

How Green Is Your Roof?

Businesses are increasingly finding benefits to “going green.” The economic savings, corporate goodwill and environmental benefits associated with sustainable building and development have led many companies and institutions to look at their businesses and consider the possibilities. This article focuses on one aspect of sustainable development and asks the question: how green is your roof?

What Is a Green Roof?

Green roofs are a “growing trend.” But what makes a roof green? This article discusses two types of roofscapes, “white roofs” and “planted roofs,” both of which help achieve the goals of sustainable development. However, the term “green roof” as used in this article refers primarily to a planted roof.

White roofs, or “cool roofs” as they are commonly called, are literally rooftops that have been painted white or have a lighter, more reflective surface. White roofs have been shown to offset greenhouse gas emissions because the white roof stays cooler in hot weather than a typical black or grey asphalt roof, because a white roof reflects more solar radiation.¹ There are economic benefits for the building owner as a result of increased solar radiation reflection because the building as a whole will be cooler, reducing the need for air conditioning and ultimately lowering utility costs in hot months. White roofs are a great, lower cost method for achieving sustainable results without some of the complexities associated with planted roofs. It should be noted, however, that in the winter, a traditional asphalt roof retains more heat and therefore is more efficient. Therefore the cost/benefit analysis of a white roof is tied to geographic location and other factors.

A planted green roof is a vegetated roof cover, with growing media and plants taking the place of gravel ballast, shingles or tiles.² Green roofs are different than rooftop gardens. A green roof is applied to the entire roof deck surface, allowing unimpeded drainage and more even weight distribution.³ In addition, the plantings are directly into the soil on the roof as opposed to containers or planters.⁴ There are a number of different planted roof systems, which vary in size, scope and plant material, but almost all include some kind of waterproofing layer or membrane, a drainage system, a root barrier, a soil system and a vegetative cover.⁵ Typically, roof space and weight load capacity determines the design, and building owners or developers should consult with a structural engineer to determine the feasibility of a green roof.

Green roofs are often referred to as either “extensive” or “intensive.”⁶ Extensive roofs, also referred to as eco-roofs and low profile, have fewer and thinner layers and are therefore lighter, less expensive and require less maintenance. Fully saturated, extensive roofs weigh between 10 and 50 pounds per square foot. Intensive roofs, also referred to as high-profile, look more like the roof gardens discussed above because they include a wider variety of plant materials and are much deeper and heavier. Fully saturated, the weight of an intensive roof can be roughly 80 to 120 pounds per square foot or greater.⁷

What Are the Benefits?

Economic and Intangible Benefits

Green roofs can help promote a company’s sustainable initiatives and generate positive public relations and corporate goodwill. In addition, overall building energy costs can be reduced because of the decrease in building temperatures that result from green roof systems. The reduction in building temperature is tied to several factors. Over a long period, a 3- to 7-degree temperature drop associated with a green roof can reduce a building’s air-conditioning costs by 10 to 30 percent.⁸ For example, the Nellie Reynolds Gardens senior housing complex in Philadelphia, Pennsylvania has a 20,000-square-foot planted roof, which reportedly generates energy savings between 10 and 20 percent.⁹

in this issue

- 1 **How Green Is Your Roof?**
- 2 **Peppercast: Leases and Bankruptcy from a Landlord’s Perspective**
- 3 **Pepper Hamilton Sponsors 24th Annual Construction SuperConference, December 9-11**

Large retailers like Wal-Mart also have begun to explore the benefits of green roofs, including a 2006 project in Chicago, Illinois for a 74,000-square-foot green roof.¹⁰ For warehouses that are used for cold storage and have substantial refrigeration and air-conditioning needs, these energy savings can grow exponentially. However, as stated above, these energy savings are tied to other building maintenance factors and in winter months when the green roof is less efficient it cuts into the building's net energy savings.

Some cities also have begun offering land-use incentives for green roofs. For example, in Portland, Oregon, buildings can receive a Floor Area Ratio (FAR) bonus based on planted roof coverage in relation to the building footprint. Under the regulations, each square foot of planted roof earns up to three square feet of additional floor area. Green roofs also have been shown to last longer than standard roofs because they are protected from ultraviolet radiation, pooling water, and extreme fluctuations in temperature that cause traditional roof membranes to deteriorate. As a result, the cost of replacing a traditional roof over thirty to forty years may far exceed the costs of installing and maintaining the green roof.

Stormwater Benefits

Green roofs also can significantly mitigate stormwater runoff, lessening the impact of continuous impervious surfaces commonly found in urban areas.¹¹ Many green roofs can absorb and retain roughly 60 to 100 percent of stormwater and release the water over a period of several hours. This level of stormwater retention can be used to meet best practices principles for two-year-storm designs. These positive stormwater attributes also may lessen the burden on local stormwater systems and mitigate pollution. In addition, as some municipalities, in connection with sewer fees, begin to consider charging for stormwater runoff tied to

impervious surfaces, it is likely that a green roof will mitigate these costs. Projects that require underground storage of stormwater also can be prohibitively expensive; in such cases, a green roof could be a cost-effective alternative.

