completing the project has been set, although all of the 3,000 street lights in the city's business district were replaced at a cost of $2.5 million during 2010. The city also installed LEDs at 800 traffic light intersections the same year at a cost of $3 million. Pittsburgh also carries "Solar America City" status, which entitles the city to federal grants to develop solar power infrastructure. With $2.6 million that Pittsburgh has received so far, the city installed its first solar hot water heater on a firehouse in 2009 and planned to install a further five in subsequent years.

Land use: 19th, 50.7 points

About 9% of the area within the Pittsburgh city limits is designated as green space, compared with an Index average of 12%, although its small size and low population density work against it. And with 5,700 persons per square mile, Pittsburgh falls well below the overall average 8,100 persons. In addition, the city's measures to maintain green spaces or protect against sprawl are not as well developed as in other Index cities. However, one highlight of its performance in land use is its proactive brownfield regeneration policy, which includes the Green Up Pittsburgh program (see "green initiatives" below). The city also has an active tree planting policy, which should help it improve in this category in the coming years.

Green initiatives: The city launched the Green Up Pittsburgh program in 2007 with the aim of planting vegetation on vacant city-owned lots. The city provides local residents who wish to take part in the program with materials, such as soil and plants, which they use to "green up" and maintain the vacant lots. The city reports that over 100 lots have been transformed in this way.

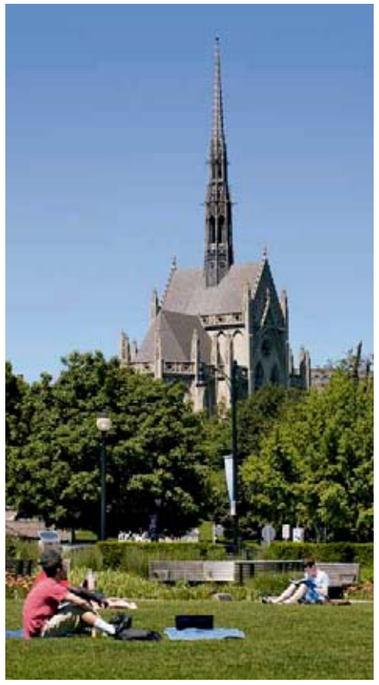
Buildings: Fourth, 78.5 points

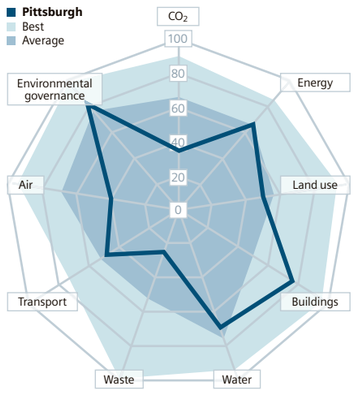
Pittsburgh achieves its highest rank in buildings. The performance is all the more impressive given that low-income cities tend to fall towards the bottom of the Index in this category. But Pittsburgh bucks that trend through strict policies, particularly on LEED certification (see "green initiatives" below). For every 100,000 people in Pittsburgh there are 15.4 LEED-certified buildings, which is more than double the Index average. The city also scores well for offering incentives for building retrofits and giving out information to offices and homes about ways to reduce energy consumption.

Green initiatives: Pittsburgh mandates that all publicly financed buildings over $2 million or 10,000 square feet attain LEED silver certification. The city also provides a so-called "density bonus" for LEED-certified buildings, which allows them to rise 20% higher and have 20% more floor area than non-LEED buildings. Furthermore, in 2010 the county unveiled its first green roof on a municipal building. The rooftop garden offers a wide range of benefits, including an expected 10-20% reduction in heating and cooling costs, and improved air quality.

Transport: 14th, 51.2 points

Pittsburgh ties with Miami in the transport category. With 25 public transport vehicles per square mile, the city is well above the overall average of nine vehicles; only three cities in the Index claim more public transport vehicles.





Nonetheless, Pittsburgh's score is weighed down by the length of its transport network; measuring just 0.13 miles per square mile, it is one of the shortest in the Index. The city is one of only four in the Index that do not have any large central pedestrian zones or areas with limited traffic. The city performs well on green transport promotion, though, and has invested in making the municipal fleet more environmentally friendly. The average commute time to work in Pittsburgh, at 25 minutes, is also one of the shortest in the Index, but the city may well have benefited on this indicator by its small size.

Green initiatives: To encourage greater use of bicycles, the city appointed its first bike-pedestrian coordinator in 2007. Since the appointment the city reports that around 13 miles of bike lanes have been built. In 2009 Pittsburgh passed an ordinance to simplify the installation of bike racks on city sidewalks and in public right-of-ways. Property and business owners can now install racks that conform with city bicycle parking standards for a flat fee of $25.

Water: 22nd, 71.6 points

Pittsburgh's water score is bolstered by a fairly robust set of policies. The city monitors main water sources for level and quality, and promotes lower water usage. Wastewater treatment and storm water management are also strong. The scoring gains made on policy are, however, undermined by weaknesses elsewhere. Over a quarter of the water passing through Pittsburgh's water distribution system is lost to leakages, compared with the 13% Index average. Water consumption per capita is 155 gallons per day in Pittsburgh, which is in line with the Index average.

Green initiatives: As noted above, in 2010 Allegheny County unveiled its first green roof on a municipal building as part of a pilot study in conjunction with the University of Pittsburgh. In addition to improving air quality and normalizing temperatures inside the building, the rooftop garden absorbs storm water, decreasing the amount of pollution flowing into the area's rivers. University researchers are monitoring water levels in the green roof, and the county expects to work with residents and businesses to develop private green roofs.

Waste: 25th, 25.5 points

Along with air, this is Pittsburgh's weakest placement in the Index. The city's proportion of recycled municipal waste, at 14%, is one of the smallest among the low-income group of cities and well below the 26% Index average. While current levels are low, Pittsburgh has made efforts to increase recycling (see "green initiatives" below). The city also picks up points for installing facilities to treat different types of waste: recyclable, hazardous and industrial. Local waste management practices, such as composting and the conversion of waste by-products to energy, however, are absent.

Green initiatives: Organizers of community events that expect 200 or more people per day are required to recycle beverage containers and corrugated cardboard. To boost the city's recycling efforts, a Let's Tackle Recycling promotion was targeted at Pittsburgh Steeler football fans during the last three games of the season, which ended in January 2011. Nearly eight tons of recyclables were collected as a result of this initiative.

Air: 25th, 40.1 points

Although air quality in Pittsburgh has undoubtedly improved over the past decade after the decline of the steel industry, it remains one of the city's biggest challenges. The city has the highest annual sulfur dioxide emissions in the Index, at 84 lb per person, for example. Although Pittsburgh's economy is not goods-intensive, the presence of manufacturing in the region likely exacerbates pollution levels, as does traffic congestion and underdeveloped air quality policies. Pittsburgh is not as rigorous as other Index cities in setting air quality targets, and polices that are in place are developed at a county level and not by city authorities.

Green initiatives: In 2006 two private groups, Clean Water Action, Pittsburgh, and the Group Against Smog and Pollution, joined forces to form the Allegheny County Partnership to Reduce Diesel Pollution. The initiative aims to reduce diesel emissions from all polluters, including school buses, transit buses, trucks, waste haulers, locomotives and marine vessels. In 2009 the group successfully lobbied the Pittsburgh Public School Board to pass a measure mandating that all school-bus operators equip 85% of their buses with diesel particulate filters by the end of the 2014 school year to reduce tailpipe emissions of diesel particulates by 90%.

Environmental governance: 14th, 85.6 points

Pittsburgh's environmental governance score is bolstered by its strong record in green management: the city has a dedicated environmental authority, gives the public access to information on environmental performance and policies, and has made environmental commitments at an international level. While Pittsburgh monitors its progress on environmental goals, the city has not yet produced a status report, which hinders its score in this category.

Green initiatives: In 2009 the city appointed its first sustainability coordinator. The coordinator is charged with implementing programs outlined in the Pittsburgh Climate Action Plan, including working with the Public Works Department to improve street lighting efficiency. Additionally, the coordinator is charged with driving efforts to improve energy efficiency and adopt renewable energies, and reviewing municipal codes to make buildings greener. Pittsburgh also boasts several private initiatives that are striving to improve the city's environmental performance through engagement with decision makers and community outreach. Sustainable Pittsburgh, for example, works with local governments, citizens and businesses across the Greater Pittsburgh Area on projects that integrate notions of economic prosperity, social equality and environmental sustainability.

Quantitative indicators

Category	Indicator	Average	Pittsburgh	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**644.9**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**24.6**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.16**	2008	City	City of Pittsburgh; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**48.6**	2008	City	City of Pittsburgh; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**8.9**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**5,666.3**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**15.4**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**9.7**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.1**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**15.5**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**25.3**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**25.4**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**13.6**	2008	City	City of Pittsburgh	
Water	Total water consumption per person per day (gallons)	155.1	**155.1**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**26.0**	2009	City	Pittsburgh Water and Sewer Authority (as reported by WTAE.com)	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**94**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**24**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**84**	2005	County	EPA; US Census Bureau	Using county population

Sacramento

US and Canada Green City Index

Background indicators

Total population [1]	467,000
Administrative area (miles^2) [1]	97
GDP per person (real) (US$) [2]	36,700
Temperature (24-hour average, annual) (°F) [1]	61
Goods employment (%) [2]	10
Services employment (%) [2]	90

Geographical basis: 1) City, 2) MSA

Sacramento is the capital of the state of California. As such, government is the biggest employer and services drive the local economy, with several large technology firms based there. Located at the confluence of two rivers, Sacramento also has a large and important deep-water port that links to the San Francisco bay. The city's GDP per capita of $36,700 is the second lowest in the US and Canada Green City Index. With 467,000 inhabitants occupying just under 100 square miles, Sacramento has a relatively low population density, leading to a particular reliance on automobiles. The wider metropolitan region has a population of 2.1 million, and data included in the Index for Sacramento are based on a mix of statistics for the city and metro area. A high-temperature city in the Index with an annual average of 71degrees Fahrenheit, Sacramento typically boasts 193 sunny days per year, putting it in a strong position to develop solar power.

Sacramento ranks 15th overall in the Index. The city's strongest categories are air, at fourth, and waste, at sixth. It has a comparatively high municipal waste recycling rate and its air quality is among the best in the Index. The city's lowest category ranking is energy, where it places 24th, a performance constrained by its relatively high electricity consumption. Despite that, Sacramento records the best overall green performance by a low-income city in the US.

CO_2: 16th, 67.6 points

Sacramento's per capita CO_2 emissions, at 11.7 metric tons, beat the Index average of 14.5 metric tons, a commendable performance given that low population density cities with hot climates generally have above average per capita CO_2 emissions. And for every $1 million of GDP that Sacramento generates it emits 269 metric tons of CO_2, less than the Index average of 296 metric tons. Although the city has set tougher reduction targets for greenhouse gas emissions than the state of California requires (see "green initiatives" below), other cities in the Index go further.

Green initiatives: Adopted in 2007, the Sacramento Sustainability Master Plan has a target to cap community-wide greenhouse gas emissions at 1990 levels by 2020. The first phase of Sacramento's 2010 Climate Action Plan aimed at improving energy efficiency at municipal facilities. The plan also established a goal to reduce carbon emissions from city operations to 13% below 2005 levels by 2020. As a result of a planned increase of renewable energy by the Sacramento local utility, the city estimates that overall greenhouse gas emissions will fall 22% below 2005 levels by 2020. That would exceed the minimum recommended greenhouse gas reduction target set by the state of California: 15% below 2005 levels by 2020.

Energy: 24th, 49 points

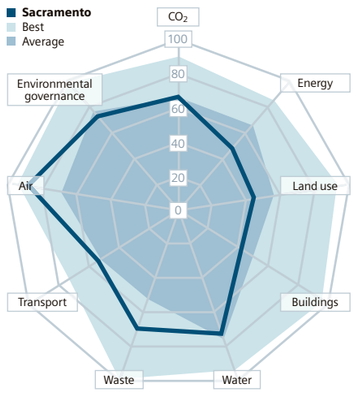
Sacramento registers its lowest ranking in energy. At 99 gigajoules per person, Sacramento's electricity consumption per capita is nearly double the Index average of 52. Electricity consumption per $1 million GDP, at 592 gigajoules, is also one of the highest in the Index. Since these electricity consumption figures were compiled in 2009 the city has increased efforts to reduce energy consumption at municipal facilities. In addition, solar energy projects are also in the planning stages (see "green initiatives" below), suggesting that Sacramento's performance in this area could improve in coming years.

