

**FEATURE**

chicago  
shows what's  
next and  
what's needed  
to meet the  
city's ambitious  
performance  
goals

the rise  
of retrofit





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USE THE  
LEARNING  
OBJECTIVES  
at right to focus  
your study while  
reading "The  
Rise of Retrofit."  
Turn to page  
114 and follow  
the instructions.  
After reading this  
article you should  
be able to:

- Discuss the significance of existing buildings in reducing emissions
- Understand the effectiveness of residential retrofits
- Describe the effectiveness of commercial retrofit measures
- Explain the key obstacles to an effective and efficient retrofit market



This course was approved by the USGBC for one GBCI CE hour for LEED Credential Maintenance.



This course was approved by the AIA for one AIA CES LU of health safety and welfare sustainable design (HSW/SD) Credit. (Valid through Nov/Dec 2012).





**The building sector** accounts for a whopping 40 percent of greenhouse gas emissions in the U.S., and consumes fully 70 percent of American electricity. While mandatory codes and voluntary checklists are raising the standard for the efficiency of new buildings, well over half of the buildings that will count towards Chicago 2020, PLANYC 2030, and the 2030 Challenge are already standing. So if we're to avoid Armageddon 2040, which would mean a lot for the world in 2050, it's time for green retrofitting, the Clark Kent of the building industry, to step into the phone booth.

Building and energy industry analysts are widely predicting a green retrofit boom. A recent report from McGraw-Hill Construction estimates green building now comprises 5 to 9 percent of the renovation market by value, and predicts this will grow to 20 to 30 percent by 2014, with dramatic growth continuing into the longer term. More conservatively, leading industrial market research firm SBI Energy predicts significant growth in green retrofits to 13 percent of the market by 2015, with green building practices in renovations emerging as the new normal in years beyond. Driving the retrofit surge are, on the public side, climate change, energy security, and economic stimulus, and on the private side, cost-benefit analysis and changing norms.

Chicago, a city of some 2.85 million and a selected participant in the Green Capital Global Challenge, provides some great examples—from single-family houses, through major commercial and institutional buildings, to the city itself—of what's possible and what's needed to meet these emerging imperatives.

The Chicago Climate Action Plan identifies the main sources of the city's greenhouse gas emissions as electricity and natural gas consumed by buildings (70 percent) and transportation (21 percent). The plan sets goals to reduce emissions and to adapt to climate changes already under way, and proposes to achieve these goals in ways that improve the city's economy and quality of life.

The overarching goal is an 80 percent

reduction below the city's 1990 greenhouse gas emissions level by 2050, with an interim goal of a 25 percent reduction by 2020. The difference between the city's 2005 trajectory and its 2020 goal is 15.1 million metric tons of carbon dioxide equivalents (MMTCO<sub>2</sub>e). To give a sense of what that figure means—it's about equal to removing 2.8 million cars from the road.

To achieve this goal, the plan sets out five strategies. Energy-efficient buildings are number one. Chicago residential housing units number just over a million, at least 80 percent of which are expected to be standing in 2020. The aim is to achieve 30 percent energy savings in 40 percent of the city's residential housing stock. Commercial, institutional, and industrial buildings in Chicago number upwards

