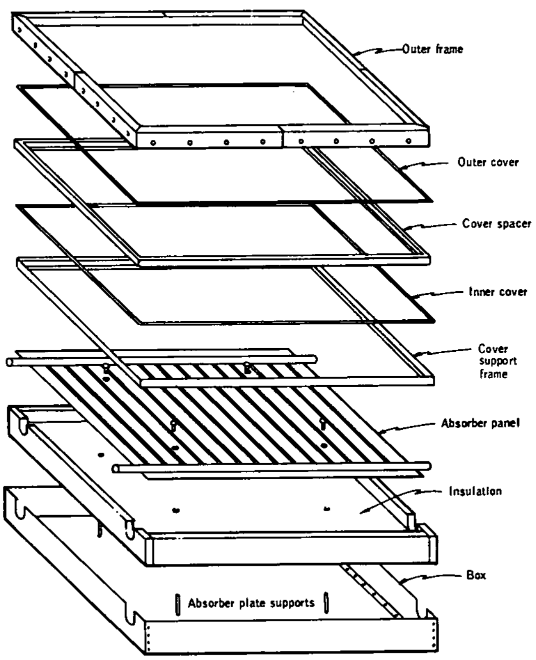
NASA TECH BRIEF
Lewis Research Center

Comparative Performance of Twenty-Three Types of Flat Plate Solar Energy Collectors



SOLAR ENERGY COLLECTOR ASSEMBLY

To aid in the development of alternate energy sources, NASA's Lewis Research Center is exploring the use of solar energy for heating and cooling buildings. An important part of this effort is investigating the potential of flat plate solar energy collectors to convert solar energy into heat. Flat plate solar energy collectors are essentially black-colored metal panels which absorb heat from the sun and transmit the absorbed heat to a working fluid. A transparent glass or plastic cover encloses a dead-air space or a vacuum to limit re-radiation from the panel (see figure).

Various designs of flat plate collector have been tested and evaluated under simulated (indoor) and actual (outdoor) conditions. The performances of twenty-three types of collector tested under simulated conditions have been published in a recent report (Note 1). From the test data, efficiencies of these collectors have been determined for four different purposes: operating a Rankine-cycle engine (working fluid at 388 K (240°F)); heating (322 K (120°F)) or absorption air-conditioning (366 K (200°F)); heating hot water (333 K (140°F)); and heating a swimming pool (300 K (80°F)). The efficiencies were also determined for a noon-hour and an all-day basis for the above four conditions.

The twenty-three types of collector tested included various combinations of copper, aluminum and steel panels, coated with flat black paint, copper oxide, black chrome, black nickel or chemically etched and all covered with glass, plastic or anti-reflection glass covers. Some collectors contained a plastic honeycomb placed between the panel and cover to channel the sunlight and reduce heat loss.

The results showed a wide range of performance efficiencies for the purposes for which the collectors were tested. The NASA/Honeywell collector (#22) had the highest efficiency of any collector tested for the purposes of a Rankine-cycle engine, heating or absorption air-conditioning a building and heating hot water. The NASA/Honeywell collector (#22) was designed using two anti-reflection glasses and black nickel as a solar selective coating. Another NASA/Honeywell designed collector (#8) had the highest efficiency for the purpose of heating swimming pools. Collector #8 was designed using black paint as a coating and a single glass as a cover.

The tests were performed in an indoor solar simulator facility which closely simulates the average North American sunlight and enables tests to be conducted under controlled and repeatable conditions. The simulator was designed and built by the NASA Lewis Research Center.

Notes:

1. Further information is available in the following report:

   NASA TM-X-71793 (N75-32591), Flat-Plate Solar Collector Performance Evaluation with a Solar Simulator as a Basis for Collector Selection and Performance Prediction

(continued overleaf)

Copies may be obtained at cost from:
Technology Application Center
University of New Mexico
Albuquerque, New Mexico 87131
Telephone: 505-277-3622
Reference: B75-10189

2. Specific technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B75-10189

3. The solar simulator used in these tests was announced previously in NASA Tech Brief 74-10086. Further details have been published in the following report:
NASA TM-X-3059 (N74-27719), Low-Cost, Air Mass 2 Solar Simulator

Copies may also be obtained from the Technology Application Center (address above).

Patent Status:

NASA has decided not to apply for a patent.

Source: F.F. Simon
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(LEW-12511)