13 June 2013
Issue 332

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Source: Ascione, F., Bianco, N., de' Rossi, F. *et al.* (2013) Green roofs in European climates. Are effective solutions for the energy savings in air-conditioning? *Applied Energy*. 104: 845–859 DOI:10.1016/j.apenergy.2012.11.068

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1. Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings. See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010L0031:EN:NOT
2. European Commission Delegated Regulation (EU) No 244/2012 of 16 January 2012 supplementing Directive 2010/31/EU of the European Parliament and of the Council on the energy performance of buildings. See: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32012R0244:EN:NOT

European Commission

Science for Environment Policy

Green roofs reduce energy demands but watering costs in warm climates can be high

Green roofs can cool buildings in summer and prevent heat loss in winter. A new study suggests, however, that in the warm climates of southern Europe the additional cost of watering means that 'cool roof coatings' may be more cost effective.

In addition to insulating a building, other recognised benefits green roofs include improving air quality in urban areas; reducing rainfall runoff that would flow into stormwater drainage systems; absorbing carbon dioxide emissions; providing habitats for wildlife; and providing pleasing surroundings in urban areas.

Regulating the energy performance of new and existing buildings is a vital part of reducing energy consumption and greenhouse gas emissions in Europe, reflected in EU policy[1,2,] and green roofs can play a role in this. The soil and plants of green roofs can act as an insulating layer for buildings. Even if winter solar radiation is partly lost, the energy losses for convection can be reduced. In summer, the cooling effect of the plants helps lower temperatures. However, there has been little research into the cost-effectiveness of using green roofs to help reduce energy consumption in buildings.

This study focused on the technical and economic feasibility of using green roofs to save energy in buildings. The researchers modelled the energy requirements of a single-storey, flat roofed, well-insulated office building, with green roofs of different vegetation types. These requirements were compared to the same building with a traditional roof (thermal insulation and a pavement coating) or a roof with a highly reflective coating (a cool roof). Energy efficiency and cost was assessed for different European weather conditions, from those of the warm, southern areas of Tenerife, Seville and Rome, to cooler, northern cities of Amsterdam, London and Oslo.

The results indicated that green roofs reduced energy demand compared to traditional roofs, especially in summer. Overall, energy demands decreased by 1% to 11% for Tenerife, by 0% to 11% for Seville, and by 2% and 8% for Rome, depending on the type of vegetation.

This was also true for cold climates; green roofs achieved energy reductions of 4% to 7% for Amsterdam and London, and up to 6% for Oslo. Compared to cool roof coatings, green roofs were more effective at reducing energy demand in colder climates. However, in warm climates, cool roof coatings performed better in general, although using tall grasses in Seville and Rome also proved just as effective.

The researchers also examined the relative costs of different roofs. In cold climates, green roofs were slightly more cost-effective than cool coated or traditional roofs. For example, annual energy costs for a building with a traditional roof in Oslo were estimated at €11,529, €310 more than a cool roof and €551 more than a green roof.

However, the cost of watering in warm climates outweighed the benefits gained from reduced energy demands. For example, annual energy and watering costs for a traditional roof in Seville were estimated at €14,314, €1736 more than a cool roof, but only €32 more than for the most suitable vegetation of a green roof. The authors do stress, however, that the use of smart watering controllers could optimise water use and reduce some of the costs for green roofs.

In addition, the researchers estimated the installation costs of a green roof and compared these with the annual savings in energy use. For all climates, the payback period was long, and in southern Europe, for example, the cost of installation was never repaid. The researchers concluded that although green roofs can provide significant energy savings, they may not be the most cost-effective method for energy improvements in buildings in Europe. Nevertheless, there are many other reasons for installing green roofs which should also be considered when planning decisions are made.