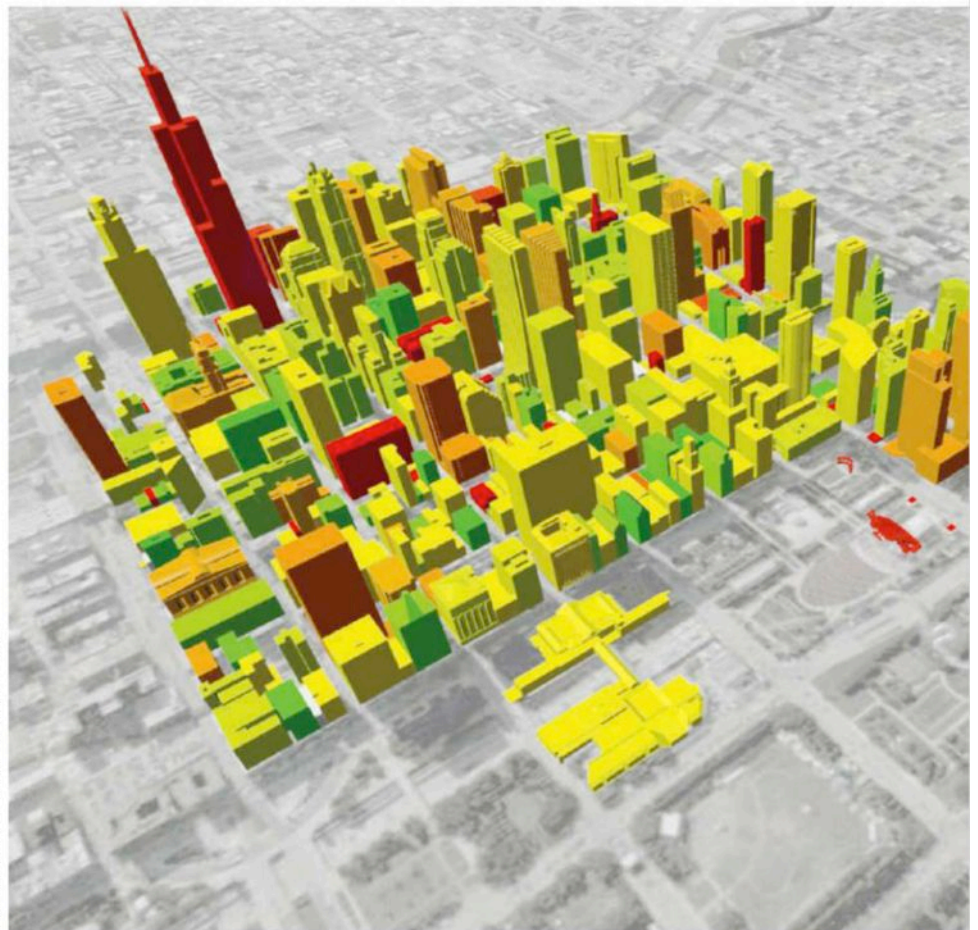


IMAGE © ADRIAN SMITH + GORDON GILL ARCHITECTURE



of 23,000. Again, the 2020 aim is a 30 percent energy reduction in 40 percent—or 9,200—of them. Combined with other strategies, targeted savings in the building sector account for 4.6 MMTCO<sub>2</sub>e or 30 percent of the 2020 total.

At the residential scale, building heat loss is the most significant energy drain. Heat loss occurs either through direct loss, as air moves through gaps in the building envelope, or through temperature differential, as components of the building envelope conduct heat out. Air sealing addresses direct heat loss and insulation addresses heat loss through temperature differential. “Those are the two main things we do,” says Tom McElherne of DNR Windows, an established Chicago area weatherization contractor. DNR performs a

blower door test of a building’s air leakage before and after each weatherization project. “If you don’t cut that number,” says McElherne, “you’re not going to cut their bills.” Faith Foley, assistant director of the Historic Chicago Bungalow Association, agrees: “Air sealing is so crucial in any household, more than insulation even—that’s where we’re educating.”

The Chicago bungalow, a brick masonry housing type built between 1910 and 1940, accounts for more than a third of Chicago’s single-family housing stock. The bungalows’ commonalities and the organization of their owners into an association makes the bungalows an ideal testing ground for a new program under development with the Center for Neighborhood Technology (CNT) in cooperation with Community

