AN EXPERIMENT WITH A PLASTIC TUBULAR SOLAR STILL

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Following other experiments with Plexiglass [207A, B], wood, sheet iron [207C], and concrete [207D] solar stills, work has been undertaken to verify the practical efficiency of a rigid tubular solar still designed to reduce to a minimum the heat losses through the bottom of the water pan. The design of the still is suggested by Howe in a Löf report [180]. The still is shown in Figure 95. The water pan is made of sheet aluminum blackened electrolytically, with 3.5 sq ft of surface. The still case is made of 0.12 in. commercial Plexiglass sheets sealed with a cement, the front surface is movable and aligned with small dies.

Figure 96 shows the amount of distilled water produced in terms of the intensity of solar radiation; the reported data were obtained during June and July 1957. These solar radiation data, observed by the Italian Air Force Meteorological Station of Bologna, have been made available to me by Prof. O. De Pasquale, coordinator for all the solar radiation data observed in Italy, his help is gratefully acknowledged. The maximum water and air inner temperatures were 160°F. The cost of the still was equivalent to about $10 per sq ft of pan surface.

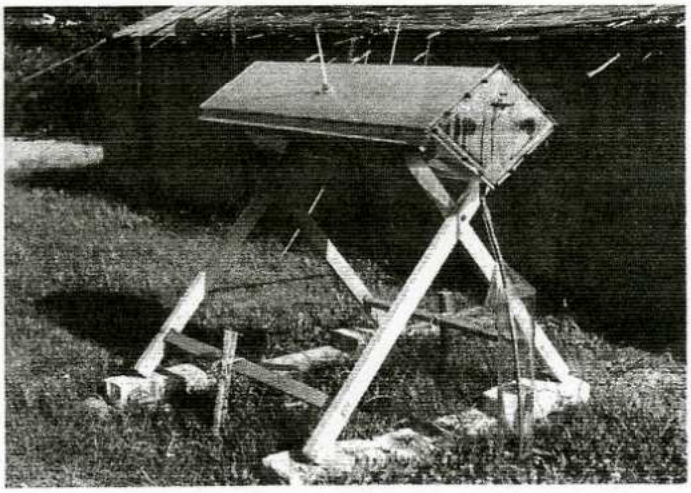

FIGURE 95–Plexiglass Tubular Solar Still (Pan Surface 3.5 sq ft).

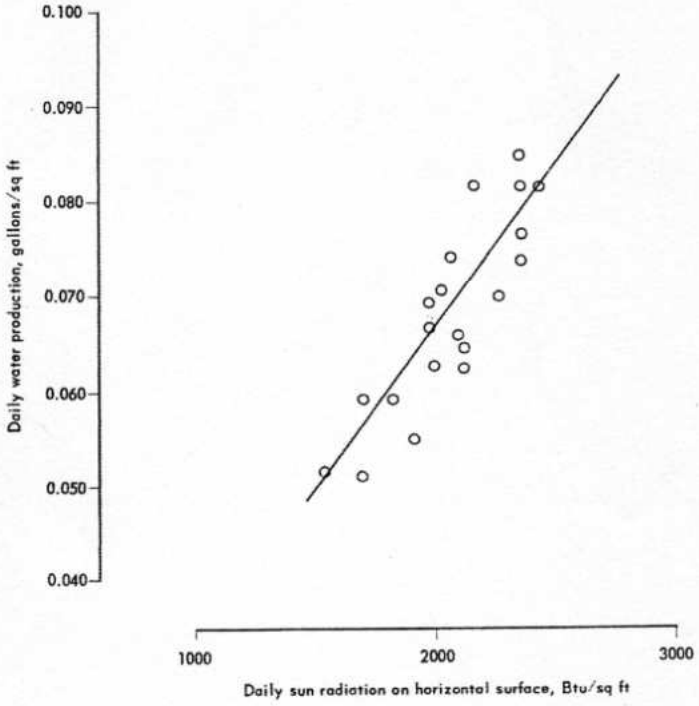

FIGURE 96–Water Production vs. Solar Radiation.

The report by Löf [180] allows an evaluation of the true efficiency of the present still. Estimates are presented for rigid plastic tubular units in Table 4 of the report.

The ultimate water yield, predicated upon the development of materials and techniques to avoid the drop-wise condensation, is 0.10 gallons/sq ft for a daily average sun radiation of 1 800 BTU/sq ft. This represents utilisation of 50% of the incident radiation, considering that in a simple distillation process operating at atmospheric pressure about 9 200 BTU are required per gallon of distilled water.