Green initiatives: Sacramento is one of 25 US cities carrying "Solar America City" status, entitling it to federal funding of $200,000 to develop solar power. In early 2011 the city signed a deal to generate 1.9 megawatts of solar power through "power purchase agreements". Under the program, a third party was granted a long-term lease to install, operate and maintain solar power infrastructure on eight municipal buildings. The solar power will be charged to the city at rates cheaper than standard utility prices. Sacramento is negotiating with a local private solar energy company to lease out city-owned land for a 20-megawatt solar farm. Construction is expected to begin in early 2012.

Land use: 22nd, 44.4 points

Sacramento scores well for its green land use policies, which include measures to protect green space from building development. However, its performance in this category is weighed down by its low population density – at just 4,800 persons per square mile compared with the Index average of 8,100. This is coupled with the relative lack of green space within city limits, at 9% of the city area, compared with the Index average of 12%. Furthermore, although efforts have been made in recent years to attract residents back to the downtown and to develop abandoned lots (see "green initiatives" below), the city is one of just five cities in the Index that lack comprehensive measures to limit the conversion of green space into built areas.

Green initiatives: Sacramento's 2030 General Plan, approved in 2009, calls for two-thirds of city growth to be on vacant or under-used land in urban areas and emphasizes "infill" development. Furthermore, the US Environmental Protection Agency (EPA) awarded Sacramento a $400,000 grant in 2009 to encourage brownfield redevelopment. The funds are used mainly to provide potential redevelopers with free assessments of contaminated sites. Additionally, the Greenwise Sacramento Regional Action Plan, published in January 2011, establishes a goal for the city to plant three million trees by 2020. The plan also recommends the design of new communities to be based on the "20-minute neighborhood" principle, where all amenities are within walking distance. And, as a member of the Sacramento Area Council of Governments (SACOG), an association of governments across the six-county metropolitan region, the city participates in the Rural-Urban Connections Strategy to protect the economic and environmental suitability of its rural areas. Working groups are currently developing plans that will drive regional cooperation and strategy in the areas of land use and conservation, agriculture, economic opportunities, forest management and regulations.



Buildings: 17th, 41.7 points

Sacramento performs relatively well for the number of Leadership in Energy and Environmental Design (LEED)-certified buildings, at 9 per 100,000 people, compared with the Index average of 6.4. This is in part due to mandatory standards that came into effect in 2004 (see "green initiatives" below). However, energy efficiency standards for new buildings are not as strict in Sacramento as in many other Index cities. Calgreen, a statewide mandatory building code introduced in January 2011, will change that. The code mandates that all new buildings in California use 20% less water than an average comparable building in the state, requires builders to recycle 50% of construction waste, and mandates energy audits for all non-residential buildings over 10,000 square feet to ensure energy efficiency.

Green initiatives: LEED certification for all municipal building projects has been mandatory in Sacramento since 2004. For projects over 5,000 square feet, the city stipulates LEED silver certification. With the help of federal funds awarded in 2009, Sacramento began retrofits at selected city facilities to make them more energy efficient. The city expects the upgrades, completed in 2011, will save $2.4 million over ten years. A countywide task force has produced a set of sustainability recommendations for new and existing buildings. The recommendations will feed into Sacramento's new Green Building Ordinance, expected to be approved in 2011.

Transport: Tenth, 56 points

Like most low-density cities in the Index, Sacramento's public transport network, measuring 0.3 miles per square mile, is considerably shorter than the Index average of 1.1 miles. As a result, only 6% of commuters in Sacramento use public transport, bicycles or go by foot to work, well below the Index average of 13%. City authorities seem aware of the need to improve in this area, however. City-hired private consultants, paid for by federal funds, began a study in March 2011 to assess the environmental impact that streetcars might have in Sacramento. The city's performance in transport is already boosted as a result of robust efforts aimed at green transport promotion. Sacramento actively promotes public awareness around sustainable transport and is making progress "greening" the public transport fleet (see "green initiatives" below).

Green initiatives: As part of Sacramento's sustainable fleet program, started in 2007, the city aims to replace all of its diesel solid-waste refuse trucks with ones that run on liquefied natural gas by 2014. To streamline fleet operations, the city already installed telemetry and GPS equipment in some 400 vehicles during 2010 and another 100 vehicles are slated for 2011. The telemetry system is designed to find more energy efficient routes for drivers and promises fuel savings of up to 25% a year. Furthermore, in conjunction with the SACOG, Sacramento participated in drafting the Preferred Blueprint Scenario in 2004. The blueprint calls for the development of transport choices across the metropolitan region that encourage people to walk, bicycle, use public transport or carpool, and identifies the close link between transport and land use policies. It was used as the basis for the Metropolitan Transportation Plan for 2035, which SACOG adopted in 2008. Specific projects to receive funding are currently under review.

Water: 20th, 76.3 points

Sacramento's water performance is hindered by higher than average water consumption, a challenge also for other high-temperature cities in the Index. At 207 gallons per capita per day, Sacramento exceeds the Index average of 155 gallons and is among the highest water consumers in the Index on a per capita basis. The city scores well, however, for its water conservation efforts (see "green initiatives" below) and for using recycled water. The city also has a fairly efficient water distribution system by the standards of the Index, losing only 10% of its supply to leaks against the average of 13%.

Green initiatives: New and stricter restrictions on outdoor water use came into effect in 2009. They include a ban on washing sidewalks and driveways and landscape irrigation is limited to certain times and days of the week. The city provides free house calls from water conservation specialists to advise residents on ways to reduce water consumption and offers rebates for the installation of low-flow toilets and high-efficiency clothes washers. A Water Conservation Ambassadors program, launched by the city in 2010, provides volunteer ambassadors free training on water conservation. The lessons learned can be passed onto friends, neighbors and family.

Waste: Sixth, 72.2 points

Sacramento achieves one of its highest rankings in the waste category. The city has the fifth highest recycling rate in the Index, at 47% versus the average of 26%, the result of comprehensive policies and public participation. Measures are in place to reduce waste creation, as are facilities to treat different types of waste (recyclable, hazardous and industrial). Local waste management practices, such as composting or converting local waste by-products to energy, are relatively underdeveloped but the city has made recent efforts to improve in this area (see "green initiatives" below).

Green initiatives: Sacramento has a citywide program, involving 100,000 households, to put lawn and other green waste in special containers. The containers are collected for composting. To encourage backyard residential composting, the city runs a series of free workshops and sells discounted compost bins. A rewards recycle pilot scheme began in May 2010. Residents earn points for the amount of recyclables they put aside correctly, which can be used to purchase items at participating local and national retail stores. The pilot area saw a 7% decrease in contamination of recyclables (mixing of garbage and recyclables) through the rewards program. Sacramento is considering extending the scheme citywide.

Air: Fourth, 89.1 points

Sacramento achieves its highest ranking in the air category. The city is marked up for having one of the lowest annual emissions per capita of sulfur dioxide and nitrogen oxides in the Index. Emissions of particulate matter, at 23 lb per person, are just below the Index average of 25 lb. Although Sacramento already has one of the most robust sets of clean air policies in the Index, it is making further efforts to reduce harmful dust pollution (see "green initiatives").

Green initiatives: The city's five-minute idling time limit on heavy duty vehicles was extended to all the city fleet in August 2010. Anti-idling reminder stickers are placed on municipal vehicles when they are serviced to reinforce the message. To curb emissions of harmful fine particles, since 2007 residents and businesses have been banned from burning solid fuel between November and February – the time year when fine particle pollution is at its highest.

Environmental governance: 18th, 76.7 points

Sacramento ties with Calgary in the environmental governance category. The city scores well for producing regular reports on environmental progress, as well as for setting explicit targets. It has also made firm commitments at an international level, including signing the UN Urban Environmental Accords, an international voluntary agreement, in 2006. Under the accords, the city pledges to reduce greenhouse gas emissions 25% below 1990 levels by 2030. Sacramento's score in the environmental governance category is hindered by the lack of a dedicated and separate city unit dealing with citizens' complaints about environmental issues, and mixed progress on public awareness campaigns. Most campaigns have been launched at the state or regional level.

Green initiatives: Sacramento's 2007 Sustainability Master Plan integrates environmentally sustainable practices into city policies and is intended to drive climate change efforts across city agencies. The plan promotes the responsible management and effective stewardship of Sacramento's built and natural environments, and aims to transform the city administration into a resource-efficient and environmentally-conscientious agency. It calls for Sacramento to reduce pollution from city vehicles, reduce the city's use of pesticides, encourage staff members to drive less, and increase the efficiency of city buildings and operations, among others. Additionally, the Sacramento Area Green Partnership, which convenes officials from across the metropolitan region, meets quarterly to harmonize climate change efforts in local governments. In 2009 it published a county-wide greenhouse gas emissions inventory to encourage local collaboration on air quality.

Quantitative indicators

Category	Indicator	Average	Sacramento	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**268.9**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**11.7**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.59**	2009	City	Sacramento Municipal Utility District; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**98.9**	2009	City	Sacramento Municipal Utility District; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**9.4**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**4,811.1**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**9.0**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**6.1**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.3**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**13.0**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.6**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**25.6**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**47.0**	2009	City	City of Sacramento	
Water	Total water consumption per person per day (gallons)	155.1	**207.2**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**10.0**	2009	City	City of Sacramento	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**44**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**23**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**4**	2005	County	EPA; US Census Bureau	Using county population

San Francisco

US and Canada Green City Index

Background indicators

Total population [1]	820,000
Administrative area (miles^2) [1]	49
GDP per person (real) (US$) [2]	60,300
Temperature (24-hour average, annual) (°F) [1]	57
Goods employment (%) [2]	11
Services employment (%) [2]	89

Geographical basis: 1) City, 2) MSA

San Francisco is located on the northern coast of the US state of California, surrounded on three sides by the Pacific Ocean, the Golden Gate strait and the San Francisco bay. The city spans across the nearly 50 hills within its small administrative area. Covering just 49 square miles, San Francisco is one of the smallest cities in the US and Canada Green City Index, but with 820,000 residents, it is the second most densely populated. Data included in the Index come from a mix of statistics for the city and metropolitan area, which has a population of 4.3 million. San Francisco is one of the country's major financial hubs; tourism and a thriving high-tech sector in the larger metropolitan area are also important drivers of the local economy. The city generates the second highest GDP per capita in the Index at $60,300.

San Francisco ranks first overall in the Index. The city's exceptional performance is supported by its strong record in all categories across the board: along with Vancouver, it is the only city to place in the top ten in all Index categories. San Francisco's strongest area is waste, where it ranks first. In 2009 it became the first US city to require that all residents and businesses separate recycling and compost material from normal trash. As a result San Francisco now boasts the best municipal recycling rate in the Index. The city claims second place in buildings, transport and air, bolstered by one of the best energy efficient building standards, the second longest public transport network, and low levels of all pollutants measured in the Index. San Francisco has been a trailblazer in partnering with the private sector on innovative green initiatives. These include energy-awareness programs paid for by business, low-cost loans to property owners to fund green improvements, and placing the onus on company bosses to promote environmentally-friendly commuting. By developing closer ties with the private sector, San Francisco is better positioned to achieve its environmental goals.

CO_2: Eighth, 81.1 points

San Francisco's CO_2 emissions are better than average both in per capita and economic output terms. San Francisco emits 181 metric tons of CO_2 for every $1 million of GDP, versus an Index average of 296. And on a per capita basis the city emits 11.4 metric tons of CO_2 compared with an overall average of 14.5 metric tons. San Francisco has made further greenhouse gas emissions reductions a top priority. The city has made impressive headway in reducing municipal greenhouse gas emissions (see "green initiatives" below), and has outlined a range of carbon-reduction initiatives aimed at non-municipal sources, particularly in the areas of buildings, energy and transport.

Green initiatives: San Francisco's Climate Action Plan, unveiled in 2008, targets a 25% reduction in citywide greenhouse gas emissions by 2017 compared with 1990 levels. The 2025 target is 40% below 1990 levels, stretching to an 80% cut by 2050. City authorities say they are on track to cut municipal greenhouse emissions 20% below 1990 levels by 2012. A carbon offset program, launched in 2007, gives San Francisco extra financial muscle to reduce emissions. Under the scheme a 13% surcharge is placed on all city employee air travel. The money goes to a carbon fund, which finances carbon-reduction programs in the San Francisco area. Special kiosks in San Francisco International Airport, set up in 2009, allow domestic and international travelers to contribute to the fund.

