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Up on the Roof

Adding a layer of vegetation on the top of buildings can keep things cooler in the summer and warmer in the winter

By Shelly Banjo

A GROWING NUMBER of urban residents are happy to have a green roof over their heads. Buildings topped with ground cover, shrubs and other greenery are sprouting up across the country. Such roofs cost more to build than conventional roofs, because of the extra materials and labor. But they also offer savings on energy, reductions in storm-water runoff and a possible way to lower urban temperatures in summer. So, many cities have started offering builders tax and other incentives to adopt the features.

Even without the incentives, the extra cost of building a green roof—a 30% to 50% premium, compared with a conventional roof—can be recouped within about five years, says Ed McMahon, senior resident fellow for sustainable development at the Urban Land Institute in Washington, D.C.

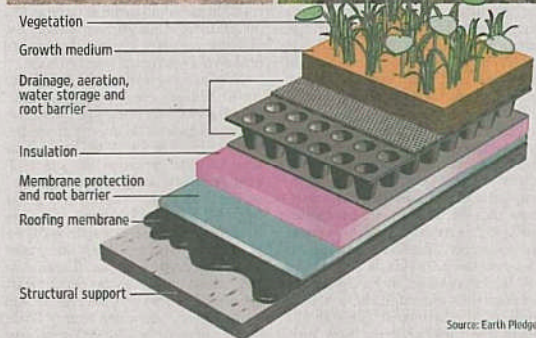
Green roofs provide a natural layer of insulation, keeping buildings cooler in summer and warmer in winter. The energy savings vary depending on materials and location, but according to one study, by the National Research Council of Canada, a green roof can reduce the average daily energy demand of a building by more than 75%. A study by a Columbia University group, meanwhile, found that green roofs can reduce the average daily energy demand of a building by about 15%.

Urban Thatch

Such insulation prevents some of the temperature-driven expansion and contraction that takes place when a roof is completely exposed to temperature extremes. Experts say that while a typical asphalt roof can reach 160 degrees on a summer day, green roofs rarely exceed 80 degrees. A protective layer of greenery “doubles the life of the roof,” says Leslie Hoffman, director of Earth Pledge, a New York nonprofit that acts as a consultant on sustainable environmental practices.

Vegetation also captures rainfall

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Source: Earth Pledge

TOP GROWTH Green roofs on residential (left) and commercial (right) buildings in Kansas City, Mo.; the layers of one kind of green roof system

and can slow the rate at which runoff goes into storm-water systems, reducing the load on urban sewers—and possibly the tax burdens of city residents. When runoff is produced by heavy rains, it can “overwhelm city water systems...becoming a very expensive problem for municipalities, as well as violating the Clean Water Act,” says Ms. Hoffman. “As individuals, we don’t think about storm water as having an effect on our bottom line,” she adds, but cities build elaborate storm-water-management systems, and “we pay those costs through taxes.”

On a larger scale, green roofs may help ease global warming by reducing what is known as the urban-heat-island effect. Heat islands are created when dark-colored, impermeable surfaces absorb heat energy and radiate it back into the air. The effect makes cities two to 10 degrees hotter than nearby suburbs, increasing energy use and causing health problems as well. “As the temperature goes up, the air quality goes down, affecting the overall health of the cities’ residents,” says Amy Norquist, founder of Green-sulate Inc., a consulting firm based in

New York and California that focuses on environmentally friendly building techniques.

According to a study by Canada’s environmental agency, Environment Canada, planting vegetation over at least 6% of Toronto’s total available roof space (70 million square feet) could reduce summer temperatures in the city by 1.8 degrees. Such a reduction, they predict, would subsequently lower cooling demands by 5% for all buildings in Toronto, and that decrease in energy use would reduce temperatures an additional degree.

Another boon: Lower roof temperatures prevent overheating in solar-energy panels placed there, and thus make them more efficient, Ms. Norquist says.

While most green roofs have been installed as part of new buildings, retrofits are increasing. However, these aren’t “do-it-yourself projects,” Ms. Hoffman warns. Just as you wouldn’t attempt to build a traditional roof, installing a green roof may require input from an architect, landscape designer and green roof consultant, among others. Building owners must be careful to check out any insurance policies that apply. Weight and fire hazards may exist.

Going to Sedum

Maintenance costs depend on the complexity of the project. The simplest of green roofs are planted with a 3-inch to 4-inch layer of grass or ground cover, like sedum, a plant whose leaves store water. Such greenery requires minimal maintenance. “These could go months without any kind of watering,” Ms. Norquist says.

More elaborate projects, including flowers, vegetable gardens and trees, require continuing attention. But the aesthetics can add to a property’s real-estate value as well. “It’s definitely an amenity,” says Michael Gubbins, resident manager of the Solaire, an environmentally friendly residential building with two rooftop gardens in the Battery Park City area of New York.

While green-roof technologies have been around for years in Japan and in some European countries, like Germany and Switzerland, the idea started gaining ground in North America only in the past decade. In 2001, Chicago Mayor Richard Daley, inspired by a trip to Hamburg, Germany, decided to cover about 20,000 square feet of the roof atop Chicago’s City Hall.

City officials in Chicago now estimate that their green roof saves the city about \$3,600 a year in cooling and heating costs. If all of Chicago’s roofs were greened, they add, the city’s peak energy demand could be cut by 720 megawatts—enough electricity for 750,000 people. The load on the city’s storm-sewer system, meanwhile, would be slashed by about 70%.

Mayor Daley says that Chicago offers grants of as much as \$5,000 toward the cost of installing a green roof, and that buildings with plans to install green roofs are pushed through the permit process quicker.

“We decided that the city had to lead by example,” by installing green roofs on government buildings and then “offering economic assistance to get the private sector involved,” the mayor says.

“Now everything from libraries, schools and apartment buildings have green roofs,” he says. Mr. Daley estimates that Chicago now has about 400 green roofs in the downtown area.

The city of Chicago also has begun hosting conferences about green roofs for other U.S. city leaders.

Cities from Tokyo to Toronto, New York, Washington, Portland, Houston and Seattle have gotten involved, offering builders and companies tax incentives, rebates and higher-density building allowances for installing green roofs. That means builders can get permission to construct bigger buildings in highly coveted downtown spaces if they incorporate a green roof into the plan. Tokyo requires new buildings with total floor space of more than 10,000 square feet to make at least 20% of their usable roof area green.

New York’s Battery Park City in 2002 started requiring new buildings to plant greenery covering 75% of the nonmechanical area of their roofs. That rule has resulted in about two acres of green roofs installed or planned in the neighborhood since then—about a third of a typical New York City block. Then, in June of this year, the city of New York began offering a one-year property-tax credit of as much as \$100,000 to building owners who install green roofs on at least 50% of available rooftop space. The credit would be equal to \$4.50 per square foot of planted area, or about 25% of the typical costs associated with the materials, labor, installation and design.

The amount of green roofing in New York more than doubled to 123,074 square feet from 2004 to 2007, according to surveys by Green Roofs for Healthy Cities-North America Inc. That is an area roughly equal to about 10 Olympic-size swimming pools. Green Roofs, an industry association based in Toronto, says the study polled only members of its association. But the group estimates that its survey reflects about 60% of all green-roof activity in the U.S. and Canada. ■

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JOURNAL VIDEO: Join the Journal’s Shelly Banjo for a tour of green roofs and a look at their costs and benefits, at WSJ.com/Reports.