EVALUATION AND TESTING OF THE NEBRASKA MODIFIED ROOF POND FOR SEVERE HEATING AND COOLING ENVIRONMENTS

by

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ABSTRACT

OBJECTIVES

Although roof ponds are not a new passive solar heating technique (1,,2,,3,4),, they have not received widespread acceptance in climates with severe winters, Test rooms of the traditional passive solar heating techniques have undergone testing and evaluation at the Passive Solar Research Test Facility. Located on them Omaha campus of the University of Nebraska, the facility has twelve passive solar test rooms which have been operated by the Passive Solar Research Group (PSRG) since 1978, but only in 1982 was any serious effort made to evaluate roof ponds. Although apparently successful in the southwestern portion of the United States where sustained freezing conditions do not exist and where sunny and dry conditions prevail in the summer, roof ponds have not been extensively tested in severe winter heating environments.

The principal design objective of the PSRG was to develop a modified roof pond which would avoid the severe winter problems associated with the technique and also to overcome certain disadvantages associated with its operation (5). These changes are discussed in succeeding paragraphs.

The concept for the Nebraska roof pond was developed jointly by Richard C Bourne of the Davis Energy Group. As shown in Fig. 1 and Fig.2, a fixed cement coated rigid insulation made by Dow Chemical for roofing applications floats over the pond itself. At night, during summer operation (Fig 2), a submersible pump in the pond places water above the roof. Through the twin processes of evaporation and radiation by night sky, the water is cooled. This cooled water then migrates downward to the pond via seams and cracks in the floating insulation. During winter time, the roof pond water is heated by employing a thermosiphon passive solar heating drive system. This is shown in Fig 1.

In contrast to traditional roof ponds, there is no need for moveable roof insulation systems. Cooling performance is because evaporation is used as part of the cooling strategy to aid night sky radiation Previous attempts used south facing windows with shutters and sloped roofs over the roof pond in order to get around the problem of freezing water in severe winter climates. This led to reduced cooling performance since the night sky aperture was reduce with the presence of a roof. Nebraska roof pond does not have any structure over the pond itself. The fixed, rigid insulation prevents the water from freezing during the winter.