Energy: Third, 81.1 points

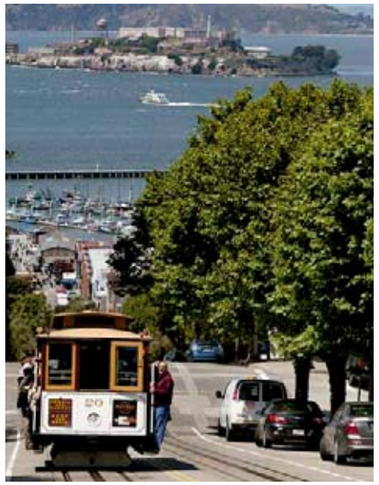
Electricity consumption in San Francisco is among the lowest in the Index. The city consumes 25 gigajoules of electricity per person, less than half the Index average. Likewise, San Francisco uses 77 gigajoules per $1 million of GDP, nearly one-fourth the overall average of 332 gigajoules. City efforts to promote energy efficiency are paying off. Between 2001 and 2010 energy efficiency programs, including the installation of greener appliances in residences and businesses, reduced electricity consumption in San Francisco by 29 megawatts – enough to power 29,000 households. Additional energy savings of six megawatts are expected in coming years as the city installs more efficient lighting, heating and cooling systems, and retrofits municipal buildings. These projects are backed by $19.2 million in state funding, awarded in 2010.

Green initiatives: San Francisco has been installing solar power systems on municipal buildings since 2001. The biggest installation is the 60,000-square-foot solar paneling on the San Francisco Convention Center, completed 2004. Generating 826,000 kilowatt hours annually, the center is the biggest city-owned solar power installation in the US. GoSolarSF, a solar incentive program started in 2008, offers rebates of up to $6,000 to residents and up to $10,000 to businesses for solar installations. Applications for solar installations jumped 450% in the first year of the program. To encourage the use of wind power, the city fast-tracks permits for the installation of municipal, commercial and residential wind turbines.

Land use: Eighth, 66.6 points

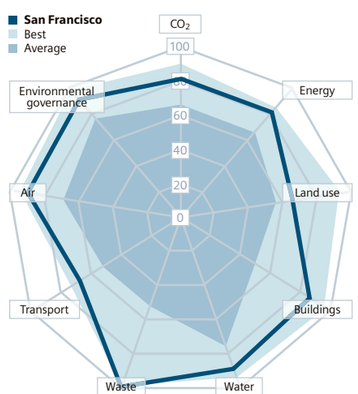
San Francisco's land use rank is bolstered by its high population density. With 16,600 residents per square mile, the city is the second most densely populated in the Index, behind New York. And despite its small area, San Francisco boasts a better than average proportion of land designated as green space – at 17% of city territory, compared with the Index average of 12%. However, some policy shortcomings hinder San Francisco's land use score. The city is found wanting in the promotion of brownfield regeneration, and efforts to contain urban sprawl could be stepped up. San Francisco does have measures, however, to improve the quantity and quality of green space.

Green initiatives: In December 2010 San Francisco adopted its A Better Streets Plan, a set of guidelines for the city's pedestrian areas (including sidewalks). Although primarily targeted at improving pedestrian safety, the plan also promotes the ecological potential of streets and identifies trees as the primary organizing element of city streetscapes. The plan calls for the increase of urban forest space through tree planting. Additionally, in 2008 San Francisco City Hall hosted an exhibition Victory Garden to encourage vegetable growing within the city. The garden produced over 100 pounds of food a week that was donated to food banks.



Buildings: Second, 85.6 points

San Francisco is one of only three cities in the Index that scores full marks for energy efficient building standards. Both private and city-owned buildings must adhere to strict energy regulations (see "green initiatives" below). The city also scores well for boasting an above average number of Leadership in Energy and Environmental Design (LEED)-certified buildings.



With 14.7 LEED-certified buildings per 100,000 people, San Francisco has more than twice the Index average of 6.4. One policy blemish is that information on how to decrease energy consumption in offices and homes is not as readily available in San Francisco as in other Index cities.

Green initiatives: Owners of commercial buildings smaller than 10,000 square feet have been required to track and publish energy consumption data every year since 2008. Commercial buildings greater than 10,000 square feet are required to complete energy efficiency audits every five years. Through compulsory audits the city estimates commercial buildings can reduce energy use by up to a half within 20 years. New private construction must also meet green building standards set by the city. LEED silver certification has been mandatory for all new municipal buildings and renovation projects of spaces over 5,000 square feet since 2004.

Transport: Second, 67 points

The San Francisco metropolitan area boasts the second-longest public transport network in the Index, measuring 5.4 miles per square mile, versus an overall average of 1.1 miles. Only Vancouver claims a more extensive public transport network. San Francisco also has the highest public transport vehicle availability. At nearly 55 vehicles per square mile, the city soundly beats second-placed New York (45 vehicles per square mile) and eclipses the relatively sparse Index average (nine vehicles). San Francisco's exceptional public transport infrastructure is complemented by the city's strong support for greener forms of transport (see "green initiatives" below). However, there is still room for improvement in the city's congestion reduction policies. San Francisco only receives partial marks for its traffic management policies and for progress on creating pedestrian zones in central areas.

Green initiatives: Under the Commuter Benefits Ordinance of 2009, businesses with 20-plus employees must incentivize public transit or carpooling to all staff working more than ten hours per week. Employers must either offer their staff members a pre-tax benefit to pay mass transit expenses, pay directly for employees' mass transportation expenses, or set up and for progress on creating pedestrian zones in central areas.

Water: Fifth, 87.4 points

San Francisco's water efficiency and treatment policies are among the strongest in the Index. Main water sources are monitored for quality and supply levels, and measures are in place to lower water usage. The city's water distribution system also has above average efficiency – 9% is lost to leaks compared with the 13% Index average. Water consumption in San Francisco, at 142 gallons per person per day, is also better than the Index average of 155 gallons. Nevertheless, authorities have recently launched a program to further reduce water consumption (see "green initiatives"). The use of recycled water, to conserve potable supplies, has also gained priority on the city's green agenda.

Green initiatives: Retrofitting of residential and commercial properties with water efficient plumbing fixtures has been mandatory since 2009. The city provides free low-flow showerheads and faucet aerators, as well as rebates on toilet and urinal replacements. These measures alone are expected to conserve up to four million gallons of water daily by 2017. And to encourage rainwater harvesting, San Francisco gives discounts to residents on rain barrels and cisterns. The city has started construction of two recycled water projects with another two in the planning phase; water from these plants will be used for landscape irrigation at parks and golf courses throughout the city.

Waste: First, 100 points

San Francisco is the only city in the Index to score full marks in a main category other than environmental governance. The city's waste performance is outstanding. San Francisco announced in August 2010 that it had achieved a municipal waste recycling rate of 77%, exceeding its 75% goal for that year. The city with the second-highest recycling rate in the Index, Los Angeles, manages to recycle a respectable 62% but other Index cities trail far behind. The 27-city average is 26%. In 2008 alone San Francisco diverted from landfills more than 1.6 million tons of waste, which is double the weight of the Golden Gate Bridge. Legislation that mandates recycling and composting, along with strong enforcement, is at the heart of San Francisco's impressive waste performance.

Green initiatives: San Francisco became the first city in the US to mandate composting and recycling in 2009. Residents, food establishments and organized events – if they are to avoid fines – must separate waste into three separate bins: recyclables, compost material and trash. In another US-city first, in 2007 San Francisco banned plastics bags. Stores now hand out certified compostable bags, reusable bags, or bags that have a minimum of 40% recycled content.

Air: Second, 91.9 points

Air quality in San Francisco is among the best in the Index. The city emits just 4 lb of sulfur dioxide per person, compared with the much higher Index average of 22 lb. Particulate matter emissions of 12 lb per person are also better than the overall average of 25 lb, as are nitrogen oxides emissions of 45 lb versus the Index average of 66. Despite its already strong record in this area, San Francisco is by no means complacent: the city's clean air policies are among the most robust in the Index (see "green initiatives").

Green initiatives: San Francisco's efforts to improve air quality started in earnest with the Healthy Air and Smog Prevention Ordinance of 1999, which required city managers to purchase the cleanest available vehicles for city fleets. By 2005 a directive was in place requiring 70% of non-emergency light-duty vehicles purchased by the city to run on alternative fuels. Furthermore, San Francisco's Green Taxi Law of 2008 requires cab companies to reduce greenhouse gas emissions 20% below 1990 levels by 2012. Nearly 60% of the city's cab fleet was running on alternative-fuel by March 2010.

Environmental governance: Eighth, 93.3 points

San Francisco ties with Minneapolis in the environmental governance category. The city has strong green management: there is a dedicated environmental authority and easy public access to information on policy and performance. The city is also marked up for its international commitments. It is a member of C40 Cities, a group of international cities working to reduce urban carbon emissions. And as a measure of San Francisco's high standing in environmental matters, the city played host to the signing of the Urban Environmental Accords, a non-binding treaty to tackle climate change, on June 5th 2005. Mayors gathered in San Francisco from all around the world to sign the agreement. However, San Francisco's governance scorecard is not without some blemishes. The city has not set explicit targets for each individual environmental issue, and the baseline review is not as far-reaching as in some other Index cities.

Green initiatives: To help achieve the greenhouse gas reduction goals laid out by San Francisco's 2008 Climate Action Plan, each city department was required to develop its own individual action plans to reduce emissions from its own activities as well as the private sector activities within its regulatory scope. The Department of the Environment coordinates green initiatives across departments and compiles annual progress reports.

Quantitative indicators

Category	Indicator	Average	San Francisco	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**180.9**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**11.4**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.08**	2009	City	California Energy Commission; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**24.5**	2009	City	California Energy Commission; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**17.1**	2008	City	Trust for Public Land; US Census Bureau	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**16,640.0**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**14.7**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**20.1**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**5.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**34.4**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**54.8**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**28.6**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**77.0**	2010	City	City of San Francisco	
Water	Total water consumption per person per day (gallons)	155.1	**142.0**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**8.8**	2005	City	City of San Francisco	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**45**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**12**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**4**	2005	County	EPA; US Census Bureau	Using county population

Seattle

US and Canada Green City Index

Background indicators

Total population [1]	620,000
Administrative area (miles^2) [1]	84
GDP per person (real) (US$) [2]	54,900
Temperature (24-hour average, annual) (°F) [1]	53
Goods employment (%) [2]	16
Services employment (%) [2]	84

Geographical basis: 1) City, 2) MSA

Seattle is located on an isthmus between Puget Sound and Lake Washington in the northwestern US state of Washington. The city has a goods-intensive economy, owing largely to manufacturing companies based there, attracted by Seattle's busy seaport. The Port of Seattle is an important hub for trade between the US and Asia. High-tech and aerospace companies are also large local employers, and Seattle boasts one of the most prosperous economies in the US and Canada Green City Index, generating a GDP per capita of $54,900. In population terms the city is mid-sized by Index standards, with some 620,000 residents within the city limits. Index data for Seattle are based on a mix of statistics for both the city and the wider metropolitan area, which has a population of 3.4 million. Long a leader among US cities on environmental policy, Seattle has set many lofty environmental goals over the past decade, and reaffirmed its status as a trailblazer when, in 2010, the city council adopted long-term carbon neutrality as one of its 16 priorities.

Seattle ranks fourth overall in the Index. The city's strongest category is buildings, where it claims first, helped by being earlier than most in mandating Leadership in Energy and Environmental Design (LEED) certification for municipal building projects. Seattle also performs particularly well in the waste category, placing second, boosted by a relatively high rate of municipal waste recycling. As much as 40% of Seattle's greenhouse gas emissions come from vehicles (private and city-owned), which has spurred city efforts to make transport greener. Those efforts have had an impact, reflected in above average performances in the CO_2 and air categories. Of the seven goods-intensive cities in the Index, Seattle's overall green performance is second only to Vancouver.

CO_2: Sixth, 84.7 points

For every $1 million of GDP that Seattle generates, it releases 157 metric tons of CO_2 into the atmosphere – considerably less than the Index average of 296 metric tons. The city's CO_2 emissions per capita, at 9.6 metric tons, are well below the overall average of 14.5. Seattle's efforts to green the city fleet, along with energy conservation efforts, have played a big part in cutting CO_2 emissions. Its CO_2 reduction strategy is also strong and includes setting a CO_2 reduction target separate from national guidelines.

Green initiatives: In 2005 Seattle's mayor launched the so-called Kyoto Challenge encouraging American cities to implement the protocol when the federal government failed to ratify it. Since then, more than 1,000 mayors have signed the US Mayors Climate Protection Agreement, which includes a commitment to meet or beat the Kyoto emission targets to reduce greenhouse gas emissions 7% below 1990 levels by 2012. Seattle reached that goal in 2008 despite a population growth of 16% since 1990. In 2010 the city council adopted carbon neutrality as one of its 16 priorities, but the city has not yet published a plan on how it will achieve this goal. Instead Seattle's current plan calls for the reduction of greenhouse gas emissions 30% below 1990 levels by 2024, and 80% by 2050. Furthermore, in 2005 the local electricity supplier Seattle City Light (SCL) became the first large US public utility to achieve zero net greenhouse gas emissions and it has achieved that feat every year since.