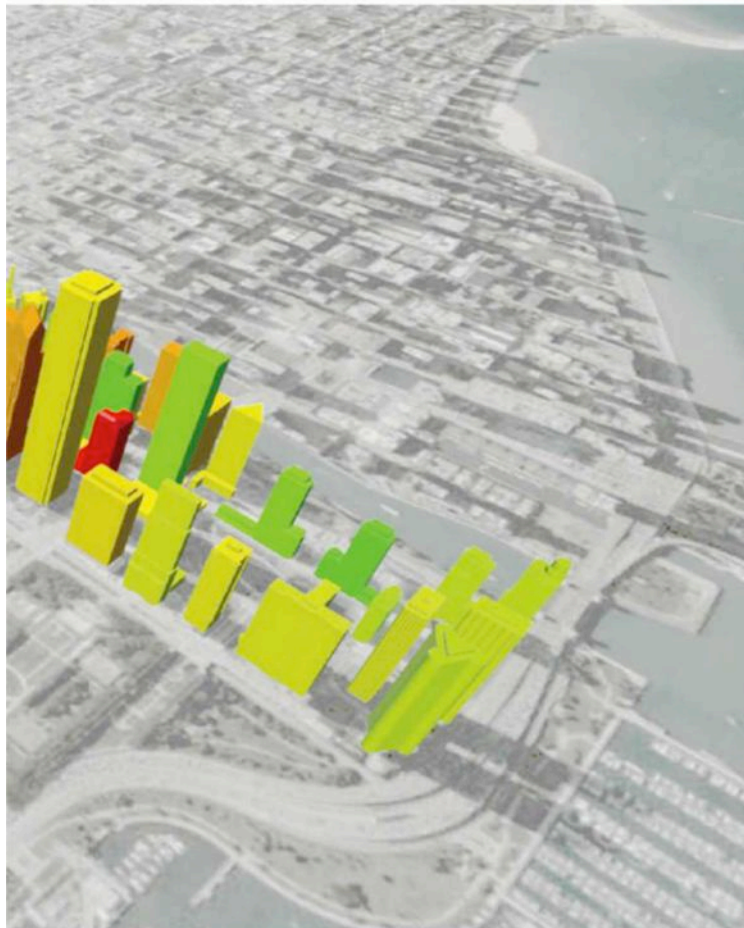
Investment Corporation.

Based on a database of actual energy use for the 1.2 million single-family homes in Cook County, CNT Energy is developing a website where home owners can find out their home’s energy score and rank it against comparable homes. The Web site will make retrofit recommendations tailored to the specific home, and provide connections to qualified contractors to do the work. Further supporting the value of retrofits, the database will ultimately enable the retrofits to measure in the real estate market. With an average project cost of \$8,600, early results coming in from the bungalow retrofit program suggest 60 percent of bungalows are showing a reduction in utility bills of more than 25 percent.

Another CNT program, Energy Savers, serves owners of multi-family rental buildings. Steve Thomas of Genesis Group, an owner of several low-income rental properties, is retrofitting three buildings with Energy Savers. “It’s been very enlightening, very helpful,” he says of the energy audit CNT conducted on each building, and the report they provided identifying the buildings’ inefficiencies, making recommendations for retrofitting, and quantifying savings and payback periods.

Retrofits Thomas is making include sealing floor-to-wall joints, insulating roofs, wrapping pipes, and changing common area light bulbs. “Some of it’s common sense and little things,” he says, but he’s impressed at the difference attention to detail can make. “It might cost you a little more up front, but over the life of the project you’ll see the savings, and those are savings that I can pass on to my tenants.” With an average expenditure of \$59,000, retrofits under the program are typically averaging 28 percent, which, for a typical 24-unit building, is reducing annual operating costs by \$8,000 to \$10,000.

CNT not only develops initiatives to help citizens and communities reduce energy use, it also has its own house in order, with a LEED Platinum renovation of its 1920s headquarters reaping energy



Left The Chicago Central Area DeCarbonization Plan focuses on a “study area” of Chicago called “The Loop.” The city’s central core encompasses about 550 buildings with some 85 million square feet. The area accounts for 1 percent of the city’s total area, but ten percent of its carbon emissions. The goal is to rejuvenate the area and increase the density while reducing carbon emissions and energy use per person.

