



Environmental and Developmental Goals Coexist in Singapore

Rewriting Old Narratives

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The Index scores national environmental performance across two overarching categories: the protection of ecosystem vitality and the protection of human health from environmental dangers.

For the first time, Singapore placed in the Top 10 of the Environmental Performance Index (EPI), a global ranking of how well countries address pressing environmental issues. The Yale Center for Environmental Law and Policy (YCELP), one of the creators of the EPI, provides an overview of why Singapore garnered top marks and where it still stands to improve.

Singapore highlights the ways in which urban centres, particularly in Southeast Asia, reframe how environmental sustainability is defined and experienced. As a small island nation with a population of over 5 million but a land area of only 671 square kilometres, Singapore has been forced to focus on efficient resource consumption and reuse. Given its limited geography, Singapore has undertaken robust, integrated, and long-term land-use planning measures that have made it a recognised international leader on sustainable development.

Leveraging high-density development and infrastructure enables urban areas to link sustainability and economic growth. Singapore's identity as a "city in a garden" has drawn new investors to the country, sometimes pulling them from competing economies.¹ In the process, it has rewritten old narratives that pit environmental and public health against economic growth, though significant conflicts and challenges persist.

Singapore's emergence as a global leader in environmental sustainability was bolstered when it garnered the fourth highest performance in the 2014 Environmental Performance Index (EPI).² A joint project between YCELP and the Center for International Earth Science Information Network (CIESIN) at Columbia University, the 2014 EPI ranks 178 countries, whose combined

populations represent 99 percent of the global population. The Index scores national environmental performance across two overarching categories: the protection of ecosystem vitality and the protection of human health from environmental dangers. In addition to enabling countries to compare their progress with other nations, the EPI also tracks each nation's progress in the rankings over time.

Strong scores in climate and energy, water and sanitation, and wastewater treatment contributed to Singapore's rise in the rankings. However, biodiversity protection lagged behind the nation's other indicators. Singapore ranked 109th out of 178 countries, in terms of terrestrial and marine protected areas, and received a score of 0 for its fisheries management, indicating insufficient or incomplete reporting. Despite strong internal air quality standards, transboundary pollution from Indonesia and, to a lesser extent, Malaysia³ creates major environmental and public health risks. As it meets these challenges, which fall outside the traditional scope of urban environmentalism, Singapore has an opportunity to expand its environmental leadership within South-east Asia.

Energy and Climate

The EPI considers the trends and changes in carbon intensity and the trend in carbon dioxide emissions per kilowatt hour (kWh) to compile each country's climate and energy score. The rankings also take each country's economic and industrial development into consideration, using the World Bank's Gross National Income per capita to weight the scores of low-income, middle-income, and high-income countries differently.

The scores for high-income countries, like Singapore, focus on trends in carbon intensity, or, in other words, on these nations' ability to reduce carbon emissions from energy consumption, transportation, industry, and electricity use. In contrast, middle-income countries, such as the Philippines, Indonesia, China, and Vietnam, are primarily scored based on the rate at which their carbon intensity growth has slowed. Their scoring system reflects the fact that these nations must continue to develop while gradually moving toward more sustainable energy sectors.⁴

Over the past decade, Singapore's trend in carbon intensity has decreased significantly. This achievement propelled it to a second-place ranking in this category, just behind Papua New Guinea, and ahead of countries traditionally seen as leaders in clean energy. Sweden ranked 8th in this category, just ahead of Norway (in 10th place), Iceland (in 13th place), Denmark (in 15th place), and Germany (in 31st place). Australia and New Zealand, which share the South-Pacific region and the category of high-income countries with Singapore, ranked 71st and 28th respectively. The Top 10 finishers also included several European countries, specifically Switzerland, Albania, Spain, and Portugal.