Energy: 12th, 69.8 points

Seattle's electricity consumption in relation to economic output, at an estimated 195 gigajoules for every $1 million of GDP, is around two-thirds of the Index average. The city has more work to do on reducing electricity consumption per capita: it consumes 59 gigajoules per person, slightly more than the Index average of 52 gigajoules. This is the third highest rate of per capita electricity consumption among mid-population cities. Seattle officials are well aware of the challenges and have embarked on a series of energy-conservation programs (see "green initiatives" below). Moreover, the city is leading by example. The majority of its electricity comes from renewable sources, primarily hydropower and wind, and the utility offsets emissions from other sources by investment in carbon reduction projects.

Green initiatives: In 2008 the local electricity utility launched a five-year Conservation Action Plan designed to save customers more than $310 million in energy bills and avoid nearly 1 million metric tons of greenhouse gas emissions between 2008 and 2012. The program includes incentives for residences and businesses to conserve energy, including assistance in designing buildings for energy conservation, rebates for replacing older home and commercial equipment with new Energy Star appliances, and encouraging the installation of real-time energy consumption monitors. Home energy audits for a subsidized rate of $95 are available from SCL. In 2010 it upgraded 5,000 streetlights to more energy efficient LEDs and will replace an additional 40,000 lights by 2014. The light-replacement program is expected to reduce energy consumption by 40%.

Land use: 14th, 56.2 points

This is Seattle's weakest category placement, but still it ranks in the middle of the Index. Although the city boasts an average amount of green space, at 12% of city territory, all other cities that are both low-area and high-income do better than Seattle on this indicator. The city's population density of 7,400 people per square mile is slightly lower than the overall average, 8,100. It is also marked down for some policy omissions: Seattle only gets partial marks for its efforts to promote brownfield regeneration and contain urban sprawl.

Green initiatives: In 2008 the city introduced a Parks and Green Spaces Levy, which aims to raise $146 million over six years through a property tax increase. The levy is to fund various projects to increase green space in Seattle's administrative area. In 2010 the city inaugurated its newest park, the 12-acre Lake Union Park, located on the waterfront near downtown. Seattle's park levy fund provided about $5 million of the $30 million project Furthermore, Seattle set a goal in 2006 of increasing the city's tree canopy to 30% by 2037; in 2010 the tree canopy stood at about 20%.

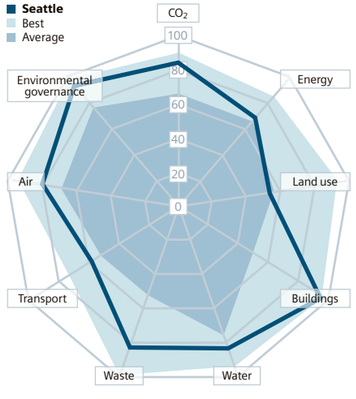
Buildings: First, 98.2 points

High-income cities generally do well in buildings, but Seattle's performance is notable even compared to its high-income peers. Only New York matches Seattle's feat of scoring maximum points in the category's two main policy areas for energy efficient buildings: standards and incentives. And owing to a 2002 mandate that all municipal buildings over 5,000 square feet receive LEED silver certification, Seattle now boast an impressive number of LEED-certified buildings in relation to population: 17 for every 100,000 people, versus an Index average of 6.4. Only Atlanta has a higher LEED-to-population ratio.

Green initiatives: In November 2010 the city launched its Community Power Works program, funded with federal stimulus grants of $20 million and local funds of $120 million. The goal of the program, which has created 2,000 jobs, is to retrofit 15% of Seattle's buildings (municipal and non-municipal) to achieve 15%-45% in energy savings per building. Additionally, the Green Building Capital Initiative, launched in 2009, aims to improve energy efficiency 20% in existing residential and commercial buildings through incentives and loan programs for energy-saving improvements. The initiative also requires large commercial and multi-family buildings to monitor energy usage.

Transport: Ninth, 59.8 points

Seattle is among the Index leaders on green transport promotion, which helps bolster its placement in this category. The city actively encourages residents to use green forms of



transport, including public transport, walking or cycling, and has made progress greening its own fleet. It also has the seventh longest public transport system in the Index, measuring nearly 1 mile per square mile of metropolitan area, just narrowly missing the Index average of 1.1 miles. The city is on par with the overall average in terms of the share of workers commuting by public transport, bicycle or foot at 13%. However, when measured against the other high-income cities in the Index, which tend to perform better than average on this indictor, Seattle falls behind. Among its high-income peers Seattle has the second lowest rate of commuters traveling by greener forms of transport.

Green initiatives: With a $20 million federal energy grant awarded in 2009, the city is investing in electric charging-station infrastructure. The grant also enables the city to subsidize at least 1,000 electric vehicles, encouraging their sale to the general public. The city received an additional $1.4 million in federal funding for green transport projects, $500,000 of which will be invested in public charging infrastructure. The remainder will be used to

purchase 15 diesel-electric hybrid trucks that will save 10,000 gallons of diesel fuel and reduce greenhouse gas emissions by over 112 tons annually. In July 2009 Sound Transit, the state transit authority, opened the city's first electric light rail line, measuring 14 miles. Plans are in place to provide additional regional express bus and commuter rail service, and add 36 miles to the light-rail system.

Water: 11th, 83.3 points

Seattle consumes 128 gallons of water per person each day, the eighth best performance in the Index and considerably less than the Index average of 155 gallons. The city boasts the third lowest water consumption rate among mid-temperature cities. Seattle's water rank is further bolstered by its efficient water distribution system: the city loses only 8% of water to system leaks, versus a 13% overall average. But there is still room for improvement. By Index standards Seattle has made only modest progress promoting the use of recycled water.

Green initiatives: Seattle Public Utilities, the city-owned water company, has the goal of conserving, on average, 15 million gallons per day between 2007 and 2030. To achieve these savings, the utility company has implemented a wide range of rebate programs for residences and businesses. The Multifamily Showerhead and Aerator Distribution program gave out nearly 9,000 showerheads to apartments and condos in 2009. Furthermore, in 2000 Seattle Public Utilities partnered with other local utility companies to form the Saving Water Partnership (SWP) to promote efficient water use in Seattle and King County. The same year, the group launched its 1% Water Conservation Initiative to reduce total commercial and residential water use 1% every year between 2000 and 2010. The program's final report is not yet available, but the SWP said in 2009 it was on track. SWP also gives out rebates for efficient washing machines, dishwashers, sprinklers and toilets.

Waste: Second, 83.1 points

Seattle records one of its highest ranks in waste. The city recycles 51% of its municipal waste – only three cities in the Index do better on this indicator – and has ambitious plans to increase that to 60% by 2012 and 70% by 2025. Seattle also scores well on policy. It is marked up for its facilities to treat different types of waste (recyclable, hazardous and industrial), for reducing reliance on landfills, and for introducing measures to reduce waste creation.

Green initiatives: The city unveiled its "zero waste" strategy in 2007. Programs to increase municipal waste recycling include a voluntary opt-out program to receive phone books (which represented almost 3% by weight of curbside recycling collection in 2005). In 2009 all single-family residences were required to separate food and yard waste for composting, which increased the number of households engaged in composting by 40,000. The city is expanding mandatory composting to multi-family dwellings in 2011. Seattle is also investigating reducing garbage pickup in single-family zones to a biweekly schedule now that mandatory composting has reduced the amount of garbage to be collected. Since 2010 restaurants in Seattle have been required to use take-out containers that are either fully compostable or fully recyclable. To assist with implementation of this program, the city has helped restaurants to find alternative packaging and set up clearly-marked disposal bins. The program is expected to divert 6,000 tons of plastic and plastic-tainted waste from landfills every year.

Air: Seventh, 80.5 points

Seattle's performance is bolstered by having some of the strongest clean air policies in the Index. Air quality targets have been set and measures are in place to improve air quality. They have had some positive effect. Seattle's annual sulfur dioxide emissions, at 7 lb per person, fall well below the 27-city average of 22 lb. But there is still room for improvement. Particulate matter emissions of 22 lb, though below the Index average of 25 lb, place it in the middle of the Index. The city performs worse on nitrogen oxides, emitting 77 lb compared with the Index average of 66 lb.

Green initiatives: Seattle's efforts to improve air quality have centered on making the city fleet greener. In 2001 the city converted its diesel fleet to ultra low-sulfur fuel and began retrofitting 400 municipal heavy-duty trucks with emission-control devices. This has reduced particulates and toxics emissions 50% from these vehicles. Since 2003 more than three-quarters of light-duty vehicles purchased by the city have been biodiesel or hybrid. Seattle also uses Segways, personal mobility vehicles, for jobs such as watermeter reading. These vehicles have zero emissions and cost only $3 per year to recharge.

Environmental governance: Fourth, 96.7 points

Seattle's high rank in this category is supported by a strong green action plan. The plan established environmental targets and the city con-

ducted a baseline review. Regular environmental reports are also published that monitor and evaluate the city's efforts to become greener. Seattle also scores strongly for green management. It has a dedicated environmental authority, gives the public access to information on the city's environmental performance and policies, and has made environmental commitments at an international level. One relative weakness is Seattle's baseline review, which is not as far-reaching as in other Index cities.

Green initiatives: The city launched the Climate COOLective program in 2010: community groups receive training on developing a climate change engagement program. Six community groups with diverse memberships participated in the ten-week program, during which they planned achievable projects and developed strategic campaigns. Each of the groups received seed money to implement the projects they devised. Projects included educating elderly residents about recycling and composting, and starting "no idling" campaigns at area schools to encourage parents to turn off their motors while waiting to pick up children.

Quantitative indicators

Category	Indicator	Average	Seattle	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**156.7**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**9.6**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.20**	2009	City	Seattle City Light; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**59.3**	2009	City	Seattle City Light; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**11.6**	2008	City	Trust for Public Land	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**7,359.7**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**17.0**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**13.2**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**1.0**	2009	Metro-area	National Transit Database; US Census Bureau	
	Annual vehicle revenue miles (miles/person)	24.4	**22.3**	2009	Metro-area	National Transit Database; US Census Bureau	Using MSA population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**2.8**	2009	Metro-area	National Transit Database; US Census Bureau	Using city area
	Average commute time from residence to work (minutes)	28.9	**27.4**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**51.0**	2009	City	City of Seattle	
Water	Total water consumption per person per day (gallons)	155.1	**127.7**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**8.0**	Average of 2009,2008 2007	City	Seattle Public Utilities	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**77**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**22**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**7**	2005	County	EPA; US Census Bureau	Using county population

St Louis

US and Canada Green City Index

Background indicators

Total population [1)]	360,000
Administrative area (miles^2) [1)]	61
GDP per person (real) (US$) [2)]	37,600
Temperature (24-hour average, annual) (°F) [1)]	56
Goods employment (%) [2)]	14
Services employment (%) [2)]	86

Geographical basis: 1) City, 2) MSA

Bounded by two rivers – the Mississippi River on the east and the River Des Peres on the south – St Louis is one of the smaller cities in the US and Canada Green City Index, with a population of 360,000 and an administrative area of only 61 square miles. Its per capita GDP, at $37,600, is the fifth lowest in the Index. Historically, the city served as a major inland port, and it remains the second largest inland port in the US today. The city of St Louis is within the county of St Louis, but maintains separate administrative authority over most aspects of city management. However, in some areas, such as water treatment and distribution, the city relies on a regional authority. This status has limited St Louis officials' ability to initiate environmental programs and policies. Most of the data for St Louis came from the statistics for the city and wider metropolitan area, which has a population of 2.8 million.

St Louis ranks 26th overall among the 27 cities in the Index. The city performs best in the area of water, at 19th. St Louis faces challenges in many of the other categories, in particular for CO_2 emissions, air and environmental governance. It is encouraging, however, that the state of Missouri has enacted an electricity standard requiring, as of 2008, that 15% of the power generated by the state's utilities come from renewable sources by 2020. This legislation is likely to have a positive impact on St Louis in terms of emissions, and hopefully will also encourage and help city officials rally local political support for more aggressive initiatives. City officials have also demonstrated their commitment to improving environmental performance. In 2009 the mayor appointed St Louis's first sustainability director to spearhead local efforts; as a result of this political will the city's performance is likely to improve in coming years.

CO_2: 26th, 10.9 points

Per capita CO_2 emissions, at 27.1 metric tons per person, compare unfavorably with the Index average of 14.5 metric tons per person. The city's CO_2 emissions per $1 million of GDP are 689 metric tons, also well above the Index average of 296 metric tons. The city's high levels of emissions are due, in part, to the dependence on automobiles, as well as the high concentration of coal-fired power plants in the area. However, for reasons of data availability and comparability, the Index figures were taken from 2002 for all of the US cities in the Index. But as a signatory of the US Mayors Climate Protection Agreement, St Louis is likely to have cut emissions in the meantime.

