THE LIVING RAINFOREST SUSTAINABLE GREENHOUSES

Gerard Bot[1], Karl Hansen[2], Adrew Logan[2], Feije de Zwart[1]

[1]Wageningen UR Greenhouse Horticulture Bornsesteeg 65, 6708 PD Wageningen, The Netherlands
[2]The Living Rainforest, Hampstead Norreys, Berkshire RG18 0TN, UK
gerard.bot@wur.nl

Keywords

Low k-value, seasonal storage, heat pump, bio-energy, integration of greenhouses, other buildings

Abstract

The Living Rainforest (www.livingrainforest.org) is an educational charity that uses rainforest ecology as a metaphor for communicating general sustainability issues to the public. Its greenhouses and office buildings are to be renovated using the most sustainable methods currently available. This will be realised through construction of a high insulating greenhouse covering with a low k-value of less than 2 Wm-2K-1, passive seasonal storage of surplus summer solar energy in the soil by a vertical soil heat exchanger (VSHE) and exploitation of this low degree solar energy for heating in winter by a heat pump. Similarly, the heat pump will produce cold water to cool the VSHE, allowing a cooling function in summer. It will be demonstrated that a VSHE is an alternative for an open aquifer in regions with no aquifer availability. The heat pump will deliver the basic heating load, the peak load will be delivered by a biomass boiler, fired with locally-sourced low-cost wood chips. It is expected that the energy saving will be about 75%, resulting in a major cost reduction. The climate in the office buildings will be very comfortable in summer due to the available cooling from the seasonal storage. Moreover, the winter climate will be comfortable due to wall and floor heating. The low k-value of the covering is linked to a light transmission of 75 %. This is high enough for the demands of the vegetation in The Living Rainforest. Because the inner greenhouse climate demands are comparable to that of ornamentals, the results will be applicable to commercial ornamental production. In future low k-value coverings will also be available with high light transmission, allowing wider application of the results. This paper focuses on the correlation between k-value, light transmission and energy demand in order to investigate the trade-off between light transmittance (a major energy gain) and heat loss.
The effects of these design parameters on storage and harvesting capacity are

also studied. The renovated greenhouse site at The Living Rainforest will show that new greeenhouses and ecology can be linked to sustainability and this will be communicated and demonstrated to the public.