Like many of the Scandinavian countries that share high EPI scores in this category, Singapore's small size and demanding climate shape its approach to energy efficiency. However, while Iceland and Norway's landscapes enable them to harness geothermal heat or hydropower, Singapore's small geographic size limits its ability to draw on renewable industries. Instead of solar, wind, and nuclear power, energy efficiency drives Singapore's carbon-reduction strategy. A creative mix of supportive and regulatory initiatives across its energy, industry, and transportation sectors enables the nation to emerge as a leader through this approach.

Singapore's cityscape represents both the scope and ingenuity of the nation's work to reduce its carbon footprint. The Sustainable Singapore Blueprint 2009 set a number of ambitious environmental targets, including a goal of certifying 80 percent of its buildings as energy-efficient by 2030. The Green Mark certification and rating system, along with the allocation of S\$100 million to retrofit existing buildings, makes this goal feasible and accountable.⁵ Since launching the Green Mark in 2005, the Building and Construction Authority (BCA) has certified 1,534 new and 215 pre-existing buildings.⁶ In total, these certified buildings cover more than a fifth of the country's gross floor area.⁷

Like many of Singapore's successful environmental initiatives, this strategy also delivers significant financial benefits. Green Mark's energy efficiency standards cut a building's operational costs by an average of 11.6 percent and boost its capital value by an average of 2.3 percent.⁸ This economic incentive, along with the certification's

focus on energy use in tropical climates, may explain Green Mark's rising profile in Southeast Asia, China, and parts of tropical Africa. Green Mark is also gaining ground in places, such as Malaysia, where it must compete against local certification systems.⁹

In addition to promoting energy efficiency in the commercial sector, a number of strategies target carbon use within industry. The government provides no energy production or consumption subsidies, and introduced the 2013 Energy Conservation Act to increase energy efficiency. In addition to regulating emissions, this legislation builds capacity to increase energy efficiency, by asking businesses to self-monitor. It requires the approximately 170 companies that consume more than 15 gigawatt hours per year to implement a three-part plan to: appoint an energy manager; monitor and report energy use and greenhouse gas emissions; and submit energy efficiency plans.¹⁰ The most successful strategies and transformations are shared through the National Environment Agency's Energy Efficiency Circle Programme. Using data as a centerpiece of this act enables Singapore to simultaneously set and support efficiency goals.

Singapore's transportation goals also leverage data to support both individual and nationwide environmental action. One of the only countries to successfully implement a vehicle quota, Singapore plans to continue reducing its vehicle population to 1.2 million vehicles by 2020—a cut of nearly 40 percent from 2009.¹¹ The rollout of the Fuel Economy Labeling Scheme (FELS), which provides car consumers with information about the fuel economy, enables drivers to reduce their fuel expenses and footprint of remaining vehicles. An increase in the service areas and linkages between existing public transportation options also helps to facilitate the transition away from car-dependent travel. Since Singapore's transportation sector accounts for approximately 13 percent of its overall energy consumption and 50 percent of the fine particles (including the dangerous fine particulate or PM_{2.5}) in the air,¹² these changes have promising implications for both carbon emissions and public health.

Water and Sanitation and Wastewater Treatment

Singapore also emerged as a leader in categories that focused on the nexus between public health and water management. Along with 20 other countries, it achieved a rank of one in both the water and sanitation and wastewater treatment categories. In its scores for access to drinking water and to sanitation, the nation performed 17.09 percent better than countries with similar levels of Gross Domestic Product and 99.2 percent better than other countries in the Asia-Pacific region. The 2014 report marks the first year that the EPI assessed wastewater treatment, an indicator with strong impacts on both ecological and human health. This category measures a country's wastewater treatment, as a function of its wastewater volume and total population. On this metric, Singapore performed

65.55 percent better than its peers with similar income levels and 100 percent better than other Asian-Pacific countries.

Singapore's strong water, sanitation, and wastewater scores reflect an increasing drive towards self-sufficiency. As with energy, Singapore's small geographic area necessitates a strong focus on efficiency and conservation; despite frequent rainfall, limited land area prevents the country from storing large amounts of water. Tensions over the future of Singapore's current water-sharing agreement with Malaysia also heighten the desire to reduce the need to import this vital resource. As a result, Singapore's strong water sanitation and wastewater treatment scores emerge from the country's holistic commitment to water conservation and reuse.

Highly reclaimed purified water, branded "NEWater" by the Public Utilities Board, makes up one part of a four-pronged water source plan. In addition to relying on reclaimed, imported, and desalinated water, Singapore is one of a few countries harvesting urban stormwater at a large scale to augment their water supply.¹³ The transfer of sewage and drainage responsibilities from the then-named Ministry of the Environment to the Public Utilities Board in 2001 gave this agency oversight of the nation's overall water cycle. This bird's-eye view enables the Board to identify and act on these kinds of linkages and synergies,¹⁴ transforming "vulnerability to strength".¹⁵

This big-picture perspective extends to the implementation of Singapore's water infrastructure. By relying on metering and frequent inspections and repairs of infrastructure, Singapore has cut its rate of unaccounted-for-water loss—water leaked from pipes and infrastructure—to five percent. In comparison, the rates of many countries fall between 10 and 30 percent.¹⁶ Singapore's attention to human behaviour also expands the nation's capacity to preserve its water supply. A range of water conservation programmes encourage households and industries to reduce their water use; these initiatives aim to lower per capita domestic consumption by five litres per day before 2020.¹⁷

Singapore's response to water scarcity recasts wastewater as a developmental asset, rather than a burden. Its merger of environmental and economic goals may offer valuable models for emerging cities looking to maximise the return on their infrastructure. The scale of urban areas multiplies even small efficiency gains, justifying this kind of sustained focus on all of the components that influence the water-supply chain. However, while Singapore stands as proof of the value of wastewater management, it also demonstrates that a country's governing capacity forms a crucial part of this infrastructure. As water becomes increasingly valuable, changes in household and industrial resource use may become an increasingly important part of water management portfolios.



1. Singapore's identity as a "city in a garden" has drawn new investors to the country, sometimes pulling them from competing economies (Photo: Ah Lamb/iStock/ Thinkstock).

2. Smoke from Sumatra drifts over Singapore. An image taken on June 19 2013 by NASA's Terra and Aqua satellites captures smoke blowing east from illegal wildfires on the Indonesian island of Sumatra towards southern Malaysia and Singapore. On June 20, 2013, the Pollutant Standards Index (PSI)—Singapore's primary measure of pollution—rose to 371, the highest level ever recorded. Despite local laws prohibiting this practice, Sumatran farmers often use fires to prepare soil for new crops. Transboundary pollution remains a challenge for Singapore's air quality (Image: NASA, available on <http://earthobservatory.nasa.gov/IOTD/view.php?id=81431>).

NAME OF INDICATOR	SCORE	RANK	COMPARED TO GDP PEER SET	COMPARED TO REGION PEER SET
Climate and Energy	86.85	2	61.61%	81.24%
Trend in Carbon Intensity	90	1	66.53%	100%
Change of Trend in Carbon Intensity	0	118	-100%	-100%
Access to Electricity	73	118	-23.99%	1.45%
Trend in CO ₂ Emissions per kWh	81.37	15	34.05%	57.41%

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Singapore ranked second out of 178 countries in the EPI's Climate and Energy category, achieving an overall score of 86.85 out of 100. Despite its high overall ranking, Singapore's Access to Electricity score remained low and indicates that households may burn liquid fuels, such as kerosene and natural gas, in lieu of electricity, if they lack a grid connection.

NAME OF INDICATOR	SCORE	RANK	COMPARED TO GDP PEER SET	COMPARED TO REGION PEER SET
Water and Sanitation	100	1	17.09%	99.2%
Access to Sanitation	100	1	21.4%	100%
Access to Drinking Water	100	1	13.08%	75.93%
Water Resources	99.65	1	65.55%	100%
Wastewater Treatment	99.65	1	65.55%	100%

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Singapore scored highly in both the water and sanitation and water resources categories, achieving an overall score of 99.65 out of 100 for wastewater treatment and 100 out of 100 for access to sanitation and drinking water.

Emerging Challenges


While dense urban areas offer tremendous opportunities for efficient resource use, they can also concentrate and magnify the impact of human populations on the landscape. Perhaps unsurprisingly, Singapore's urban character creates a number of risks for its wildlife. While 4 nature reserves and 18 nature areas protect the island's significant biodiversity, direct competition for land uses, as well as indirect impacts from pollution, habitat fragmentation and degradation, pollution, and competition from invasive species still threaten flora and fauna.¹⁸ Poaching has also emerged as a growing concern, as wild boars and ornamental birds are caught for food or sold to pet shops.¹⁹

The nation's impact on its natural species extends to the sea. Along with 57 other nations, Singapore received a score of 0 on the EPI's fisheries indicator, reflecting incomplete or insufficient data and mirroring a very poor global performance on this issue. Without strong baseline data, implementing and monitoring the recovery of fisheries has proven extremely difficult, putting a vital source of food and economic security at risk.

In addition to concentrating environmental impacts, cities increasingly concentrate wealth, sitting at the centre of complex supply chains that cross geographic boundaries. This move towards regional and global economies often pulls the causes and effects of environmental challenges apart. For instance, Singapore's air quality increasingly reflects transboundary pollution from Indonesia and Malaysia, in addition to emissions from within its borders. Over the summer of 2013, smoke from illegal fires on the Indonesian island of Sumatra pushed Singapore's Pollution Standards Index to 371, topping the previous 1997 record of 226. Health officials consider pollution levels above 300 hazardous to health, and the poor air quality closed airports, schools, and other city activities.²⁰

While Singapore urged Indonesia to take action to curb the fires, Indonesian officials argued, "Malaysia and Singapore deserve[d] part of the blame because their companies control many of the palm oil plantations where the burning takes place."²¹ A mix of diplomatic discussions and joint monitoring tools are laying the groundwork for a regional approach to these challenges. The ASEAN [Association of Southeast Asian Nations] Agreement on Transboundary Haze Pollution and a joint haze monitoring system represent "small, but positive, steps forward in regional efforts to tackle transboundary haze."²²

This crisis also prompted Singapore to act on its own, by incorporating particulate matter of 2.5 microns or smaller (PM_{2.5}) into its Air Pollution Index. This pollutant, which has been linked to increased respiratory and cardiovascular hospital admissions, emergency department visits, and deaths,²³ is released through combustion and emerged as a major source of uncertainty and concern during the June 2013 fires. The National Environment Agency added PM_{2.5} as the sixth component of the Air Pollution Index in April 2014. Its inclusion reflects the regional determination of air quality as well as the importance of data in helping citizens adjust to unfamiliar environmental threats.

Singapore's dense urban character shapes its innovative environmental solutions, but also presents ongoing challenges. The country's continued leadership in urban environmentalism may turn on its ability to apply the resourceful and data-driven approach that works well within its borders to challenges outside of them. The importance of working regionally comes at an opportunity-rich time. Forty percent of people in the Asia-Pacific region already live in cities, and the United Nations estimates that this figure could grow to two-thirds by 2050.²⁴ Singapore's expertise in melding environmental and developmental goals could offer a promising starting point as the region works together to envision a sustainable future. 

Singapore's EPI Scores and Ranking

NAME OF INDICATOR	SCORE	RANK
Overall Score	81.78	4
Health Impacts	100	1
Air Quality	98.33	15
Water and Sanitation	100	1
Water Resources	99.65	1
Agriculture	96	1
Fisheries	0	98
Biodiversity and Habitat	46.33	109
Climate and Energy	86.85	2

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Singapore ranked 4th out of 178 countries in the 2014 EPI, a significant jump from its 52nd place finish in the 2012 report. High scores in water and sanitation, the new category of water resources, and climate and energy helped power this climb in the rankings.

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