Green initiatives: In 2010 the city partnered with St Louis Community College to conduct its first comprehensive greenhouse gas emissions inventory. The results are expected to be published in the coming months and the review will be updated annually. Furthermore St Louis recently used $250,000 in federal stimulus funding to replace energy intensive sodium street lights with LED lighting as part of a plan to redesign one of its commercial districts.

Energy: 23rd, 50.2 points

With electricity consumption at an estimated 171 gigajoules per $1 million of GDP, St Louis performs considerably better than the Index average of 332 gigajoules per $1 million. Per capita electricity use is an estimated 51 gigajoules, similar to the Index average of 52 gigajoules per person. Both electricity consumption figures were estimated by scaling down state retail electricity sales data to the city level. On a policy level, St Louis would benefit from the development of renewable energy projects or the offering of financial incentives for homes or businesses to use greener forms of energy.

Green initiatives: The Missouri state government has enacted a renewable energy standard that strongly encourages, but does not mandate, municipal utilities to generate 5% of electricity from renewable sources by 2012, and 15% by 2022. The standard also includes a goal for 1% of power to come from solar energy. In addition, using $3.7 million in federal stimulus funding, the municipal government has set up an energy efficiency and conservation block grant program to pursue eight energy efficiency projects. Among the activities planned are city building energy audits, energy efficient street light upgrades and city building retrofits.

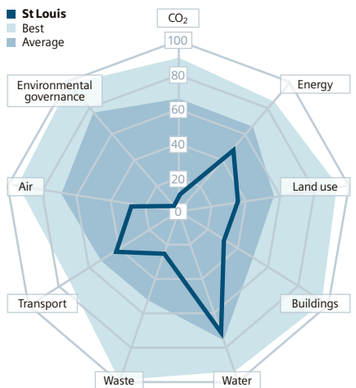
Land use: 24th, 38 points

Green space comprises 9% of St Louis' total area, compared with the Index average of 12%, and the city has policies in place to improve the amount and quality of green space. In terms of density, the city has 5,800 people per square mile, compared with the Index average of 8,100 persons, and according to the US Census Bureau density in the region grew by 21% between 2000 and 2005. Perhaps for this reason, the city has less effective policies to contain sprawl than other cities in the Index.

Green initiatives: St Louis has launched a Downtown Next plan for revitalization by 2020. Under the plan more than 100 historic buildings have been redeveloped in the last ten years. In addition, $383 million is currently invested in downtown development. Also, the city has established the St Louis Brownfields Cleanup Fund, which extends low-interest loans, grants, and other deferred payment plans to non-profit organizations that develop brownfield sites. Although several sites have been improved under the program, it is not clear how many total acres of brownfields have been redeveloped in the city, or the overall environmental impact of the initiative.

Buildings: 20th, 33.8 points

St Louis performs well against the Index average for the number of buildings certified by Leadership in Energy and Environmental Design (LEED), with 9.3 buildings per 100,000 persons compared with the average of 6.4. This may be due, in part, to the cluster of LEED buildings on the city's university campuses, particularly the renowned School of Architecture and Urban Design at Washington University. In addition, the city has an active chapter of the US Green Business Council (the organization that establishes standards for LEED), which has secured



participation from local non-profit organizations and various segments of the building industry, including insurance entities and product manufacturers.

Green initiatives: The city government has demonstrated a commitment to sustainable building by passing two ordinances in 2007 focusing on this issue. One measure requires municipal building contractors to analyze energy consumption, long-term operating costs and possible energy efficiency measures for all new construction and major renovations. The other ordinance adopted the LEED rating system for new and renovated city-owned facilities, and required them to comply with LEED silver standards, at a minimum. Since then, St Louis-based utility AmerenUE and the US Green Building Council's regional chapter have awarded $90,000 to 18 project owners or developers, many of them in St Louis, who are trying to obtain LEED certification.

Transport: 23rd, 44.4 points

St Louis has fewer than one public transit vehicle per square mile, compared with the Index average of 9 public transit vehicles. Likewise, St Louis has only 0.2 miles per square mile of public transit, compared with the Index average of 1.1, and only 4% of workers commute by public transit, bicycle or foot versus the Index average of 13%. These figures are not altogether surprising

given that 90% of city residents own at least one vehicle and 75% own two or more. In addition, between 1990 and 2000, 95% of job growth in the region occurred outside the high-density areas, accompanied by resident relocation to outlying suburbs. Both factors have created unfavorable conditions for public transit and encouraged the use of personal automobiles.

Green initiatives: The non-profit, taxpayer-funded organization Great Rivers Greenway has been authorized by the city to undertake several efforts to increase the use of non-motorized transportation. One of the main initiatives is a bicycle master plan, which calls for expanding the number of bike lanes on city roads, and creating more multi-use trails in the city and neighboring county. So far, research and data collection have been completed and public feedback is being collected prior to issuing policy recommendations. Even before the plan was conceived, Great Rivers Greenway added more than 50 miles of on-street bike routes in St Louis in 2008. In April 2011 the City of St Louis opened a public commuter bike station, funded under the federal stimulus package, with storage for 100 bicycles and about 70 lockers.

Water: 19th, 77 points

St Louis's water distribution system loses only about 3% to leakages, according to city estimates. This is the second best rate in the Index and compares favorably with the overall average of 13%. However, city residents consume 186 gallons of water per person per day versus the Index average of 155. The city has a strong record in terms of policies, wastewater treatment and use of recycled water, and undertakes optional monitoring of its water, beyond the requirements of the federal Environmental Protection Agency. Nevertheless, St Louis officials recognize that there is room for improvement in this area. While noting the difficulty the city faces in eliminating sewer overflows, St Louis has also blamed its water-related troubles on a lack of accountability and transparency by the regional utility, which in 2003 was rocked by a legal scandal.

Green initiatives: The city has been working to minimize sewer overflows in recent years. Dedicating $4 billion to system-wide capital improvements, the city's sewer department is expanding and upgrading its treatment plants, including addressing leakages. The department is also encouraging residents to use green roofs and permeable paving that allows water to run through it to limit the amount of water entering the wastewater system.

Waste: 24th, 26.6 points

The city has faced challenges establishing a successful recycling program and recycles only 3% of waste, compared with the Index average of 26%. Only one city in the Index, Detroit, has a lower recycling rate, but St Louis has increased access recently (see "green initiatives" below). St Louis could stand to improve by developing a waste reduction strategy and sustainable waste management plan, neither of which it has currently.

Green initiatives: Until recently, St Louis had 27 sites throughout the city where residents could drop off recyclable items. Beginning in 2010, however, the municipal government significantly increased access by starting a weekly recycling pickup service, collecting recyclables from 2,500 dumpsters distributed leveling neighborhoods around the city. St Louis plans to add about 900 more bins in coming months. Furthermore the city offers free, year-round classes to residents on how to compost at home.

Air: 27th, 29.5 points

St Louis ranks at the bottom of the Index for air quality, with the city's heavy vehicular travel doubtless a major contributor to the region's problems. The city's annual particulate emissions measure an estimated 35 lb person, compared with the Index average of 25 lb. St Louis annually emits an estimated 125 lb of nitrogen oxides per person, compared with the Index average of 66, and 64 lb per person of sulfur dioxide, compared with the average of 22. Enacting stronger policies may help St Louis face some of its air quality challenges.

Green initiatives: In 2007 the city began installing intelligent telematics devices into city vehicles to conserve fuel and reduce emissions. The system, which uses on-board technology to track vehicle operations and find more efficient routes, has been installed in nearly 300 municipal vehicles. City officials credit the system with general savings in fuel, greenhouse gases and other costs, but have not released official data. In addition, the city, in partnership with the federal Energy Department's National Renewable Energy Lab, is evaluating the performance of buses operating on 20% biofuel against those running on ultra-low sulfur diesel. Preliminary findings released in 2008 revealed comparable performance overall, and the city has not announced any plans as a result of the study.

Environmental governance: 27th, 5.6 points

St Louis lacks many of the basic environmental criteria that other Index cities have established, such as a reporting mechanism and environmental targets, and its environmental strategy lacks the coherence and specificity found in that of other cities. In this area St Louis has an opportunity to make major improvements, which could begin with the appointment of a dedicated environmental authority; already the 2009 appointment of the first sustainability director demonstrates the city's commitment to improving its overall environmental performance. Officials say St Louis will release a comprehensive Sustainability Plan by the end of 2011.

Green initiatives: In 2004 the East-West Gateway Council of regional governments, which includes representatives from the St Louis municipal government, issued a strategy to engage the public in the regional planning process. Revisions in 2007 and 2009 detailed how the Council intends to include residents by establishing public committees, producing new environmental publications in multiple languages, and conducting technical assistance workshops. At this stage it is unclear to what extent the plan has been implemented. The council also runs a range of programs to increase community participation in transport and environmental programs, including the St Louis Bicycle and Pedestrian Advocacy Committee. In addition, the non-profit organization, Sustainable St Louis, has been active in advocating sustainability initiatives, educating and providing resources to the community, and keeping track of existing sustainability-focused efforts in the city.

Quantitative indicators

Category	Indicator	Average	St Louis	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**689.0**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**27.1**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.17**	2008	Mixed	Energy Information Administration; US Bureau of Economic Analysis	State retail electricity sales; Scaled down to city level using population data; Indicator constructed using MSA GDP
	Electricity consumption per person (GJ)	52.2	**50.8**	2008	Mixed	Energy Information Administration; US Census Bureau	State retail electricity sales scaled down to city level using population data
Land use	Green spaces as % of total area (%)	11.9	**8.7**	2008	City	Trust for Public Land	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**5,845.7**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**9.3**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**4.4**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.2**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**23.3**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**1.0**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**24.8**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**2.5**	2008 – 2009	City	City of St. Louis, Department of Streets, Refuse Division	
Water	Total water consumption per person per day (gallons)	155.1	**185.9**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**3.0**	2009	City	City of St. Louis	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**125**	2005	County	EPA; US Census Bureau	Using county population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**35**	2005	County	EPA; US Census Bureau	Using county population
	Sulfur dioxide emissions per annum (pounds/person)	22	**64**	2005	County	EPA; US Census Bureau	Using county population

Toronto

US and Canada Green City Index

Background indicators

Total population [1)]	2.5 million
Administrative area (miles^2) [1)]	240
GDP per person (real) (US$) [2)]	45,000
Temperature (24-hour average, annual) (°F) [1)]	49
Goods employment (%) [2)]	20
Services employment (%) [2)]	80

Geographical basis: 1) City, 2) CMA

With 2.5 million people, Toronto is the largest city in Canada and the fourth largest in the US and Canada Green City Index. The quickly growing metropolitan area extends to include 5.1 million people, and a mix of city and metropolitan data are used in this analysis. Toronto is also the capital of the province of Ontario, a center for Canada's finance and media industries, and is home to one of the most diverse populations in the world. With a per capita GDP of $45,000, the city is near the Index average for income, but second among the five Canadian cities, behind Calgary. It is also on average one of the colder cities in the Index, which places a larger burden on its energy needs.

Toronto places ninth overall in the Index and second in Canada, behind Vancouver. The city's strongest category performance is in waste, where it ranks fourth. It also places in the top half of the Index in CO_2, energy, buildings, water and air. Toronto fares well when compared to other large cities, placing second among this group in the energy, waste and water categories. It also places first among the group of cities with lower average temperatures in the Index.

CO_2: Seventh, 81.6 points

Toronto has among the lowest CO_2 emissions levels in the Index. Its per capita emissions, at an estimated 7.6 metric tons, are well below the average of 14.5 metric tons, and its emissions of an estimated 158 metric tons per $1 million of GDP are almost half the average of 296 metric tons. The city has shown international leadership on the issue, with its former mayor, David Miller, serving as the chair of the C40 Climate Leadership Group between 2008 and 2010.

Green initiatives: In 2007 Toronto launched its Climate Change, Clean Air and Sustainable Energy Action Plan, with the goal of reducing CO_2 emissions from 1990 levels by 6% by 2012, 30% by 2020, and 50% by 2050. The plan allocated initial funding of $42 million for energy conservation measures, $20 million for renewable energy projects, and $22 million for retrofitting city facilities through revolving loans to non-profit organizations, institutions, and some private enterprises. Specific actions relate to residents, businesses and the wider community, including community energy planning, energy efficiency, and low-emission transportation, as well as providing a one-stop online source of information on federal, provincial, municipal, private sector, and community programs related to energy and the environment.

