
The Economics of Green Roofs from the Perspective of the Commercial Client
A Cost-Benefit Analysis of Extensive Green Roofs

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INTRODUCTION

In 1994, Fritz Hämmerle published an analysis on the economic benefits of extensive green roofs for the very first time in the international green roof magazine *Dach + Grün*.² Nearly 20 years later, it is now undisputed that extensive green roofs have numerous positive effects on the environment and the physical properties of buildings.³ Nevertheless, today only a small amount of extensive green roofs have been installed in North America and this is mainly due to the high initial costs of construction and the commitment to proper long-term maintenance.

For the green roof industry to survive in the long run, potential clients must be provided with a simple to read yet detailed cost-benefit analysis of their extensive green roof investment. Very often building construction budgets are tight and ecological compensatory systems are the first items to be 'value engineered' because they are thought to be expensive and essentially a money pit, i.e. no return on investment.

The purpose of this 'Cost-Benefit Analysis of Extensive Green Roofs' is to eliminate these economic reservations and provide conclusive evidence that extensive green roofs are able to provide a short and long-term return on investment. The following will present an example of an extensive green roof with defined properties and specific data to demonstrate that modern green roof technology can be economical solely from the perspective of the client.

THE EXTENSIVE GREEN ROOF SYSTEM

Associated green roof costs are based on a 10,000 square foot FLL-confirmed extensive green roof system in multi-course construction, over all depth 4.5 inch, with a diverse vegetation of Sedum species and hardy herbaceous perennials. There is no permanent irrigation, and includes a gravel strip, some pavers and inspection boxes (Praxis example).



COSTS

There is a direct correlation between the high ecological effects of green roofs and their resulting costs. All construction causes massive intrusion in the local ecology. If partial restoration of ecological damages is to be achieved through the installation of a green roof, then the vegetation must meet the highest quality standards. While creating vegetated ecosystems on structures has proven to be of high ecological value, they still have their economic price.

Only in-place, multi-course constructed green roofs (or wall-to-wall green roof systems) are able to deliver the standard necessary to fulfill long-term investment goals. Additionally, wall-to-wall green roof systems are completely customizable for any project and able to meet the industries rigorous long-term expectations.

Pre-vegetated systems, planters, green roof boxes, modular or so called hybrid systems are not considered in this assessment. They might be able to be installed quickly but their higher costs for purchasing and maintenance render them irrelevant for ecologic and economic responsible clients. Instant green delivered in containers might offer a higher promotional value in the first years, but they do not offer the long-term reliability we require.

Table 1: The Investment Costs of an Extensive Green Roof:

The Extensive Green Roof System.	14.00 \$/sf.
Expenses for Care and Maintenance over 40 years.	15.00 \$/sf.
The additional cost for the statics (average cost of increasing the roof load).	4.00 \$/sf.
I. Total costs for the client over 40 years	33.00 \$/sf.



SAVINGS

Modern green roofs have an equally positive effect ecologically and physically. They protect the roof's waterproofing membrane from external influences, which may lead to serious damages, and prevents accelerated aging due to UV degradation. The combination of the functional layers and the vegetation insulates the building against heat loss and creates potential energy savings during the intense air conditioning months in the summer. Above all else, the stormwater retention capability of extensive green roofs is the number one advantage in savings for the client and the community.

Table 2: The Benefits to the Operator of the Green Building:

Extending the lifespan of the waterproofing significantly. Green Roof experts predict a doubling of the lifespan at least 40 years. Assumed waterproofing lifetime of 20 year without Green Roof and initial waterproofing cost of \$25.00 / sf. Cost of the complete waterproofing assembly 25 \$/ sf.	25.00 \$/sf.
Insulating effect of Green Roofs over 40 years. The insulation effect is in this case – and there is still a lack of reliable data - rated by experts as 2.5 cm (1") of conventional insulating materials. Savings of 2.5 cm (1") Insulation: 3.00 \$/ sf .	3.00 \$/sf.
Reducing in repair costs over 40 years. The roof is protected against mechanical damage (assumed value).	4.00 \$/sf.
II. Preliminary potential savings for the building owner	32.00 \$/sf.

