

# How Green Is My City

Retrofitting is the best way to clean up urban living

*By David Biello*

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T WAS TO BE THE ULTIMATE URBAN PARADISE. Hundreds of pages of plans, maps and charts detailed the construction of a state-of-the-art eco-city called Dongtan on China's Chongming Island, at the mouth of the Yangtze River. Energy-efficient buildings would be clustered together to encourage residents to travel on foot; only battery- or hydrogen-powered cars would be permitted in the development. Surrounding organic farms would supply food; sea breezes and the burning of husks of China's staple crop, rice, would furnish power. Canals and ponds would incorporate the local wetlands, providing restful views for humans and continued respite for migrating birds.

Yet for all its grand goals, this island city-to-be remains unbuilt. Whether China has abandoned the project totally is unclear. It was originally slated for completion in 2010 but has failed to proceed beyond the construction in 2009 of a tunnel and bridge linking Chongming to the mainland. It is one of numerous planned eco-cities around the world that have fizzled, many because of cost. Even if every planned eco-city were successful, however, their effect on overall energy use and emissions would be minimal because the vast majority of urbanites would still live in existing cities. All these reasons suggest that we cannot rely on new construction to fully address the challenges of feeding, housing and transporting urban populations in ecologically sound ways. We need another solution.

The solution needs to take the future into account. Today's cities are by many measures greener than suburbs—among other things, urbanites use less energy and emit less carbon dioxide per household than their suburban counterparts do because they live in closer quarters and use public transportation. But it is not enough to be green. Cities need to be sustainable, too. That is, they must be able, as the United Nations's World Commission on Environment and Development stated in 1987, to meet “the needs of the present without compromising the ability of future generations to meet their own needs.” Existing metropolises will not be able to sustain themselves if left to operate on a business-as-usual basis—demand for resources will outstrip supply as the number of people inhabiting cities swells from more than three billion today to more than six billion by 2050. The many traditional cities that are mushrooming in China and India and elsewhere are facing the same conundrum.

In theory, new cities could have sustainability built into their infrastructure from the start—as was planned for Dongtan. But a larger payoff would come from retrofitting existing cities for sustainability.

### IN BRIEF

The planning of new eco-cities generates buzz, but retrofitting existing metropolises to be environmentally friendly and sustainable would be more effective because they already house so many people.

Readying today's cities for the future will require both high-tech and low-tech changes.



**New York City** and other existing metropolises need to be updated to lessen their impact on the environment and boost their sustainability. Pictured here is the High Line, an elevated rail structure-turned-park on Manhattan's West Side.



## A HIGHER PITCH

Urban great tits (*Parus major*) sing at higher frequencies to be heard over the relentless din of urban noise

SOURCE: "Ecology: Birds Sing at a Higher Pitch in Urban Noise," by Hans Slabbekoorn and Margriet Peet, in *Nature*, Vol. 424, July 17, 2003

ability, given how many there already are. "We must work with existing cities; I have no doubt about it," asserts sociologist Saskia Sassen of Columbia University, who has spent her career studying cities. That approach would be less costly than rebuilding cities from scratch and could still conceivably save enormous amounts of energy and water, allowing today's cities to flourish for centuries to come. To meet these objectives, engineers, city planners and locals could take good ideas from planned eco-cities that have failed as cities but succeeded as incubators for innovation. Simple changes, such as training building superintendents in best practices, can also go a long way toward helping cities support us well into the future.

### SAVING ENERGY

A KEY PRIORITY for cities adapting to a world transformed by global warming is increasing energy efficiency and reducing greenhouse gas emissions to stave off even more catastrophic climate change. "As the primary centers of economic activity globally, cities are significant consumers of energy and emit nearly three quarters of the world's carbon emissions," New York City mayor Michael Bloomberg told a recent conclave of mayors at a meeting of C40, a planning group for 59 major cities engaged in efforts to combat climate change.

A major focus of C40 is equipping old buildings with energy-efficient features. In the U.S., the average building—whether skyscraper, house or church—was built in the 1970s. Replacing their black-tar roofs with white roofs that reflect sunlight to keep buildings cooler in the summer or installing solar-thermal hot-water heaters, for example, can translate into major energy savings: heating hot water accounts for 17 percent of the energy used by buildings in the U.S., according to the Department of Energy. C40 has thus partnered with the World Bank to ensure funding for such retrofitting projects, among other climate action plans for cities.

Existing cities might also benefit from installing transportation systems originally conceived of for planned eco-cities. Tailpipes in the U.S. spew 1.7 billion metric tons of carbon dioxide a year, along with a host of noxious fumes. In contrast, the electric car system proposed for Fujisawa City in Japan would produce no tailpipe emissions. Electric car systems require infrastructure, though, particularly to ensure that people can charge the cars. In Tokyo a company called Better Place has had success in testing a system of electric vehicles powered by batteries that, when depleted, can be quickly and easily swapped out for recharged ones at battery switch stations. In the near term, simple changes, such as converting buses to run on compressed natural gas rather than diesel, can both clean up the air and improve efficiency. Already such efforts have helped Denver save more

than 24 million gallons of gasoline between 2005 and 2009.