Drop-wise condensation has been observed with the Plexiglass still here described and the water yield has been 0.06 gallons per 1 800 BTU, with a utilisation of 30% of the incident radiation. It is

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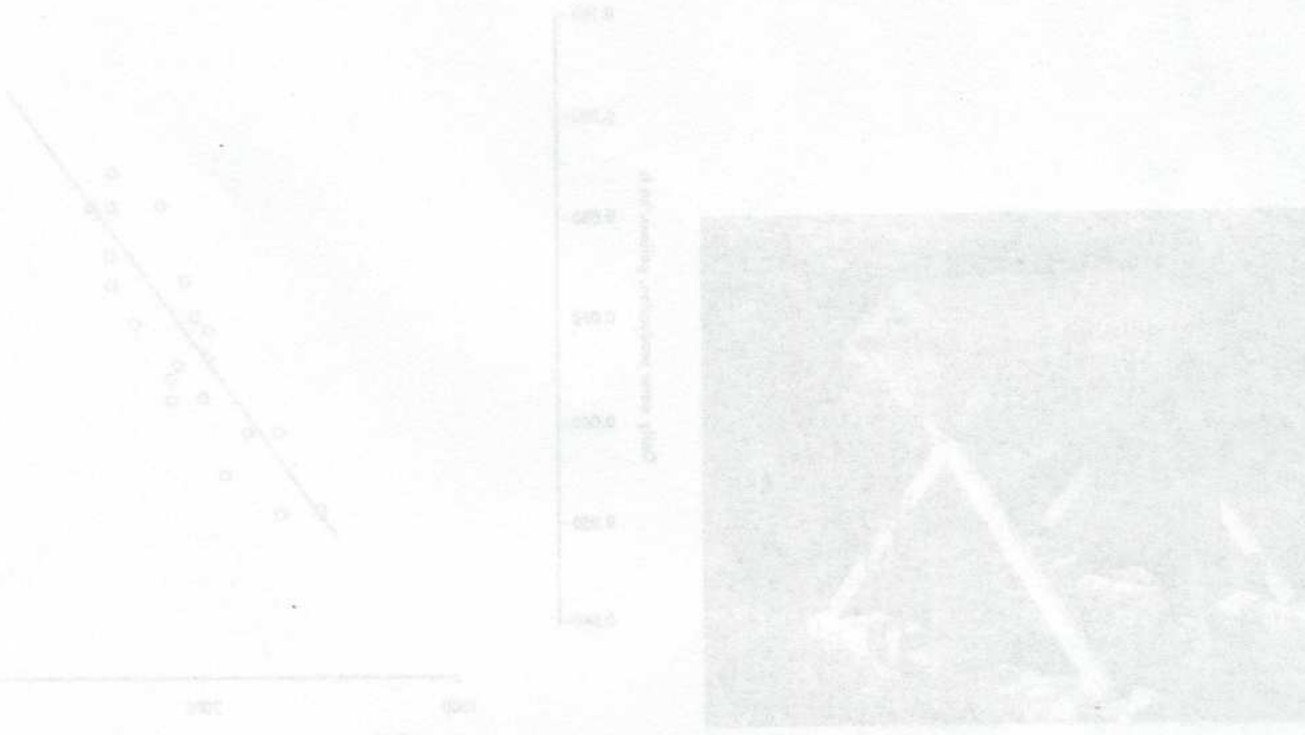
well known that drop-wise condensation is the most important limiting factor in the development of plastic solar stills, although its effects are considered differently by the various authors. Telkes [278] states that drop-wise condensation may cause a lowering of the roof transmission to about 60% of the incident radiation; while Björksten [289] reports that drop-wise condensation has a relatively low effect on the reduction of solar transmission for many plastic roofs.

The results of the present experiment show that the loss of solar energy may be considered to be about 40%; another 30% of the incident heat is lost because of imperfect blackening, reradiation, air circulation, and heat exchange through the condensing surface. The heat transfer to external air may be considered relatively low because the designed still works as a very well insulated evaporator, the tray bottom being surrounded by hot stationary air. The under side of the cover surface has been sprayed with a surface active agent (Aerosol OT, Rohm & Haas Co.) to avoid drop-wise condensation, but it has been observed that the condensing water washes off the surface active agent rapidly (in few hours), and the vapor again condenses in drop form.



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