Energy: Fifth, 77.8 points

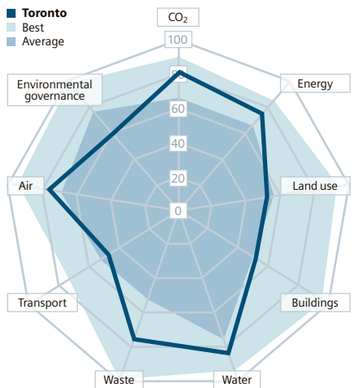
Energy is Toronto's second strongest category performance. Toronto's electricity consumption as a proportion of GDP is higher than the Index average – it consumes 437 gigajoules of electricity per $1 million of GDP, compared with the average of 332 gigajoules. But its per capita consumption is better than the average, at 40 gigajoules per person, compared with the average of 52. Meanwhile though, Toronto benefits from strong efforts to promote and implement green and local energy that include a feed-in tariff-and-loan program for green buildings. Toronto is one of only three cities to receive the highest scores for promoting green energy adoption, developing green energy projects and local energy production.

Green initiatives: Exhibition Place – a city-owned space including parkland, historical buildings and a convention center – houses Canada's largest single solar photovoltaic installation. The 100-kilowatt pilot project is part of a series of innovative energy initiatives designed to make Exhibition Place energy self-sufficient. This also includes a 750-kilowatt wind turbine, which is the first such device constructed in an urban setting in North America. Toronto's solar city program includes one of the largest residential solar hot water system pilot programs in Canada, as well as a best practices and knowledge transfer program for municipalities and others interested in solar installations.

Land use: 17th, 54.3 points

Toronto's population density, at 10,300 people per square mile (4,000 people per square kilometer), is above the average of 8,100 (3,100). And it has slightly more green space than average, at 13% compared to 12%. The city has established policies to redevelop brownfields and the waterfront, and receives full marks for efforts to sustain and improve green space within city limits (see "green initiatives" below). The city's efforts to contain urban sprawl are not as developed as in other Index cities, but most of the growth is in the suburbs, outside the city's jurisdiction. However, the Toronto Regional Conservation Authority, which is supported by six regional municipalities including Toronto, regulates new developments in area greenbelts.

Green initiatives: Toronto's Natural Heritage Protection Plan, based on a conservation study from 2001, contains policies to protect the city's natural heritage system for the long term. The program includes specific initiatives such as waterfront and parkland naturalization to maintain green space in the city. The goal of the plan is to engage the public in projects that promote stewardship of natural waterfront and parkland ecosystems. The effort is carried out in partnership with community groups and schools. Another initiative, Trees Across Toronto, is a municipal effort that has planted over 300,000 trees in recent years. The trees are planted along streets and arterial roads, in ravines and in neighborhood parks.



Buildings: 13th, 53.4 points

With a quickly growing population and cold weather concerns, building efficiency is a high priority, and Toronto appears to be on track to improve its score in this category. The city offers energy efficiency education and incentives to retrofit, while its Green Building Standard (see "green initiatives" below) has been key to regulating energy efficiency. The city also has a law requiring green roofs for new buildings with a minimum of 2,000 square meters of floor space. Toronto's score in this category is weighed down by having a low proportion of buildings certified by Leadership in Energy and Environmental Design (LEED). Only 1.8 buildings per 100,000 people are LEED-certified, which is well below the average of 6.4.

Green initiatives: The Toronto Green Standard is a two-tier set of performance measures that encourage developers to build environmentally friendly buildings, addressing air quality, greenhouse gas emissions, energy efficiency and water quality. All new public and private buildings are required to meet the tier 1 standard, which entails a 25% reduction in energy consumption. Buildings that meet a requisite number of additional voluntary standards (which vary according to building type) qualify for the second tier and are eligible for a refund of 20% of development fees. In another initiative, when the city had to move its water-intake pipe deeper into Lake Ontario, the water was too cold to treat without heating. Enwave Corporation, owned in part by the city, used the cold from the water to provide air conditioning to downtown offices, freeing up 61 megawatts of energy annually and, through the process, heating up the water sufficiently to be treated.

Transport: 22nd, 47.1 points

Transport is one of Toronto's weakest category performances, mainly due to having the longest commute time of all the 27 cities in the Index. Due to heavy congestion and sprawl, residents need on average 40 minutes to drive to work, compared with the Index average of 29 minutes. The length of the city's public transport network, at 1 mile per square mile, and its supply of public transit vehicles, at 7 vehicles per square mile, are close to the Index averages. Despite this, the city has the fourth highest share of non-automobile commuters in the Index, at 28%, compared with the Index average of 13%. However, Toronto is one of only four cities in the Index that lacks large, centrally located pedestrian-only zones. The city has programs to encourage walking, for example, a pedometer-lending program. These programs are geared predominantly towards public health and not for practical transportation.

Green initiatives: In 2001 Toronto established a bike plan that sets out integrated principles, objectives and recommendations regarding safety, education and promotional programs. It also calls for more cycling-related infrastructure, including a comprehensive bikeway network with 56 miles of bike lanes, bicycle-public transit connections, and expanded bicycle parking. Its goal was to double the number of cycling trips by 2011, while reducing accidents. The city has achieved its goals, with ridership tripling in districts where bike lanes and parking were added.

Water: Tenth, 83.5 points

In terms of both water consumption and distribution leakage, Toronto is better than average; it consumes 114 gallons (431 liters) of water per person per day – the fifth lowest figure in the Index – compared with the Index average of 155 gallons (587 liters), while its leakage rate is 10%, compared with the average of 13%. Meanwhile, through the city's Water Efficiency Plan (see "green initiatives"), which includes a number of incentives for residents and businesses, the city is well positioned to reduce overall water consumption even further.

Green initiatives: In 2002 Toronto developed a comprehensive Water Efficiency Plan that allows the city to conserve enough water to accommodate expected population growth, while only spending one-third of expected costs on new infrastructure. Measures include system leak detection, computer-controlled irrigation, toilet and washing machine replacement, indoor and outdoor water audits, and restrictions on watering plants and grass. By 2011 the plan was estimated to have saved the city approximately 66 million gallons of water per day.

Waste: Fourth, 78.6 points

Toronto performs better in waste than in any other category. This result is driven by a 44% recycling rate that is solidly above the average of 26%, which is supported by the city's well-regarded waste-reduction policies. Toronto's policies include composting, waste-to-energy, waste separation, volume-based trash payment, and a public awareness campaign.

Green initiatives: In 2007 Toronto set a target of diverting 70% of waste from landfills by 2010, and by 2009 – the most recent year for which statistics are available – the diversion rate had improved from 35% to 44%. The city implemented a comprehensive plan to achieve the target, including a new funding system and the volume-based rate structure (in which residents pay fees for excess trash) to pay for the required additional programs and services. Additionally, Toronto collects, burns and generates electricity from landfill gases emitted by its three largest landfill sites, none of which are still operational for dumping.

Air: Ninth, 79.2 points

Toronto's air pollutions levels are all better than average, led by the city's 35 lb (16 kg) of nitrogen oxides emissions. This is the second best rate in the Index and well below the average of 66 lb (30 kg). Toronto also emits only 17 lb (8 kg) of particulate matter, compared with the average of 25 lb (11 kg), and just 8 lb (4 kg) of sulfur dioxide, compared with the average of 22 lb (10 kg). Although the city has not set air quality targets, officials have implemented numerous programs to reduce pollution, including "air sweepers" (see "green initiatives" below). In addition, Toronto has laws against vehicle idling and has implemented numerous public awareness campaigns intended to change behavior and reduce air pollution.

Green initiatives: The 20/20 The Way to Clean Air campaign aims to help reduce home energy use and vehicle use by up to 20% by providing planners with tips for businesses and homeowners on how to improve air quality, lower energy costs, and increase in-home comfort. In 2003 the city introduced street-sweeper technologies to improve air quality. The 25 new regenerative-air sweepers have contributed to a reduction in airborne fine particulate matter, at street level, of 21% while also allowing for year-round cleaning. As a result, the sweepers can remove more toxic loads from the streets and improve stormwater quality while still contributing less to air pollution.

Environmental governance: 24th, 60 points

The city of Toronto does have a number of individual environmental plans, including a climate-change action plan, a climate-change adaptation strategy, and a sustainable energy strategy, all of which were developed with extensive public participation. However the reporting and transparency of these plans fall below the standards of most other cities in the Index, which weighs on Toronto's score in the environmental governance category.

Green initiatives: EcoSchools is an environmental certification program for schools. With the goal of supporting students and staff in caring for and protecting their school environment, it addresses what is taught as well as how schools are maintained, and encourages initiatives that involve students in the environmental stewardship of their community. Since the program's launch in 2007, 345 schools have been certified as platinum, gold, silver, or bronze EcoSchools, with rankings based on how many programs the schools have implemented. Bronze and silver schools, for example, will have planted trees and improved the school environment, but may not have a full environmental curriculum; higher ranking schools will have fully sustained exemplary practices and community programs. Another initiative, Live Green Toronto, is a city program that supports neighborhoods in energy and water conservation, waste reduction, and growing local food.

Quantitative indicators

Category	Indicator	Average	Toronto	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**158.4**	2004	City	ICF International/Toronto Atmospheric Fund/Toronto Environment Office	Using estimated city GDP
	CO_2 emissions per person (metric tons)	14.5	**7.6**	2004	City	ICF International/Toronto Atmospheric Fund/Toronto Environment Office	Using city population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.44**	2008	City	City of Toronto, Energy Efficiency Office	Using CMA GDP
	Electricity consumption per person (GJ)	52.2	**40.2**	2008	City	City of Toronto, Energy Efficiency Office	Using city population
Land use	Green spaces as % of total area (%)	11.9	**12.7**	2007	City	City of Toronto	Using area of city in 2006
	Population density (persons/miles^2)	8,106.8	**10,288.3**	2006	City	Statistics Canada	Equivalent in metric units: 3,972 persons/km^2
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**1.8**	2010	City	CaGBC LEED Database	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**28.0**	2006	CMA	Statistics Canada	
	Length of public transport (miles/miles^2)	1.1	**1.0**	2009	Metro-area	Toronto Transit Commission	Using city area; Equivalent in metric units: 0.6 km/km^2
	Annual vehicle revenue miles (miles/person)	24.4	**26.1**	2009	Metro-area	Toronto Transit Commission	Using CMA population; Equivalent in metric units: 42.0 km/person
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**7.3**	2009	Metro-area	Toronto Transit Commission	Using city area; Equivalent in metric units: 2.8 vehicles/km^2
	Average commute time from residence to work (minutes)	28.9	**39.5**	2005	CMA	Statistics Canada	
Waste	Recycled municipal waste (%)	25.8	**44.0**	2009	City	City of Toronto	Covers only residential waste
Water	Total water consumption per person per day (gallons)	155.1	**113.8**	2010	City	City of Toronto, communication with city official	Using city population; Equivalent in metric units: 430.8 liters
	Water leakages in water distribution system (%)	12.8	**10.0**	2004	City	Toronto Water/Veritec Consulting Inc.	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**35**	2007	City	ICF International/Toronto Atmospheric Fund/Toronto Environment Office	Using city population; Equivalent in metric units: 16 kg
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**17**	2007	City	ICF International/Toronto Atmospheric Fund/Toronto Environment Office	Using city population; Equivalent in metric units: 8 kg
	Sulfur dioxide emissions per annum (pounds/person)	22	**8**	2007	City	ICF International/Toronto Atmospheric Fund/Toronto Environment Office	Using city population; Equivalent in metric units: 4 kg

Vancouver

US and Canada Green City Index

A coastal city in western Canada, the Vancouver metropolitan area is home to some 2.1 million people, making it the third most populous in the country. However, with just 580,000 people living within the city limits, Vancouver is the smallest Canadian city in the US and Canada Green City Index, and a combination of metropolitan and city-level data are used in the Index. Vancouver houses Canada's largest port, and its economy is dominated by shipping, forest products and mining. Despite recent surges in the tourism, film and high-tech industries, Vancouver's per capita GDP is estimated at just $37,500 per person – the fourth lowest in the Index. Like San Francisco and New York, Vancouver is made up of islands and peninsulas, restricting the city's lateral growth. Vancouver ranks second overall in the Index, and tops the rankings in the CO_2 and air categories. The city has the lowest CO_2 emissions in terms of both population and GDP, while it ranks in the top three for emissions of all air pollutants measured in the Index. Perhaps more impressively though, Vancouver ranks in the top seven for all categories, with the exception of environmental governance, where it ranks tenth. Already one of the best cities overall, Vancouver fares even better when compared with its peers; compared to other low-income cities, for example, Vancouver places first overall, and in the top two in all categories.

CO_2: First, 91.4 points

This is one of Vancouver's strongest categories in the Index. The city emits just 4.2 metric tons of CO_2 per person, well below the Index average of 14.5 metric tons. Measured against economic output, Vancouver emits just an estimated 111 metric tons of CO_2 per $1 million of GDP, compared with the Index average of 296 metric tons. The city's low emissions are a result of policies geared at green energy promotion and the dominance of hydropower in Vancouver's energy grid. Furthermore, officials are in the process of adopting a target to reduce CO_2 emissions by 33% by 2020, compared to 2007 levels. Vancouver is likely, therefore, to remain among the lowest emitters of CO_2 of major cities in North America.

