No fuss solar air heating system

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Abstract

This innovation consists of combining two common solar technologies: that of solar heated air with PV driven fans to move the air, much as Kerr MacGregor combined hot water panels with PV driven pumps in SolarTwin. Warmed air has some advantages, in that it cannot freeze and leaks do not matter much. Although the combination seems obvious, it has not been much applied and not at all in Scotland. Small brushless DC fans have become much more available with greater variety. After various small-scale trials, two full size systems have been made and shown to function as designed. One is for house heating and the other for timber drying. These two examples are shown below, Both systems are automatous, needing no attention.

THE CONVERTED STABLES LOFT

The South facing 18th century stables roof was replaced with multilayered polycarbonate sheet. The whole loft serves as a solar collector and is fitted with black internal surfaces.

Fig.1. Converted stables loft. Polycarbonate roof to the right; thin black aluminium heat absorbing panels, left; chimney from supplementary wood boiler (on ground floor) in centre; behind the chimney at far end of loft, cardboard duct with two 7W 12V fans blowing warmed air into lounge below. Conventional vacuum domestic hot water tubes are visible top right.

The fans in the cardboard duct in Fig. 4, blow the loft-warmed air from the roof apex at 80 cu.m./ hr into the living room below, thereby contributing at least half a kW of fresh air warmth. (these fans are controlled by a thermostat set to 20^{o}C, so that on sunny cold mornings no air is blown until it is warm). When the outside is 2^{o} or below, the living room is 21^{o} or above. Similar fans (not controlled) blow outside air onto the loft floor. Two or more further fans (also not controlled), blow warm air into other rooms of the house. All PV panels of 10-20W are fitted internally, low down between the rafters

This system was designed and built by myself about 10 years ago and was visited by Kerr MacGegor during construction. It has been running without trouble since then. Of course in the few days of hot summer, the house overheats, and then windows are opened wide.

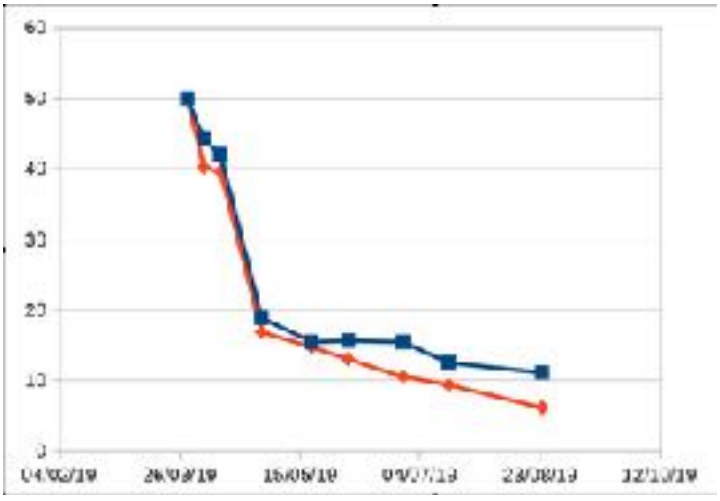
THE SOLAR KILN

For timber drying, solar warm air collectors, consisting of multilayers of black metal insect mesh under double layered polycarbonate, were fitted to the south side of a shipping container, as shown in Figs 2 and 3.

Fig.2 Front of kiln with heat absorbing mesh

Fig.3 Kiln front with polycarbonate fitted

From an inlet at the base, air is drawn in zig-zag fashion through the collector and into the top of the kiln by ten 16-30W fans, These are driven by two 100W PV panels on the roof (Fig2) and then through the spacer stacked timber inside and out through 100mm holes at the base of the rear doors. At over 80 m^3/hr per fan that achieves about 20 air changes /hr. Temperature and humidity are monitored but there are no switches or any controls. Temperature rarely reached or exceeded 30^0. It seems that the day/night fluctuations lead to stress-free timber quality. Such fluctuation cannot be afforded in conventional powered kilns.



The results show that fresh sawn wet timbers can be dried to the required 10% moisture within 3 or 4 months and yield timber without internal stresses. This is faster and better than the conventional year of air drying followed by 2 months of powered kiln drying, often leading to stresses.

Fig. 4. Moisture % of Sycamore (blue) and Walnut (red) y axis,% moisture; x axis, date

I am grateful to Malcolm Mack and colleagues for useful discussions and for much of the construction work, and to ASHS members for help and advice. I initiated the project and fitted the PV panels and fans and internal baffles whic distribute the air.