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Solar Thermal Heating and Cooling
A Bibliography with Abstracts
Quarterly Update, April-June 1979

New Mexico Univ.
Albuquerque

Prepared for

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Solar Thermal Heating and Cooling

Quarterly Update April-June 1979

TECHNOLOGY APPLICATION CENTER
THE UNIVERSITY OF NEW MEXICO
ALBUQUERQUE, NEW MEXICO 87131

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This bibliographic series cites and abstracts the literature and technical papers on the heating and cooling of buildings with solar thermal energy. The quarterly volumes are divided into ten categories: Space Heating and Cooling Systems, Space Heating and Cooling Models, Building Energy Conservation, Architectural Considerations, Therma Load Computations, Thermal Load Measurements, Domestic Hot Water, Solar and Atmospheri Radiation, Swimming Pools, and Economics.

Each quarterly volume is compiled from a wide variety of data bases, report literature technical briefs, journal articles and other traditional and non-traditional sources. The Technology Application Center maintains a library containing many of the articles and publications referenced in the series.

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A BIBLIOGRAPHY WITH ABSTRACTS

QUARTERLY UPDATE

APRIL-JUNE 1979

PREPARED BY THE

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of the

TECHNOLOGY APPLICATION CENTER

AUGUST 1979

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ALBUQUERQUE, NEW MEXICO

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INTRODUCTION

This quarter of Heating and Cooling contains over 650 citations, our largest yet. Obviously, the field of solar energy is rapidly expanding, as are our capabilities to keep up with the literature.

Within each section, abstracts are alphabetized by title if no author is given. Abstracts with authors follow.

We have introduced some changes in the Heating and Cooling category descriptions. "Systems Overviews" (30,000) now includes a separate section entitled "Demonstrations" (A30,000). Most of these abstracts describe installed or proposed solar systems, with a preponderance of articles in reference to state and federal demonstration projects.

"Insolation and Instruments" (37,000) has been expanded to include monitoring systems, such as "Turbine Flowmeters for Monitoring Solar Systems" (37,024). Many of the monitoring citations in this section are from the Conference on Performance Monitoring Techniques for Evaluation of Solar Heating and Cooling Systems, held at the University of California, Davis, California on April 3, 1978. Solar simulators (materials testing facilities which can simulate the sun's radiation) have also been included in this section.

Our section, "Passive Solar Energy" (34,000), is also growing rapidly. Be sure to check "Architectural Considerations" (32,000) when looking for articles on passive solar, since many of the design characteristics of passive systems are directly related to a building's architecture.

Readers and users of the bibliography are encouraged to bring mistakes and omissions to our attention at the Technology Application Center. Comments will be greatly appreciated.

Mike Arenson
Melissa Fassett

Co-Editors

GUIDE TO USE OF THIS PUBLICATION

A number of features have been incorporated to help the reader use this document. They consist of:

-- A TABLE OF CONTENTS; listing general categories of subject content and indexes. More specific coverage by subject keyword and author is available through the appropriate index.

-- CITATION NUMBERS assigned to each reference. These numbers, with the prefix omitted, are used to identify references found in the indexes. They are used as TAC identifier numbers when dealing with document order, so please use the entire (prefix included) citation number when corresponding with TAC. An open ended numbering system allows for easy incorporation of subsequent updates in this system, and numbers assigned to new citations will follow directly the last assigned numbers in the previous issue. Citation number of the last reference on each page appears in the upper right-hand corner to facilitate quick location of a specific article.

-- A REFERENCE FORMAT; containing the TAC citation number, title of reference, author, corporate affiliation, reference source, and abstract. The reference source tells, to the best of our knowledge, where the reference came from. If from a periodical, the reference source contains its title, volume, page number and date.

-- An INDEX OF AUTHORS; alphabetized by author's last name, followed by the reference citation number. For multiple authors, each one is indexed.

-- An INDEX OF KEYWORDS affords access to each citation through an assigned set of descriptive terms. All words pertaining to a reference are permuted alphabetically and the corresponding citation numbers appear as many times as there are keywords. These permuted keywords run down the center of an index page, while the remaining keywords are clustered adjacently. A "#" indicates the end of a set of keywords, while a "/" indicates where a set has been cut off within the line due to overflow.

-- A LIST OF ABBREVIATIONS used in describing frequently occurring titles or corporate sources.

CONTENTS

A30,000 DEMONSTRATIONS

ST79 A30001 Air Conditioning and Heating With Solar Power

Solar Heat. Cool. p. 10-13 Dec. 1977
Avail:TIC

A solar air conditioning and heating system for a new 3200-ft^2 house in Indiana is described. More than 800 ft^2 of flat-plate collectors is used to provide about 75 percent of the annual air conditioning and heating requirements. A description of the thermal insulation that was designed for optimum energy conservation is included. The system is funded by a United States ERDA demonstration program. Total cost of the system is $25,000.

ST79 A30002 Attic Becomes Collector

Solar Engng. Mag. V 2 No. 5 p. 35
Avail:TIC, May 1977

A double layer of Filon corrugated fiberglass was attached directly to the rafters in place of the standard roofing material. The fiberglass covers about 400 ft^2 at a cost of about $2.50 per ft^2. The south facing roof has a 50° angle tilt. The ½-inch thick plywood floor and the opposite wall of the attic interior were painted with a flat black paint to increase their heat abosrption. Ductwork through the attic carried the heated air directly into the home or storage area, which contains 963 ft^3 of egg-sized rocks. When needed, warmed air from the storage is distributed through the duct system with a ½ HP fan. Total cost of the system was about $6000.

ST79 A30003 Basking Ridge, New Jersey Environmental Education Center: Commercial Solar Demonstration Design and Construction Report

GE Co., Space Div., Philadelphia, PA
Avail:NTIS, TID-28544 Oct 1977 p. 70

The design, analysis, construction, and operational verification are summarized for the EEC solar energy project. The computed system performance for a typical heating and cooling season is presented. The system uses 3100 ft^2 of flat-plate collectors to space heat, cool, and supply domestic hot water to the 18,000-ft^2 EEC building. There are 6000 gallons of thermal energy storage.

ST79 A30004 Bivalent Heating System for New Hotel

Oel- Gasfeurung V 22 No. 8 p. 406-410 Aug. 1977 In German

A bivalent heating and water heating system was installed in a hotel just built. Solar energy is to be used; in a bivalent phase of operation, heat pumps whose evaporator preheat is led via the collectors into a store are used. Details of the overall concept are presented.

ST79 A30005 Control of a Rankine Chiller and an Absorption Chiller in the National Security and Resources Study Center

Los Alamos Scientific Lab., Los Alamos, NM
Workshop on the Control of Solar Energy Hyannis, MA
Avail:NTIS, LA-UR-78-2228, CONF-7805126-2 p. 5 May 23, 1978

The National Security Resources Study Center (NSRSC) at Los Alamos, New Mexico, has 60,000 ft^2 of air conditioned space, solar heated and cooled with an 8000-ft^2 array of flat-plate collectors. The collectors have a selective surface of black chrome and are single-glazed with water white glass. A paraffinic oil is used as the collector coolant, transferring heat to water through a heat exchanger. In the cooling mode, hot water is stored in a 5000-gallon pressurized tank and chilled water is stored in a 10,000-gallon tank. Two water chillers are installed in the system: a York lithium bromide absorption unit (ESIA2), derated to 85 tons with 18[illegible] F water; and a Rankine cycle unit designed and fabricated by Barber-Nichols, rated at 77 tons with 200° F water. The chillers are installed in series with the 10,000-gallon cold storage tank. The mean daily values of measured energies in the NSRSC for 1978 are given. The percent solar cooling measured for the 1977 cooling season is August, 73 percent and September, 92 percent. Observations on the system indicate that very little auxiliary energy is now used due to optimum management of solar energy and cold storage.

ST79 A30006 Corona Del Sol High School Commercial Demonstration Project: Solar Heating and Cooling Demonstration Program Contractor's Review, Volume 2, Papers

Solar Heating and Cooling Demonstration Program Contractors' Review
New Orleans, LA Dec. 5,1977 p. 18-22 CONF-771229-P2

The system proposed is a space heating and domestic hot water heating system with water as the transfer media for energy collection and distribution. The energy collection system utilizes a solar array of 20,261 ft^2 gross area and 17,589 ft^2 of net area of dual-glazed flat-plate collectors at a cost of $209,000 for the collector panels alone. This is an equivalent of $10.00/$ft^2$ of gross panel area. The underground storage tank is 47,000 gallons with a working storage volume of 40,000 gallons. The entire solar system cost, which includes the design cost, materials, and construction of the system, is at $769,000.

ST79 A30007 Design and Operation of a Solar Heating and Cooling System for a Residential Size Building

NASA, Marshall Space Flight Center, Huntsville, AL
Avail:NTIS, DOE/NASA/TM-78169 p. 35 May 1978

The first year of operation of the Marshall Space Flight Center's solar house is discussed. Selected design information, together with a brief system description, is included. The house is equipped with an integrated solar heating and cooling system which uses fully automated state-of-the-art equipment. Overall performance for the first year is summarized. In addition, information pertaining to modifications made to improve performance is provided, and problems encountered during the operation are discussed. Evaluation of data from the first year of operation indicates that the MSFC Solar House heating and cooling system is capable of supplying nearly 100 percent of the thermal energy required for heating and approximately 50 percent of the thermal energy required to operate the absorption cycle air conditioner. The lower percentage of the energy provided for the cooling mode as compared to the heating mode is due to the significantly higher temperature needed to operate the air conditioner, requiring the solar collector to operate at low efficiencies, due to the higher inlet temperatures. Operation of the facility in the cooling mode has shown the need for basic subsystem improvements such as decreasing the operating temperature of the air conditioner and/or improving collector performance.

ST79 A30008 Distilling Detroit Sunshine

Prog. Architecture V 58 No. 11 p. 75-76 Dec. 1977

Architects have installed 1000 ft^2 of solar collectors on a renovated building in downtown Detroit. The solar system supplies hot water for laboratories, heat for a rooftop cooling tower basin and heated water for an abosrption refrigeration system. The evacuated tube solar collector's "Sunpak" was used in the system. The system was monitored with a Honeywell Δ-1000 unit logging all of the data for analyzation reported that the collectors had an efficiency from 26 percent to 39 percent. The same architect's firm has completed work on the Tarraset Elementary School in Reston, Virginia.

ST79 A30009 Grading Solar Schools

Solar Engng. V 2 No. 9 p. 21-25 Sept. 1977

Experience in school solar heating systems funded by United States' ERDA demonstration projects is briefly reviewed. Both new and retrofitted systems in schools across the United States are illustrated and described. Performance, reliability, and cost experience are included. Student involvement is briefly discussed.

ST79 A30010 Hillside Headquarters: Four-Level Plan Gives Electric Cooperative's Office Visibility, Energy Savings, and Outside Views for Employees

Bldg. Des. Construc. p. 52-55 Aug. 1977

Although its architecture is dramatic, the new headquarters of the Basin Electric Cooperative in Bismarck, North Dakota, makes an even greater impact in the area of energy engineering. Its energy requirements are about half that of a conventional building of comparable size. Because the 66,000-ft^2 building is set into a hill, four floors are exposed on one of its long elevations, but only one floor rises above grade on the opposite elevation. This variation in height has obvious energy saving implications. The one-story elevation faces northwest, allowing the hill to shield the lower three floors from prevailing winds; the southeast facing four-story elevation permits low-angled winter sun to pass through the windows and warm the building. Overhangs block out the higher angled rays of the summer sun.

ST79 A30011 Innovative Heating Systems Operate Successfully

Solar Engng. Mag. V 3 No. 7 p. 25-28, 30 July 1978

Features of six solar liquid space heating systems are described. One home employs a microprocessor to choose the most appropriate operating mode for prevailing time and ambient conditions. Another integrates solar collectors into rafters and sheathing of the roof and uses a new Rankine-type heat transfer cycle. A new luxury ski/vacation condominium is heating five units primarily from solar energy stored in a central tank. In Phoenix, Arizona solar heats a home, hot water, pool, and spa. In Colorado solar assists a fireplace system. In a home in Vermont, the owner has combined solar with passive features to achieve a major portion of his space heating.

ST79 A30012 Installation of Solar Furnace Cuts Utility Costs

Solar Heat. Cool. V 3 No. 4 p. 18-19 Aug. 1978

Retrofitting a solar heating system to a home built in 1840 is described. Aluminum siding, extra insulation, and storm windows were added first. The unit added was the free-standing Champion solar furnace with Vertafin collector and 6½ yd^3 of rock storage.

ST79 A30013 Maine Wastewater Treatment Plant Opts for Solar Heating

Water Sewage Works V 124 No. 11 p. 72 Nov. 1977

The design of the Ellsworth, Maine Waste Water Treatment Plant and its energy conservation features including weathertight wall and roof panels which insulate while transmitting solar radiation for light and heat is briefly described.

ST79 A30014 Monthly Performance Report, Alpha Construction Co., Canton, Ohio

Avail:NTIS, SOLAR/1034-78/05 p. 14 May 1978

The Alpha Construction Company site is a single-family residence in Canton, Ohio. The solar energy system is designed to provide approximately 50 percent of the space heating and 70 percent of the hot water energy requirements for the home. It has an array of flat-plate collectors with a gross area of 436 ft^2. The array faces south from the collector array to storage. Solar energy is stored in a bin containing 50,100 pounds of rock. The solar heated air, passing through a heat exchanger, also preheats incoming city water which is stored in an 80-gallon preheat storage tank and supplied, on demand, to a conventional 52-gallon domestic hot water tank. The system, shown schematically, has four modes of solar operation. The measured demand for space heating during May was 0.69 million BTU, 0.47 million BTU of which were provided by the solar energy system. Loss of the hot water consumption measurement has affected the hot water performance results.

ST79 A30015 Monthly Performance Report, Greenmoss Builders, Inc., Waitsfield, Vermont

Avail:NTIS, SOLAR-/1009-78/05 p. 13 May 1978

The Greenhouse Builders, Inc. solar energy system located at Waitsfield, Vermont consists of a passive solar space heating subsystem and an active solar hot water subsystem installed in a single-family residence with approximately 1000 ft^2 of living space. Accuracy of the performance results of the solar hot water subsystem is degraded substantially due to difficulties in measurement of the water flow through the system. The use of current measurements indicates a hot water consumption of approximately 698 gallons for the month. Assuming this much hot water demand, the solar preheat provided 12 percent of the demand or 0.05 million BTU, resulting in an estimated fossil energy savings of 86 ft^3 of gas. During May, the passive solar space heating subsystem provided approximately 46 percent of the energy requirements for space heating.

ST79 A30016 Monthly Performance Report, Perl-Mack Enterprises, Inc., Denver, Colorado

Avail:NTIS, SOLAR/1015-78/03 p. 14 March 1978

Performance results are presented for a system to provide space heating and domestic hot water preheating. The site is a single-family dwelling in Denver with 470 ft^2 of flat-plate collectors with a water-glycol heat transfer medium. The energy is stored in a a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. In March solar energy supplied 61 of the combined heating and hot water demand of 3.61 million BTU.

ST79 A30017 Monthly Performance Report, Perl-Mack Enterprises, Inc., Denver, CO

Avail:NTIS, SOLAR/1015-78/04 p. 14 April 1978

Performance results are presented for a system to provide space heating and domestic hot water preheating. The site is a single-family dwelling in Denver with 470 ft^2 of flat-plate collectors with a water-glycol heat transfer medium. The energy is stored in a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. The measured demand for space heating during April was 0.58 million BTU, 0.51 million BTU (88 percent) of which were provided by the solar energy system. Solar energy supplied 67 percent of the hot water load of 1.71 million BTU.

ST79 A30018 Monthly Performance Report, Perl-Mack Enterprises, Inc., Denver, CO

Avail:NTIS, SOLAR/1015-78/05 p. 16 May 1978

Performance results are presented for a system to provide space heating and domestic hot water preheating. The site is a single-family dwelling in Denver with 470 ft^2 of flat-plate collectors with a water-glycol heat transfer medium. The energy is stored in a 945-gallon tank after passing through a liquid-to-liquid heat exchanger. The system is shown schematically and its five modes of operation are described. Solar energy satisfied 64 percent of the combined heating and hot water demand of 2.94 million BTU in May.

ST79 A30019 Monthly Performance Report, Radian Corp., Austin, Texas

Avail:NTIS, SOLAR/2002-78/07 p. 14 July 1978

The Radian Solar Energy System is designed to heat and cool approximately 800 ft^2 of office and laboratory area in a two-story modern office building in Austin, Texas. The system utilizes 36 Northrup tracking concentrating collectors which provide an effective aperture area of 350 ft^2 with a gross collector array area of 1380 ft^2. The working fluid, water in summer and water/glycol in the winter, is pumped from the collectors to a heat exchanger between the collectors and the storage tank. A 1500-gallon insulated fiberglass storage tank is located above ground on a concrete pad near the building. The solar cooling equipment for the system is an Arkla three-ton packaged absorption air cooler located on the second floor of the building and a cooling tower on the roof. The system, shown schematically , has three modes of solar operation. The Radian Solar System has been inactive for the entire month due to a collector tracking failure.

ST79 A30020 Monthly Performance Report, Reedy Creek Utilities Co., Inc., Lake Buena Vista, Florida

Avail:NTIS, SOLAR/2018-78/07 p. 18 July 1978

The Reedy Creek site is a two-story, 5625-ft^2 concrete block office building located in Lake Buena Vista, Florida. The solar energy system is designed to provide 100 percent of the space heating and domestic hot water demands and 80 percent of the space cooling demand. The collector subsystem is composed of an array of parabolic trough collectors with tracking absorber tubes forming an integral part of the building's roof, and oriented with its major axis in an east-west direction. The total collector aperture area is 3840 ft^2. Water is used as the heat collection, transfer, and storage medium. Collected solar energy is stored in a 10,000-gallon hot water tank. Domestic hot water is provided by a heat exchanger immersed in this tank. Space heating is provided by circulation of hot water from the storage tank through heat exchangers located in the central air distribution system. No auxiliary energy is provided for either domestic hot water or space heating. A 25-ton absorption cycle water chiller utilizes hot water from storage to provide chilled water to a 10,000-gallon cold water storage tank. The system, shown schematically, has five modes of operation, which are described. The total measured month cooling demand was 51.4 million BTU; of this the solar syrtem provided 12.7 million BTU. The domestic hot water system operated successfully, providing water at approximately 140^o F on demand.

ST79 A30021 Monthly Performance Report, Scattergood School, West Branch, Iowa

Avail:NTIS, SOLAR/2003-78/07 p. 14 July 1978

The solar system designed to supply 75 percent of the average annual energy require requirements for space heating the gymnasium and for heating the hot water for an adjacent locker room. Solar heating is also available for a grain drying silo retrofitted at the site. The site has array of 2496 ft^2 of flat-plate solar air heaters, a heat storage bin of 130,000 pounds of rocks, and two 120-gallon water preheating tanks. The five modes of solar operation are described. The Scattergood Solar Energy System satisfied 99 percent of the combined heating and hot water demand of 3.9 million BTU in July.

ST79 A30022 New Solar Heating/Cooling System

Ind. Pet. Monde, Gaz-Chim. V 44 No. 471 p. 12 May 1976

The solar-mec was demonstrated at the Third Energy Technology Conference, in Washington, D.C., by Gas Development Corp., an Institute of Gas Technology subsidiary, which has conducted research on the concept since 1966. The fully operating system, housed in a trailer with solar collectors on the roof, heats, cools, and control humidity without using compressors, special fluids, or condensing coils. The residential-sized unit has three tons/hr of cooling capacity and 100,000 BTU/hr of heating capacity. Its ability to use low-grade solar heat for air cooling in summer exceeds that of all other known systems; this provides the maximum savings of conventional gas heat by use of solar augmentation. The solar collectors on the roof heat water, which drives the environmental control unit for both heating and cooling. The environmental control unit was constructed for gas development by Air Enterprises, Inc., and the vacuum-jacketed glass tube solar collectors were manufactured by Owens-Illinois, Inc.

ST79 A30023 Performance of Los Alamos Solar Mobile/Modular Home Unit No. 1

Los Alamos Scientific Lab., Los Alamos, NM
Solar Heating and Cooling Systems Operational Results Conf., Colorado Springs, CO
Avail:NTIS, LA-UR-78-2587, CONF-781102-1 p. 7 Nov. 29, 1978

Mobile/Modular Home Unit No. 1 at the Los Alamos Scientific Laboratory is an active air system which incorporates 340 ft^2 of flat black single-glazed flat-plate air collectors mounted at a 60° tilt on the south wall. The thermal storage is in 1536 pint jars of water spaced apart by 5/8 inch to allow air flow around the jars. Data have been obtained on the unit from October 1976, up to the present. Data acquisition is by a Hewlett-Packard 3050 system controlled with a HP 9825 desk top calculator. Complete energy summaries for the heating seasons have been obtained. The solar energy system has provided about 70 percent of the heating requirements of the house each season. Although the solar energy system provides a major fraction of the space and domestic hot water requirements, the yearly total energy supplied is low. This is primarily because the house load was lower than expected due to passive gains and internal heat generation; low performance is also due to a low storage mass (5.3 BTU/ft^2 °F) and several possible uncontrolled air leaks.

ST79 A30024 Prototype Retrofit Heats, Cools House and Pool

Solar Heat. Cool. V 3 No. 4 p. 33-34 Aug. 1978

A swimming pool room was built to accommodate 700 ft^2 of glazed elastomer rollout tube-plate collectors built on site. The system incorporates a water-to-air heat pump and uses the pool as a heat sink.

ST68 A30025 Pyramidal Optical Collector System Operates in Condominium Project

Solar Engng. V 2 No. 7 p. 30-32 July 1977

Two solar assisted home heating systems incorporating pyramidal optical collectors are described. Back up systems are electrical resistance heat and a heat pump. The skylight-mounted collector system allows a factor of four reduction in area over flat-plate collectors. Performance of the collectors in homes in Delaware and South Carolina is discussed. Cost and economics of the system are analyzed.

ST79 A30026 Review of Three Solar Energy Demonstration Projects in the Midwest

Argonne Nat'l Lab., Argonne, IL
Conf. on Energy Solar Updates Atlanta, GA
Avail:NTIS, CONF-780701-2 p. 22 July 1978

Three projects initiated for economics, ecological, and educational reasons are described. Two projects have air systems and one has a liquid system. The buildings are a school building, a medical office building, and a college residence hall. The system designs, experiences, and problems are reviewed briefly.

ST79 A30027 Santa Clara, California Community Center Commercial Solar Demonstration Progress Report, Six Months Data Acquisition and Analysis of Cooling Performance

Santa Clara Univ., Santa Clara, CA
Avail:NTIS, SAN-1083-78/1 p. 115 March 1978

The Santa Clara Community Center is a 27,000-ft^2 one-story building set in a Mediterranean climate. The peak summer cooling load is estimated to be 5.9 x 10^6 BTU/day and is roughly twice the peak winter heating load. The solar driven hydronic system includes 7085 ft^2 of double-glazed flat-plate collectors with a selective coating, two 25-ton Arkla absorption chillers, a 50,000-gallon stratified cold storage tank, and a 10,000-gallon hot storage tank. The solar system is designed to satisfy roughly 80 percent of the annual thermal energy requirements. A boiler is used for backup. The system is well instrumented and has been providing operational data, including detailed energy balance information since April 1977. Data for one complete cooling season has been obtained. Detailed results are presented in this report. The data acquisition system used has "event sense" capability; hence, the collected data include the periods of operation in each of the system modes. This capability makes it possible to calculate the auxiliary electrical and gas consumption of the present solar system and to compare it to the estimates for the original nonsolar HVAC design which used vapor compression chillers. Preliminary evaluation indicates that the present system during the cooling season consumes roughly the same amount of fossil fuel energy as the original nonsolar design.

ST79 A30028 Solar Bivalent Heating and Water Heating for a 50-Bed Hotel

Ikz Fachz. Sanit.-Heiz.-Klima V 32 No. 15 p. 57-59 1977 In German

In the 50-bed hotel in Hodenhagen (Lower Saxony), a solar bivalent system has been installed for heating and water heating. The rooms are heated with a floor heating system. Solar energy is utilized with the aid of heat pumps. For the operating costs of this heating system, a 35 percent saving is expected compared to the costs of an oil-fired heating system. The functioning of the plant is illustrated by a layout plan.

ST79 A30029 Solar Energy Storage: Four Million Heat Units in the Front Yard

Sanit.-Heizungstech. V 41 No. 1 p.8-10 1976 In German

The system of a solar heating plant installed in single-family house in Deizisau near Esslingen is described. Heat is emitted by a floor-radiator combination. On the roof, there is a collector area of about 16 m^2. Days without sunshine are bridged by two heat accumulators, the larger of which (70 m^3) is installed underground in the front yard of the house.

ST79 A30030 Solar Energy System Performance Evaluation: Aratex Services, Inc., Industrial Laundry, Fresno, California, November 1977-May 1978

Internat'l Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/2008-78/14 p. 49 July 1978

An operational summary of how the solar energy system installed at Aratex Services, Ind., an industrial laundry located in Fresno, California performed during the report period is provided. This analysis is made by evaluation of measured system performance and by comparison of measured climatic data with long term average climatic conditions. Performance of major subsystems is also presented to illustrate their operation. Included are: a brief system description, review of actual system performance during the report period, analysis of performance based on evaluation of meteorological load and operational conditions, and an overall discussion of results. Monthly values of average daily insolation and average ambient temperature measured at the Aratex site are presented. Also presented are the long-term average monthly values for these climatic parameters. The Aratex system collected an average of 67 million BTUs of solar energy per month. The available solar radiation was 75 percent of the long-term average. The use of both a solar energy and heat recovery system at Aratex has combined to reduce the total load of a system without heat recovery by approximately 45 percent. The solar energy system alone contributed 16 percent of the total hot water load at the site. Damage to the Lexan covers on 14 of the total 140 collectors was reported. This damage is believed to have been caused by winds.

ST79 A30031 Solar Energy System Performance Evaluation: Radian Corporation Office Building, Austin, Texas, September 1977-May 1978

Int. Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/2002-78/14 p. 56 July 1978

A summary of the September 1977 to May 1978 operation of the Radian Corporation Solar Energy System is presented. This system is designed to provide space heating and cooling for approximately 700 ft^2 of office and laboratory area in an Austin, Texas office building. Presented are results of an evaluation of measured system performance and a comparison of measured micrometeorological data with long-term average conditions. Performance evaluations of each major subsystem are also presented. Included are: a brief system description; review of actual system performance during the report period; analysis of performance based on evaluation of climatic, load, and operational conditions; and an overall discussion of the results of analysis. Also presented are results of a special study of the Radian collector array subsystem. During the periods September and October 1977, and December 1977 through May 1978, the solar energy system at Radian provided 1.63 million BTUs of the 12 million BTU deamnd for space heating. During this time, the solar energy system provided none of the 46.2 million BTU demand for space cooling. This measured performance of the solar energy system was less than that expected based on the performance evaluation and the meteorological conditions. Primary reasons for this level of performance are problems attributed to the collector array tracking mechanism throughout the report period and excessive energy losses from the storage tank prior to January 1978.

ST79 A30032 Solar Energy System Performance Evaluation: Scattergood School Recreation Center, West Branch, Iowa

Int. Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/2003-78/14 p. 67 July 1978

An operational summary is provided of the solar system performance at Scattergood School, West Branch, Iowa. This analysis is made by evaluation of measured system performance and by comparison of measured climatic data with long-term average climatic conditions. Performance of major subsystems is also presented to illustrate their operation. The solar energy system, utilizing 2496 ft^2 of flat-plate air collectors, supplies a portion of the space heating and domestic hot water requirements for the 6900-ft^2 gymnasium and 1966 ft^2 of locker rooms at the Scattergood school, West Branch, Iowa. The solar energy system was installed during building construction. A 6000-bushel grain dryer, installed later, may also use the solar system during its operation. Included are: a brief system description; review of actual system performance during the report period; analysis of performance based on evaluation of climatic, load, and operational conditions; and an overall discussion of results. The Scattergood Solar Energy System availability was 65 percent for the ECSS subsystem, 95 percent for the space heating subsystem, and 55 percent for the hot water heating subsystem. The ECSS availability was affected by a malfunction of the total solar system during April 1-8, and April 14-May 11. The hot water availability was greatly affected by the failure of the subsystem and resultant repair interval. The space heating subsystem operated throughout the entire reporting period except when the solar system was down in April and May.

ST79 A30033 Solar Energy System Performance Evaluation: Terrell D. Mosely Office Building, Lynchburg, Virginia, February 1978-May 1978

Int. Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/2011-78/14 p. 46 July 1978

A summary of the February to May 1978 operation of the Terrel D. Mosely solar energy system is presented. This system is designed to provide space heating and domestic hot water preheating for approximately 1780 ft^2 of office area in a Lynchburg, Virginia office building. Presented are results of an evaluation of measured system performance and a comparison of measured micrometeorological data with long-term average conditions. Performance evaluations of each major subsystem are also presented. Included are: a brief system description; review of actual system performance during the report period; analysis of performance based on evaluation of climatic, load, and operational conditions; and an overall discussion of the results of analysis. Also presented are results of a special study of actual versus expected performance of the Terrell D. Moseley Solar Energy System. During the report period the Terrell D. Moseley Solar Energy System provided 13.6 million BTUs of the 18.3 million BTU demand for space heating. The 74 percent solar utilization was greater than the 70 percent expected. Solar energy for space heating was available 100 percent of the time.

ST79 A30034 Solar Heating and Cooling Demonstration Project Summaries, Department of Energy, Washington, D.C.

DOE, Washington, D.C.
Avail:NTIS, N79-11503 270 p.

The design and operating characteristics of all commercial and federal residential solar heating and cooling systems and the structures themselves are described. Also included are available pictures of the buildings and simplified solar system diagrams. A list of nonfederal residential installations is provided.

ST79 A30035 Solar Heating System Installed at Lynchburg, Virginia

Moseley (Terrell E.), Inc., Lynchburg, VA
Avail:NTIS, DOE/NASA/CR-150729 p. 166 Dec. 1, 1976

A detailed design report for a retrofitted solar heating and cooling system for a 1780 ft^2 office building is presented. The system is composed of a 400 ft^2 flat-plate collectors, a 2000-gallon storage tank, a gas auxiliary boiler, a duct distribution system utilizing a hot water duct coil and water-to-air heat pump, and a hot water preheater. The control system, data acquisition system, technical data, and maintenance procedure are discussed. Detailed specifications, circuits, and drawings for the components are included.

ST79 A30036 Solar House of the Eindhoven University of Technology

Technische Hogeschool Eindhoven, Netherlands
Avail:TIC, NP-23360 p. 30 1977

The solar heating system, the house design, the research program and measuring system, and the performance of the solar heating system are described briefly. Color photographs of the house and sketches of the components are included. The collectors have plates designed as one-piece radial finned aluminum tubes. There is sensible heat storage heat with a water tank in the system.

ST79 A30037 Solar Housing: A Reality For Builders

Prof. Build. p. 107-116 June 1976

Twelve homes which demonstrate solar energy as a realistic alternative are discussed briefly. These homes are mainly located in the American southwest, midwest, and northeast where either energy costs or climatic conditions make solar energy competitive. Various systems for the custom home, multiple dwellings, development (tract) home, and prefabricated home markets are illustrated. Solar system costs ranged from $1500-20,000 for a simple hot water and space heating application to a total home system including swimming pool heating and air conditioning. An appendix lists suppliers of solar systems.

ST79 A30038 The Solar System Field Test Takes Year to Correct Snags

Multihousing News V 12 No. 7 p. 20-22 July 1977

Four new townhouses were solar heated with $40,000 government grant and $16,000 in funds from the urban investment and Development Company. The experimental installation program has taken a year to de-bug and is ready for cost-effective monitoring for the winter of 1977. The system was designed by Ecosol, Ltd. of New York City. The collectors were made by Owens-Illinois, Inc. The system will supply 60 percent of the space heating needs and most of the domestic hot water requirements. The system has a conventional cooling system. Automatic instruments will monitor and record the performance of the system. Some of the problems encountered include leaks in the solar system where it is linked to the piping, replacement of the white roof shingles, and basement leaks due to freezing. Insulation in the ceiling was increased from 6 to 12 inches. Four compressors failed and were replaced. Heat pumps were found to use excessive amounts of energy so the thermostatic controls were lowered. With the onset of warm weather, the large amounts of heat being generated produced steam that was discharged through the vents in the roof. The engineers are working on ways to alleviate this problem. Part of their problems are believed to be due to the fact that there are no standards for solar equipment. United has also learned that regular building tradesmen can be used for solar installation.

ST79 A30039 Solar Plant With Heat Pump and Waste Heat Utilization

Baier, K.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 40-41 Nov. 1977 In German

An energy supply plant for a workshop and residential building is described. The already existing heating system was extended by a solar plant with heat pump while at the same time making use of the process waste heat of the welding facilities. Apart from this, a waste oil combustion plant was included in the overall concept. The costs for the extension amounted to DM 200,000. During the first year of operation more than 20,000 l fuel oil were saved.

ST79 A30040 System Design Report, March 1978, Bell Telephone Co., Pennsylvania

Philadelphia, PA
Avail:NTIS, COO-4048-78-1 p. 126 March 1978

A solar space heating demonstration project is reported. It describes an integrated system providing solar energy space heating for a 9982 ft^2 newly bulit, one-story building. The building is located at 966 Matlack Street, West Goshen Township, Chester County, Pennsylvania. The office part of the building is heated by solar assisted water-to-air heat pump units. The storeroom part of the building is heated by an airhandling unit, containing a water-to-air coil. Solar energy is expected to provide 62 percent of the heating load, with the balance provided by a back-up electric boiler. The system includes 1900 active ft^2 of flat-plate solar collectors, and a 6000-gallon above-ground storage tank. Freeze protection is provided by a gravity drain-down scheme combined with nitrogen pressurization in a closed circuit.

ST79 A30041 Thermal Performance of a Building and Two Flat-Plate Collector Systems

Colorado State Univ., Ft. Collins, CO
Avail:Univ. Microfilms Order no. 78-20,869 p. 284

A study of the thermal performance of a 71.3 m^2 (768 ft^2) liquid coolant collector, and a 67.1 m^2 (722 ft^2) air coolant collector was performed from thermal performance data that were measured and recorded for each system. The liquid collector is found to operate at 28.3 percent average efficiency (based on all-day calculated efficiency), and the air collector is found to operate at 32.5 percent efficiency. The actual performance of the two collector systems was compared against predicted performance calculated from the energy equation model which is based on the Hottel-Whillier-Bliss equation, and the results indicate that the actual performance is lower than the prediction by 32 percent for the liquid collector and lower by 27 percent for the air collector.

ST79 A30042 Thermal Performance of the Aratex Services, Inc. Solar Energy System

Int. Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/2008-78/25 p. 10 July 1978

The International Business Machines Corporation is contributing to the National Solar Data Program of the Department of Energy by monitoring, evaluating, and reporting the performance of designated solar energy systems. The Aratex Services, Inc. solar energy system for preheating process water in an industrial laundry in Fresno, California and its modes of operation are briefly described, and a performance evaluation of the system is presented. The evaluation is based on comparison of predictions of climatic, load, and operational conditions with those measured at the site. The technique for determining the thermal performance is also presented. Associated documentation is described and seasonal as well as typical monthly data are presented. These data are then briefly analyzed to produce an evaluation of the system performance.

ST79 A30043 Thermal Performance of the Perl-Mack Enterprises, Inc. Solar Energy System

Int. Business Machines Corp., Huntsville, AL
Avail:NTIS, SOLAR/1015-78/21 p. 13 July 1978

The Perl-Mack Enterprises, Inc. solar energy system in Denver, Colorado, and its modes of operation are described briefly and then a performance evaluation of the system is presented. The evaluation is based on comparison of predictions of climatic, load, and operational conditions with those measured at the site. The technique for determining the thermal performance is presented. These data are then briefly analyzed to produce an evaluation of the system performance.

ST79 A30044 Thermoroc House: An Experimental Low-Energy House in Sweden

Swedish Council for Building Res., Stockholm, Sweden
Avail:NTIS, NP-23369 p. 77 1977

The drain-down system uses flat-plate collectors with water as the heat transfer fluid. When the system drains, nitrogen gas fills the collectors to prevent corrosion. Heat is stored in two water tanks with electric heat for backup. There is a delayed waste water outlet which heats the basement floor. Window insulation is provided by indoor fitted flexible and foldable window screens of cellular plastic. The house, the heating system, and its components are shown and described. Environmental and performance data are included.

ST79 A30045 West Chester Work Center Solar Space Heating Demonstration Project

Bell Telephone Co., Philadelphia, PA
Avail:NTIS, COO-4048-1 p. 121 March 1978

A solar space heating demonstration project is reported. An integrated system is described providing solar energy space heating for a 9982 ft^2 newly built one-story building located at 966 Matlock Street, West Goshen Township, Chester County, Pennsylvania. The office part of the building is heated by solar assisted water-to-air heat pump units. The storeroom part of the building is heated by an air-handling unit, containing a water-to-air coil. Solar energy is expected to provide 62 percent of the heating load, with the balance provided by a backup electric boiler. The system includes 1900 active ft^2 of flat-plate solar collectors and a 6000-gallon above-ground storage tank. Freeze protection is provided by a gravity drain-down scheme combined with nitrogen pressurization in a closed circuit.

ST79 A30046 Wettringen Solar House

Ikz Fachz. Sanit.-Heiz.-Klima V 32 No. 24 p. 80-81 1977 In German

The solar energy system of a one-family house is described. With a collector surface of 30 m^2, it is used for space heating and service water heating. The collectors heat a 3000-l tank. Heating plates are used for space heating. When a certain storage temperature has been reached, the whole heating system is switched to solar energy utilization. If the storage temperature is not high enough, the oil heating is automatically switched on again. The collecror circuit is filled with a synthetic heat carrier oil.

ST79 A30047 Solar For Area Health and Education Center

Abernathy, L.L.
FWD Engng., Inc., Charlotte, NC
Solar Heating and Cooling Demonstration Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 287-290 New Orleans, LA Dec. 5, 1977

The solar system installed was a retrofit to the six-story area health and education facility. The retrofit consisted of adding a hydronic space and domestic hot water heating system with underground storage to the system. The collector array consists of 171 General Electric type FP collectors with single Lexan[R] cover at a cost of $49,590 for the 3950 ft^2. The calculations indicate the system should provide 52.5 percent of the total yearly energy requirement for heating which is approximately 709 MMBTU per year. This breaks down to approximately 39.5 percent of the space heating requirements and 78.6 percent of the domestic water requirements. There is a 6000-gallon steel storage tank.

ST79 A30048 Nambe Pueblo Community Building Solar System

Balcomb, J.D.; Bankston, C.A.; Moore, S.W.; Hedstrom, J.C.; Murray, H.S.
Los Alamos Scientific Lab., Los Alamos, NM
Solar Heating and Cooling Demonstration Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 272-276 New Orleans, LA Dec. 5, 1977

A solar air heating system with evaporative cooling is described using 440 ft^2 of vertical flat-plate nonselective air heater with a long horizontal flow path. A 17-ton rock bed is used for storage along with the 14-inch adobe walls. Foam insulation protected by stucco exterior is used to improve heat retention.

ST79 A30049 Solar Energy Utilization in Multivalent Heating Systems

Baltrusch, H.
Inst. Klimatech. Zentralheiz. V 32 No. 1 p. 39-42 1977 In German

This final part of the report deals with multivalent heating systems in practice. A building consisting of prefabricated parts was equipped with a heating system of this type; convectors were used for central heating while the swimming pool was equipped with a floor heating. The functions of the system components are described: heat pump, solar collector, collector system, oil-fired heating boiler, automatic control. The capital investments for a multivalent heating system are higher than with an oil-fired heating, but these costs are made up for by considerable savings in the operating costs. Solar energy utilization in solar heating systems yields the following positive resuls: energy savings, economy, no environmental pollution, comfort, safety.

ST79 A30050 Solar System for First Baptist Church, Aberdeen, South Dakota

Bansal, J.M.
Michaud Cooley Hallberg and Erickson, Minneapolis, MN
Solar Heating and Cooling Demonstration Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 324-326 New Orleans, LA Dec. 5, 1977

The building has approximately 7000 ft^2 of worship center and an additional 4000 ft^2 of office and miscellaneous area. A solar air collector system is described for space heating and domestic hot water preheating to augment the hot water heating produced in an electric boiler. There are 1404 ft^2 of flat-plate air collectors and 700 ft^3 of rock bed storage.

ST79 A30051 Somerset County Environmental Education Center Building Solar Energy System, Design Philosophy and Construction Experiences

Becker, P.C.
Environmental Education Center, Basking Ridge, NJ
Solar Heating and Cooling Demonstration Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 259-265 New Orleans, LA Dec. 5, 1977

The Park Commission's 18,000 ft^2 Environmental Education Center's solar heating system is described. It has 3105 ft^2 of aluminum flat-plate collectors with selective coating and 6000 gallons of hot water storage 3 to 4 feet underground in two insulated steel tanks. The system heats, cools, and heats domestic hot water.

ST79 A30052 Design and Bidding Concepts For a Solar Cooled School Building in a Subtropical Region

Blank, S.A.; Hedden, R.E.
Dade County Public Schools, Miami, FL
Solar Heating and Cooling Demonstration Program Contractors' Reveiw, V 2, Papers
CONF-771229-P2 p. 85-91 New Orleans, LA Dec. 5, 1977

A solar cooling and domestic water heating system for a 70,000 ft^2 two-story elementary school building for Dade County, Florida is described. The building is highly insulated and partially covered with an earth berm; most fenestration is shaded; and internal heat generation has been lowered. The system uses 18,000 to 20,000 ft^2 of high-performance black chrome coated flat-plate collectors and three 20,000-gallon steel heat storage tanks buried in the earth berm.

ST79 A30053 Solar Heated House that Steve and Alice and Sue and Mark and Walter Built

Brown, S.
Country Journal p. 70-80 Nov. 1977

A solar heated house was built by Steve Brown and his wife with assistance from a local architect and Total Environmental Action, a engineering firm. Considerations were given to cost, efficiency, and aesthetics. The storage tank is made of poured concrete and insulated with styrofoam. The capacity of the tank is almost 6000 gallons. They decided on a radiant hot water system for use with their flat-plate collectors, in addition to a conventional oil furnace backup. They decided on a trickle-type collector after reading Thomason's Solar House Plans, and built it themselves. The final cost for the entire solar system was approximately $10,000. The anticipated payback period is about 15 years.

ST79 A30054 Austria's First Solar Hotel, 96 M^2 Collector Surface Save Each Summer Season Some 40,000 KWH Energy

Brunner, R.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 27-28 Nov. 1977
In German

A solar plant for the water heating in a hotel is described. A 96 m^2 collector surface saves about 40,000 kWh/a energy. Assuming an energy price increase of 10 percent per annum, the plant would have an amortization period of about eight years.

ST79 A30055 Solar Energy Saves Annually 5000 L Heating Fuel Oil; Water and Additional Heating in Simbach/Inn

Brunner, R.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 5 p. 33 Sept. 1977
In German

A solar energy plant is described; the collector surface has 18 m^2. The plant meets the major part of the heat consumption for water heating and supplies in the interseason part of the space heating. The solar energy converted into heat is stored in a 600-l tank. All in all, the plant is to save about 5000-l heating fuel oil per annum, i.e., some 45 percent of the overall heating fuel oil consumption. The plant costs approximately DM 20,000.

ST79 A30056 Philips Experimental House

Bruno, R.; Hermann, W.; Hoerster, H.; Kersten, R.; Mahdjuri, F.
Philips GMBH Forschungslaboratorium, Aachen, Germany
Conf. on European Solar Houses London, England
CONF-7604149 p. 1-10 April 1976

This house uses evacuated tube collectors and a 42 m^3 annual storage water tank. Summer cooling is with the stored capacity of the earth. The windows are specially coated double-glass with enhanced heat insulation.

ST79 A30057 Demonstration Project: North Hampton Park Recreation and Health Center

Burgesser, B.; Orlowski, H.
City of Dallas, TX
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 350-358 New Orleans, LA Dec. 5, 1977

The system includes 3650 ft^2 of flat-plate hydronic collectors, tilted at 25^o from the horizontal with 6000 gallons of thermal storage and 2000 gallons of chilled water storage. The system is designed to provide 54 percent of the heating and cooling for the 8000 ft^2 of the building included in the demonstration. Domestic water heating is also included.

ST79 A30058 Albuquerque Animal Control Center Addition, City of Albuquerque, New Mexico

Burns, W.L.
Burns/Peters, Architects-Planners, Albuquerque, NM
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 277-280 New Orleans, LA Dec. 5, 1977

A solar heating system is described which is active for the office area and passive for the kennel area. The office area has 650 ft^2 of parabolic concentrating and tracking collectors and a 1500-gallon steel storage tank. The kennel area has 425 ft^2 of glass clerestory window with a styrene core operable insulation panel. The storage is 480 ft^3 of concrete floor and partitions. The active collectors are operated as an open-loop drain-down system.

ST79 A30059 Site One

Calthorpe, P.
Rain, Portland, OR V 4 No. 2 p. 10-11 Nov. 1977

A new four-story California state office building was designed in Sacramento. The building's thermal mass was used to assist cooling. A combination of shading, lighting, and insulating techniques were used to reduce the energy demand. Another energy efficient strategy used was better lighting and low level ambient lighting supplemented by natural daylight. A central atrium is used as a vestibule, preheater, and cooler for building ventilation, lighting, dining, and a resting place. Graphs are included of the heat load in the winter months and summer time, as well as the building's capacity for absorbing heat.

ST79 A30060 Operation of a Solar Heating and Cooling System in a Full-Scale Solar Building Test Facility

Carr, B.C.
NASA, Hampton, VA
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 406-407 New Orleans, LA Dec. 5, 1977

The Solar Building Test Facility (SBTF), at Langley Research Center, Hampton, Virginia, became operational in early summer 1976. Its purposes are to: (1)test system components which include high-performance collectors; (2)test performance of complete solar heating and cooling systems; (3)investigate component interactions; and (4)investigate SBTF consists of a 50,000 ft^2 office building modified to accept solar heated water for operation of an absorption air conditioner and for a baseboard heating system. A 12,600 ft^2 solar flat-plate collector field with a 30,000-gallon storage tank provides the solar heated water. A description of the system and the collectors selected is given, along with the objectives, test approach, expected system performance, and some operational results. Typically, the solar energy system has provided 60 percent of the hot water energy required by the absorption chiller for cooling and 90 percent of the heating energy. Best operating temperatures for the cooling system run between 185 and 205^o F. Presently, seven different types of flat-plate collectors are being tested in the solar field. One hundred and fifty temperature, pressure, and flow points are measured and recorded every five minutes during the operating day and once per hour at night.

ST79 A30061 Solar Heating and Cooling of Mount Rushmore National Memorial Visitor Center

Chiang, C.W.
South Dakota School of Mines and Tech., Rapid City, SD
Solar Heating and Cooling Demo. Program Contractor's Rev., V 2, Papers
CONF-771229-P2 p. 332-336 New Orleans, LA Dec. 5, 1977

This is a solar retrofit of Mount Rushmore National Memorial Visitor Center at Keystone, South Dakota, where over two million tourists visit each year. The visitor center has a total space of approximately 6000 ft^2. The solar system is designed to furnish approximately 45 percent of heating for the total facility, and approximately 53 percent partial cooling of the 2000 ft^2 observatory room. There are a total of 112 panels of Lennox liquid circulated collectors, each 3' x 6' in dimension, with a gross surface of approximately 2000 ft^2. The unit cost of the collector is about $13.00 per ft^2. Collector panels are mounted in 5¼ rows on the roof of the visitor center owned by National Park Service of the Department of the Interior. There is a 3000-gallon heat storage tank.

ST79 A30062 Design Philosophy and Solar Configuration of CSI Corporate Headquarters

Christopher, J.C.
Contemporary Systems, Inc., Jaffrey, NH
Solar Heating and Cooling Demonstration Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 251-255 New Orleans, LA Dec. 5, 1977

A combined solar heating and night air cooling system is to be integrated into a 7000 ft^2 structure consisting of a two-level office section with extensive hybrid systems utilization and a production section with a large air-type active array comprising the south wall of the structure. The system has 1200 ft^2 of collector and two 1100 ft^3 heat storage units, each containing 1.08 x 10^5 pounds or rock with a thermal mass of 21,600 BTU/^{o} F.

ST79 A30063 Commercial/Industrial Applications Spur Solar Development

Comstock, W.S.
Ashrae J. V 19 No. 11 p. 32-34 Nov. 1977

Several large commercial buildings with solar systems are examined. The first building mentioned is the La Quinta Motor Inn located in Dallas, Texas. The system supplies approximately 90 percent of the hot water for the rooms and laundry. The largest solar cooling system is located in Frenchman's Ree , the Holiday Inn, St. Thomas, Virgin Islands. The system was funded by a 75 percent grant from the Energy Research and Development Administration. In Decatur, Alabama, construction has begun on a solar heating system that will be used at a large soybean oil extraction facility. The project is also sponsored in part by ERDA. The solar panels will be used to air dry the soy beans. The largest solar powered irrigation system is located in Gila River Ranch southwest of Phoenix, Arizona. The system includes a 50-HP pump capable of delivering up to 10,000 gallons of irrigation water per minute. It operates with 5500 ft^2 of parabolic tracking collectors.

ST79 A30064 <u>Telex Communications, Inc. Solar Space Heating System, Blue Earth, Minnesota</u>

Costello, F.A.
Intertech./Solar Corp., Warrenton, VA
Solar Heating and Cooling Demo. Program Contractors' Review, V 2, Papers
CONF-771229-P2   p. 229-232   New Orleans, LA   Dec. 5, 1977

A hydronic solar heating system is described using 10,550 net ft^2 of single-glazed black chrome flat-plate collectors and a 20,000-gallon steel storage tank. A drain-down system is used.

ST79 A30065 <u>Terraset</u>

Davis, J.L.
Ashrae J.   V 20   No. 2   p. 47-48   Feb. 1978

A 69,000 ft^2 school building that is covered by three to four feet of earth is described. The solar heating and cooling system employs nonconcentrating, evacuated tubular-type collectors which can efficiently produce up to 240° F water. The primary chilled water system consists of two absorption chillers, a reciprocating chiller with a double-bundle condensor, and three 10,000-gallon thermal storage tanks. The heating system uses the reciprocating chiller and the solar system heat exchanger.

ST79 A30066 <u>Underground School Gets its Energy From the Sun</u>

Davis, J.L.
James A. Federline, Inc., Gaithersburg, MD
Heat., Piping Air Cond.   V 50   No. 1   p. 93-96   Jan. 1978

The Terraset School at Reston, Virginia is described. The three energy-saving features of the building are: the earth cover, the heat recovery system, and the solar heating and cooling system. The solar heating and cooling system is described in some detail. This system employs evacuated tube collectors to supply water at up to 240° F to two absorption chillers, piped in series with an electrically driven reciprocating chiller to supply chilled water for cooling the building. The solar heated water is also used directly for heating.

ST79 A30067 <u>Santa Clara Community Recreation Center Solar Heating and Cooling Project</u>

Davis, J.N.
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2   p. 40-44   New Orleans, LA   Dec. 5, 1977

The solar system used 7095 ft^2 of double-glazed selectively coated copper absorber solar collectors. Cooling is provided by two 25-ton Arkla lithium bromide absorption chillers. Storage consists of a 10,000-gallon hot water tank and a 50,000-gallon cold water tank. Computer simulations indicated that the system would provide 84 percent of the center's heating requirements and 65 percent of the cooling needs. A complete fresh air economizer cycle is incorporated into the cooling system design. The building has been occupied since June 1975 and the solar system became fully operational in April 1977. During the intermediate period, the center has been heated and cooled using the backup system.

ST79 A30068 Solar Heating and Cooling System Utilizing Evacuated Tube Collectors and Absorption Chillers as Applied to the Kaw Valley State Bank and Trust Company, Topeka, Kansas

Dressler, W.E.
Burgess Engng., Inc., Kansas City, MO
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 173-176 New Orleans, LA Dec. 5, 1977

This facility now under construction will utilize 72 General Electric evacuated-tube liquid collectors, creating 1068 ft^2 of effective collector area, which will heat in an 1100-gallon thermal energy storage tank. Energy will be drawn from the tank as required to provide space heating by direct transfer to the supply air of the building environment. If cooling is required, the hot water from the storage tank will be used to fire four-staged, three-ton Arkla absorption chillers, which in turn cools the supply air. The auxiliary energy source is a conventional natural gas fired boiler. The solar system, at a cost of approximately $94,000, is expected to provide 75 percent of the annual cooling load, 47 percent of the heating load, as well as 95 percent of the domestic hot water.

ST79 A30069 Performance of the George A. Towns Elementary School Solar Heating and Cooling Project

Duncan, R.T.Jr.
Westinghouse Electric Corp., Falls Church, VA
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 116-126 New Orleans, LA Dec. 5, 1977

The solar heating and cooling hydronic system of this 32,000 ft^2 building has 10,360 ft^2 of selectively coated flat-plate collectors augmented by 10,800 ft^2 of reflectors and three 15,000-gallon steel tanks. Some findings regarding the performance of the system and of selected subsystems and components are discussed.

ST79 A30070 Basin Electric Headquarters Building Solar Heating Demonstration, Bismarck, North Dakota

Dunham, G.F.
Basin Electric, Rapid City, SD
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2

A solar assisted heat pump system is described using 5000 ft^2 of double-glazed flat-plate collectors and a 20,000-gallon steel tank for storage. The building is a four-story, 75,000 ft^2 building. The heat transfer fluid is a 50 percent by weight solution of ethylene glycol.

ST79 A30071 Solar Energy Program at the Academy

Eden, A.; Tinsley, J.T.
US Air Force Academy, CO
Air Force Engng. Serv. Q. V 19 No. 1 p. 11-14 Feb. 1978

Two years ago, the United States Air Force Academy developed a solar test house to investigate the application of solar energy systems to a typical domestic dwelling. The progress of the solar facility and the lessons learned in the operation of the systems are discussed.

ST79 A30072 Solar Heating System for a Northern New Mexico Adobe House

Edenburn, M.W.; Wessling, F.C.Jr.
Sandia Lab., Albuquerque, NM
Am. Soc. Mech. Engng., Paper no. 75-WA/SOL- p VP 1975

A solar heating system for the N.A. Cordova adobe ranch house in northern New Mexico has been designed and its performance simulated by an energy system simulation computer program. The system consists of flat-plate collectors mounted on the roof of the house; a gravel thermal storage unit located in the basement; a fan to force air through the collectors, storage unit, and house; ducts; and system controls. The collectors are constructed of corrugated steel or aluminum roofing sheet, two glass or transparent plastic cover sheets, and bottom insulation. Air, which is blown over both sides of the corrugated sheet, gains energy in the collector and deposits it in the storage unit and in the house.

ST79 A30073 GE's Boston School Experiment

Engholm, G.
GE Corp., Philadelphia, PA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2   p. 202-205   New Orleans, LA   Dec. 5, 1977

A hydronic solar heating system is described using 4600 ft^2 of flat-plate collectors of aluminum rollbond with Lexan covers. The storage is 2000 gallons of water. The system provides 52 percent of the space heating. Problems with the system and steps taken are listed.

ST79 A30074 Solar System for Radisson Plaza Hotel

Erickson, D.D.
Solar Heating, Cooling Demonstration Program Contractors' Rev., V 2, Papers
CONF-771229-P2   p. 234-240   New Orleans, LA   Dec. 5, 1977

This project consists of a two-part solar system which will provide a significant percentage of the domestic hot water heating requirements and ventilation air heating for a hotel in downtown St. Paul, Minnesota. The hotel is a major convention center of 250 rooms in a 16-story tower and meeting space and restaurants consisting of a total gross area of 190,000 ft^2. The solar system consists of two parts, the first part being 5000 ft^2 of liquid collector, whose primary function is to provide heating for the domestic water system. The other system is approximately 3000 ft^2 of air collector, which will provide heating primarily for the ventilation air of the guest rooms in the tower. These two systems are interconnected so that either can provide additional heating for the other when its own demands are met. The combination of the two systems will provide approximately 35 percent of the hot water and ventilation air heating demands for the building. The total cost for the system, including design and administrative expenses, is estimated at $400,000. The collected energy will provide a 16.8 year payback based on an annual 10 percent fuel escalation cost.

ST79 A30075 Design of a Low-Energy House In Denmark Heated by a Combination of Solar and Wind Energy

Esbensen, T.V.; Strabo, F.
1st German Solar Energy Forum, Hamburg, W. Germany   Sept. 26-28, 1977   Proc., V 2
Munich. Deutsche Gesellschaft fuer Sonnenenergie, p. 437-447   1977

The paper describes the project for a low-energy house constructed in Skive, Jutland, Denmark. With energy conservation arrangements such as well-insulated structures, mobile insulation of the windows, and heat recovery in the ventilating system, the heat requirement for space heating is calculated to 6000 kWh per year. The energy system consists of a 13-m^2 flat-plate solar collector integrated into the roof structure, a wind rotor with a coated area of 25 m^2 and a water storage tank with a capacity of 4 m^3. The storage tank is provided with a water brake driven by the wind rotor. This energy system supplies the house with 7200 kWh, which is 67 percent of the total heat requirement for space heating and hot water supply.

ST79 A30076 Dimensioning of the Solar Heating System in the Zero Energy House in Denmark

Esbensen, T.V.; Korsgaard, T.V.
Tech. Univ. of Denmark, Lyngby, Denmark
Conf. on European Solar Houses   London, England
CONF-7604149   p. 39-51   April 1976

The zero energy house consists of two "living boxes" of 60 m^2 each, separated by an unheated glass-roofed atrium of 70 m^2. The south facing upper vertical part of the atrium contains a flat-plate collector of 42 m^2. An insulated storage tank of 30 m^3 is buried in the ground just outside the atrium.

ST79 A30077 Supplemental Solar Heater for Egg Production

Esmay, M.L.; Hall, F.W.; Flegal, C.J.; Sheppard, C.C.; Zindel, H.C.
Michigan State Univ., E. Lansing, MI
Agric. Mech. Asia   V 9   No. 1   p.19-22   1978

Solar energy utilization for the supplemental heating of egg production housing in the northern states during the winter months is being investigated by the Agricultural, Engineering, and Poultry Science Departments of Michigan State University. The objectives of the project are to maintain 70 to 75° F house temperatures, increase feed efficiency, maximize in-house excreta drying, and minimize undesirable odors. A low-cost flat-plate solar collector was constructed to provide supplemental heating for a 5000-bird poultry laying house in Michigan.

ST79 A30078 Solar Heating for LSU Field House

Evans, W.J.
Louisiana State Univ., Baton Rouge, LA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 182-186 New Orleans, LA Dec. 5, 1977

A solar space and water heating system is described using 5560 ft^2 of selective flat-plate collectors and a 10,000-gallon steel storage tank. The system is expected to meet 34 percent of the annual load.

ST79 A30079 Radian Corporation's Solar Demonstration System

Feller, D.W.
Radian Corp., Austin, TX
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 372-376 New Orleans, LA Dec. 5, 1977

A hydronic heating and cooling system is described using 350 ft^2 of concentrating and tracking Fresnel lenses. The fiberglass storage tank selected has a 1500-gallon capacity. The system provides approximately 80 percent of the heating load and 50 percent of the cooling load for the portion of the office building it services in Austin, Texas.

ST79 A30080 Town of Concord, Massachusetts Solar Energy Project, Municipal Light Plant Building

Flynn, P.J.; Hartwell, D.W.
Town of Concord, MA
Solar Heating,Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 206-208 New Orleans, LA Dec. 5, 1977

A space heating system is described using 1932 ft^2 of air-type flat-plate collectors and 45 tons of rock in a masonry storage bin. The system is expected to provide 75 percent of the heating load for the 8400 ft^2 building.

ST79 A30081 City Dwelling Goes Solar

Forster, D.
Alternative Sources Energy No. 25 p. 15-19 April 1977

In Minneapolis, Minnesota a 50-year-old home is being converted to a self-sufficient solar home. The Christophersons hope their system will provide 80 to 90 percent of their heating needs. The system will use a roof-mounted air system, insulated shutters, and extra-thick insulation throughout the house. Their roof is pitched 55° to the south and 35° to the north. An addition to the house has a large storage of well-rounded stones that is 20 x 24 feet and extends five feet under the ground. Within the rock storage are two layers of four-inch diameter sewer tile that serve as heating ducts. Temperatures within the rocks are expected to reach 150° F. Rockfill was added along the south-facing wall to eliminate further heat loss. The house has a wood foundation instead of concrete. The north-facing roof has an R-value of 42; in the walls and elsewhere it will be 22. The main insulation material is cellulose. For the future, a computerized monitor is being devised for the rockpile and the earth outside.

ST79 A30082 Project Description: Solar Heating, Cooling, and Hot Water: Arts Village Complex, Hampshire College, Amherst, Massachusetts

Frissora, J.
Solar Energy Assoc., Andover, MA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 New Orleans, LA Dec. 5, 1977

A hydronic heating, cooling, and hot water system is described using 5000 ft^2 of selectively coated evacuated tube collectors and two 5000-gallon hot water storage tanks and one 10,000-gallon cold water storage tank. The energy conservation features, load profiles, systems operation, and control systems are described.

ST79 A30083 Solar Energy Heats New Mexico Home

Gardenhire, L.
Saw V 2 No. 1 p. 6 March 1957

No abstract available.

ST79 A30084 Solar Hot Water and Space Heating for Blakedale Center, Greenwood, South Carolina

Gilbert, W.E.
Solar Heating,Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 318-323 New Orleans, LA Dec. 5, 1977

A portable hot water and space heating hydronic solar system is described using 945 ft^2 of selectively coated copper flat-plate collectors. There is a 5000-gallon steel tank for storage.

ST79 A30085 Large Solar Heating System for a Saudi Campus Complex

Glover, F.
Bldg. Syst. Desc. V 77 No. 5 p. 28-43 Aug.-Sept. 1977

Sverdrup and Parcel were commissioned by the Army Corps of Engineers to design a school for the Saudi Arabian government. The solar heating potential was found to be very good in Saudi Arabia due to the extremely clear sky. The design heat load was 36,000 gallons per day of domestic hot water and a winter time space heating load of an equivalent amount. Passive designs helped to make the project economically feasible. Energy efficient features were integrated into the architectural design of the building. A collector design with a selective surface and a single cover glass was found through a computer model to be the most cost effective. Detailed descriptions are given of the space heating and hot water systems. Schematic drawings of the different types of systems are included in the article. The cost effectiveness was estimated on a 20-year life cycle cost basis. Seventy percent of the heating load is supplied by the solar heating system. The 70 percent breaks down into 100 percent hot water needs and 40 percent of the space heating. The system is considered usable for a total of 30 to 35 years.

ST79 A30086 Solar House Hoehenkirchen, Converting an Experimental Facility into a Commercial System

Grallert, H.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 47-48 Nov. 1977 In German

The article presents results of the utilization of solar energy for supplying one-family houses. The experiment covered 1½ years. After the investigations were completed, a series-manufactures solar plant was installed. A technical description of this plant is presented. Experience gained so far shows that there can be a saving of 55 percent in heating fuel oil.

ST79 A30087 Heating and Cooling of a Florida Welcome Station

Hancock, O.G.Jr.; Turknett, R.
Florida Solar Energy Center, Cape Canaveral, FL
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 111-115 New Orleans, LA Dec. 5, 1977

The 3300 ft^2 welcome station is to be retrofitted with a solar heating and cooling system. The system has 2720 ft^2 of concentrating Fresnel lens collector with selective absorber. The storage system has 6000 gallons of hot water and 6000 gallons of chilled water.

ST79 A30088 Solar Space Heating For West Chester Work Center

Haron, A.S.
Bell of Pennsylvania, Philadelphia, PA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 310-317 New Orleans, LA Dec. 5, 1977

A hydronic heating system is described using solar-augmented heat pumps for a 9800 ft^2 office and warehouse building. There are 1900 ft^2 of single-glazed selective copper flat-plate collectors with water as the heat transfer fluid. A 6000-gallon steel tank is used for storage. Problems encountered are indicated.

ST79 A30089 Scattergood School's Solar Heated Recreation Building

Hains, C.
Scattergood School, West Branch, IA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 167-169 New Orleans, LA Dec. 5, 1977

The solar heating system is a hot air system that heats the school's new gymnasium and preheats water for use in the adjoining locker rooms. One hundred and twenty-eight flat-plate collector modules provide 2496 ft^2 of collector area. An insulated, reinforced concrete box 8' x 10', located under the collector and containing about 65 tons of washed river gravel, provides heat storage. Above the rock storage box is a 5000-CFM air handling unit. Air is distributed to the gymnasium through overhead ductwork and a series of double deflection registers. The system heats water for the locker rooms by means of a heat exchanger built into the ductwork. Water stored in the two 120-gallon glass-lined insulated tanks serves as preheated water for a fast recovery electrical water heater. Backup and supplementary heat for the gymnasium is furnished by two 250,000-BTU/hr propane heaters mounted in opposite corners of the building. It is estimated that the system will provide 75 percent of the heating needs of the recreation facility. Total cost of the solar heating system, excluding costs associated with the installation of an extensive data acquisition system, was about $93,000.

ST79 A30090 Solar Heating System for the New Spearfish High School, Spearfish, South Dakota

Hengel, P.J.
Hengel, Berg, and Assoc., Rapid City, SD
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 327-331 New Orleans, LA Dec. 5, 1977

A classroom area of 37,200 ft^2 is to be heated by solar air heaters. The system provides for preheating domestic hot water. There are 8034 ft^2 of flat-plate collectors and 4620 ft^3 of rock heat storage. The technical problems encountered are discussed.

ST79 A30091 Solar House in the Spessart; Hot Water Preparation, Floor, and Swimming Bath Heat

Herold, L.; Boelle, T.
Sonnenenergie V 3 No. 3 p. 37 May-June 1978 In German

The solar plant supplies some of the energy required for floor heating, water heating, and swimming pool heating. The collector has a surface of 18 m^2; 3800 l heating fuel oil have been saved in one year's operation. There is a water tank of 450 l. The cost of the plant amounted to about 16,000 DM.

ST79 A30092 Analysis of the Performance of the Solar House at Milton Keynes

Hodges, D.
Polytechnic of Central London, England
European Solar Houses Conf. London, England
CONF-7604149 p. 53-60 April 1976

Some of the detailed design and construction problems are reported. The following are described: integration of the collector into the roof structure, storage tanks, pipework and heat exchangers, monitoring arrangements, and summary of performance.

ST79 A30093 Veteran's Administration Solar Demonstration Project No. 1

Hornak, J.
Veteran's Admin., Washington, D.C.
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 82-84 New Orleans, LA Dec. 5, 1977

The two-story structure of approximately 10,000 ft^2 was retrofitted for solar heating and cooling. The hydronic system used 5000 ft^2 of double-glazed flat-plate collectors with selectively coated copper absorber plates and reflectors for one group of collectors. A 12,000-gallon steel storage tank was used.

ST79 A30094 Solar Energy System Retrofit

Hornak, J.P.; Knight, K.
Veteran's Administration, Washington, D.C.
Heat., Piping Air Cond. V 50 No. 1 p. 87-89 Jan. 1978

An existing research building at the VA's Wilmington, Delaware hospital was chosen for the retrofit. The system consists of 5000 ft^2 of double-glazed collectors with selectively coated copper absorber plates mounted at 40°; a reflector mounted at an angle of 30°; a 12,000-gallon storage tank; a hot water coil to provide winter heating; an absorption chiller to provide summer cooling; and a comprehensive data recording system. The heating and cooling modes of the systems operation are illustrated. A drain-down system was selected to provide freeze protection.

ST79 A30095 Solar Air Conditioning, Heating, Hot Water, and Pool Heating System for the Brandon Life Clinic

Hudson, W.T.; Williams, J.R.
Independent Living, Inc., Atlanta, GA
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 103-110 New Orleans, LA Dec. 5, 1977

A solar system has been designed and is in the initial construction phase for solar heating, cooling, and domestic hot water for a sports-medical center and heating for Florida's largest swimming pool. The system is expected to have a payback time of about 10 years. The reasons for this are that in addition to direct heating and pool heating, solar cooling is required year round, with waste condenser heat used for swimming pool heating, so the collectors are used at nearly 100 percent capacity year round. In addition, while the building is currently in use, it was specifically designed for solar retrofit. The solar energy system for the Brandon Life Clinic will utilize a 5660 ft^2 copper tube-in-strip flat-plate solar collector array for the 20,000 ft^2 building. The solar system is being retrofitted to the existing building, which was designed specifically for solar retrofit. This hydronic solar system uses tap water to transfer and store heat. Steel tanks coated on the interior with Epicon-925 epoxy provide storage for 5000 gallons of hot water for space heating and 9000 gallons of chilled water for space cooling. A 500-gallon buffer tank is also used in the circuit to reduce thermal cycling of the chiller. An Arkla-Servel Solaire-300 lithium bromide absorption chiller, rated at 25 tons for 195° F firing water at 90 GPM, produces chilled water which is stored in the chilled water tank.

ST79 A30096 New Energy Efficient Office Building Provides Living Laboratory

Jacobs, M.
Met. Bldg. Review p. 10-17 July 1977

In Manchester, New Hampshire, a federal building that is energy efficient and solar heated is presently being monitored. Government Services Administration designed the $8.7 million office structure. A sophisticated computer program was devised for analyzing and evaluating nonconventional and innovative building construction designs. The building has a cubic shape with no windows on the north side and maximum exposure on the south side. Windows are smaller than most office buildings and are double-glazed. The building also has well-insulated walls and an open landscape on the interior for maximum light use. Four variations of the heating and cooling system are located in the building along with different lighting systems for each floor. Office furniture has its own built-in lighting equipment. The solar energy system consists of 414 m^2 of roof-mounted collectors. The system is expected to provide 20 to 30 percent of the total energy for hot water and heating and cooling. In the next three years the system will be evaluated by the National Bureau of Standards. With this information they will be able to discover which features of the building are the most energy efficient. GSA is incorporating many of the energy saving features in other federal office buildings.

ST79 A30097 Solar Demonstration Project Animal Quarantine Facility

Jacobson, L.A.
Brookhaven Nat'l Lab., Upton, NY
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 281-286 New Orleans, LA Dec. 5, 1977

No abstract available.

ST79 A30098 Navy Pier Solar Demonstration Project

Jones, D.
City of Chicago, IL
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 153-166 New Orleans, LA Dec. 5, 1977

A solar hydronic system for space and hot water heating at Chicago's Navy Pier is described. The system uses 8000 ft^2 of selective-coated flat-plate collectors and 15,000 gallons of storage. The system is expected to furnish 33 percent of the space heating load and 100 percent of the domestic hot water load for the terminal building, a 36,000 ft^2 three-story masonry structure serving as the gateway to the east complex. The design, installation, and problems are described.

ST79 A30099 Solar Office Building, Reedy Creek Utilities Co., Inc., Walt Disney World

Jones, H.C.
Reedy Creek Utilities Co., Inc., Lake Buena Vista, FL
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 92-95 New Orleans, LA Dec. 5, 1977

A solar hydronic system for cooling, heating, and hot water system is described which uses 3840 ft^2 of fixed horizontal parabolic trough mirrored roof with moving absorbers as collectors. The storage system includes a 10,000-gallon hot water steel tank plus a 10,000-gallon chilled water steel tank.

ST79 A30100 Solar Heating and Cooling System For a Commercial Building and Energy Conservation Program

Keith, F.W.Jr.; Weaver, R.D.
Miller and Weaver, Inc., Birmingham, AL
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 12-17 New Orleans, LA Dec. 5, 1977

A hydronic heating and cooling system is described using 2340 ft^2 of double-glazed selectively coated flat-plate collectors plus reflectors. The storage system includes 8000 gallons of hot water storage and 8000 gallons chilled water storage. The solar cooling system includes a 25-ton lithium bromide absorption chiller. The backup system consists of a 100-kW electric hot water boiler and a reciprocating 30-ton water chiller.

ST79 A30101 How Solar System Heats and Cools Single-Family Home in Texas

Kellogg, T.
Contractor V 23 No. 8 p. 40-41 April 15, 1976

A solar heated and cooled single-family demonstration home which is a project of the Construction Research Center of the University of Texas at Arlington is described. A battery of 42 concentrating collectors (10-foot-long, V-shaped metal troughs) is mounted on the roof. The top of each trough is covered by a curved acrylic lens, a computer-designed series of prisms which refract and concentrate the sun's rays on a black chrome covered copper tube at the bottom of each trough through which water flows and is heated. The concentrating collectors are automatically tracked so that they face the sun directly at all times during the day. The collectors can provide water at a temperature of 250° F and at a rate of 25 gallons/min (for all collectors) on a bright warm day. The house includes a heat pump which has a water-to-water system capable of functioning with solar energy assistance. In addition, an air handling system is provided that can be used with the heat pump or the absorption heating system under various optional modes of operation. A three-ton lithium bromide air conditioner is also provided and requires 55,000 BTU heat input at the rated load. Heat pump operation at times other than peak temperature is electrically powered. The home is equipped with three 1200-gallon capacity tanks to provide efficient storage of collected solar energy. Except for the heat pump and the storage tanks plus some modifications in the absorption unit, the system uses standard off-the-shelf components.

ST79 A30102 Organic Compounds, Organic Nitrogen Compounds, Renewable Energy Sources, Residential Buildings, Solar Heating, Space Heating

Korsgaard, V.; Esbensen, T.
Varme V 39 No. 6 p. 115-119 Dec. 1974
Zero-Energy House Project at the Danish College of Tech. In Danish

A project for prototype house is described which can be heated throughout winter with no fuel energy supply, main heat source being solar energy.

ST79 A30103 Norris Cotton Federal Building, Manchester, New Hampshire Energy Conservation Demonstration Project, Retrofit Installation of Solar Collectors

Kushlan, M.J.
General Services Admin., Boston, MA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 pl 246-250 New Orleans, LA Dec. 5, 1977

The system has a retrofit installation of 3320 ft^2 of flat-plate collectors and three 10,000-gallon storage tanks and provides 16 or 17 percent of the annual heating and cooling load. Technical and institutional problems are reviewed briefly.

ST79 A30104 Presentation For Department of Energy Solar Information Exchange Meeting, New Orleans, December 5-7, 1977, Hyatt Regency Hotel, Subject: Northview School Howards Grove, Wisconsin

Linde, R.
Linde-Groth Architecture, Sheboygan, WI
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 418-424 New Orleans, LA Dec. 5, 1977

The heating system for the school addition uses zoned, forced warm air. There are 2277 ft^2 of fixed, nonselective, two-pass air flat-plate collectors. The heat storage is a 1500 ft^3 rock bin. Experience with the system is reviewed.

ST79 A30105 Contractor's Review for a New 40,000 Square Foot Hydronically Operated, Solar Heated and Air Conditioned Control Valve MFG. Facility Located in Southern New Jersey

Little, R.K.
RKL Controls, Inc., Hainesport, NJ
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 266-271 New Orleans, LA Dec. 5, 1977

The solar system is a liquid-type system and consists of three basic loops: a closed pressurized loop between a heat exchanger in the mechanical room (within the building) and the solar arrays, an atmospheric pressurized loop between the heat exchanger and the storage tanks, and a distribution loop between the storage tanks and the air handling units in the manufacturing and office areas. The solar arrays are of the tilting type which are seasonally and hourly adjustable. They consist of 6000 ft^2 of double glass glazed flat-plate Sunworks collectors, having a selective coating on the copper heat exchange plate and tube surface. The total cost of these arrays, in place, with their separate drive motors and associated piping is $159,902. The solar system is expected to supply 50 percent of the total annual heating and air conditioning load.

ST79 A30106 Evacuated-Tube Solar Collector: Effect of Control on Efficiency at High Operating Temperatures

Louie, W.C.; Miller, D.C.
ASHRAE J. V 20 No. 5 p. 39-42 May 1978

Data are presented illustrating the operation of an evacuated-tube solar collector mounted on the penthouse of SHANDG headquarters in downtown Detroit, Michigan. Problems in retaining system efficiency at elevated operating temperatures point to the importance of systems control strategy. The system consists of the modules, circulating pump, flow meter, air separator, compression tank, thermal storage tank, piping and control valves. The load side has its own circulating pump, flow meter, and heat exchangers.

ST79 A30107 Lake Valley Firehouse Solar Project

Lucas, J.
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 45-49 New Orleans, LA Dec. 5, 1977

A hydronic solar space and domestic hot water heating system is described using 336 ft^2 of flat-plate collectors and a 1900-gallon concrete storage tank. The problems involved in using a concrete septic tank for storage are detailed and the lessons learned from this are pointed out.

ST79 A30108 Buried Bookstore Saves Energy, Saves Space, Saves the View

Marcovich, S.J.
Pop. Science V 211 No. 3 p. 96-97 Sept. 1977

The design is described of the semi-underground bookstore at the University of Minnesota. A solar heating and cooling system is expected to supply more than 50 percent of the building's needs. Solar collectors will supply hot water to run an absorption air conditioner for summer cooling. Building construction is briefly discussed.

ST79 A30109 Power From The Sun

McVeigh, J.C.
Brighton Polytechnic
Architect, London, England V 123 No. 4 p. 56-59 April 1977

Recent solar energy experiments in the United Kingdom are reviewed. An experimental domestic water and space heating system was installed in a standard terrace house; a 37 m^2 solar collector replaced part of the tiled roof of the house. About 70 percent of the hot water demand is met in summer months. One feature of the system is direct connection of aluminum roll bond panels to the main storage tank, with domestic hot water preheated by passing through heat exchangers in this tank. An old coach house was converted into a four-bedroom solar heated house. The whole southwestern roof was replaced with standard corrugated aluminum panels painted with an acrylic matt black paint and single-glazed with 4 mm horticultural glass. Water trickles down the channels from a horizontal perforated pipe just below the roof and is recirculated from the main storage tank. Estimations of 80 percent of the space and domestic water heating demand are met by the solar energy system. A solar heated house satisfying normal Building Society requirements employs a closed circuit system using a 30 percent glycol/water solution operating through conventional heat exchanger coils at the bottom of a standard 75-gallon combination cylinder for the domestic hot water. A 4000-liter spherical space heating storage tank is buried outside the house. A solar space heating/domestic hot water system was installed in an exhibition hall with a total heated area of 200 m^2. A double-glazed trickle-type collector contains a 70 m^2 main section inclined at 34° to horizontal and a 25 m^2 secondary section inclined at 70° to horizontal for better use of winter sunshine. The main heat storage tank of 100 m^3 capacity is divided into two temperature zones, with a fast response tank of 400-gallon capacity. The space heating consists of 10 mm diameter nylon pipe buried in the concrete floor of the building and connected directly to the heat storage tanks.

ST79 A30110 First Solar Heated Workshop in Austria, In Gallneukirchen Up to 8000 Liters Liquid Gas is Saved Annually

Mittasch, E.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 39 Nov. 1977 In German

The concept of a solar heated workshop is described. The collector surface has 48 m^2. The basement under the floor with a storage capacity of 100 m^3 serves as a store. Water is heated via a solar boiler with 500 l contents. The plant cost all in all DM 35,000. It has been calculated that it will make a saving 8000 kg liquid gas possible.

ST79 A30111 Solar Plant and Large-Scale Store for Office Buildings, Operational Experience Confirms: 42 M^2Collector Area and A 15 M^3 Store Save 6800 L Heating Fuel Oil Annually

Mittermeier, F.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 5 p. 27-28 Sept. 1977
In German

A solar energy plant is described which, together with a heat pump, covers about 50 percent of the energy used so far for space heating and hot water supply. Two 7500-liter water tanks serve as the energy store. The plant costs all in all DM 38,000.

ST79 A30112 Army and Air Force Exchange Service Shopping Centers Solar Heating and Cooling Program

Moffat, J.L.; Bridgers, F.; Knebel, D.
Army and Air Force Exchange Service, Dallas, TX
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 337-349 New Orleans, LA Dec. 5, 1977

The project involves the design and construction of a solar energy system that would meet a large part of the heating and cooling requirements of an Air Force base exchange shopping center. The center consists of a large retail sales area, concession shops, mall, administrative offices, and storage facilities. The solar energy system will be interfaced with a backup heating and air conditioning system capable of meeting design requirements of the facility. The solar system includes 12,500 ft^2 of double-glazed liquid flat-plate collectors and 50,000 gallons of water heat storage. The total solar cost is $616,613 for the 62,000 ft^2 shopping center. The system selected is comprised of central equipment including water chillers (absorption and reciprocating), outside cooling tower, pumps, expansion tanks, roof-mounted flat-plate solar collectors, heat exchangers, water softener, domestic hot water boiler and storage tank, interconnecting piping controls, central station low velocity multizone, single-zone air handling units with economizer/mixed air controls, return relief fans, distribution ductwork, water storage tanks, and heat recovery units.

ST79 A30113 <u>Solar Assist: Building and Domestic Hot Water Heating, Yale Elementary School, Auror, Colorado</u>

More, D.H.
More-Combs-Burch, Denver, CO
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 63-68 New Orleans, LA Dec. 5, 1977

The new elementary school building has 2000 gross ft^2 of flat-plate collectors. The solar hydronic loop with 40 percent glycol solution circulates through a tube and shell heat exchanger in the roof return line from the building space to two 13,900-gallon storage tanks underground adjacent to the mechanical room. Tanks are insulated with four inches of foamglas and six inches of sand. Top of tank is three feet below the ground on south side of building. Tanks are steel with interior coating. The tank water supply passes through a tube and shell heat exchanger to heat domestic water when not used for building heat. The tank pumps may supply tank water directly to air handling unit coils in the building space. Then the hot water return temperature is greater than the tank temperature, the hot water return supplies heat to the tanks. An electric standby boiler provides heat when storage or building heat recovery by heat pump cannot meet the heating load. Heat pump coefficient of performance heating is 4.5 and for cooling is 2.8, including air cooled condenser.

ST79 A30114 <u>Solar Assist: Heating and Cooling Retrofit, U.S. Postal Service Building, Boulder, Colorado</u>

More, D.H.
More-Combs-Burch, Denver, CO
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 53-62 New Orleans, LA Dec. 5, 1977

The solar system retrofit to the Boulder, Colorado Post Office is a two-fluid loop, hydronic to warm air solar assisted heating system. A solar fired absorption air conditioning system is added to the conventional vapor compression system. The existing gas-fired low-pressure steam heating system is placing new steam auxiliary heating coils with hot water solar coils in the hot deck and then placing new steam auxiliary heating coils in the duct's zone downstream from the air handlers. The existing perimeter fin-tube heating sections are left intact. The domestic hot water heating system has been modified by adding a solar fired preheater, pump, and mixing valve. The system has the following major components: 4140 ft^2 of liquid-cooled flat-plate collector, 6000 gallons of water for sensible heat storage, a domestic hot water preheater, and a 25-ton absorption water chiller operating in series with the existing vapor compression cycle water chiller.

ST79 A30115 <u>Maine Audobon Society Gilsland Farm</u>

Morgan, E.
Alternatives Sources of Energy No. 25 p. 27-31 April 1977

A solar and wood heated headquarters in Falmouth, Maine was begun in October 1975. Architect George B. Terrien designed a two-story 5500 ft^2 frame structure. The building's southern exposure consists of 70' x 36' of collector space. Positioning of the site included a windbreak of 60 ft spruce and maples on the north side. Six inches of insulation was used in the walls, 8 in. beneath the collector and 9 in. in the roof along with triple-glazed windows and insulation beneath the slab. The system was built for a low heat demand and with a simple low-cost design. Air collectors were chosen to avoid the freezing problems arising with water systems. The 2000 ft^2 of air collectors were built on site with a cost of $4.50 per ft^2. Air passes through the collecror at 100° F with three single-horsepower fans on the southern side for pulling heat from the collectors to the 105-ton rock storage area. The designer of the system, Professor

Richard Hill estimates that the collectors should provide 60 to 70 percent of the heating needs for the building. The backup system for prolonged periods of cloudiness is provided by a wood furnace. Professor Hill estimates that three cords of wood are used to meet the heating needs for the entire winter. A Clivus Mulstrum is used to conserve water. The system's performance is monitored by the University of Maine under a grant from the National Science Foundation.

ST79 A30116 Solar Assisted Heat Pump System for Office Building

Moseley, T.D.
Terrell E. Moseley, Inc., Lynchburg, VA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 398-405 New Orleans, LA Dec. 5, 1977

A liquid-type solar assisted wet heat pump system that was retrofitted into a 1780 ft^2 office building is described. The space and domestic water heating installation utilized a forced air distribution system, including a hot water duct coil, as well as the heat pump, and a gas boiler for backup. The system was designed to provide 70 percent of the heating requirement by solar. The 400 ft^2 of collectors are single-glazed aluminum flat-plate with nonselective coating with copper water ways for a space and water heating system. Storage is in a 2000-gallon steel tank. The installed cost was $19,454.

ST79 A30117 School Heated With Solar Energy, 80 M^2 Collector Surface Are to Save 18,000 Liters Heating Fuel Annually in Pfaffenhofen/Ilm

Mueller, F.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 3 No. 3 p. 31 May-June 1978
In German

The author describes a solar plant which supplies hot service water to the swimming pool of a school, its hot water floor heating, and its showers. The collector surface is 80 m^2. The collectors are single-glazed with a selectively coated aluminum roll bonded bottom plate as absorber. There is a heat storage tank for a constant flow temperature of 36 C in all consumers. The solar plant has a power of about 65 kW. Up to 18,000 liters heating fuel oil can be saved per year. With investment costs of 60,000 DM, the amortisation time will be 11 years.

ST79 A30118 Solar Home in the Northland

Mueller, J.
Mech. Illus. V 74 No. 596 p. 36-37,87 Jan. 1978

A 56,000 ft^2 home on the shore of Lake Michigan is described. The home is 95 percent heated by the use of flat-plate solar air heaters. The collector area is approximately 1800 ft^2 and is used to heat a 51,000-gallon swimming pool. Some performance data for this system is described.

ST79 A30119 Custom Solar House Utilizes Hybrid Collectors

Mueller, L.
Solar Heat. Cool. V 3 No. 4 p. 27-30 Aug. 1978

The two-story 2080 ft^2 of hybrid air collectors mounted at 60° on 4" x 4" redwood staging which is elevated from the roof. An 8' x 8' x 7½' plywood box insulated wtih fiberglass holds 19 tons of typical round washed rock for heat storage. The control systems and backup systems are described.

ST79 A30120 Solar Assisted Heat Pumps For Motel Applications in La Quinta Motor Inn, Salt Lake City, Utah

Orlowski, H.; Davis, W.
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 386-389 New Orleans, LA Dec. 5,1977

The utilization of solar energy for system space heating in motel/hotel applications presents some unique barriers which required novel and ingenious solutions. These barriers and the solutions which were developed to solve them are reviewed. Mechanical problems associated with these applications were derived directly from the nature of the application. The system uses 2767 ft^2 of double-glazed flat-plate collectors and a solar assisted water source heat pump. The Salt Lake City project will consist of 122 rooms. It is anticipated that the system provide 25 percent of the space heating and 61 percent of the domestic hot water for a solar cost of $220,000. The heat storage is 10,000 gallons of water in two tanks.

ST79 A30121 Solar Assisted Hybrid Heat Pump

Owen, J.M.
Owen and Mayes Engng. Co., Lynchburg, VA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p, 395-397 New Orleans, LA Dec. 5, 1977

The David C. Wilson Neuropsychiatric Hospital in Charlottesville, Virginia is a 50-bed privately operated hospital. The proposed solar system will provide space heating for approximately 40 percent of the building space and domestic hot water for the entire hospital. The hydronic automatic drain down solar system is to be retrofitted into the existing building. The 2000 ft^2 collector array will be installed on the existing flat roof of the building and a 5000-gallon concrete storage tank will be buried below grade adjacent to the building. The building is a one-story brick built-up roof with slab on grade construction. The solar heating system is expected to provide approximately 80 percent of the heating in the portion of the building to be solar heated and is expected to provide 80 percent of the domestic hot water. The area of the building to be solar heated is presently heated by electricity and natural gas. In this system is a dual-source or hybrid heat pump that can utilize both outside air and solar heated water as a source of heat.

ST79 A30122 Solar Energy System Design, Upton Multipurpose Center, Baltimore, Maryland

Parker, A.J.Jr.; Damon, C.W.
Mueller Assoc., Inc., Baltimore, MD
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 187-195 New Orleans, LA Dec. 5, 1977

A space heating and domestic water heating system is described using 3100 ft^2 of single-glazed nonselective hydronic flat-plate collectors and a 20,000-gallon epoxy-coated steel tank. The percent heat supplied for the 18,000 ft^2 building is 64. This is a drain down system.

ST79 A30123 Arizona's Solar State Park

Parker, J.L.
Alternative Energy Sources No. 25 p. 12-19 April 1977

The 300-acre Dead Horse Ranch State Park in northern Arizona utilizes solar heat to supply domestic hot water and heat to the restrooms. Earth berms around the sides limit winter heat losses. The system was designed by Sunpower Systems Corp. and installed for $4000. It consists of eight 10-ft long parabolic collectors that track the sun with an accuracy of 0 to 10 degrees of the sun. The troughs of the collectors are chemically treated for 85 percent reflectivity. The tracking device is accurate within one-half degree and incorporate antifreeze and high-temperature defocusing. The water is directly circulated with a 500-gallon storage tank and a continuous flow circulation pump. Domestic hot water is approximately 140° F and requires no pumping since the normal pressure is 60 psi in the 500-gallon tank. Funding was attained through the Arizona Solar Research Development Commission from the Four Corners Regional Commission. One feature of the construction is the cor-ten steel roof consisting of two layers. The first layer rusts and protects the steel underneath. Six to twelve inches of insulation is used in the roof.

ST79 A30124 Troy-Miami County Public Library

Pearson, R.J.
Heapy and Assoc., Dayton, OH
Solar Heating, Cooling Demo. Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 304-309 New Orleans, LA Dec. 5, 1977

The 23,200 ft^2 library is in Troy, Ohio, 40° latitude. There are 3264 ft^2 of evacuated glass tube collectors for the hydronic heating system and a 5000-gallon underground steel storage tank. Calculations indicate that the installation will provide 69 percent of the heating load.

ST79 A30125 Grand Junction, Colorado DOE Solar Demonstration Project

Price, T.D.
Bendix Field Engng., Grand Junction, CO
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 69-72 New Orleans, LA Dec. 5, 1977

The system chosen for the Department of Energy, Grand Junction Demonstration Project was added to the new 120-seat, 3000 ft^2 cafeteria while it was under construction in 1977. The solar system is designed to provide both building domestic hot water and space heating. The 496 ft^2 collectors are liquid filled using a 75 percent Sunsol 60 (propylene glycol) and 25 percent water, which transfers heat to the 750-gallon storage system through a single isolation h at exchanger. It is estimated that approximately 40 percent of the building heat requirements will be supplied by the 500 ft^2 collector. System costs are given.

ST79 A30126 Design Curves for a Solar Heated and Cooled Kuwaiti Home

Puri, V.M.; Malik, M.A.S.
Kuwait Inst. for Scientific Res.
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 415-417 Dec. 5, 1977

No abstract available.

ST79 A30127 Solar Heating System Applied at Rademaker Corporation, Louisville, Kentucky

Rademaker, R.W.
Rademaker Corp., Louisville, KY
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 177-181 New Orleans, LA Dec. 5, 1977

A Butler building with a total area of 10,000 ft^2 was constructed in 1969. The front portion of the building is office space with 1080 ft^2 of ground cover. The front wall of the office is brick veneer with relatively large glass area. The solar heating system described herein is for space heating and for heating domestic hot water. Two systems are employed, one a liquid heating system employing ethylene glycol through six collectors of 40 ft^2 each, inclined at 53°, facing south. The second system is an air collector system employing ten panels of 19½ ft^2 each inclined at 33°, facing south. The liquid system uses a 560-gallon water tank for storage. The air system uses 110 ft^3 of one-inch diameter washed river gravel for storage. The auxiliary energy employed to heat the building is natural gas.

ST79 A30128 Highlights Building Solar Energy Program

Reid, E.A.Jr.
Columbia Gas System, Columbus, OH
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 299-303 New Orleans, LA Dec. 5, 1977

The Highlights Building is a three-story, 25,000 ft^2 office building located at 2200 West Fifth Avenue in Columbus, Ohio. The solar energy system currently being installed in the Highlights Building is designed to provide solar energy for space heating, space cooling, and domestic hot water applications. The collector array is the first installation of the Honeywell single-axis tracking concentrating collector. The Honeywell collector is a north/south tracking collector with a 40:1 concentration ratio. The system in the Highlights Building includes 44 collector panels arranged in 11 rows with a total field area of approximately 3000 ft^2. The primary loop heat transfer fluid is a Dowtherm SR1/water solution. The storage system consists of a 5000-gallon ASME pressure vessel located in an addition to the existing building. The fluid in the secondary loop and storage system is a Mogul O-301/water solution, and the maximum temperature of the heated storage water is 220° F. The solar system for the Highlights Building was designed to provide 32 percent of the energy required for space heating, 23 percent of the energy for space cooling, and 70 percent of the energy to produce domestic hot water in the building for a total annual solar assist of approximately 30 percent. The system installed cost is estimated at $354,000 or $118/$ft^2$ of collector area.

ST79 A30129 Project SAGE (Solar Assisted Gas Energy)

Rice, J.F.
South California Gas Co., Los Angeles, CA
Solar Heating and Cooling Demo Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 50-52 New Orleans, LA Dec. 5, 1977

The basic SAGE system is designed to provide 70 percent of the annual hot water demand for multi-family dwellings. Two systems were built: a retrofit system and a new construction system. The basic system utilizes a heat exchanger between the solar collectors and the storage tank. This gave greater flexibility in the choice and operation of the solar collectors. One system used 1008 ft^2 of standard flat-plate collector and the other 936 ft^2 of single-glazed, selectively coated collector. Storage is in 1200-gallon glass-lined tanks. Specifications and experiences are reviewed for each of the systems.

ST79 A30130 Report on Project Sunburst: A Department of Energy Commercial Solar Demonstration at Richland, Washington

Ripley, C.C.; Poplin, R.S.; Allen, R.D.
Olympic Engng. Corp., Richland, WA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 408-417 New Orleans, LA Dec. 5, 1977

A current project is the design and installation of a solar space heating, space cooling, and domestic water heating system in the 14,400 ft^2 Project Sunburst office building at Richland, Washington. The system is designed to provide 71 percent of the space heating, 97 percent of the space cooling, and most of the domestic water heating required for year-round operation of the building. An array of 6000 ft^2 of room-mounted General Electric flat-plate collectors supplies energy through a heat exchanger to an underground insulated 9000-gallon thermal energy storage tank. Hot water to drive a 25-ton Arkla absorption chiller in the summer, and to supply hot water directly to eight water-to-air coils in the forced air ductwork in the winter is pumped from TES on demand by eight zone thermostats. The chiller cools water in a 2000-gallon storage tank to supply cold water to the same water-to-air coils in the summer. An identical nonsolar building on the same site offers the advantage of determining the solar energy contribution by comparing the electrical energy consumption of the solar building with that of the control building.

ST79 A30131 Fire Station No. 24, Kansas City, Missouri

Shaughnessy, C.M.
Midgley Shaughnessy Fickel and Scott Brohs, Inc., Kansas City, MO
Solar Heating and Cooling Demo. Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 241-245 New Orleans, LA Dec. 5, 1977

Fire Station No. 24 consists of 8800 ft^2. Of this, 6000 ft^2 is in the apparatus bay with a winter design temperature of 50° F and 2800 ft^2 of living quarters with a winter design temperature of 70° F. The solar system is an air system developed by Solaron Corporation located in Denver, Colorado. The system provides for 50 percent of the annual space heating requirements. There are three arrays of collectors totaling 2808 ft^2. The storage system consists of a concrete box 34' x 7' x 6' tall containing 1428 ft^3 or approximately 71½ tons of 3/4" to 1" diameter rocks. The total cost directly attributed to the solar installation is $130,369 or $46.42/$ft^2$ of collector.

ST79 A30132 Solar System Retrofit of Row Houses: A Proven Energy Conservation Method

Shore, S.; Lepore, J.A.; Lior, N.
Univ. of Pennsylvania, Philadelphia, PA
Conf. on Tech. for Energy Conservation Washington, D.C.
CONF-7706140 p. 180-183 June 8, 1977 Information Transfer, Inc., Rockville, MD

A demonstration retrofit project is described for a typical row house in Philadelphia for space and hot water heating using a solar system. It was concluded that it was feasible to retrofit using off-the-shelf materials and equipment. However, the cost-benefit ratio is too high on a single-row house basis.

ST79 A30133 A Natural House for Northern Maine

Steven, T.
Alternative Energy Sources p. 15-19 June 1977

Steven Travis designed a self-sufficient house in northern Maine with a solar pond, insulation panels for the windows, a solar oven, and solar composting toilet. The pond raises the temperature on a sunny January day from 2 to 4° and behaves like an outdoor pond in the summertime. The insulation panels are based on Steve Baer's product, "Skylids." Other sources of energy include a wind generator that turns a 12-volt, 200-watt generator. The solar pond acts as a source of food with fish farming, as well as providing humidity for the house. Design modifications are being redone for increased energy sufficiency. Drawings of the system can be ordered through the author.

ST79 A30134 Solar Power for a Motor Home

Thoms, W.
Mech. Illus. V 74 No. 599 p. 32 April 1978

Two 4' x 8' flat-plate collectors assembled from salvaged materials sit on the motor home roof. The collectors, which contain parallel copper-pipe radiators, recirculate the water by convection and hold about 1¼ gallons each. Some 1000 ft of copper tubing throughout the motor home's system circulates 150 gallons of water to heat the vehicle's interior. A pair of 30-gallon beer kegs store heated water. The motor home is well-insulated. Its owner tours the country and gives solar demonstrations.

ST79 A30135 Tomorrow is Our Permanent Address

Todd, J.
J. New Alchemists p. 85-106 1977

The Ark on Prince Edward Island in Canada is described. It is considered as a bioshelter since it provides its own energy and climate for its residents. It includes its own wind-powered generation facilities and waste treatment plant. Solar ponds provide the food for the inhabitants. The Ark has two domestic hot water systems, including a 700 ft^2 collector for space heating and a passive warm water aquaculture facility for heating. Energy conservation techniques help to minimize the energy needs. Suggestions are made for the adoption of the biological design models. Over thirty sensors monitor the Ark for performance of energy, climatological, and biological processes. A mini-computer will be installed in the project for simulation and observation.

ST79 A30136 Solar Plant As a Preheater, Positive Results With Austrian Experimental House

Turnheim, G.
Vienna, Univ., Vienna, Austria
Vereinigte Metallwerke Ranshofen-Berndorf A.G., Braunau-Ranshofen, Austria, Inst. fuer Physikalische Chemie
Sanit. Heizungstech. No. 10 p. 625-627 1976 In German

In 1975 several solar plants for the preparation of heating water and service water and for swimming pool heating were taken into operation for the first time. The awkward long-term storage problem was avoided in such a way, that the planners saw solar heat not as the main, but as a supplementary energy. In periods without sun, it merely serves to preheat the boiler water and the warm water. The article describes a plant of this kind for a one-family house.

ST79 A30137 Europe's Biggest Solar House Stands in Swabia, Hot Water Supply and Space Heating in "Heggbach," A Home for the Disabled

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 5 p. 19-22 Sept. 1977
In German

The construction of a rather big house is described, the energy supply of which is partly met by solar energy. The collector has an area of 920 m^2, with which some 600,000 kWh thermal energy for floor and water heating are generated. Architectural measures, such as insulation, use of special windows, and walls help to utilize energy efficiency.

ST79 A30138 Europe's Largest Solar Plant Dries Fodder

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 3 No. 1 p. 21-22 1978 In German

A report is given on a solar dryer. A thermal power of maximum 1 MW is obtained with a collector surface of 1500 m^2 and a reflector surface of about 2100 m^2. The collector efficiency is about 64 to 84 percent. Air is used as heat transport medium. About 180,000 liters heating oil is to be saved per year by this plant.

ST79 A30139 First Camping Site With Solar System, In the High Black Forest, 63 M^2 of Collector Surface Save 12,000 Liters Heating Oil Per Year

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 5 p. 23-26 Sept. 1977
In German

A solar energy system used in the service water supply of a camping site in the Black Forest is described. The collector surface of the system is 63 m^2. The solar heat which is converted is stored in a storage of 16 m^3. A heat recovery system is to be integrated in the supply system. The solar system cost DM 65,000. Precalculations show that the fuel oil consumption of 20,000 liters/year is reduced by 50 percent by the system.

ST79 A30140 How a Gable Became A Solar Roof, An Architect in the Munich Area Acquires A South Roof

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 3 No. 3 p. 33-35 May-June 1978
In German

A solar system is described which was installed in the gable of a house where the ridge of the roof runs from north to south. The installation is used for swimming pool heating, water heating, and floor heating. A storage tank with a volume of 8 m^3 and a service water tank with a volume of 210 liters are integrated in the system. The collector surface is 40 m^2. According to the calculations, about 50 percent of the 50,000 kWh/A will be supplied by solar energy. With investment costs of 28,000 DM, the amortisation time will be 12 years.

ST79 A30141 Solar House Weiz., Saving Electricity by Going Over From the "All-Electric" House to Solar Technology -- Solar Water Heating and Heat Recovery for 33 Apartments

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 30-31 Nov. 1977
In German

The supply of flats in a high-rise building with the aid of solar energy is described. The collectors have a surface of 96 m^2. Possible savings in electric power will be about 35,000 kWh per annum. Another 23,000 kWh/year are saved by heat recovery. Thus, the electric connect load for water heating could be cut from 60 kW to 15 kW. As a safety reserve for water heating, there is a 15 kW instantaneous heater.

ST79 A30142 Trinity University Solar Energy System

Wakeland, W.R.
Trinity Univ., San Antonio, TX
Solar Heating and Cooling Demo. Program Contractors' Review, V 2, Papers
CONF-771229-P2 p. 377-385 New Orleans, LA Dec. 5, 1977

The solar heating, cooling, and domestic hot water system is powered by 16,080 ft^2 of Northrup tracking, concentrating, selective surfaced collectors. The system is a retrofit system added to an existing central plant system which serves six dormitory buildings consisting of 153,712 ft^2 and a physical education group of 131,216 ft^2. It is calculated that this system will provide 66 percent of the building heat requirement for space and water heating and 5.2 percent of the total cooling load.

ST79 A30143 Collectors on a Pergola: Solution for an Installation at a Later Data in the Solar House Wettringen

Waltermann, R.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 50-51 Nov. 1977
In German

In order to save fuel oil, a solar collector plant was installed in a one-family house equipped with a conventional oil heater. The plant serves for space heating and for water heating. Technical details are presented of the flat-plate collectors and heat storage. The control equipment of the plant is described as well.

ST79 A30144 Honeywell General Offices Solar System

Waters, D.E.; Block, R.E.
Honeywell, Inc., Minneapolis, MN
Solar Concentrating Collector Conf. Atlanta, GA
CONF-770953 p. 8.21-8.28 Sept. 26, 1977

A description of an advanced solar energy HVAC system presently under construction by Honeywell, Inc. is presented. The solar system will provide 82 percent of the cooling energy, 53 percent of the heating energy, and 100 percent of the domestic hot water energy for a 100,000 ft^2 office building in Minneapolis, Minnesota. The solar system components are described, including the parabolic trough collectors, the heating and cooling subsystems and the solar system controls. The technical rationale for the selection of the collector, the Rankine cycle turbine, the heat transfer fluids, and the thermal storage system is discussed. Annual and peak load system performance predictions are also presented.

ST79 A30145 Industry Warms Up to the Idea of Solar Heat

Weimer, G.A.
Iron Age V 220 No. 16 p. 32-33 Oct. 17, 1977

General Extrusions, Inc. of Youngstown, Ohio has 100 semi-parabolic collector panels supplying heat for the company's aluminum anodizing department's hot acid dipping process. The collectors are semi-parabolic panels with limited tracking. All parts of the plant's solar panels are aluminum except for the insulation and acrylic glazing. An oil-based heat transfer fluid is used to eliminate corrosion and protect against freezing. General Extrusions is hoping to market its system as soon as it has collected enough performance data to provide equation of its efficiency.

ST79 A30146 Planning a Bivalent Heating System for Heating a One-Family House

Wieland, J.
Haustech. Rundsch. V 76 No. 4 p. 262-266 1977 In German

A heating plant with central water heating for a detached one-family house is described. The system makes use of solar energy with roof collectors geothermal heat with a pipe network of an overall length of 800 m, and a heat pump for the production of thermal heat in the low-tariff period. Operating time is minimized by using several stores. The hot water floor heating system is described, and a basis of calculation and circuit diagram are given.

ST79 A30147 Padonia Elementary School Solar Heating and Cooling Project

Wilkening, H.A.
AAI Corp., Baltimore, MD
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 196-198 New Orleans, LA Dec. 5, 1977

A retrofit hydronic solar heating and cooling system is described using 3400 ft^2 of concentrating collectors with 420 ft^2 selective coated absorbers and 10,000 gallons of hot storage and 10,000 cold storage. It is designed to provide 75 percent of the heating and cooling load and cost $670,000. Technical and institutional problems are reviewed briefly.

ST79 A30148 Timonium Elementary School Solar Heating and Cooling Project

Wilkening, H.A.
AAI Corp., Baltimore, MD
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 199-201 Dec. 5, 1977 New Orleans, LA

A 9000 ft^2 wing of the school building is retrofitted with 5040 ft^2 of flat-plate gravity feed collectors and 5300 ft^2 of second-surface reflective glass mirrors. The hot water storage system contains 15,000 gallons of hot and 40,000 gallons of chilled water. The system meets 60 percent of the heating load and 90 percent of the cooling load.

ST79 A30149 Shenandoah Solar Recreational Center

Williams, J.R.; Craig, J.I.; Hartman, T.L.III
Geogia Inst. of Tech., Atlanta, GA
Solar Heating and Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 127-138 New Orleans, LA Dec. 5, 1977

When completed early in 1977, this was the world's largest building to have most of its heating, air conditioning, and domestic hot water needs met by solar energy. The building incorporates 11,213 ft^2 of double-glazed black chrome selectively coated copper tube-in-strip flat-plate solar collectors oriented at an angle of 45° to the south with 23,000 ft^2 of highly polished aluminum reflectors to provide energy for heating and air conditioning the 59,000 ft^2 community center. Each of the 63 solar collectors are 8.61 ft high and 20.7 ft wide with the copper tube-in-strip absorber plates insulated on the back side to a K value of 0.05 BTU/ft^2/° F/hr. Thermal storage is provided by 15,000 gallon hot water storage tank, 2200 gallon buffer tank, and two 30,000 gallon chilled water storage tanks. The large tanks are buried beneath the earth berm surrounding the sides of the building. The building has been operating in all its modes since early April 1977. The hydronic solar energy system uses demineralized water to transfer and store heat. The solar system was designed to provide a highly reliable system for efficient utilization of the available solar energy for heating, cooling, domestic water heating, and pool heating. The system incorporates copper plumbing and copper collectors, tempered glass glazing, the black chrome selective coating, steel thermal storage tanks, and low-speed industrial grade pumps. The conservative design approach has paid off in good performance and minimal startup problems.

ST79 A30150 Solar Collection and Storage Techniques in a House Conversion at MacClesfield for Granada TV

Wilson, D.R.
Univ. of Manchester, England
Conf. on Practical Aspects of Domestic Solar Water Heaters
CONF-7710135 Int. Solar Energy Soc., London, England p. 85-97 Oct. 1977

In 1975 Granada television limited commissioned the design and construction of an energy saving house, based on the conversion of an existing building. Their purpose was to show, through a series of programs based on the house, currently available energy conservation and collection techniques. The main solar collection and storage system is described.

ST79 A30151 Solar Energy: 1st Performance Results on 21 Projects

Witte, O.R.
Bldg. Des. Constr. p. 28-51 June 1977

A brief description is given of 21 different commercial, institutional, and industrial building projects across the United States now using solar energy for heating, cooling, or electricity. The costs and payback for each project are discussed. New questions generated by each experience concerning the economics and design trade-offs of solar energy systems are brought out. Some discussion of ERDA/HUD FY78 funding available for demonstration building projects is included. Heat storage systems employed in the projects are water, rocks, and eutectic salts. Design trade-offs in solar collectors are related to the of fossil energy in each area. Three of the 21 projects are retrofits. Payback periods range from less than four years to possible never.

ST79 A30152 Solar Heated Animal Shelters

Wood, J.M.
Georgia Inst. of Tech., Atlanta, GA
Proc. of 4th Annual UMR-DNR Conf. on Energy Rolla, MO
CONF-7710136 p. 573-577 Oct. 11, 1977

Modern agricultural methods have made farmers dependent upon fossil fuels to maintain their productivity. One aspect of the problem, the heating of animal shelters, is discussed. In particular, the solar heating of a broiler grow-out house, where temperatures of up to 95° F must be maintained, is discussed. A detailed analysis of a solar heated broiler grow-out house that has been operating for over a year is presented. The solar system provided 47 percent of the heat required to grow 22,000 chickens. The system utilizes a 3200 . integrated rock absorption and storage collecto An economic analysis of the solar system which cost $6600 shows that it has a payback period of five years. Another circulating hot air collector has been designed and its design, construction, and operation is discussed.

ST79 A30153 Solar Retrofit Executive East Office Building, Stamford, Connecticut

Wormser, E.M.
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 77-81 New Orleans, LA Dec. 5, 1977

The 25,000 ft^2, 2½-story building has a solar system with 2561 ft^2 of single-glazed, selectively coated liquid-cooled flat-plate collectors. Energy storage is in a 6000-gallon stone-lined insulated steel tank. Solar reflectors augment the energy collection by 40 percent in the winter months.

ST79 A30154 "Sunbird:" Utah's First Commercial Solar Home

Young, G.W.
Ford, Bacon, and Davis, Salt Lake City, UT
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 409-410 1977

No abstract available.

ST79 A30155 Solar Heating and Hot Water System for Technology Properties Trust Building, Burlington, Massachusetts

Zvara, J.
Aerospace Systems, Inc., Burlington, MA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 209-212 New Orleans, LA Dec. 5, 1977

A solar heating and hot water system is described using 1872 ft^2 of hydronic flat-plate collectors and 6000 gallons of storage. Solar reflectors increase the effective collection area to 2620 ft^2. The system is expected to provide 79 percent of the heating requirements.

30,000 SYSTEM OVERVIEWS

ST79 30063 Air-Liquid Solar Collector for Solar Heating, Combined Heating and Cooling, and Hot Water Subsystems, First Quarterly Report, November 1, 1976-October 31, 1977

Owens-Illinois, Inc., Toledo, OH
Avail:NTIS, DOE/NASA/CR-150569 p. 82 March 1978

A collection of quarterly reports prepared by Owens-Illinois in the development of an air-liquid solar collector for solar heating, combined heating and cooling, and/or hot water subsystems are presented.

ST79 30064 All That Energy From the Sun is Not Exactly Free

Butane-Propane News V 8 No. 11 p. 10,16 Nov. 1976

Tentative proposals within the California Public Utilities Commission calling for the encouragement or subsidization of solar energy among the state's utility customers would not be in the public interest, according to estimated costs supplied by H.F. Lippitt, Executive Secretary of the California Gas Producers Association. On a 12-month basis, monthly bills for gas vs. for amortization/interest on a solar energy system would be: for water heating, $7 vs. $22; for space heating, $10 vs. $112; and for pool heating, $41 vs. $45.

ST79 30065 Analysis and Design of Air Heating Unglazed Flat-Plate Solar Collectors

Sandia Labs., Albuquerque, NM
ASME Mtg. San Francisco, CA Dec. 10, 1978
Avail:NTIS, SAND-78-0077C, CONF-781202-19 p. 10

A simplified analysis of unglazed flat-plate air heating collectors is developed for use in conjunction with studies of systems involving these collectors. To develop the analysis, an energy balance is formulated for a generalized unglazed collector configuration and then solved via the Laplace transform technique. The analysis was verified by application to a collector configuration for which experimental results are available. Based on the verified analysis, preliminary design and optimization procedures are developed and illustrated by example. A discussion of the relative importance and interplay of the various parameters used to describe collector performance is developed via sensitivity analysis to aid in understanding the behavior of unglazed collectors.

ST79 30066 Analysis of an Improved Solar Powered Cooling System Utilizing Open-Cycle Absorbent Regeneration

Los Alamos Scientific Lab., Los Alamos,NM
Mtg. of Am. Sect. of ISES Denver, CO Aug. 28, 1978
Avail:NTIS, LA-UR-78-1663, CONF-780808-10 p. 6

A solar powered cooling system which promises high system COPs and low collector cost is analyzed. It consists of a desiccant and an absorption cooling system operating in series to both dry and cool the air. A common solution of lithium chloride is used as the absorbant. The lithium chloride solution is regenerated by evaporating the excess water to the atmosphere in an open collector. This collector consists merely of a blackened flat surface. The weak solution of lithium chloride is introduced at the top of the collector and then flows by gravity over the entire collector surface where it is subsequently heated and dried. The daily performance of this combined system is compared by computer simulation to that of either an absorption or desiccant system alone using actual weather data for five typical U.S. cities. The performance improvement of the combined system ranged from 25 percent to 95 percent, the greatest improvement being for humid windy conditions.

ST79 30067 Annual Collection and Storage of Solar Energy for the Heating of Buildings, Report No. 3, SemiAnnual Progress Report, August 1977-January 1978

Univ. of Virginia, Charlottesville, VA
Avail:NTIS, ORO-5136-78/1 p. 36 Jan. 1978

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A new system for year-round collection and storage of solar heated water for heating of buildings has been operated over the past year at the University of Virginia. The system is composed of an energy storage subsystem, which stores hot water in an underground pool, and of a solar collector subsystem, which acts not only to collect solar energy throughout the year, but also to limit the evaporative and convective heat losses from the storage system. Results are presented to illustrate the transient heat transfer from the pool which occurs during the energy collection mode of operation. Thermal performance results are presented illustrating the efficiency of the solar collector under summer conditions (without a reflector) and winter conditions (with assistance from a vertical reflector). Results also show the transient behavior of energy storage in the water and in in the earth which surrounds the storage pool. An Analog computer model and a digital computer model have been used to analyze the transient energy phenomena which occur within the earth surrounding the pool. Results of the models are confirmed by an exact mathematical solution and by experimental results. Analog and digital models were used to determine the influence of various design modifications for improved collection and storage system performance. The experimental system has been modified to provide for energy extraction through a heat exchanger, to simulate the heat input required for a solar assisted heat pump for a residential heating application.

ST79 30068 Application of Solar Energy to the Supply of Industrial Hot Water, Volume 2, Appendix to the Final Design Report

Jacobs Engng. Co., Pasadena, CA
Am. Linen Supply, El Centro, CA
Avail:NTIS, TID-28745 p. 475 Jan. 31, 1977

The appendices for the conceptual design of a solar system for integration into the process hot water and steam services for the laundry facility, American Linen Supply, located in El Centro, California are presented. Included are: solar collector information, specifications, and design drawings; energy reduction analyses data; tables of insolation data; 36 system design drawings, analysis of heat design of electrical systems, and maintenance and repair; diagrams of instrumentation system; structure drawings and specifications; project organization chart construct schedule; method and results of economic analysis for comparison of solar process heat systems; and information on personnel involved. For Volume 1, see TID-27808.

ST79 30069 Assessment of Solar Heated Buildings and Panels, Progress Report No. 12, Final Report, January 1-December 31, 1977

Dartmouth College, Thayer School of Engng., Hanover, NH
NP-23380 p. 18 Jan. 1978

The findings of a three-year program to evaluate the performance of solar heat installations are summarized. It is noted that the northeast is one of the more favorable regions in the country for solar heating, and government policies and engineering studies are suggested that are needed to further the utilization of solar energy in this region. The establishment of regional experimental stations is strongly supported.

ST79 30070 Brief Comparison of the Inherent Capabilities of Conventional Controllers and Linear Regulator Controllers

Los Alamos Scientific Lab., Los Alamos, NM;
Notre Dame Univ., Notre Dame, IN, Dept. of Mech. Engng.
Workshop on the Control of Solar Energy Hyannis, MA
Avail:NTIS, LA-UR-78-2280, CONF-7805126-4 p. 7 May 23, 1978

Inherent capabilities of conventional controllers and linear regulator controllers for solar HVAC systems are discussed and compared. It is shown that the basic requirements of solar heating and cooling control systems are met quite well by a linear regulator controller. It is also shown that the linear regulator yields a better control than conventional methods. Even though achieving this control requires a computing device, initial studies indicate that the computing requirements are probably not prohibitive. However, if computing requirements do present a limitation to implementation of the linear regulator controller, concepts and strategies learned from the linear regulator control can lead to more effective conventional control strategies.

ST79 30071 Building Structure for Solar Energy Recovery and Utilization

US Patent no. 4,054,246
Avail:Patent Office p. 14 Nov. 18, 1976

A double-walled structure utilizes air as the heat transfer medium between solar heated outer walls and either the interior space or heat storage means beneath the structure. A load-bearing layer of gravel supporting the floor and subterranean gravel pits form the heat storage means. In summer, during the day solar heated air gives up heat to the storage means. At night, heat is radiated to the atmosphere and thus-cooled air is used for daytime cooling by storage either in the gravel pits or the gravel layer supporting the building floor. In winter, air is heated in the storage means for interior circulation and, when available during daylight hours, solar heated air may be used directly or temporarily stored for nighttime use. Cold can also be stored during winter months in separate storage means for additional summer cooling capacity.

ST79 30072 Comparison of Solar Absorption and Vapor Compression Residential Cooling Systems, Interim Report

Univ. of Texas, Arlington, TX
Avail:NTIS, EPRI-ER-843   p. 39   Aug. 1978

Texas Electric Service Company and the University of Texas at Arlington are performing testing for the direct comparison in the same facility of solar powered absorption cooling and solar assisted electric-powered heat pump cooling for a single-family residence. Solar hot water heating and space heating with electric resistance and heat pump heating as backups are also included. The facility on the campus of the University of Texas at Arlington. A complete description of the facility is presented with emphasis on the solar heating and cooling equipment and the associated instrumentation. Calculated heating and cooling loads are presented with design predictions as to the degree degree of solar participation. A review of startup and operating difficulties which have occurred since the facility has been constructed is also included. The program is beginning the second year of a two-year test plan.

ST79 30073 Compatible Building Design

Sunworld   V 4   p. 2-6   May 1977

Architectural and engineering considerations of the building design are explored for minimizing heat loss and deciding on the type of heating system used. Diagrams are included for the standard liquid heating system and standard air heating system. The major advantages/disadvantages of the two systems are the freezing, corrosion, boiling, and leaking problems of the water systems as opposed to the somewhat higher costs of the air systems. The collector arrays are considered the most expensive feature of the solar system. Most are of the flat-plate collector variety with a high-temperature selective black paint and a proper orientation of the latitude plus 10° or 15°. An approximate measure of the heating load met by solar energy is 1/2 to 3/4. Long-term performance of solar systems has been recorded for several cities; for residences of typical construction, 0.8 BTU/hr/$^{\circ}$ F heat loss/ft^2 of floor area. The collectors analyzed are commercially available, double-glazed black flat-plate collectors. Storage consists of 1/2 to 3/4 ft^3 of rock of 1½ to 2 gallons of water for each ft^2 of collector. Most systems employ a preheat tank of at least 80 gallons for four people. Pipes and ducting are sized with fluid pressures and high temperatures in mind. Electronic sensors to monitor the system and a two-stage thermostat is required. For homes that are retrofitted, it may be simpler to leave the existing system intact and allow the solar system to act as an independent heat source.

ST79 30074 Cost and Performance of Heat Pump TES and Solar TES Household Energy Systems

Avail:NTIS, ANL/EES-TM-15   p. 106   March 1977

In order to understand the various possibilities and roles thermal energy storage (TES) can play in household energy systems, Argonne National Laboratory has studied the engineering performance and economics of such systems. This phase of the study concen concentrates on the use of TES in conjunction with solar-augmented and heat pump residential energy systems that provide hot water, space heating, and space cooling. The overall effort is directed towards evaluating the interaction of these systems with electric utilities in terms of costs and benefits to both the utility and the consumer. This interaction depends on the system's overall design, performance, and cost characteristics. This evaluation covers the three basic household energy services that lend themselves to thermal energy storage: hot water, space heating, and space cooling. The systems are evaluated individually; however, it is more likely that final design could be integrated to achieve a more effective system. The exception to this is the heat pump, which is generally sized to handle the cooling load, although it also supplies heating capacity. The solar systems are augmented by an electric utility. The systems are designed to minimize their impact on the utilities load management problems by use of a TES subsystem. The study evaluates these systems for a single-family dwelling unit, although it is recognized that systems for multiple dwelling units are often technically and economically more viable. Detailed evaluations of hypothetical future systems for which there is little basis to perform an economic evaluation are not included in this report. They will be considered in an assessment of R and D alternatives in the final study report. A summary evaluation is made, however, of the characteristics of some advanced TES subsystems, in order to illustrate how much improvement they would offer over the baseline systems.

ST79 30075 Council Notes

Council Notes V 1 No. 4 p. 1-8 Spring 1976

A description is given of the design, construction, and predicted performance of a house that uses approximately one-third of the energy needed to heat a house of the same size which is built to meet 1974 insulation standards. Because of its low-energy requirements for heating, the house has been called the "Illinois Lo-Cal House." If the Lo-Cal House is compared to the typical house of 1950, the savings are even more dramatic. The two features which account for the exceptional reduction are superior insulation and solar orientation. Of the reduction, about 80 percent or more is due to the heavy insulation. The remaining reduction is due to the location of most of the windows in the south wall, where they act as solar collectors.

ST79 30076 Design and Installation Package for Solar Hot Water System

Solar Engng. and Mfg. Co., Deerfield Beach, FL
Avail:NTIS, N79-14556 32 p.

Included are the system performance specifications, system design drawings, hazard analysis, and other information necessary to evaluate the design and install the system.

ST79 30077 Design Data Brochure For CSI Series V Solar Heating System

Contemporary Systems, Inc., Jeffrey, NH
Avail:NTIS, DOE/NASA/CR-150600 p. 29 Jan. 1978

The design data brochure for Contemporary Systems, Inc.(CSI) is included, along with general information on system configuration, system sizing, and mechanical layout. CSI is developing two single-family prototype solar heating systems consisting of the following subsystems: collector, storage, control transport, and government furnished site data acquisition. The systems are being installed at York, Pennsylvania and Manchester, New Hampshire.

ST79 30078 Design Data Brochure: Solar Hot Air Heater

Solar Engng. and Equipment Co., Metairie, LA
Avail:NTIS, DOE/NASA/CR-150697 p. 26 May 1978

Information is provided on the design, installation, performance, and application of Seeco MCD-1 solar hot air heater for residential, commercial, and industrial use. The system has been installed at the Concho Indian School in El Reno, Oklahoma.

ST79 30079 Design Data Brochure: Solar Hot Water System

Solar Engng. and Mfg. Co, Ft. Lauderdale, FL
Avail:NTIS, DOE/NASA/CR-150699 p. 21 July 1978

This design data is general in nature. The intent is to provide a preliminary, not too technical approach to a subject that can be technically demanding. The example used for the design calculation has been for a single-family residence housing a family of four in a nonspecific geographical area. Drain-down freeze protection is used with the flat-plate collectors. Drawing and specifications for the solar collectors, valves, pump, and flow regulators are included.

ST79 30080 Design of a Freon Jet Pump for Use in a Solar Cooling System

Zeren, F.; Holmes, R.E.; Jenkins, P.E.
Am. Soc. of Mech. Engnrs. A79-19847
ASME Winter Annual Mtg. San Francisco, CA Dec. 10-15, 1978 10 p.

The utilization of solar energy to drive a vapor compression cooling system is considered. The compression is accomplished by use of a vapor jet pump. The functioning of a system using Freon 12 in both the solar collector and in the cooling system is explained. Equations are presented for the design of the jet pump. As an example, a freon vapor jet pump is designed for a cooling load of 14,000 BTU/hr (3528 K cal/hr).

ST79 30081 Development of Prototype Air/Liquid Solar Collector Subsystem, Sixth Quarterly Report

Owens-Illinois, Inc., Toledo, OH
Avail:NTIS, DOE/NASA/CR-150703 p. 8 May 1978

The progress made in the development of the SEC-601 collector subsystem by Owens-Illinois is covered. A description of thermal and physical performance testing of the model SEC-601 collector and a forecast of activities for completing contract task are presented. The testing of the 144 tube ERDA evacuated tubular air collector in conjunction with an air/liquid heat exchange and liquid storage elements was completed. Test results indicate care is needed to match the heat exchanger and collector characteristics with specific attention to the dynamic response of each of the elements. Formal documentation of the results of the verification and test analysis was submitted for many sections of the test plan.

ST79 30082 Energy Conservation Through Adaptive Optimal Control For a Solar Heated and and Cooled Building

Los Alamos Scientific Lab., Los Alamos, NM
Workshop on the Control of Solar Energy, Hyannis, MA
Avail:NTIS, LA-UR-78-2212, CONF-7805126-3 p. 9 May 23, 1978

A study to investigate the use of adaptive and optimal control techniques to control HVAC systems in large solar heated and cooled buildings is reported. The study has been made by computer simulation and is centered on the National Security and Resources Study Center (NSRSC), a large solar heated and cooled building at the Los Alamos Scientific Laboratory (LASL). Although the study is based on a NSRSC were simulated in the models and an adaptive optimal controller was developed and also simulated. Performance of the two simulations was compared. It was found that the adaptive controller and model demonstrated a savings in auxiliary energy of 28.8 percent for the heating simulation and 20.2 percent for the cooling simulation when compared to the conventional controller simulation models.

ST79 30083 EPRI Sponsors Solar Instrumentation

EPRI J. V 3 No. 2 p. 33-35 March 1978

The Electric Power Research Institute (EPRI) is funding research in a methodology for monitoring solar systems and evaluating the data. In a joint project with DOE, EPRI participated in data analysis and evaluation of 11 solar heating and cooling (SHAC) configurations and found the most cost-effective to be a combination of a solar assisted heat pump and water storage. Other studies underway include a hospital solar-water heating system, a solar cooling comparison study, and solar heating and cooling demonstrations. In each case EPRI has funded the portion of the project devoted to developing more accurate and reliable monitoring data. Interim reports will be published inthe summer of 1978 .

ST79 30084 ERDA Commercial Awards Involve 38 Manufacturers

Solar Engng. V 2 No. 6 p. 5-7 June 1977

A detailed listing of USERDA projects funded on a cost-sharing basis to install solar energy demonstration systems in 80 buildings across the United States is presented. A total funding of $12.6M is provided by ERDA. A detailed compilation of the projects by 28 manufacturers is tabulated. The projects include office buildings, schools, motels, fire stations, police stations, hospitals, and libraries.

ST79 30085 Fundamentals of Solar Heating: Correspondence Course

Sheet Metal and Air Conditioning Contractors Nat'l Assoc., Vienna, VA
Avail:NTIS, HCP/M4038-01(REV.1) p. 190 Aug. 1978

This revision is the August 1978 reprinting of HCP/M4038-01 which has appeared previously.

ST79 30086 Hardware Problems Encountered in Solar Heating and Cooling Systems

NASA, Marshall Space Flight Center, Huntsville, AL
Avail:NTIS, DOE/NASA/CR-78172 p. 39 May 1978

Marshall Space Flight Center personnel have worked for several years with the development and demonstration of solar heating and cooling systems in support of the Department of Energy. In this work, they have encountered numerous problems in the design, production, installation, and operation of the solar energy systems. Many of these problems have been seen in more than one system. The hardware intended to provide personnel in the solar energy field with information that will help prevent the installation of solar heating and cooling systems that will not operate satisfactorily or that will not last for the design lifetime.

ST79 30087 Heating With Sun

R.A.S. V 31 No. 12 p. 700 1976 In German

No abstract available.

ST79 30088 Heat Transfer System Particularly Applicable to Solar Heating Installations

Acme Engng. and Mfg. Corp.
US Patent no. 4,061,131
Avail:Patent Office p. 6 Nov. 24, 1975

A heat transfer system is described which is applicable to solar heating installations. It consists of an evaporator located near the heat source which may be a solar heat collector panel and a condenser that is located at an elevation lower than that of the evaporator, and which may function to heat hot water for storage. The source heat is transferred to a volatile fluid within the evaporator that absorbs the heat with an increase in temperature and a change of state from liquid to vapor. The vapor is conveyed to the condenser wherein the fluid liberates its latent heat while changing from vapor to liquid phase. The condensed liquid drains from the condenser to a trap which may be used to regulate the flow of liquid through a check valve and further piping to a transfer tank located above the evaporator. The fluid in the transfer tank is maintained at a lower temperature than that of the evaporator. A dual-level control system is employed within the transfer tank. The system is hermetically closed, containing only the liquid and vapor of the selected volatile fluid.

ST79 30089 High-Efficiency Solar Collector to be Integrated in a Heating System

German (FRG) Patent no. 2,640,754/A p. 8 March 16, 1978

To begin with, a heating system with optimum efficiency for a collector system is described. The system consists of a solar collector connected with a low-temperature storage tank. The low-temperature storage tank is connected with the real water storage tank, which again is connected with the real heating system. In addition, the layout of a solar collector is described.

ST79 30090 How to Understand Solar Energy Technology and Economics

Solar Data, Hampton, New Hampshire p. 86 $6.50

Solar energy for space and water heating is discussed. Specifically several types of solar heating systems are investigated, including both built-in and retrofitted air and water systems. Solar power is examined for space heating, for hot water heating, and for a combination of both uses. It is found that solar heating systems are often economically feasible at today's prices for use by electrically heated buildings. Furthermore, it is argued that solar systems should be immediately considered for commercial buildings which demand large amounts of hot water. Nine recommendations for state action and six recommendations for federal action are included. The following topics are covered: the use of solar energy collectors, differences in solar heating systems, the economics of solar heating systems, solar energy applications, and state strategies for promoting solar development.

ST79 30091 Installation of Solar Furnace Cuts Utility Costs

Solar Heat. Cool. V 3 No. 4 p. 18-19 Aug. 1978

Retrofitting a solar heating system to a home built in 1840 is described. Aluminum siding, extra insulation, and storm windows were added first. The unit added was the free-standing champion solar furnace with vertafin collector and 6¼ yd^3 of rock storage.

ST79 30092 Installation Package For a Solar Heating and Hot Water System

Colt, Inc., Rancho Mirage, CA
Avail:NTIS, DOE/NASA/CR-150757 p. 77 Aug. 1978

Two commercial solar heating and hot water systems have been developed. The systems have been installed at Yosemite National Park, California, and Pueblo, Colorado. The systems consist of the following subsystems: collector, storage, transport, hot water, auxiliary energy, and controls. General guidelines are provided which may be utilized in development of detailed installation plans and specifications. In addition, instruction on operation, maintenance, and repair of a solar heating and hot weather system is provided.

ST79 30093 Introduction to Solar Heating and Cooling Design and Sizing

Honeywell, Inc., Energy Resources Center, Minneapolis, MN
Avail:NTIS, DOE/CS-0011 p. 517 Aug. 1978

This manual is designed to introduce the practical aspects of solar heating/cooling systems to HVAC contractors, architects, engineers, and other interested individuals. It is intended to enable readers to assess potential solar heating/cooling applications in specific geographical areas, and includes tools necessary to do a preliminary design of the system and to analyze its economic benefits. The following are included: the case for solar energy; solar radiation and weather; passive solar design; system characteristics and selection; component performance criteria; determining solar system thermal performance and economic feasibility; requirements, availability, and applications of solar heating systems; and sources of additional information.

ST79 30094 Junkers "Tritherm" Concept

Sonnenenergie-Tech. V 3 No. 10 p. 15-17 1977 In German and English

A plant of a solar heating system is described which can utilize by means of heat pump and latent storage unit the low heat of the winter months. Experience with the new heating system in a demonstration house in Wernau is reported on.

ST79 30095 "Little Red Schoolhouse" is Teaching About Solar Heating/Cooling

Fueloil Oil Heat Syst. V 36 No. 8 p. 35-36 Aug. 1977

The use of a working model solar heating/cooling system installed in an ITT polar energy system personnel training classroom and office complex is briefly described. The fully instrumented system provides continuous guideline data and a first-hand learning environment for design engineers, contractors, and other heating/air conditioning specialists. The 2½ year operational experience accumulated at the facility is briefly summarized. Information is included for obtaining a manual of this data.

ST79 30096 Means and Methods of Preventing the Loss of Solar Heat

US Patent no. 4,088,119
Avail:Patent Office p. 4 Dec. 4, 1975

In order to prevent the cooling of the working fluid in a solar heat collecting system, the present apparatus and process responds rapidly to shut off the circulation of the working fluid (either liquid or gaseous) through the solar heat collecting equipment, when the rays of the sun are clouded over or when at nighttime they are nonexistent. Solar heat that has been properly accumulated and stored is effectually prevented from radiating back out of the solar heat collecting system into the outer atmosphere.

ST79 30097 National Solar Heating and Cooling Demonstration Program: Project Experience Handbook

DOE, Chicago, IL; DOE, San Francisco, CA; NASA, Marshall Space Flight Center, Huntsville, AL; ASHRAE, Inc., New York, NY
Avail:NTIS, DOE/CS-0045/D p. 113 Sept. 1978

This preliminary draft is a revision of TID-28722 which was previously abstracted for EDB. It will be revised and reissued on an appropriate basis and may be expanded to include additional guidelines arising from the experiences of the solar demonstration program and solar industry, particularly in the architectural areas.

ST79 30098 Plant Engineers Solar Energy Handbook

Univ. of California, Lawrence Livermore Lab., Livermore, CA
Avail:NTIS, LLL/M-086(REV. 1) p. 306 Jan. 21, 1978

This handbook is to provide plant engineers with factual information on solar energy technology and on the various methods for assessing the future potential of this alternative energy source. The following areas are covered: solar components and systems (collectors, storage, service hot water systems, space heating with liquid and air systems, space cooling, heat pumps and controls); computer programs for system optimization local solar and weather data; a description of buildings and plants in the San Francisco Bay area applying solar technology; current federal and California solar legislation; standards, codes, and performance testing information; a listing of manufacturers, distributors, and professional services that are available in northern California; and information access. Finally, solar design checklists are provided for those engineers who wish to design their own systems.

ST79 30099 Preliminary Design Package for Prototype Solar Heating System

Contemporary Systems, Inc., Jeffrey, NH
Avail:NTIS, DOE/NASA/CR-150615 p. 56 Nov 23, 1976

This report is a collation of documents that were submitted by Contemporary Systems, Inc. for the preliminary design review on the development of a prototype solar heating system for single-family dwellings. Included are the proposed instrumentation plan, deviation requirement, system changes and rationale, preliminary design drawings, and other information pertaining to the progress and design of the system. This space heating system consists of the following subsystems: collector, storage, transport, control, and government furnished site data acquisition. The two prototype systems will be installed at York, Pennsylvania and Manchester, New Hampshire.

ST79 30100 Preliminary Design Package For Prototype Solar Heating System

Honeywell, Inc., Energy Resources Center, Minneapolis, MN
Avail:NTIS, DOE/NASA/CR-150858 p. 113 Dec. 1978

A summary is given of the preliminary analysis and design activity on solar heating systems. The analysis was made without site specific data other than weather; therefore, the results indicate performance expected under these special conditions. Major items in this report include system candidates, design approaches, trade studies, and other special data required to evaluate the preliminary analysis and design. The program calls for installation and operational test. Two heating and six heating and cooling units will be delivered for single-family residences (SFR), multi-family residences (MFR), and com commercial applications.

ST79 30101 Preliminary Design Package for Solar Heating and Hot Water System

Colt, Inc. of Southern California, Rancho Mirage, CA
Avail:NTIS, N79-10520 69 p.

Two prototype solar heating and hot water systems for use in single-family dwellings or commercial buildings were designed. Subsystems included are: collector, storage, transport, hot water, auxiliary energy, and government furnished site data acquisition. The systems are designed for Yosemite, California and Pueblo, Colorado. The necessary information to evaluate the preliminary design for these solar heating and hot water systems is presented. Included are a proposed instrumentation plan, a training program, hazard analysis, preliminary design drawings, and other information about the design of the system.

ST79 30102 Preliminary Design Package For Solar Heating and Hot Water System

Fern Engng. Co., Buzzard's Bay, MA
Avail:NTIS, DOE/NASA/CR-150613 p. 135 Jan. 1977

A collection of documents submitted by the Fern Engineering Company for the preliminary design review on the development of two prototype solar heating and hot water systems is presented. The information includes system certification, system functional description, system configuration, system specification, system performance, and other documents pertaining to the progress and the design of the system. This system, which is intended for use in the normal single-family residence, consists of the following subsystems: collector, storage, control, transport, and government furnished site data acquisition. One of the two prototype units will be installed in Lansing, Michigan, and the other in Tunkhannock, Pennsylvania.

ST79 30103 Prototype Solar Heating and Combined Heating and Cooling Systems, Quarterly Report

GE Co., Philadelphia, PA, Space Div.
Avail:NTIS, DOE/NASA/CR-150687 Jan. 1, 1977 p. 118

The General Electric Company is developing eight prototype solar heating and combined heating and cooling systems. This effort includes development, manufacture, test, installation, maintenance, problem resolution, and performance evaluation.

ST79 30104 Prototype Solar Heating and Cooling Systems

Airesearch Mfg. Co., Torrance, CA
Avail:NTIS, N79-12552 25 p.

Eight prototype systems were developed. The systems are 3, 25, and 75-ton size units. The manufacture, test, installation, maintenance, problem resolution, and performance evaluation of the systems is described. Size activities for the various systems are included.

ST79 30105 Prototype Solar Heating and Cooling Systems, Including Potable Hot Water, Quarterly Report

Solaron Corp., Denver, CO
Avail:NTIS, DOE/NASA/CR-150576 p. 124 Dec. 1977

The progress made in the development, delivery, and support of two prototype solar heating and cooling systems including potable hot water is reported. The system consists of the following subsystems: collector, auxiliary heating, potable hot water, storage, control, transport, and government furnished site data acquisition. Included is a comparison of the proposed Solaron heat pump and Solaron desiccant heating and cooling systems, installation drawings, data on the Akron House at Akron, Ohio, and other program activities from July 1, 1977 through November 9, 1977.

ST79 30106 Prototype Solar Heating and Hot Water Systems

Colt, Inc., Rancho Mirage, CA
Avail:NTIS, DOE/NASA/CR-150785 p. 17 April 1978

This document is a collection of two quarterly status reports from Colt, Inc., covering the period from October 1, 1977 through June 30, 1978. Colt is developing two prototype solar heating and hot water systems consisting of the following subsystems: collector, storage, control, transport, hot water, and auxiliary energy. The two systems are being installed at Yosemite, California and Pueblo, Colorado.

ST79 30107 Prototype Solar Heating and Hot Water Systems Quarterly Report

Solafern, Ltd., Bourne, MA
Avail:NTIS, DOE/NASA/CR-150592 p. 27 Jan. 1977

This report contains one quarterly status report from Solafern, Ltd., reflecting work progress from October 7, 1976 through January 28, 1977. Solafern is developing two prototype solar heating and water systems consisting of the following subsystems: collector, storage, control, and transport.

ST79 30108 Pumping in the Sun's Heat

Domest. Heat. News V 15 No. 4 p. 12 April 1975

The Battelle Institute's Columbus Laboratories, in a study for the United States National Science Foundation, are developing a combined heat pump/solar heating system for homes. The concept involves a solar heated working fluid to drive a low friction heat pump instead of being circulated to radiators for direct heating; the heat pump could provide heating or cooling, if run in reverse.

ST79 30109 Quarterly and Monthly Reports for Solar Heating and Cooling System

Solar Engng. and Equipment Co., Metairie, LA
Avail:NTIS, DOE/NASA/CR-150589 p. 31 Oct. 1977

This document is a collection of six monthly reports and one quarterly report from solar engineering and equipment company (SEECO), covering the progress of work from September 30, 1976 through September 30, 1977. SEECO is developing two prototype solar heating systems consisting of the following subsystems: collector, control, and storage.

ST79 30110 Rays of Hope

Prog. Architecture V 58 No. 11 p. 70-79 Dec. 1977

Solar architecture and the basic types of solar systems, passive and active, are described. Solar assisted heat pumps are explained in the terms of the decrease in collector area and the increased efficiency of the solar system. The two types of storage, rock and contained liquid, are examined. Phase change materials are also briefly described.

ST79 30111 Roof-Mountable Chamber and Conduit Device for Solar Heat Collecting Apparatus

US Patent no. 4,085,733
Avail:Patent Office p. 8 Aug. 30, 1976

A combined chamber and conduit device to be mounted on a roof at an elevation higher than an assembly of one or more solar radiation receptors comprises a container having a depending well portion to extend through an opening in the roof or like support structure, which container forms part of a liquid flow circuit extending from the receptors and to a heat exchange zone beneath the roof for transferring heat from the solar heated liquid, serves for filling the receptors and the flow circuit with liquid which it holds under low hydrostatic pressure while letting the liquid expand and contract with temperature changes. It has lengths of tubing extending through the well portion and the container side wall for return flow of liquid to the receptors and for displacements of gaseous fluid between a cover space over the receptors and fluid dessicating and expansion chambers beneath the roof.

ST79 30112 Sims Prototype System I: Design Data Brochure

IBM Federal Systems Div., Huntsville, AL
Avail:NTIS, DOE/NASA/CR-150534 p. 68 Jan. 1978

A prototype solar heating and hot water system is described using air as the collector fluid and a pebble bed for heat storage. The system was designed for installation into a single-family dwelling. Described are the system, subsystem, and installation requirements. System operation and performance are discussed, and a procedure for sizing the system to a specific site is presented.

ST79 30113 Design Data Brochure: Sims Prototype System

IBM Federal Systems Div., Huntsville, AL
Avail:NTIS, DOE/NASA/CR-150707 p. 41 May 30, 1978

A closed hydronic solar system for space and hot water heating is described. Design, performance, and hardware specifications are presented sufficient for architectural engineers and contractors to procure, install, operate, and maintain a similar solar application.

ST79 30114 Sims Prototype System 4: Performance Test Report

IBM Federal Systems Div., Huntsville, AL
Avail:NTIS, DOE/NASA/CR-150820 p. 131 Oct. 9, 1978

The results obtained during testing of s self-contained, preassembled air-type solar system, designed for installation remote from the dwelling to provide space and hot water, are presented. Data analysis is included which documents the system perforamnce and verifies the suitability of Sims Prototype Systen 4 for field installation.

ST79 30115 Solafern Solar System Design Brochure

Solafern, Ltd., Bourne, MA
Avail:NTIS, DOE/NASA/CR-150515 p. 47 Dec. 1977

The Solafern system is a complete residential solar space heating and hot water system. When installed in a highly insulated energy saver home, the solar system can supply a large percentage of the total energy demand for space heating and domestic hot water. Low maintenance, durable, and efficient air heating collectors are used. The collectors have a selective absorber and a tempered glass cover nearly ¼-inch thick with an aluminum frame. The solar energy can be delivered directly to the living area when there is a demand; otherwise, it is stored in the form of hot water. Hot water storage is accomplished through the use of an air-to-water exchanger. The hot water storage is used simultaneously to preheat the domestic hot water, as well as to store energy for space heating. The system has a one-year warranty on all parts and service, and a five-year warranty on the collector, except for glass breakage. The service life of the collector is estimated as 30 years.

ST79 30116 Solar Actuated Boiler and Appurtenances

US Patent no. 4,064,865
Avail:Patent Office p. 4 April 28, 1975

A solar actuated boiler is described which receives the incident rays of the sun, magnifying them and concentrating them at precise multiple points. This concentration results in an aqueous solution, under pressure, being heated to temperatures resulting in hydrokinetic motion. The heat from this solution will then be convected through a system of piping, deposited and stored in the system's heat storage vault. This stored heat is then converted through a companion system of piping for the purpose of heating, domestic hot water, air conditioning, and electrical energy.

ST79 30117 Solar Air Heating And Cooling Systems for Residential and Light Commercial Applications

Colorado State Univ., Solar Energy Applications Lab., Ft. Collins, CO
Mtg. of Am. Sect. of ISES Denver, CO
Avail:NTIS, COO-2858-10, CONF-780808-21 p. 6 Aug. 28, 1978

The integration of air heating evacuated tube collectors with pebble bed thermal storage and other air system components to provide the most cost-effective state-of-the-art solar space and domestic hot water heating systems is discussed. The combination of these exceptional high-temperature performance collectors with currently available lithium bromide absorption cooling units is described. The operation of the pebble bed thermal storage subsystem at different temperature levels at different seasons is mentioned.

ST79 30118 Solar Collector for Space Conditioning

Nat'l Engng. V 82 No. 1 p. 5 Jan. 1977

The system described derives energy from a solar collector, which is supplemented by natural gas, electricity, or propane during periods of low solar input. The paper shows how the MEC unit operates in the cooling mode. Room air is directed through a drying wheel, which contains a desiccant. The air is then cooled in the heat exchange wheel. After humidification, the air is returned to the room. The drying wheel is continually regenerated by the outside air stream. This stream is first cooled by humidification and then removes the heat accumulated in the heat exchange wheel.

ST79 30119 Solar Collector Installation Tips

Domestic Engng., Heat. Vent. V 230 No. 5 p. 49-51 Nov. 1977

A step-by-step approach is taken to the installation of a solar system. Diagrams are included for the distance between collectors to avoid shading, the proper tilt, and spacing. Procedures were taken from the Solar Energy Products, Inc. Manual for installation instructions.

ST79 30120 Solar Collector Manufacturing Activity and Applications in the Residential Sector, January-June 1977

Nat'l Energy Info. Center, Washington, D.C.
Avail:NTIS, DOE/EIA-0039/1 p. 30 Feb. 1978

Survey results show there are 186 companies currently manufacturing or importing medium-temperature and special solar collectors. Production during the first half of 1977 was 54 percent greater than during the second half of 1976 and 168 percent greater than one year ago. Results also show that there are 15 companies manufacturing low-temperature or pool heating collectors. Production of these collectors has increased by about 40 percent since the second half of 1976, and is 105 percent greater than one year ago. An estimate of the number of installations made in the residential sector as a result of production during this six-month period is included. Companies reporting manufacture and sale of at least 100 ft^2 of collector are included in the appendix

ST79 30121 Solar Collector Module; Book

Deutsche Forschungs und Versuchsanstalt fuer Luft und Raumfahrt E.V., Koeln, Germany, F.R., Abt. Sonnensimulation
C.F. Mueller, Karlsruhe, Germany, F.R.
ISBN-3-7880-7086-2 p. 122 1977

This book discusses the physical and technical fundamentals for the utilization of solar energy. The first two chapters are dedicated to the physical fundamentals of solar radiation. After this, the layout and functioning of solar collectors are described. Systems of equations to be used for the design of solar collectors are derived and discussed; they lead to a comparison between the possible systems. Test methods for solar collectors are discussed, as well as material and construction problems. Finally, the overall system "solar collector" and its applications are discussed. An appendix contains information on producers of solar collectors and on scientific organizations working in the field of solar energy utilization.

ST79 30122 Solar Control Design Package

Solar Control Corp., Boulder, CO
Avail:NTIS, DOE/NASA/CR-150771 p. 54 Aug. 1978

Information used in the evaluation of design of solar control's solar heating and cooling system controller and the Solarstat is presented. System performance specifications, design data brochures, and detailed design drawings are presented.

ST79 30123 Solar Cooling "Not Yet Commercial"

Refrig. Air Cond. V 80 No. 951 p. 52 June 1977

A brief review of some factors preventing commercialization of solar refrigeration equipment is presented. Methods of solar cooling based on the greenhouse effect, the absorption principle, and on the chimney effect are mentioned.

ST79 30124 Solar Energy Collection System

U.S. Patent no. 4,050,445
Atlantic Fluidics, Inc.
Avail:Patent Office p. 8 July 23, 1976

A system is described for collecting solar energy in the form of heat in liquid at low temperature, raising the temperature by vapor compressor, and by heat transfer means storing the heat energy at a temperature which is higher than the temperature originally obtained from the solar heat collector.

ST79 30125 Solar Energy Developments

RIBA J. V 84 No. 3 p. 103-110 March 1977

Research activities being conducted by solar energy developments are reviewed. The activities include the design and construction of houses utilizing the principles of passive solar collection, houses with high (100 m^3) heat storage capacity in the form of water-filled concrete tanks situated underneath the building, houses with solar space heating systems which use air as the heat transfer medium and rock stores for heat storage, houses with solar water heating systems, and houses with heat of fusion storage systems. A solar laboratory with three roof pitches and rotational capability has also been constructed to monitor variables affecting solar energy collection. A solar air conditioning system has been constructed for a large residential/office complex. The air conditioning system includes concentrating collector troughs which are situated on the roof and track the sun to heat water to 180°C. Heat is taken from a thermal store to heat an ammonia solution in an absorption refrigerator. A solar energy factory scheme for meeting process hot water requirements and assisting space heating demands has also been developed. With air-to-air heat exchange ventilation and water to water heat reclamation systems, a predicted saving of 75 percent of the fuel costs was achieved without altering the insulation value of the envelope. Other research activities include the development of portable solar water heaters and water boilers for campers, thermal electric modules for the production of electricity (using silicon solar cells) and low-grade heat in the form of hot water (70°C), and solar balloons and doses which utilize a double-skin construction for trapping hot air.

ST79 30126 Solar Energy Device and System

US Patent no. 4,050,443
Univ. Patents, Inc.
Avail:Patent Office p. 4 June 27, 1975

A system constitutes a see-through portion of an enclosure, such as a wall or window portion of a building, collects heat from solar radiation and transfer it to a utilization location. There is a light-transmissive exterior and a light-transmissive interior wall member. One heat absorbing member is mounted in the space between the exterior and interior wall members. Fluid means, preferably air, occupies the remaining space between the inner and outer wall members. The fluid means receives heat energy from the heat absorbing member. Means are provided for recirculating the fluid between the utilization location and the space between the inner and outer wall members.

ST79 30127 Solar Energy: Fundamentals in Building Design; Book

Total Environmental Action, Inc., Harrisville, NH
ISBN-0-07-001751-4 p. 383 1977 $21.00

The following areas are covered: good building design, passive uses of solar energy, complex solar HVAC systems, and solar water heating. The major methods of using solar energy for heating and cooling buildings and water heating are compared, evaluated, and critiqued. Rules for evaluating products and materials are included.

ST79 30128 Solar Energy Offers Advantages for Laboratory Buildings

Laboratory Manage. V 5 No. 7 p. 32-36 1957

No abstract available.

ST79 30129 Solar Energy Program: Annual Report, 1977; Univ. of California at Berkeley, Lawrence Berkeley Laboratory

Avail:NTIS, PUB-248 p. 45 1978

Progress is summarized briefly on the following topics: analysis of the California solar resource; measurement of circumsolar radiation; controller development and evaluation of control strategies for solar heating and cooling of buildings; LBL building 90 solar demonstration project; development of solar-driven ammonia-water absorption air conditioners and heat pumps; radiative and passive cooling; regional solar energy retrofit of low and moderate-cost homes; solar information support for DOE (LLL) support activities for DOE solar heating and cooling research and development program; ocean thermal energy conversion; environmental program; appropriate energy technology; functional linking between H_2 consumption, N_2 fixation, and photosynthesis in blue-green bacteria; photovoltaic effects of bacteriorhodopsin and studies on its mechanism of action; and environmental assessment of solar energy conversion.

ST79 30130 Solar Energy Utilization for Residential Heating

Plumb. Heat. J. V 54 No. 6 p. 11-12 Nov. 1974

System derived from space technology is illustrated using solar energy for residential cooling and heating in Marshall Space Flight Center, Alabama.

ST79 30131 Solar Furnace Heating System

US Patent no. 4,051,129
Avail:Patent Office p. 10 Sept. 13, 1976

A solar furnace heating system is disclosed which is characterized by novel rotary vane-type heat collector elements arranged in a heat collecting chamber beneath the generally vertical transparent wall of a housing. The fluid to be heated crosses the heat collecting chamber in heat transfer relationship with the rotary heat collector elements and then to a heat storage chamber contained in the bottom portion of the housing. After the temperature of the fluid in the heat storage chamber reaches a given value, heated fluid from the heat storage chamber may be conveyed upon demand to the enclosure to be heated. The heat collector elements are mounted for free rotation in the housing by the fluid that is conveyed through the heat collecting chamber. Means are provided for rotatably driving the heat collector elements in the synchronism.

ST79 30132 Solar-Geothermal Heat System

US Patent no. 4,062,489
Avail:Patent Office p. 8 April 21, 1976

A heating system is described that includes a solar collector assembly that is fluidly connected by inlet and return conduits to separate chambers in a heat transfer tank located in the building. A heat pump furnace unit having an evaporation-condensor coil located in the heat transfer tank so that as the liquid flows in the tank from one chamber to the other, it flows in heat transfer relationship to the coil. The heat pump furnace unit located outside of the tank supplies heat to the building heating system of vertically elongated ground heat exchangers extended into the earth and connected by conduits so that there is provided a liquid flow path from one of the tank chambers through the ground heat exchangers, and then back to the other chamber. Pumps are provided in the above conduits for pumping the liquid between the tank and the solar collector assembly, and the tank and the ground heat exchangers.

ST79 30133 Solar Heated Shelter With Moveable Secondary Roof

US Patent no. 4,067,347
Avail:Patent Office p. 8 Jan. 30, 1976

A portable solar-heated shelter is described comprising at least one fixed roof layer and a second roof layer which can be selectively deployed to vary the thermal characteristics of the shelter. The shelter preferably comprises a rigid frame on which first and second end walls are preferably pivotally mounted. The end walls are preferably foldable between a vertically upright operative position and a generally horizontal, lowered storage position and when deployed support the roof layers to define the enclosure. The second roof layer is adapted to be unwound from a storage spool and drawn into a take-up spool, passing over the first roof layer by a cranking action. The second roof layer preferably comprises a first sunshade portion and a series connected heat-insulative portion of opaque material which may be selectively deployed to control the thermal characteristics of the enclosure.

ST79 30134 Solar Heating

German (FRG) Patent no. 2,617,753/A Nov. 3, 1977 p. 8 In German

The solar heating system for heating water consists of a solar collector connected to a primary heat carrier circuit with a heat carrier accumulator, and of a water storage tank with a heat exchanger which is connected up with the heat carrier accumulator of the primary heat carrier circuit via a secondary heat carrier circuit. Pumps controlled by temperature dependent thermostats are responsible for the forced circulation of the heating medium.

ST79 30135 Solar Heating and Cooling of Residential Buildings: Design of Systems

Dept. of Commerce, Washington, D.C.
p. 200 Oct. 1977 $8.25

This course is designed to train home designers and builders in the fundamentals of solar hydronic and air systems for space heating and cooling and domestic hot water heatin heating for residential buildings. The following topics are covered: course orientation; general descriptions of solar heating and cooling systems; solar radiation information for design purposes; system design guidelines; heating and cooling load analyses; simplified design calculations; detailed design methods; economic considerations; energy conservation trade-offs; detailed calculations; collectors; storage systems; laboratory; computer-aided F-chart calculations; system controls; selection of subsystem components; solar cooling systems; automated design techniques; service hot water systems; design case study; structural, mechanical, and scheduling considerations; future prospects for solar heating and cooling systems; and buyer's guide.

ST79 30136 Solar Heating and Cooling of Residential Buildings: Sizing, Installation, and Operation of Systems

Dept. of Commerce, Washington, D.C.
Avail:GPO p. 531 1977 $7.00

This training course is designed to train home designers and builders in the fundamentals of solar hydronic and air systems for space heating and cooling and domestic hot water heating for residential buildings. The following topics are covered: energy problem, course orientation, introduction to solar heating and cooling systems, solar radiation, fluid heating solar collectors, thermal storage subsystems, service hot water systems, solar heating systems, solar space cooling systems, solar heating and cooling systems, solar system controls, operations laboratory, heating load calculations, solar system sizing, system economics, solar system sizing calculations by trainees, cost effectiveness of energy conservation, retrofit considerations, scheduling of solar installations, constraints and incentives, buyer's guide, and future prospects for solar heating and cooling systems.

ST79 30137 Solar Heating as a Major Source of Energy for Australia

Commonwealth Scientific and Industrial Research Organization, Canberra, Australia
10th World Energy Conf. on Availability and Rational Use of Energy Resources
Istanbul, Turkey Sept. 19, 1977
Avail:NTIS, CONF-770980-1 p. 22

Solar energy can make its most effective contribution to Australian primary energy in the form of heat for industrial applications. About 50 percent of all end use energy is required as heat and it is estimated that 40 percent of this amounting to 1 EJ/A by 2000 could be supplied by solar heat generating systems. This would be 12 percent of estimated primary energy requirements by that time, and could help reduce the country's increasing dependence on imported oil. Energy self-sufficiency for Australia is possible, based on coal, solar energy, and natural gas as primary energy sources. The reason for the present orientation towards residential solar water heaters is that there are many places where electric power for water heating costs between 2 and 4 cents per kWh which makes a solar water heater an attractive proposition. There is also a growing interest in the solar heating of swimming pools, mostly for private homes but also in larger installations for public and institutional pools. Industrial applications, on the other hand, are inhibited by the current low energy prices in Australia, which in some cases are around 0.13 cents/mj (.47 cents/kWh). Industry, however, uses 40 percent of Australian primary energy and represents by far the greatest potential for solar heat generating systems. Demonstration plants are being planned to obtain data on capital and running costs, and at the same time build up professional design and constructional skills in this area. The first demonstration solar industrial process heating system was commissioned in December 1976 and supplied a portion of the heat requirements of a soft drink plant in conjunction with the existing oil-fired boiler. Integrated solar/oil-fired systems of this sort ensure continuous operation of the plant and over a year can result in significant oil savings.

ST79 30138 Solar Heating Control System

US Patent no. 4,060,195
Diy-Sol, Inc.
Avail:Patent Office p. 6 July 26, 1976

A control circuit for a solar heating system has a solar collector, a heating load, and a heat transfer control unit. It includes a collector valve for controlling the flow of heating fluid to and from the solar collector; a load valve for controlling the flow of heating fluid to and from the solar collector; a load valve for controlling the flow of heating fluid to and from the heating load; a heating pump for moving the heating fluid; a heat exchanger; and a storage pump for circulating a storage fluid from a storage tank through the heat exchanger and a control system.

ST79 30139 Solar Heating For Space Heating and Hot Water

ERDA, Div. of Solar Energy, Washington, D.C.
Avail:GPO p. 14 May 1976 ERP-0019707

The availability and use of solar energy for building heating and hot water systems are explored. The practicality of both liquid and air solar collection systems is noted. Most of the examples given in this pamphlet relate to liquid systems. Climatic factors such as temperature, cloud cover, humidity, and wind affect ways in which solar systems are useful. Basic elements of a solar heating and hot water system are detailed and illustrated. The system provides two basic functions: capturing the sun's radiant energy, converting it into heat energy, and storing heat in an insulated energy storage tank; and delivering stored energy as needed to meet hot water or heating needs. Most solar systems are designed to supply between 50 and 80 percent of the yearly heating and hot water energy requirements of buildings. Data on energy available, collected, and required for a 1500-ft^2 house in various climatic zones are provided. Cost data are also presented. The role of the federal government in solar heating and hot water system development is discussed.

ST79 30140 Solar Homes: The Winning Combinations

EPRI J. V 3 No. 2 p. 6-13 March 1978

Several Electric Power Research Institute (EPRI) sponsored experiments are underway to determine whether utilities will need more or less generating capacity to supplement solar heating and cooling systems. Studies of solar-electric rates indicate that electric utilities must charge different rates for solar heating customers or they will suffer revenue deficiencies. The EPRI program will collect data from ten geographically separated houses having different system configurations and will develop a computer model to predict the effect on utilities. Definitions for load management, heat pumps, energy conservation, and energy storage were agreed upon in the interests of better communication. The EPRI study is well-timed because of the long lead time for new power plants and the possibility of government incentives to encourage solar heating and cooling.

ST79 30141 Solar House Design

Mont. Rural Electr. News V 25 No. 5 p. 30 Jan. 1978

A solar heated home design that uses solar energy for 75 percent of its heating needs is described. The design, a USDA rural housing research unit development, incorporates a built-in solar air heating collector in the attic and a rock bed heat storage area in the crawl space. A system of air ducts and blowers is used to transfer solar-heated air from the attic into a conventional forced air heating system. Complete working drawings showing construction details are available upon request.

ST79 30142 Solar Houses in France

Sonnenenergie-Tech. V 2 No. 6 p. 9-11 1976 In German and English

No abstract available.

ST79 30143 Solar Systems Ready For Commercial Buildings

Aircond. Refrig. Bus. V 24 No. 11 p. 53-56 Nov. 1977

Computer simulations can aid in the design of solar energy systems for commercial buildings, indicate energy savings, and show the return on investment and payback period for these systems. Computer simulations proved that cold climates were most economical for solar systems with moderate collector area, large storage, and a heat pump. Alt Alteration of the collector orientation increased electric consumption by only 5 percent. Evacuated tube collectors with large storage systems were found most efficient for absorption cooling. Three buildings were investigated for possible application of solar-assisted heat pumps, with the following results: (1)solar-assisted heat pumps can be retrofitted economically to buildings; (2)computer simulation insures maximum payback; (3)payback is greatest in the northers climates with supplemental heat pumps. The possibility of using solar hot water systems for restaurants was also investigated. The study took place in three cities. Federal government aid is described in terms of the various types of incentives currently available. Several of the incentives are included in the national energy plan.

ST79 30144 Solar Water Heater Installation Guidelines: A Manual For Homeowners and Professionals

Massachusetts Office of Consumer Affairs, Solar Action Office, Boston, MA
Avail:TIC, NP-23365 p. 47 April 1978

The guidelines include detailed diagrams, a selected glossary, a bibliography of book books and manuals which might prove useful, and a checklist which should be used during and after the installation. The guidelines explain generally how to install a liquid solar hot water heater, but not a specific system. The following are covered: collector location, collector installation, plumbing, solar storage tanks, electrical, and insulation.

ST79 30145 Status Report on Preliminary Design Activities for Solar Heating and Cooling Systems

Airesearch Mfg. Co., Torrance, CA
Avail:NTIS, DOE/NASA/CR-150673 p. 222 May 1978

Information presented provides status and progress on the development of solar heating and cooling systems. The major emphasis is placed on program organization, system size definition, site identification, system approaches, heat pump and equipment design, collector procurement, and other preliminary design activities as part of the contract requirements.

ST79 30146 The Sun on Your Roof "Dollars in Your Pocket"

The Contractor V 24 No. 11 p. 14-17 1975

Technological and economical aspects of solar heating and cooling systems are reviewed. The basic principle of operation for such systems is the conversion of solar radiation to heat by means of an absorbing surface incorporated in a flat-plate collector assembly. The most common collector is a metal black-coated plate with a glass or plastic covering which transmits the sun's rays but does not permit the reflected radiant waves to pass through. A heat transfer fluid, water, a water antifreeze mixture, or air is passed through channels in contact with the heat absorber surface. The fluid is circulated to a heat storage unit or to the heating and cooling services system. A solar heating system which includes a 5000-ft^2 collector array, a 15,000-gallon water storage tank, and a hot water heating system has been installed in one wing of a public school and has resulted in a savings of 1200 gallons of fuel oil from March 1 to May 15, 1974. Solar energy conversion is most practical in the southwest, deep south, and midwest regions of the country, with the ratio of clear sunny days being of greater importance than temperature variation. Although solar collectors currently cost an estimated $6/$ft^2$, the cost should be reduced to about $4 by 1980 and to about $2 by 1985. A solar system may increase the cost of a newly built home by $2000 or more; however, the solar system when perfected, may last 20 years or more, thus offsetting the initial cost. It is estimated that solar heating and cooling can become competitive by 1985-1990.

ST79 30147 System Design Package for IBM System One: Solar Heating and Domestic Hot Water

IBM Corp., Huntsville, AL
Avail:NTIS, N78-21589, NASA-CR-150614 p. 174 Feb. 1977

This report is a collation of documents and drawings that describe a prototype solar heating and hot water system using air as the collector fluid and a pebble bed for heat storage. The system was designed for installation into a single-family dwelling. The description, performance specification, subsystem drawings, verification plan/procedure, and hazard analysis of the system was packaged for evaluation of the system with information sufficient to assemble a similar system.

ST79 30148 System Design Package for Sims Prototype System 2, Solar Hot Water

IBM Federal Systems Div., Huntsville, Al
Avail:NTIS, DOE/NASA/CR-150521 p. 112 Dec. 1977

This report is a collection of documents and drawings that describe a solar hot water system. The necessary information to evaluate the design and with information sufficient to assemble a similar system is presented. The International Business Machines Corporation developed Prototype System 2, solar hot water for use in a single-family dwelling. The system has been installed in building number 20, which is a single-family residence on the grounds of the Veterans' Administration Hospital at Togus, Maine. It consists of the following subsystems: collector, storage, energy transport, and control. It is a design with widespread application potential with only slight adjustments necessary in system size.

ST79 30149 Taking the Guesswork out of Solarjobs

Design Engng. J. V 229 No. 1 p. 53,54

One of the problems of buying a solar hot water heating system is sizing. Manufacturers of solar water heating equipment are improving their efficiency. Taco, Inc., for example, produced a single unit including all valves, controls, and circulators. The Taco unit includes a heat exchanger that operates efficiently even in periods of marginal sunlight. Taco's solar system module is completely prewired and prepiped. Supply and two sensors are the only additional components needed. The standard unit adequately handles a residential load. The modulated system requires only the calculation of piping. Storage tanks are purchased separately. Taco supplies installation and operating instructions with their units.

ST79 30150 Technical Status Report no. 7, March 15-May 15,1978

McColl-Wade, Inc., Branford, CT
Avail:NTIS, COO-4400-7 p.6 1978

The objective is to develop a commercial demonstration project for an air solar heating and hot water system. Problems and solutions for rock bed storage are reviewed briefly.

ST79 30151 Thermal Collection Devices; Principles and Applications of Solar Energy

Ann Arbor Science Publishers, Inc., Ann Arbor,MI
ISBN 0-250-40247-5 p. 31-56 1978 $15

The various types, applications, and configurations of concentrating and nonconcentrating solar collectors are described. Nonconcentrating flat-plate collectors must incorporate an absorber surface, a heat transfer interface/fluid passage, glazing, insulation, and a protective casing. Flat-plate collectors may be constructed of copper, aluminum, galvanized steel, or plastic coated with black paint or a selective surface; heat absorption configurations include the trickle-type, tube, and sheet type, the integral fluid passage type, or the sandwich type absorber plate. The heat absorption medium may be either air or fluid such as water or anti-freeze solutions. Evacuated tube-type collectors are able to perform at higher operating temperatures than flat-plate collectors because they are able to collect diffuse and reflected light, as well as direct. Concentrating collectors employ refraction lenses or reflecting surfaces which concentrate the radiation on an absorbing focal point; various configurations of concentrating collectors have been developed.

ST79 30152 Thermal Performance and Economics of Solar Space and Hot Water Heating System on Long Island, New York

Brookhaven Nat'l Lab., Upton, NY
KSEA Symp., Seoul, Republic of Korea
Avail:NTIS, BNL-24665, CONF-780752-1 p. 28 July 1978

A practical method for designing solar space and water heating systems, called the F-Chart Method, is described with the results calculated for Long Island, New York. The solar heating systems to be considered consist of a solar collector which uses either liquid or air, an energy storage which can be either a water tank or a pebble bed, and an auxiliary energy source which supplies heat when solar energy is not available. Solar heated water from storage can be used either for space heating or for preheating the domestic hot water. The results of the F-Chart analysis can simply be expressed as follows: for the thermal performance, annual load fraction supplied by solar energy versus collector; and for the economic performance, life cycle cost versus collector area.

ST79 30153 Thermal Solar Energy Applications: Principles and Applications of Solar Energy

Ann Arbor Science Publishers, Inc., Ann Arbor, MI
ISBN 0-250-40247-5 p. 57-79 1978 $15

A review of the various applications and systems of thermal solar energy is presented. For the heating of buildings, solar energy systems require collection elements, storage elements, a heat distribution system, and an auxiliary heat source as a backup. Heating systems may utilize air as the heat transfer medium or may be hydronic systems utilizing water or antifreeze solutions; instrumentation systems for controlling heating systems are described. Absorption cooling systems such as lithium bromide or ammonia absorption cycles utilize the heat from solar collectors to cool buildings. Thermal solar energy may also be applied to the heating of domestic hot water; a typical solar hot water system is reproduced. Solar energy has been used to power pumps for the irrigation of crops and several test sites utilizing solar irrigation are described. Systems generating electricity from solar energy include power towers, heliostats, and thermal storage liquids liquids or solids; these systems are currently under investigation by several companies.

ST79 30154 $30 Solar Setup Heats a 30' x 40' Workshop for Five Hours or More Every Sunny Winter Day

Mother Earth News No. 48 p. 125-128 Nov.-Dec. 1977

A do-it-yourself project involving the construction of a solar collector is described. The low cost of the collector was achieved by using inexpensive plastic film, using the south wall of the workshop for the back of the collector, not building any heat storage into the design and by using available materials. The only upkeep of the system involves the power supply for the blower and replacing the plastic film every two years.

ST79 30155 Your Guide to Good Shelter: How to Plan, Build, or Convert for Energy Conservation

Prentice-Hall Co., Reston, VA
ISBN 0-87909-963-1 p. 251 1978 $12.95

The authors claim to have used an astonishing 46 percent less energy than other comparable homes in their area when building their own energy efficient home. Filled with proven inflation fighting energy saving tips and techniques, the book shows how to conserve energy and save money. Emphasizing conservation and practicality, this book guides the process of planning and building your own home or converting your present home in a step-by-step manner. A well-designed home should be structurally sound, functional, aesthetic, livable, and most importantly, affordable. It is felt this book will help achieve all these qualities and more. It shows how to plan a home that meets the family's needs; employs an energy efficient design, including solar energy; and incorporates security, health, and safety features. The book shows prospective home owners how to cope with inflation and overcome energy problems.

ST79 30156 Solar Heat Easily Measured

Abel, K.
Fachhochschule Luebeck, Germany, F.R.
Elektr. Energ. Tech. V 22 No. 5 p. 241-242 Oct. 1977 In German

The basic principle of measurement of the heat transported to the heat exchanger is explained. Also, the efficiency of a collector is discussed.

ST79 30157 Solar Energy for Homes: An Annotated Bibliography

Aitken, D.W.
Sunworld No. 3 p. 23-28 Feb. 1977

This bibliography includes 43 references on various aspects of solar energy for home use. An abstract is included with each reference.

ST79 30158 Experiments in Solar Space Heating and Cooling for Moderately Insolated Regions

Aranovitch, E.; Le Det, M.; Roumengous, C.
Sun: Mankind's Future Source of Energy, Proc. of Int. Solar Energy Congr.
Pergamon Press, Inc., p. 1378-1386 Elmsford, NY
A79-17464 V 3 Jan. 16-21, 1978 New Delhi, India

A solar laboratory has been constructed specifically for intercomparisons between different solar heating and cooling systems under European insolation conditions. Various techniques for increasing solar system performance are described, including high-efficiency collectors with selective surfaces, honeycomb structures, and V-corrugations, along with low operating temperatures, seasonal storage, or combined heating and cooling systems in order to assure year-round utilization of the system. A model based on monthly averages is used to extrapolate results to other climatic conditions or to perform parametric optimizations.

ST79 30159 Heat Pump

Baier, W.
Bild Wiss. V 15 No. 1 p. 66-76 Jan. 1978 In German

After a brief explanation of why there is only a small chance in the Federal Republic of Germany for space heating only by solar energy using solar cells or collectors, the importance of using heat pumps is pointed out by means of some examples. Among others, the Junkers "Tritherm House" is described, where solar collectors, heat pump, and supplementary heating system are being operated jointly, controlled by a computer. Apart from improvements of the collector efficiency gained by using heat pumps, air, soil, and ground water can be used as supplementary heat sources, so that thermal requirements of a house can be covered completely at 83 percent of all days during the heating period.

ST79 30160 Annual Collection and Storage of Solar Energy for the Heating of Buildings

Beard, J.T.; Iachetta, F.A.; Lilleleht, L.U.; Duvall, M.D.; Dirhan, L.A.Jr.; Dickey, J.W.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc., Elmsford, NY, ERDA-supp'd research p. 1060-1066
A79-17415 Jan. 16-21, 1978 New Delhi, India V 2

Results are presented of the first year's operation of a new system for year-round collection and storage of solar heated water for heating of buildings at the University of Virginia. The system is composed of an energy storage subsystem which stores hot water in an underground pool, and of a solar collector subsystem which acts not only to collect solar energy throughout the year but also to limit the evaporative and convective heat losses from the storage system. System temperatures and rates of energy gain and loss are presented for the system operated in an energy collection mode. Thermal performance results are presented illustrating the efficiency of the solar collector under summer conditions (without a reflector) and winter conditions (with assistance from a vertical reflector). Analog and digital models were used to determine the influence of various design modifications for improved collection and storage system performance.

ST79 30161 Ingenuity and Experiment are Needed to Advance Solar Cooling

Beckman, W.A.
Univ. of Wisconsin, Madison, WI
Sunworld No. 6 p. 2-6 Nov. 1977

The author examines various solar cooling systems and points out some of the operational problems that must be solved if solar cooling is to be used extensively. Absorption cooling systems, liquid desiccant systems, solid desiccant systems, and Rankine cycle powered cooling are discussed.

ST79 30162 Low-Cost Electronic Solar Energy Control

Blade, R.A.; Small, C.T.
Univ. of Colorado, Colorado Springs, CO
Am. J. Phys. V 46 No. 8 p. 863-864 Aug. 1978

A simple, inexpensive differential thermostat circuit, for use with a solar heating system, is described.

ST79 30163 Collector Types and Their Different Constructional Characteristics

Bossel, U.
Deutsche Forschungs und Versuchsanstalt fuer Luft und Raumfahrt E.V., Goettingen, Germany, F.R.
Sanit.-Heizungstech. No. 10 p. 628-631 1976 In German

Three components form the core of every solar heating plant: the collector which is the component collecting the heat, the store as a heat buffer and the heating system which is the heat emitting element. As an example, underfloor heating acts as the heating system system. The problem of storage is not solved, while collector development has just begun. In the interim phase, which will last for some years yet, one will be able to combine them, without storage, with low-temperature heaters to form functional plants.

ST79 30164 Inexpensive Solar Energy Utilization in Human Settlements

Bowen, A.
Int. Symp.-Workshop on Solar Energy Cairo, Egypt June 16-22, 1978
Symp. Lectures Univ. of Miami Coral Gables, FL
A79-16470 p. 499-551

Several solar energy applications for use in or near houses are surveyed, and some simple air and liquid solar collectors and storage systems are described. Equipment required for applications such as cooking, drying, dehydration, distillation, and desalination is discussed, and the use of solar energy to aid or accelerate bioconversion is examined. Other topics include the solar sterilization of medical instruments, a passive icemaker, and passive heating or cooling.

ST79 30165 Design Optimization for Solar Array of Multiple Collector Types

Bradley, J.O.; Posner, D.; Bingham, C.E.
Annual Conf. on Energy, 4th Rolla, MO
Proc., Univ. of Missouri, Rolla p. 25-37
A79-14677 Oct. 11-13, 1977

Methodology is presented for optimizing solar arrays used for heating fluids from ambient to elevated temperatures. The optimal array consists of the appropriate combination of available collector types which delivers the most energy per dollar invested in the array. An example of optimization is presented and verified using computer simulation of numerous combinations of collector types.

ST79 30166 Solar Energy Utilization for Water Heating and Space Heating

Birnbreier, H.
Brown, Boveri, und Cie A.G., Heidelberg, Germany, F.R., Zentrales Forschungslabor
Fi-Bau V 11 No. 3 p. 23-25 1976 In German

There are great differences in solar radiation at different latitudes in the course of a year, but in summer, even temperate regions may dispose of nearly the same amount of energy as the equator regions--only, of course, for a shorter period of time. Therefore, solar energy may be of advantage also in Germany for cooling and water heating during the warm season.

ST79 30167 Thermic Diode Solar Panels for Space Heating

Buckley, S.
MIT, Cambridge, MA
Solar Energy V 20 No. 6 p. 495-503 1978

Panel operation is discussed and thermic panels are compared to other solar heating systems: air heating, water heating, active and passive. Residential and commercial applications are also discussed. The performance of thermic panels are compared to conventional solar systems. Computer simulation of thermic panels in a residential space heating application resulted in predictions of the percentage of solar heat provided by the panels. The predictions are compared to similar analyses of conventional solar systems. It is shown that thermic panels are compared to similar analyses of conventional solar systems. It is shown that thermic panels improve the economics of flat-plate collectors by their modularity and simplicity.

ST79 30168 Solar Hot Water Demonstration Project

Burnett, E.S.
Aratex Services, Inc., Encino, CA
Solar Heating, Cooling Demo. Program Contractors' Rev., V 2, Papers
CONF-771229-P2 p. 23-28 Dec. 5, 1977 New Orleans, LA

A hot water preheating system for a laundry is described which includes a wastewater heat recovery subsystem and a 6500 ft^2 flat-plate solar collector with a 12,500-gallon fiberglass storage tank. The system is designed to preheat approximately 60,000 gallons a day of city water at a temperature from 70 and 80° F to between 125 and 135° F.

ST79 30169 Heat Pumps Could Inject Life Into Solar Energy

Butler, P.
Engineer; London, England V 245 No. 6329 p. 52, 54-55 July 14, 1977

Prospects for the use of solar energy in Great Britain are discussed. The only economically feasible solar system is considered to be a solar assisted heat pump. One of the factors included in an economic assessment of the solar system include the degree to which the house is insulated. Government incentives were suggested to increase solar consumerism. Detailed calculations showed that solar collectors on small British houses were currently uneconomical. The most promising market for solar collectors is outside the domestic market. The lack of standardization of solar collectors also is a hindrance to public acceptance of solar. Heat pumps with a coefficient of performance of 3:1 and giving a heat output of 3 kW for every kW of electricity are considered economically feasible. Wind powered heat pumps are considered. Estimates of future heat pump use are as high as 30 percent of the domestic heating market. The United States is considered technically more advanced than Britain for many types of solar applications. Technology of solar cells in the United States as opposed to Britain is also discussed.

ST79 30170 Some Experimental Investigations on Solar Space Heating in Korea

Cha, J.H.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc. Elmsford, NY
A79-17470 p. 1446-1451 Jan. 16-21, 1978

Experiments performed to examine the technical feasibility of liquid-type and air-type solar space heating systems in Korea are described. The liquid system resulted in a heating load capacity of up to 85 percent when the area between the solar collector unit and the heating space was the same. The air system was found to be very competitive with the liquid one in terms of performance and also favorable in terms of cost.

ST79 30171 Solar Wall Performance

Cash, J.
College of Tech., Dublin, Ireland
Int. J. of Energy Res. V 2 No. 3 p. 229-245 July-Sept. 1978

The basic solar wall consists of an opaque inner leaf and a transparent outer leaf. According to one-dimensional heat transfer theory the thermal behavior of the wall can be described using a wall thermal transmittance, a solar gain factor, and an environmental temperature. Tests on small units at Bolton Street, Dublin during the period April 3-13, 1976 support the theory. As well as test results, this paper includes radiation measurements made during the period.

ST79 30172 Proposals for the Production and Seasonal Storage of Hot Water to Heat a City

Cavalleri, G.; Foligno, G.
Univ. Di Milano, Milano, Italy
Solar Energy 19 No. 6 p. 677-683 1977

It is proposed to use an artificial lake, thermally insulated in the upper part only, to be filled during the spring, summer, and autumn with hot water at 98°C as a big storage of heat. Both the lake and the solar collectors should be placed in the mountains to exploit the low cost of the land and the higher solar radiation. To extract the maximum heat from the water, the aqueduct first feeds usual heaters, then in cascade, radiating panels, and finally, warm air conditioners equipped with a heat pump so that the discharged water is at 5°C. The design of the relevant moving tubular boiler is presented.

ST79 30173 Solar Heating

Chant, R.E.
Univ. of Manitoba, Winnipeg, Canada
Applications of Solar Energy: Solar Energy Seminar, Saskatoon, Saskatchewan, Canada
CONF-7603118 p. 48-64 March 26, 1976

The advantages, equipment, and potential of the utilization of solar energy for space heating in Canada are discussed. The design and performance of typical solar heating systems are illustrated, and some heat storage materials are compared.

ST79 30174 Evaluation of Matrix Solar Collector For Heating Air

Clary, B.L.; Morgan, R.G.
Oklahoma State Univ., Stillwater, OK
Solar Crop Drying Conf. Proc. Raleigh, NC
CONF-770686 p. 44-66 June 30, 1977

The results and validation of a simplified theoretical technique for predicting the performance of matrix absorbers for use in drying peanut pods are presented. Validation of the results were obtained from experimental tests conducted on laboratory models while drying farmers' stock peanut pods and by comparing the simplified analysis with results of rigorous analyses available in the literature. Several assumptions were made to reduce mathematical relationships governing flow and heat transfer characteristics of the matrix solar collector. It was assumed that axial and horizontal conduction through the nonmetallic porous bed could be neglected. The bed was assumed to be a gray nonscattering body and to have a constant absorption coefficient. The bed was considered to have a one-dimensional steady-state temperature distribution within an isotropic porous media. Only direct radiation effects were considered. However, diffuse radiation also contributes to solar radiation and can become significant in an overcast sky.

ST79 30175 Lennox Reaches Back to Move Forward

Consdorf, A.P.
Appliance Mfg. p. 48-54 Nov. 1977

In September of 1975, Lennox joined forces with Honeywell in the production and experimentation of solar collectors. While Lennox gains access to the technology from Honeywell's research and development of solar energy from the 1940's, it contributes knowledge in the auxiliary heating system needed to accompany the collectors. Lennox began production nine months after the merger. They hope to streamline production by plating and etching the absorbers. Lennox plans to sell both residential and commercial systems. A job-related training program is being offered for the dealers. The s[illegible]rmate system has collectors capable of reaching temperatures of 185° F to 215° F. The systems are capable of space heating hot water and cooling. Tests conducted at the NASA-Lewis center showed the Lennox/Honeywell collector design to be the most efficient.

ST79 30176 Enhancement of Intrinsic Solar Heating

Converse, A.O.; Kachadorian, J.
Sun: Mankind's Future Source of Energy: Proc. of Int. Solar Energy Congress
Pergamon Press, Elmsford, NY
A79-17494 p. 1677-1680 V 3 Jan. 16-21, 1978

The Green Mountain Homes "Solar Slab" building's thermal performance is summarized for the period October 1976 to May 1977. Descriptions of the building and monitoring and data processing procedures are also presented. The measured heat loss for this 117.5 mi^2

building was 1.52 W/m^2-C of living space including insolation, or 0.95 for purchased energy only. Thirty-seven percent of the heating energy came from the sun. The monthly average of the maximum daily temperature ranged from 22.1-23.3 C. The total cost of oil and electricity for heating was $249.

ST79 30177 Pumps in Solar Energy Systems

Cook, J.E.
Domestic Engng., Heat Vent. V 230 No. 4 p. 46-47 Oct. 1977

The question of where pumps should be included in the solar system is discussed. Only the thermosiphon solar system does not use pumps. Other types of solar systems employ centrifugal water circulation pumps. Pumps operate in the solar systems when the differential controller indicates that water or fluid in the outlet of the collector is hotter than the water or fluid in the storage tank. Most controllers turn off the pumps when the temperature differential decreases to 2 to 3° F. The pump in the solar system may operate only a few minutes or as many as 12 hours per day. Pumps in the solar system should not be mounted at the highest point because of the likelihood of air entering. Ideally, the pump should be located upstream from the solar collectors. The pumps should also be placed in a dry environment, protected from wind, rain, and moisture. In selecting pumps for a fresh water open system, only stainless steel and brass should be used. Greater pump efficiency and adaptability is achieved with variable speed pumps. The water circulation pump should be installed at least 3 feet below the top of the water in the storage tank to maintain the proper water pressure. For residential uses, pumps should be selected that do not consume an amount of electricity equal to more than one percent of the energy (BTUs) gained by the solar system.

ST79 30178 Economics of Solar Heating and Cooling Systems

Corcoran, W.L.
ERDA, Washington, D.C.
ASHRAE J. V 20 No. 4 p. 47-50 April 1978

Solar energy conversion technologies have been demonstrated but current use of the solar resource is hampered by a variety of economic and other barriers. The purpose of this paper is to outline the character of some of these barriers and indicate the progress made in reducing them.

ST79 30179 High-Efficiency Solar Collectors For Flat Roofs, Part 1

Dalhoff, W.; Dohse, G.; Knippertz, H.J.; Timmerberg, C.
Ikz Fachz. Sanit.-Heiz.-Klima V 32 No. 20 p. 120-124 Oct. 1977 In German

Of the overall energy consumption in the Federal Republic of Germany, about 40 percent is used for space heating and about 36 percent for hot water preparation and process heat. Here, solar radiation energy can contribute its share and thus, help to relieve petroleum as the main primary energy carrier. A survey of available solar radiation energy is followed by a description of the functional characteristics and solar collector design. In this context, the installation of solar collectors on flat roofs is very important as there are a lot of flat-roofed buildings. In solar techniques, flat roofs offer a number of advantages: east-west orientation, as is required for steep roofs, not necessary; architectural advantages, no awkward reflection; easy assembly; etc. Model measurements on solar simulation equipment are reported. The measurements supplied basic data for the optimum design of collector-reflector systems.

ST79 30180 High-Efficiency Solar Collectors for Flat Roofs, Part 2

Dalhoff, W.; Dohse, G.; Knippertz, H.J.; Timmerberg, C.
Ikz Fachz. Sanit.-Heiz.-Klima V 32 No. 21 p. 31-33,36

Of the overall energy consumption in the Federal Republic of Germany, about 40 percent percent is used for space heating and about 36 percent for hot water preparation and process heat. Here, solar radiation energy can contribute its share and thus, help to relieve petroleum as the main primary energy carrier. A survey of available solar radiation energy is followed by a description of the functional characteristics and solar collector design. In this context, the installation of solar collectors on flat roofs is very important as there are a lot of flat-roofed buildings. In solar techniques, flat roofs offer a number of advantages: east-west orientation, as is required for steep roofs, is not necessary; architectural advantages; no awkward reflection; easy assembly; etc. Model measurements on solar simulation equipment are reported. The measurements supplied basic data for the optimum design of collector-reflector systems.

ST79 30181 High-Efficiency Solar Collectors for Flat Roofs, Part 3

Dalhoff, W.; Dohse, G.; Knippertz, H.J.; Timmerberg, C.
Ikz Fachz. Sanit.-Heiz.-Klina V 32 No. 22 p. 44,46 Nov. 1977 In German

Of the overall energy consumption in the Federal Republic of Germany, about 40 percent is used for space heating and about 36 percent for hot water preparation and process heat. