Economics of Green Roofs

This flyer is one in a series about green roofs, developed by an Ohio University green roof committee. Information about green roofs and the variety of benefits they offer can be found on our website.

Green roofs are more expensive to build and maintain than conventional roofs but yield substantial benefits for building owners and the broader community. In addition to the cost of the roof itself, most buildings are not constructed with the weight of a green roof in mind, necessitating additional upfront investment. While these costs are typically assumed by individual property owners or developers, many communities offer incentives to help offset them. The precise economic benefits of a green roof depend upon its size and design, as well as the local climate, but life cycle assessments suggest that green roofs outperform conventional roofs through energy savings, longevity of the roof itself, and ecological benefits.

Costs and Challenges

Green roofs are more expensive than conventional roofs, but some municipalities recognize their benefits and offer financial incentives to encourage property owners and developers to install them (*Policy Flyer*).

- The most substantial cost of a green roof is associated with the construction. The building must support the additional weight of the rooftop infrastructure, especially the soil when it is completely saturated with water and is at its heaviest. Two main categories of rooftops differ in these upfront costs. Extensive rooftops have shallower soil and are lighter than intensive rooftops which must bear the load of deeper soils with woody and herbaceous plant species.
- Retrofitting an existing rooftop will require analysis of the weight bearing capacity by a structural engineer and, possibly, reinforcements to increase capacity of load bearing structures (Cascone et al. 2018). Retrofits may have less storage space for building materials and require other modifications to existing infrastructure, such as plumbing (U.S. General Services Administration, GSA, 2011).
- The cost of the living portion of the rooftop varies by design with tray or layered systems as options. Engineered lightweight soil, drainage layers, root barriers, mulch, and plants, seeds or plugs are typical expenses.
- Maintenance costs after installation include removal of unwanted vegetation, plant replacement, and management of plant growth through irrigation or nutrient additions. Extensive green roofs planted with drought-tolerant plants such as *Sedum* species reduce maintenance needs.

A green roof designed to support research at OHIO includes irrigation, engineered soil, seeds and biodegradable mulch. Installed by Omni Ecosystems®

- Municipal green roof programs, both regulatory and incentive-based, require the investment of public tax dollars. Local governments do this in recognition of the benefits of green roofs and to increase their coverage and benefits for the community (Manso et al. 2021).

Ohio University is a Regional Living Architecture Center and Greater Ohio Living Architecture (GOLA) Center member.

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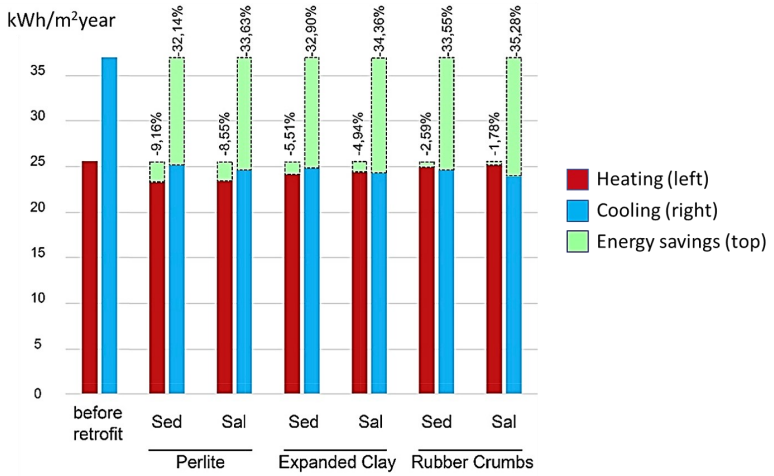
Benefits

Individual: Property owners are more likely to install a green roof if it adds visible or usable green space (van der Meulin 2019) but they also provide a variety of economic benefits which offset costs over time.

- ***Energy savings:*** Shading and evapotranspiration by plants reduce temperatures in and on the building, lowering cooling costs (GSA 2011). Reduced energy usage is most valuable in hot climates (van der Muelin 2019). Soil and plant material provide additional insulation for a building, which further reduces heating and cooling costs if it improves existing insulation (Cascone et al. 2018). Living roofs also improve performance of solar arrays due to cooler ambient temperatures (Schindler et al. 2018).
- ***Longer roof life:*** Green roofs insulate a building against diurnal fluctuations, UV radiation, and thermal stress protecting the rooftop structure. This doubles the service life of a rooftop, lowering replacement costs over time and providing long-term savings (Manso et al. 2020; GSA 2011).
- ***Increased property value:*** Property value is more likely to increase if the roof is visible from the residence or the street. An average increase of 8.24% was reported by Manso et al. (2021).

Energy Savings on Green Roofs (Right)

The annual energy consumption of a green roof before and after a retrofit of a traditional roof in a Mediterranean climate. Two plant types were compared: *Sedum* (Sed) and *Salvia* (Sal) in substrates with one of three drainage layers (perlite, expanded clay, and rubber crumb from recycled tires). A 31-35% reduction in energy used for cooling was observed in summer (Cascone et al. 2018).



Community: Green roofs have greater impact when they cover a broader area in highly developed or urban environments which have a high amount of impervious surface and less traditional green space.

- ***Improved stormwater management:*** Green roofs retain rain water throughout the year with significant runoff reduction during rainy seasons (Squier-Babcock & Davidson 2020). This reduces the potential for flooding and lowers stormwater management costs, particularly in communities with fees based on the amount of impervious surface area (EPA 2009; Liberalesso et al. 2020).
- ***Mitigation of climate change:*** A reduction of energy consumption on green roofs, lowers green house gas emissions when fossil fuels are used for heating and cooling. Green roofs also fix carbon dioxide, a greenhouse gas, in plant tissue reducing carbon emissions and meeting climate change objectives (Shafique et al. 2020). Green roofs on a city-wide scale reduce urban heat islands (U.S. EPA 2008) and could lower health care costs associated with heat-related illnesses (Sanchez & Reames 2019).
- ***Improved public space:*** Converting unused rooftop space to green roofs improves quality of life and could attract new residents. Green roofs cool cities, attenuate noise pollution, and can support mental health, lowering health care costs (Shafique et al. 2018).

For more information please visit:
www. ohio.edu/sustainability/schoonover-green-roof-project

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