Green initiatives: Vancouver's Community Climate Change Action Plan in 2005 aimed to reduce the city's greenhouse gas emissions by 6% from 1990 levels by 2012. The plan included initiatives for integrated land use; more sustainable energy; green building standards; road space allocation and pricing programs that promote walking, cycling and mass transit; and waste reduction. A greenhouse gas inventory in 2008 indicated that emissions had already been reduced to 1990 levels and the city was expected to reach its goal of a 6% reduction by the end of 2011. These reductions are all the more impressive because they have occurred while the population has grown by more than 27% and the number of jobs has increased by over 18%. In 2010 Vancouver unveiled a new plan – the Greenest City Action Plan, currently awaiting approval – which aims to accelerate the current momentum by reducing greenhouse gas emissions by 33% by 2020 from 2007 levels and reach its stated aim of becoming the "greenest city in the world". In addition, the city runs the voluntary Corporate Climate Leader program for local businesses. Participating companies complete a GHG inventory, set targets for reductions, and then commit to having the inventory updated to see if they met the targets. The long-term goal of Vancouver's climate change strategy is to totally eliminate the city's dependence on fossil fuels.

Energy: Fourth, 80.1 points

Vancouver's per capita electricity consumption is better than average at 33 gigajoules per person, versus the Index average of 52 gigajoules. Likewise, the city consumes 237 gigajoules of electricity per $1 million of GDP, compared with the overall mean of 332 gigajoules. Where Vancouver shines, though, is in its sustainable energy strategy, which seeks to provide high-density neighborhoods with financing for community renewable-energy systems, helping cover high up-front costs, while recouping the benefits through long-term lower operating expenses. Vancouver is one of just six Index cities actively increasing the amount of locally produced and consumed energy.

Green initiatives: Vancouver's Neighborhood Energy Utility (NEU) is a local government-owned utility that provides locally generated heat and hot water to the neighborhood surrounding the city's Olympic village. NEU is the first utility in North America to use waste heat recovery from untreated urban wastewater, an innovative green technology that eliminates over 60% of the carbon emissions associated with the heating of buildings. Furthermore, Vancouver is financing up to 50%, or about $3,500, of the cost of installing residential solar hot water systems. As a pilot, the incentive is available to 50 new houses on a first-come, first-served basis.

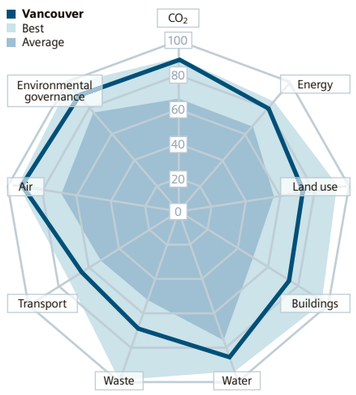
Land use: Fifth, 74.1 points

Like other cities with geographical constraints, Vancouver has a high population density, at 13,100 people per square mile (5,000 people per square kilometer), far above the average of 8,100 people per square mile (3,130 people per square kilometer), and the fourth highest in the Index. Twelve percent of Vancouver's territory is considered green space, which is on par with the Index average. However, the city is likely to improve in this area thanks to policies aimed at encouraging tree planting and park creation (see "green initiatives" below).

Green initiatives: In 2010 Vancouver set a target for all residents to live within a five-minute walk of a park, greenway, or other green space – while also planting 150,000 new trees – by 2020. Specific strategies include acquiring new parkland, adding trees and planted areas to existing bikeways, and preparing a citywide urban forest management plan. Additionally, in the run-up to the Winter Olympics in 2010, Vancouver sought to regenerate brownfields for new Olympic sites, including the Olympic village, which now serves as apartments. The projects have increased downtown Vancouver's residential population by nearly 13,000 people and provided them with extensive waterfront parkland.

Buildings: Fifth, 77.2 points

Vancouver's score in this category is bolstered by the abundance of Leadership in Energy and Environmental Design (LEED)-certified buildings. It has among the most in the Index with



Background indicators

Total population 1)	580,000
Administrative area (miles^2) 1)	44
GDP per person (real) (US$) 2)	37,500
Temperature (24-hour average, annual) (°F) 1)	50
Goods employment (%) 2)	17
Services employment (%) 2)	83

Geographical basis: 1) City, 2) CMA





10.2 per 100,000 people, compared with the average of 6.4. The city also scores well in the area of policies aimed at promoting energy efficiency in buildings. While Vancouver does not fully require energy efficiency audits, the city's One Day program offers a number of building efficiency incentives such as free energy assessments, mortgage rebates for energy efficient home improvements, and preferential loans for efficiency upgrades.

Green initiatives: In 2008 Vancouver set a goal of making all new construction carbon neutral by 2030. As part of this goal, the Green Homes program requires that all new building permit applications for single-family homes meet a specific set of requirements, which will reduce energy consumption by 33% from current levels. The program also includes requirements that will improve the air quality in all new houses, such as requiring a heat-recovery ventilator, as well as the installation of a vertical service shaft to allow future roof-mounted solar PV panels. Furthermore, in 2010 Vancouver required all newly rezoned buildings to meet the LEED gold standard, the highest green building standard for rezoned buildings in North America. This includes strict minimum requirements for energy savings, water efficiency, CO_2 emissions reduction, and improved indoor environmental quality, and is expected to result in 20 to 30 new green buildings being constructed annually.

Transport: Third, 66.6 points

Vancouver boasts the longest public transit system in the Index, at 5.4 miles per square mile (3.3 kilometers per square kilometer), nearly five times the overall average of 1.1 miles (0.7 kilometers). Its performance is further helped by a high percentage of workers commuting by public transit, bicycle, or foot, at 25%, compared with the average of 13%. With efforts to implement a new streetcar underway (see "green initiatives"), the city is poised to improve even further upon its already strong public transport system. Meanwhile, the city has been expanding bicycle and pedestrian lanes, and is looking to implement a bike share program.

Green initiatives: Vancouver's Downtown Streetcar is expected to be a key element of the city's transition to more sustainable transportation. The trams link Vancouver's metropolitan core with other mass transit, including the Canada and Expo Lines. In 2008 the first line of the Downtown Streetcar was added as a showcase project for the 2010 Olympic Winter Games, and three future line extensions are planned, although there is not yet a concrete time frame.

Water: Sixth, 86.6 points

Vancouver consumes 137 gallons (519 liters) of water per person per day, better than the Index average of 155 gallons (587 liters). Its score is further bolstered by its water leakage rate of 11%, slightly better than the average of 13%. Vancouver officials have demonstrated eagerness to further improve the city's water performance. The city has set a goal to reduce per capita water consumption by 33% over 2006 levels by 2020. To achieve this ambitious aim officials plan to develop incentive programs to accelerate the installation of water-efficient infrastructure, and to unveil full service retrofit programs in partnership with other utilities.

Green initiatives: Vancouver has several programs to encourage efficient water use. All commercial properties are metered, and the city sells subsidized indoor and outdoor water-saving kits, and rain barrels for watering plants. Vancouver also runs public awareness campaigns in elementary schools.

Waste: Seventh, 69 points

Although Vancouver recycles 55% of municipal waste – the third best rate in the Index and more than double the average of 26% – the city's waste performance is hindered by a comparative lack of incentives in place to reduce overall waste. The city instead relies on advocacy measures, including efforts to create a "zero waste" culture, by working with schools, developing educational campaigns, establishing a network of zero-waste businesses, and challenging other cities to reuse or recycle all waste.

Green initiatives: Vancouver aims to reduce total solid waste going to landfills or incinerators by 50% by 2020 from 2008 levels. To this end the city is creating mandatory "take-back" programs – by 2015 all businesses will have to pay for materials they do not recycle, and the program will include packaging, printed paper and hazardous waste. Construction and demolition waste, carpet, furniture and textiles will follow by 2017. Together, these product categories will account for more than 60% of garbage going to a landfill or incinerator.

Air: First, 95.1 points

Vancouver's impressive performance in the air category is a result of low emission levels of all pollutants measured in this Index. The city has one of the lowest rates of particulate matter emissions in the Index, at just 7 lb (3 kg) per person versus an overall average of 25 lb (11 kg). Vancouver has similarly low emission levels of sulfur dioxide, at 5 lb (2 kg) per person, less than a quarter of the Index average of 22 lb (10 kg); and nitrogen oxides, at 37 lb (17 kg) per person, compared with the average of 66 lb (30 kg). Vancouver has a relatively higher population density than other Index cities – which contributes to air quality through increased use of public transport, for example. In addition, over the last half-decade the city has actively promoted a suite of air quality improvement policies while ensuring that air pollution does not disproportionately affect the poor (see "green initiatives" below).

Green initiatives: In 2005 officials approved the Air Quality Management Plan for Greater Vancouver. The plan includes 33 specific actions, including increasing emissions standards, providing incentives for vehicle retrofits, strengthening regulations on fuels that may be sold in Vancouver, and increasing dialogue with businesses about appropriate mutually beneficial air quality measures. Additionally, Vancouver is looking to alter its building regulations to assist vulnerable populations through policies specifically designed to enhance the air quality in low-income housing, by reducing the degree to which high-polluting facilities can be located in low-income neighborhoods.

Environmental governance: Tenth, 91.1 points

Vancouver is among ten cities in the Index that score more than 90 points. The city has a robust environmental strategy in place, demonstrated by its strong performance across the board. And while Vancouver has also launched multiple environmental campaigns such as the Greenest City and One Day programs that enjoy strong political support, the city's somewhat lower placement in this category is the result of a comparative lack of transparency. Not all of the city's targets have been reported, and while information is accessible and the sustainability campaign is widely known, data is not collected and provided in a unified location. The city has partnered with a private company to monitor energy-use plans to make strides to that end.

Green initiatives: Since 2005 Vancouver has provided links to programs and resources for teachers who would like to bring climate protection into the classroom. School projects include workshops, games and contests, field trips, and a school play about climate change. Additionally, Vancouver's Green Streets program offers residents an opportunity to become volunteer street gardeners in their neighborhoods by sponsoring a traffic circle or street-corner garden.

Quantitative indicators

Category	Indicator	Average	Vancouver	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**111.0**	2008	City	City of Vancouver	Using estimated city GDP
	CO_2 emissions per person (metric tons)	14.5	**4.2**	2008	City	City of Vancouver	Using city population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.24**	2009	City	BC Hydro	Using CMA GDP
	Electricity consumption per person (GJ)	52.2	**32.5**	2009	City	BC Hydro	Using city population
Land use	Green spaces as % of total area (%)	11.9	**11.7**	2010	City	City of Vancouver, communication with city official	Using area of city in 2006
	Population density (persons/miles^2)	8,106.8	**13,051.3**	2006	City	Statistics Canada	Equivalent in metric units: 5,039 persons/km^2
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**10.2**	2010	City	CaGBC LEED Database	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**24.5**	2006	CMA	Statistics Canada	
	Length of public transport (miles/miles^2)	1.1	**5.4**	2006	Metro-area	TransLink	Using city area; Equivalent in metric units: 3.3 km/km^2
	Annual vehicle revenue miles (miles/person)	24.4	**40.5**	2009	Metro-area	Translink	Using CMA population; Equivalent in metric units: 65.1 km/person
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**42.0**	2009	Metro-area	Translink	Using city area; Equivalent in metric units: 16.2 vehicles/km^2
	Average commute time from residence to work (minutes)	28.9	**33.5**	2005	CMA	Statistics Canada	
Waste	Recycled municipal waste (%)	25.8	**55.0**	2007	City	Metro Vancouver	
Water	Total water consumption per person per day (gallons)	155.1	**137.0**	2009	City	City of Vancouver, Water Design Branch	Using city population; Equivalent in metric units: 518.6 liters
	Water leakages in water distribution system (%)	12.8	**11.0**	2009	City	City of Vancouver, Water Design Branch	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**37**	2007	Metro-area	Metro Vancouver	Using metro-area population; Equivalent in metric units: 17 kg
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**7**	2007	Metro-area	Metro Vancouver	Using metro-area population; Equivalent in metric units: 3 kg
	Sulfur dioxide emissions per annum (pounds/person)	22	**5**	2007	Metro-area	Metro Vancouver	SOx; Using metro-area population; Equivalent in metric units: 2 kg

Washington DC

US and Canada Green City Index

Located on the Potomac River, Washington DC is the capital of the US. The city's economy is largely dependent on the federal government, although it also houses a wide array of international institutions and research centers. As a result, services make up a higher percentage of economic activity than in any other city in the US and Canada Green City Index, at nearly 93%. Washington also has the highest GDP per capita in the Index, at $60,500. Although the metropolitan area has 5.5 million residents, data for the Index are based primarily on the city boundary, which is home to 600,000 people, placing it 18th in the Index in terms of population.

