

An Economic Analysis of Green Roofs

Evaluating costs and savings to building owners in Toronto and surrounding regions

The environmental and social benefits of urban green spaces have been well documented by researchers around the world, and have spurred the development of new and innovative ways of increasing green cover in built up areas where land costs are at a premium. Roof greening is one technique that has emerged as a promising solution to the urban greenspace issue.

Within the Greater Toronto Area (GTA), significant progress has been made in the areas of green roof research and policy development, with a focus on the



public benefits that this technology can provide for the city. Despite this progress, building owners remain reluctant to build green roofs, partly due to concerns that green roofs require higher capital and maintenance costs than conventional roofs, without the demonstration of offsetting benefits to the proponent.



Objectives

While it is widely recognized that the initial costs of green roofs are higher than conventional ones, there is uncertainty surrounding the magnitude of this cost differential and the key life cycle factors that affect costs.

The primary aim of this study was to estimate the life cycle costs and savings associated with building and owning a green roof in the GTA. Costs related to structural modifications, installation materials and labour, and long-term maintenance were investigated for both new and retrofit installations.

Approach

Cost and savings data were gathered based on published research, product supplier quotations and completed green roof project budgets. The best data obtained were used to determine the life cycle costs (LCC) of green and conventional roofs through the use of an LCC calculator developed by the Athena Sustainable Materials Institute (ASMI). The LCC analysis was based upon the hypothetical installation of a green and conventional roof on a model one storey office building in Waterloo, Ontario. The relative importance of various factors impacting the life cycle costs were determined through alternative scenario analyses.

Results

Figure 1 summarizes the installed capital cost of extensive green roof systems as obtained from two key literature sources (Peck and Kuhn, 2002 and GRHC, 2005), industry surveys, and supplier interviews.



Figure 1: Summary of installed capital cost of extensive green roof systems from various sources

Key factors influencing green roof capital costs included the following:

Size and complexity of the installation

Building height

Use of special features for safety and/or aesthetics

Local availability of materials

Availability of labour-reducing technologies

Abundance of experienced local labour

Market competition

Availability of packaged vs. custom systems

Need for structural modifications to increase loadbearing capacity on the roof

In terms of life cycle costs, the differential between conventional and green roofs was found to be most

affected by factors that impact capital or replacement costs. These factors included: (i) roof membrane longevity, (ii) market transformation, and (iii) the interest rate applied to future investments. Variations in annual costs and savings associated with maintenance and energy use reduction did not significantly impact the LCC.

Recommendations

A direct financial incentive of \$4 - \$7 /ft² would be required in order to make green roofs an attractive option in the GTA, and thus spur market growth.

An incentive higher than \$8/ft² could stunt market growth by allowing suppliers to keep costs high.

Other creative ways of encouraging green roof construction should be explored. Examples may include requiring smaller end-of pipe stormwater facilities, or expedited approval of applications for developments including green roofs

Further research should investigate

- innovative strategies for minimizing structural modifications needed for green roofs;
- membrane longevity based on laboratory tests;
- ✓ the dollar value of the amenity and public relations benefits of green roofs; and
- ✓ whether the cost of green roofs borne by owners is offset by their overall societal value.

References:

Peck, S.W. and M.E. Kuhn, 2002. Design Guidelines for Green Roofs. Prepared for the Ontario Association of Architects and the Canada Mortgage and Housing Corporation, Toronto, ON.

Green Roofs for Healthy Cities (GRHC), 2005. Green Roof Design 101 Introductory Course Participant Manual. Green Roofs for Healthy Cities and the Cardinal Group Inc.

For more information on this project or the Sustainable Technologies Evaluation Program, contact Glenn MacMillan at (416) 661-6600 x5212 or Tim Van Seters at x5337 The full report for this study is available for download from the STEP website at www.sustainabletechnologies.ca.

Project Funding Partners

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