Cities must not only conserve energy and limit emissions but also diversify their energy supply. New York City recently mandated a switch from heavy heating oils to lighter, cleaner-burning fuels, such as natural gas, in a bid to improve air quality. Yet even such seemingly straightforward decisions can demand difficult trade-offs: David Bragdon, director of Bloomberg's Office of Long-Term Planning and Sustainability, notes that New York is struggling to reconcile this increase in the use of natural gas with its desire to prevent hydraulic fracturing, or fracking—a process for producing natural gas from deep rock—in its watershed because fracking can contaminate water supplies.

### WATER AND WASTE

ENSURING THAT sustainable supplies of freshwater continue flowing to growing urban populations is another daunting task facing the international community. Large swathes of the world are already pushing the limits of water availability. Cities throughout the western U.S., from Denver to Phoenix, for instance, are using up more than the normal flow of the Colorado River. And the International Food Policy Research Institute estimates that about half of global grain production will be at risk because of limited water by 2050. To help cities conserve, C40 has developed a list of best practices based on case studies of strategies employed by cities ranging from Austin, Tex., to Tokyo. Austin, which launched its water-efficiency program in 1983 in response to a housing and commercial boom, offers a number of incentives to curb water use, including rebates for installing rainwater-harvesting systems and water-conserving toilets. Tokyo, meanwhile, is the world leader in detecting and controlling leaks in its waterworks. It has earned this distinction by systematically checking, repairing and replacing pipes and by fixing leaks on the same day that they are identified.

For its part, the planned city of Masdar in the United Arab Emirates (not a C40 city) takes a Big Brother-like approach to conserving water: showers shut off automatically after a few minutes, and each resident's water use, along with energy use, is monitored via a computerized smart grid that allows the provider to intervene if users get greedy.

Water must also be clean. For most cities, meeting this objective will mean not maintaining the status quo but vastly improving on it: according to the U.N., nearly a third of city dwellers live in slums, which typically lack access to safe drinking water and sanitation services, leaving them vulnerable to cholera and other waterborne diseases.

Poor waste management is not just a problem for water quality, however. New York City, for example, has closed its landfills in Brooklyn and Staten



Island and now pays as much as \$100 a ton to move waste hundreds of kilometers away. Even recycling is not a panacea—Dubuque, Iowa, halted its glass recycling program, according to Mayor Roy Buol, because trucking the material to far-flung processing plants added more to the city's greenhouse gas emissions than dumping it in a landfill. Even better than simply disposing of waste or recycling it, of course, would be making something useful from it. Just such a transformation is taking place in an industrial park outside the city of Rizhao in China, where Luxin Jinhe Biochemical Company makes citric acid for beverages from cassava, corn and sweet potatoes. The leftover waste flows into tanks called biodigesters, where microbes turn it into solids that can be converted into meal for animal feed and methane that can be burned for industrial purposes, such as generating electricity. In fact, capturing methane from landfills is one of the cheapest ways to cut down on greenhouse gas emissions while making a new “natural” resource.

### EASY FIXES

WITHOUT A DOUBT, existing cities will need cutting-edge technology to help achieve their long-term sustainability goals. But policy tweaks and low-tech solutions can play an important role, too—for instance, changing building codes to require more energy efficiency, which could be achieved with better insulation. Indeed, the real battle to make an existing city such as New York more sustainable may be won in the minds of superintendents managing the metropolis's roughly one million buildings.

Hence, the U.S. Department of Energy's Green Supers program, which trains building service workers in green operations and which recently graduated its first class. “I was under the impression that these techniques were very expensive. It's just time, it's just dedication and just applying it,” said superintendent Victor Nazario during his address to his fellow classmates at commencement.

These concepts are spreading worldwide, thanks to organizations that bring leading cities together to share plans that work, such as C40 and ICLEI—Local Governments for Sustainability. And when cities act, national governments notice—taking its cue from the 259 cities in China that are striving to be low-carbon, the Chinese Ministry of Housing and Urban-Rural Development is now studying plans to encourage the use of more energy-efficient and long-lasting building materials, which could significantly enhance the sustainability of the country's boomtowns.

Cities are an expression of our collective will, a potent mix of economics and environment, private visions and public dreams. Boosting their ability to provide clean energy, transportation, food, water and waste disposal will be key strategies to ensuring a brighter future for humankind. But when it comes to eco-cities, those efforts too often prioritize aesthetics over the real-world needs of people. And it is the people who ultimately make a city sustainable or not. ■

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**Eco-dreaming:**  
Artist's conception of Dongtan, a sustainable city that China planned but has not built.

### MORE TO EXPLORE

Eco-Cities of the Future.  
David Biello in *Scientific American Earth* 3.0, pages 68–73; September 2008.  
C40 Cities: [www.c40cities.org](http://www.c40cities.org)  
Urban Visions: The Future of Cities: [ScientificAmerican.com/report.cfm?id=future-cities](http://ScientificAmerican.com/report.cfm?id=future-cities)

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