Washington ranks eighth overall in the Index. Perhaps unsurprisingly for the nation's capital, the city performs best in environmental governance, earning a top ranking along with Denver and New York, mainly for the strength of its green action plan and a high level of public participation in environmental policies. The city also places third in the buildings category, owing to strong energy efficiency incentives and the third highest number of Leadership in Energy and Environmental Design (LEED)-certified buildings in the Index. Washington scores well for land use, at sixth, with the fourth highest percentage of green space, and receives top marks for its green land use policies. The city is weakest in the water category, at 24th, largely due to high levels of leakage in the system. Washington also fares relatively poorly in the waste category, placing 18th, in large part due to low recycling rates.

CO_2: Ninth, 80.8 points

Washington has slightly lower than average per capita CO_2 emissions, at 13.3 tons, compared with the Index average of 14.5 tons. It also outperforms the average for emissions per $1 million of GDP, at 193 tons, versus 296 tons. The city's above average performance on carbon emissions comes in spite of the fact that nearly half of the electricity provided to the city is produced using coal-fired power plants. Washington has a highly rated greenhouse gas reduction strategy; included in the strategy is a goal to reduce greenhouse gas emissions by 20% by 2020, compared with 2006 levels.

Green initiatives: In September 2010 Washington launched a sweeping plan to reduce greenhouse gas emissions throughout the city. As a starting point, the city has committed to reducing greenhouse gas emissions from municipal operations by 20% by 2012, 30% by 2020 and 80% by 2050, based on a 2006 baseline. The city is engaging in community outreach and negotiating with residents and local businesses over appropriate reduction targets for the municipality as a whole. Its goal is to set city-wide emissions-reduction targets of 10% by 2012, again based on a 2006 baseline; goals for 2020 and 2050 are the same as for municipal operations. The overall plan currently encompasses a total of 33 specific measures that focus on buildings, transportation, land use and waste management.

Energy: 13th, 69.4 points

Washington's electricity consumption per capita, at 70 gigajoules per person, is above the Index average of 52 and the highest rate among high-income cities in the Index. The city does better when GDP is taken into account, consuming only 127 gigajoules per $1 million of GDP, far less than the average of 332 gigajoules. Washington's performance in the energy category is held back due to only partial scores for its efforts to deploy green and local energy. The city has only small solar and wind power projects, although it does provide incentives for green energy adoption (see "green initiatives" below).

Green initiatives: The city's Renewable Energy Incentive Program provides rebates for residents and businesses that produce renewable sources of energy. In 2009 and 2010 the program provided rebates for a total of approximately 900 kilowatts, far exceeding its initial goal of 200 kilowatts. As of 2010 the program was only accepting applications for homes and businesses installing solar photovoltaic panels and wind turbines, but in the next two years it expects to expand to other sources of energy such as solar thermal, geothermal heating and air conditioning, biomass, and waste-gas capture.

Land use: Sixth, 69.9 points

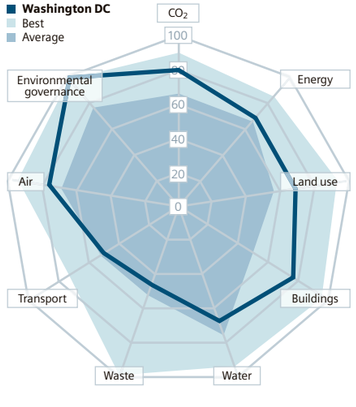
Washington is buoyed in this category by a high percentage of green space and strong green land-use policies. With 19% of the city's 61 square miles devoted to green space, the city has the fourth highest share in the Index, and well above the Index average of 12%. The city is also above average for population density, with 9,800 people per square mile compared with an average of 8,100 people. Not surprisingly, the city is strong on policies to sustain and improve green space, and indeed, over the last decade, it has launched several programs to improve and increase green space. Programs include the Anacostia Waterfront Initiative to clean up and develop the urban waterfront, and the DC schoolyard greening program. The city could improve efforts on sprawl, achieving only partial marks for brownfield regeneration and protecting greenbelts from development.

Green initiatives: Plant a Tree in DC is a program originally launched in 2008 that grants residents a $50 rebate if they plant a large canopy tree, such as an oak or elm, at any residence in Washington, and pledge to water and care for it for at least two years. The program is administered by Casey Trees, a local non-profit organization, in partnership with the city's environmental department. Through the program the city has contributed to planting over 2,000 trees over the past few years, while Casey Trees has planted over 6,000 more on its own. Additionally, Washington's CapitalSpace partnership unifies green space management across various levels of government. It concentrates on six themes: creating a greenway to link parks, improving public schoolyards, enhancing urban natural areas, improving playing fields, enhancing center-city parks, and transforming small parks into public spaces.

Background indicators

Total population [1]	600,000
Administrative area (miles^2) [1]	61
GDP per person (real) (US$) [2]	60,500
Temperature (24-hour average, annual) (°F) [1]	58
Goods employment (%) [2]	7
Services employment (%) [2]	93

Geographical basis: 1) City, 2) MSA



Buildings: Third, 79.3 points

Washington has the third highest percentage of LEED-certified buildings in the Index, at 15.8 buildings per 100,000 people, well above the Index average of 6.4. Since 2007 the city has had regulations in place requiring buildings in the city over a certain size to meet the standards (see "green initiatives" below), and it was the first US city to include private buildings in the regulations. The city also has strong incentives for energy efficiency retrofits, including full weatherization for low-income residents. In addition, it offers free home energy audits.

Green initiatives: Washington's Green Building Act of 2007 requires that all new public buildings over 10,000 square feet and new private buildings over 50,000 square feet comply with LEED standards. These standards include minimum requirements for energy savings, water efficiency and CO_2 emissions reductions. The city also expedites building permits for LEED gold-level projects, which have higher standards for green design than standard LEED-certified projects.

Transport: 13th, 52 points

The city performs well for the share of commuters that do not drive to work, at 18% compared to the Index average of 13%, and a higher than average total vehicle revenue miles per person (a measure of public transport supply), at 40 miles per year versus the Index average of 24 miles per year. Washington's performance in this area could improve even more in the coming years as the city has been focusing recently on increasing bicycle and pedestrian transport, and it has the largest bicycle sharing service of any US city (see "green initiatives"). However, the city's performance on other indicators suggests it could strengthen aspects of the public transport network, when compared with other cities in the Index. For example, the city's public transport network is shorter than average, at 0.4 miles per square mile, compared with the average of 1.1 miles. Furthermore, the city has one of the longest average commute times among cities in the Index, at 33 minutes compared with the average of 29 minutes.

Green initiatives: Launched in September 2010, Capital Bikeshare is currently the largest bicycle sharing service in the US. The service, operated by the city's department of transportation in cooperation with a private bike sharing company, provides over 1,100 bikes at more than 110 stations. As of January 2011 the program had over 5,000 members. Capital Bikeshare stations are powered by solar panels, and the system's pricing scheme favors commuters by making the bicycles free to members for the first 30 minutes, sufficient to cover most Washington commutes.

Water: 24th, 67.3 points

This is Washington's weakest category in the Index. Although the city's daily water consumption at 150 gallons per person per day is actually slightly better than the Index average of 155 gallons, Washington's score is weighed down by its water system leakage rate. Washington loses 14% of its water to system leakages, slightly more than the overall average of 13%. And while Washington's water conservation policies are strong, including a partnership with the US Environmental Protection Agency's WaterSense program to promote conservation among city residents, the city receives only partial points for its efforts to use recycled water and is one of two cities in the Index that does not have a completed storm water management plan on file.

Green initiatives: Since 2008 the Anacostia Watershed Trash Reduction Plan has worked to clean up the Anacostia River – one of the most polluted on the East Coast – and aims to make the river trash-free by 2013. Starting in January 2010 residents have paid a five-cent fee for every disposable bag from grocery and similar retail stores, four cents of which go to river cleanup efforts. As of October 2010 Washington merchants reported giving out over 80% fewer disposable bags than the year before, while the number of bags found as litter in the Anacostia River has declined by 66%.

Waste: 18th, 44.8 points

Washington's ranking in this category is largely the result of a middling recycling rate of 18%, which is well below the Index average of 26%, but the city is working to improve this situation (see "green initiatives" below). Although Washington also has limited policies for diverting waste from landfills, the city's environmental department has made waste reduction a focal point of its public advocacy efforts, and offers advice on reducing junk mail, donating unneeded items, buying used goods and goods with less packaging, and composting food and yard waste.

Green initiatives: In 2010, as part of a larger effort to increase recycling in Washington, the city's public works department expanded its recycling services to provide monthly curbside recycling of household hazardous waste and unwanted electronic equipment.

Air: 11th, 78.9 points

Washington has better than average performances for all three of the pollutants measured in the Index – nitrogen oxides, particulate matter and sulfur dioxide – largely because it is the most services-dominated economy in the Index and has a relatively low reliance on automobiles. Washington also has robust air quality policies, including a cap-and-trade program to control nitrogen oxides emissions. However, it is marked down in the Index for only partial efforts at setting specific targets. The city is looking to set air quality targets to improve its air quality performance, but progress has thus far been limited.

Green initiatives: The city's ongoing Small Business Assistance Program has improved compliance on air quality regulations by small businesses. The program provides free specialists that can help owners and managers understand which rules apply, develop plans for reducing pollution, cooperate in the development of regulations, and resolve disputes. Since its inception in 1993 the program has been used on average by 15 businesses per month.

Environmental governance: First, 100 points

Washington tops the Index in environmental governance, along with Denver and New York. The city's overall environmental strategy, called the Climate of Opportunity, has a wide network of political support from the mayor, other elected officials and city staff. It includes a baseline review, continuous reporting and strong targets. The municipal government frequently engages local communities and solicits input into its environmental policies through public notices and hearings. Residents and local businesses have been closely involved in crafting the city's environmental strategy, and officials recently held hearings on renewable energy development, watershed implementation plans, regional haze control programs, cleanup sites, and more. Furthermore the city has a dedicated environmental department, the District Department of the Environment.

Green initiatives: The city has partnered with the non-profit Alliance to Save Energy to educate Washington students about how energy use impacts the environment and demonstrate practical ways to increase energy efficiency. The partnership also created a summer jobs program to give students hands-on training in implementing energy efficiency measures. Since the program's inception in 2009, it has reached more than 2,000 students.

Quantitative indicators

Category	Indicator	Average	Washington DC	Year	Basis	Source	Comments
CO_2	CO_2 emissions per unit of GDP (metric tons/US$m)	296.4	**192.8**	2002	MSA	Purdue University – The Vulcan Project; US Bureau of Economic Analysis	Using MSA GDP
	CO_2 emissions per person (metric tons)	14.5	**13.3**	2002	MSA	Purdue University – The Vulcan Project; US Census Bureau	Using MSA population
Energy	Electricity consumption per unit of US$ GDP (TJ/US$m)	0.33	**0.13**	2008	City	Pepco; US Bureau of Economic Analysis	Using MSA GDP
	Electricity consumption per person (GJ)	52.2	**70.4**	2008	City	Pepco; US Census Bureau	Using city population
Land use	Green spaces as % of total area (%)	11.9	**19.4**	2008	City	Trust for Public Land	Using area of city in 2000
	Population density (persons/miles^2)	8,106.8	**9,766.4**	2009	City	US Census Bureau	
Buildings	Number of LEED certified buildings (silver, gold or platinum) (buildings/100,000 persons)	6.4	**15.8**	2010	City	US Green Building Council; US Census Bureau	Using city population
Transport	Share of workers traveling by public transport, bicycle, or foot (%)	13.0	**17.9**	2009	MSA	US Census Bureau American Community Survey	
	Length of public transport (miles/miles^2)	1.1	**0.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Annual vehicle revenue miles (miles/person)	24.4	**40.2**	2009	Metro-area	National Transit Database	Using service area population
	Maximum public transport vehicles available per square mile (vehicles/miles^2)	9.0	**5.4**	2009	Metro-area	National Transit Database	Using service area square miles
	Average commute time from residence to work (minutes)	28.9	**33.4**	2009	MSA	US Census Bureau American Community Survey	
Waste	Recycled municipal waste (%)	25.8	**17.6**	2007	City	District of Columbia Department of Public Works	
Water	Total water consumption per person per day (gallons)	155.1	**149.5**	2005	MSA	USGS	Using USGS publicly supplied population
	Water leakages in water distribution system (%)	12.8	**14.4**	2009	City	District of Columbia Water and Sewer Authority	
Air	Nitrogen oxides emissions per annum (pounds/person)	66	**48**	2005	City	EPA; US Census Bureau	Using city population
	Particulate matter (PM10) emissions per annum (pounds/person)	25	**24**	2005	City	EPA; US Census Bureau	Using city population
	Sulfur dioxide emissions per annum (pounds/person)	22	**14**	2005	City	EPA; US Census Bureau	Using city population

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