[For a video about the plan, go to greensourcemag.com/features/greenbuild/2010](http://greensourcemag.com/features/greenbuild/2010)



savings of 40 percent. One of the primary goals of CNT's own retrofit was to achieve Platinum certification on a conventional budget. It succeeded through the creative use of "state of the shelf" technology and a focus on the energy efficiency basics: tight envelope, high insulation levels, and high efficiency systems.

CNT is also committed to ongoing improvement. "Measure and improve is a theme through all our building energy work," says Rachel Scheu, CNT Energy's Green Building Research Coordinator (CNT Energy is a division of the Center for Neighborhood Technology). "Go do it," says Scheu, "but then measure your success so that you know what you've done correctly." CNT's energy monitoring tells them that performance varies with changes in occupancy and use: in the years since the initial retrofit, heating and cooling costs have stayed constant, but a significant increase in building occupants has increased plug and lighting loads. For ongoing conservation efforts, this information validates the renovation, and focuses attention on behavioral and operational improvements.

It might be expected that the older the building, the greater the potential for energy savings through green retrofitting would be. In fact, a study by the U.S. Department of Energy tracks building energy use increasing over the course of the twentieth century from 80,000 Btus per square foot in buildings built before 1920, to 100,000 Btus in the 1980s. Older buildings have inherent efficiencies with high mass and smaller windows—and some have already been retrofitted. Environmental Systems Design (ESD), an engineering firm with a record of green innovation in Chicago as well as internationally, is the environmental controls consultant on the retrofit of two Mies van der Rohe buildings in downtown Chicago: the Dirksen Federal Building, completed in 1964; and 330 North Wabash, completed in 1973. "There are thousands of buildings like this across the U.S.," says Andrew Silverstein, vice-president of ESD's commercial and international projects group. "Air conditioning hit its stride at the



Above Chicago's new Center for Neighborhood Technology is a LEED Platinum certified renovation of its 1920s headquarters, a former textile factory.

same time as all-glass transparent facades."

Retrofitting a building of this scale consists of a series of compromises as the design team balances energy performance with a plethora of competing priorities. "If you can think of all the complications on a project," says Brett Taylor at SOM, architects for the Dirksen retrofit, "we have them on that building." Asbestos remediation, historic preservation standards, maintenance of high security levels and, most of all, conducting work in and around the occupants of an operating courthouse: energy conservation is one priority among many.

The lighting upgrade, for example, is constrained by a historic pattern of luminaires embedded in a unique plaster ceiling. Without the ability to change lighting density, the design team's solution is to reduce the output of the fixtures. The result is a higher wattage per square foot than would be typical today, says Taylor, but it's better than it was.

HVAC upgrades must work around tenant operations and vacancies. Upgrading the entire HVAC system is not an option for a tenanted building. Instead, inefficient perimeter induction units are being replaced floor-by-floor with a quieter and more efficient version of the same technology. Replacement of the

energy-profligate all-glass facade is simply not in the budget.

The base building retrofit of 330 North Wabash, a 52-story, 1.5 million-square-foot mixed-use building, has achieved Silver certification under LEED for Existing Buildings—Operations and Management, ENERGY STAR certification, and BOMA 360 Performance designation. For the building's owner, Prime Group Realty Trust (PGRT), achieving these certifications is "a great way to see all you actually do all in one place," according to Susan Hammer, general manager at PGRT. "By doing that, we're able to market our management skills to prospective tenants and to existing tenants as well. It really helps show the marketplace that you're doing a great job."

Energy conservation measures for the building include a green roof, lighting efficiency upgrades, floor-by-floor HVAC upgrades, and rush-hour shuttle service to and from Chicago's commuter rail stations. As part of the building's sustainability strategy, PGRT facilitates the efforts of tenants to green their operations. To date three tenants, DeStefano Partners, architects for the base building renovation; Perkins+Will; and Thornton Tomasetti have certified under LEED CI. "The building makes it very easy to lead by example," says Beth Murphy, AIA, architect of DeStefano's office fit-out.

The greening and modernization plan for another Chicago icon, the Willis Tower,