At this point, the accumulated costs (33.00 \$/sf) and the quantified long-term benefits (32.00 \$/sf) makes the investment in an extensive green roof system nearly net-zero. We have assumed a rather high initial square foot cost of the green roof system. Savings per square foot are extremely likely, and therefore the cost of investment has already shown a return.



KEY BENEFIT OF GREEN ROOFS

Multiple scientific studies from around the world, specifically Germany in the last 30 years, have shown that stormwater retention is as the most important feature of modern extensive green roof systems. Vegetated roofs act like a giant stormwater retention facility. Typically 150,000 sf. of extensive green roofs can replace a stormwater retention basin. In this regard, green roofs save property owners and municipalities valuable land and allow denser construction without the expensive investments in increasing existing stormwater systems. Most communities, municipalities, counties or states have recognized these benefits and now provide a variety of incentives for green roof installation, including tax breaks or significant reductions in stormwater fees. This example considers potential average saving in many large cities throughout North America.

Table 3: Additional Savings:

Savings through reduced wastewater charges. ⁴	1.00 \$/sf.
Typical tax incentives (write-offs, sales tax, depreciation etc.).	3.00 \$/sf.
Direct incentives after installation by organizations (varies from \$ 0.00 - \$ 5.00 \$/sf), through reduction in insurance or voiding long-term roofing warranties.	5.00 \$/sf.
III. Additional potential savings for the building owner	9.00 \$/sf.

Table 4: Cost-Benefit Comparison of an Extensive Green Roof:

I. Total costs for the client over 40 years.	33.00 \$/sf.
II. Preliminary potential savings for the client/building owner.	32.00 \$/sf.
III. Additional potential savings for the client/building owner.	9.00 \$/sf.
Total pay back or savings for the client/building owner over 40 years.	8.00 \$/sf.

Under these conditions, the construction of a green roof is rewarding since many cities already have discharge regulations with reductions for stormwater fees.



CONCLUSION

This cost analysis shows that extensive green roofs are a sound investment and can be a profitable long-term investment. All the economic caveats floating around the internet claiming green roofs are a poor investment are now essentially invalidated. Extensive green roofs are economical in every sense.

This Cost-Benefit Analysis of Extensive Green Roofs did not take in to consideration cost reductions for building insurance, increased promotional value, the low costs of LEED® credits, faster building permitting times, potential permits for a larger building foot print and general increases in a building's value. Recently, in Boston, MA, an \$112,500 investment in an extensive green roof system is reported to have raised the value of the building by \$2.4 Million.⁵

Further studies by Green Roof Service LLC / Green Roof Technology have shown that combining extensive green roofs with photovoltaic panels accelerates the roof's pay back to around 10 years.⁶ Without a doubt, the return on investment of an extensive green roof system is unmatched compared to any traditional roofing option.

REFERENCES

- ¹ Jörg Breuning, President of Green Roof Service LLC presenting Green Roof Technology since 1980 with uncountable projects designed, installed and maintained. He brought modern Green Roof Technology to the USA and systematically educated the nowadays recognized experts and research institutions. His knowledge is based on more than 32 years of hands-on experience.
- ² Fritz Hämmerle, Dipl. Ing. agr. Recognized as one of the leading green roof expert in Germany and CEO of arti-grün. He is the chair of the German Green Roof Association FBB, active member of FLL and president of the European Federation of Green Roof Associations – EFB. Since more than 30 years he is well-known and multiple times awarded in the German Green Roof industry.
- ³ Green Roof Benefits see at <http://www.greenrooftechology.com/advantages-of-green-roofs>.
- ⁴ Depending on State, Counties, Municipalities. More details at: <http://myplantconnection.com/green-roofs-legislation.php>.
- ⁵ Blackwell, Tim. 'Green Roof Installation Raises Value of Boston Apartments by \$2.4 Million.' <http://www.propertymanagementinsider.com/green-roof-installation-raises-boston-apartment-value-by-2-4-million.html>. 2012.
- ⁶ Case Studies by Green Roof Service LLC are based on over 30 years of Green Roof research at different Universities in Germany
- ⁷ The Sun-Root™ System. The first integrated solution for the combination of PV and vegetated roofs. https://www.youtube.com/watch?v=N8XpFwevS_s.