Tax Incentives

New York, Philadelphia and other cities have already implemented tax incentive programs for green roofs. New York permits a tax abatement for a green roof on a New York City building as part of the city's long-term sustainability plan. The incentive is a tax abatement equal to \$4.50 per square foot of green roof not to exceed \$100,000 or the tax liability for the entire building. Philadelphia has a Green Roof Tax Credit that offsets the Business Privilege Tax equal to 25 percent of all costs actually incurred to construct the green roof, provided the total credit does not exceed \$100,000 per building. A business can seek the credit for multiple buildings.

Chicago has risen to the forefront of green roof development through the use of project grants. Starting in 2005, Chicago implemented a Green Roof Grant Program, which led to more than 20 green roof projects. The program was expanded in 2006 and ultimately paid 40 projects grants of \$5,000 each. The program requires the applicant to provide a written commitment to maintain the green roof project for at least five years, and is available for small commercial buildings of fewer than 10,000 square feet. Despite the program's success, Chicago is not now accepting green roof grant applications.

The federal government also is looking to get into the green roof game. Recently, Sen. Maria Cantwell (D-WA) introduced the Clean Energy Stimulus and Investment Assurance Act of 2009, which includes a green roof tax incentive. Section 506 of the bill gives a 30 percent tax credit



Peppercast: Leases and Bankruptcy from a Landlord's Perspective

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for qualified green roof property expenditures on residential and commercial buildings. The legislation is pending before the Senate Finance Committee.

LEED® Certification

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a major driving force in the increasing popularity of green roofs. The U.S. Green Building Council (USGBC), which administers the LEED rating system awards points based on the sustainable attributes of buildings, and green roofs can contribute to the accumulated points needed to achieve LEED certification for a project. A green roof can obtain at least one point, and in most cases a green roof installation can earn as many as six points.

What Are Some Drawbacks?

Up-Front Capital Costs

Green roofs are not cheap, and without government subsidies represent a significant upfront capital cost. Extensive green roof systems can cost anywhere between \$8 and \$20 per square foot, however the national average tends to be roughly \$16 to \$18 per square foot. Intensive green roof systems on the other hand can have limitless costs depending on the size and scope of the project. Intensive roofs start at roughly \$20 per square foot and increase in proportion to size and site constraints.¹² There also are other costs associated with installing a green roof including consultant fees, structural analysis, irrigation systems, plant material, maintenance, and zoning/building code approvals. These costs also will vary based on the size, scope, and location of the project as well as whether the green roof is part of a retrofit of an existing building or new construction.

Land Use Issues

Installing a green roof likely will require some form of land use approval and review by the local planning or zoning agency. This can add another layer of costs to a project. The green roof could be included in an overall site plan application for new construction, but it is less clear what level of municipal review will be required to retrofit an existing building with a green roof. It is likely that such an undertaking will require a site plan review or environmental review for stormwater because of the substantial changes to the building and the impact on the existing stormwater drainage facilities and permitting. Property owners should be prepared for questions and confusion from the local land use agencies, as green roofs are still relatively new technology that is very recently coming into use. However, a well planned presentation with examples and structural

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analysis should effectively address any of the boards' concerns.

Building Code Compliance

In many cases, innovations such as green roofs sometimes can outpace regulation. The International Building Code provides minimal guidance specific to green roof systems.¹³ In addition, most local code enforcement authorities have not adopted specific regulations on this issue. Although some cities such as New York, Portland and Chicago have directly addressed green roof installations, permits needed for building a green roof can vary from city to city due to differences in climate, zoning and building codes. The weight of a green roof system alone raises structural concerns demanding the attention of government building code compliance. Before undertaking any planted roof project, a site owner should consult with local code enforcement.

Maintenance and Mold Concerns

Maintenance of the plants and waterproofing membrane is required. Maintenance is less of a concern for extensive roofs. In the case of intensive roofs, plant maintenance can range from infrequent inspection for weeds and damage to weekly irrigation, pruning and replanting.¹⁴ Irrigation can be particularly important because the green roof needs watering like any other plant material and will die if not properly maintained. In some projects, a plant health alert system and maintenance guidelines are necessary to keep the green roof functioning properly. Irrigation needs are tied to the geographic location of the building. Addition-

ally, like any roof, eventually the membrane will need to be replaced, however green roofs have a much longer usable life than traditional asphalt roofs.¹⁵

Maintenance of the waterproofing membrane can be complicated and expensive. Although generally protected by the vegetative cover, the membrane is still susceptible to leaks or penetrations.¹⁶ Regular maintenance inspections can mitigate these issues and electric leak detection systems can be implemented underneath the waterproofing membrane to pinpoint any water leaks.¹⁷ Leaks could result in water seepage that potentially can create mold concerns. Building engineers also are concerned about the impact of high, sustained concentrations of pollen and mold spores so close to the building's HVAC system. However, these concerns have been largely unfounded to date.

Conclusions

According to the Greenroof Project Database available on www.greenroofs.com, there are already as many as 38 green roof projects in Pennsylvania, totaling approximately 449,504 square feet of roof space in the commonwealth. These and other green roof projects throughout the country are examples of how businesses, schools, and government entities have successfully implemented this form of sustainable development.

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Endnotes

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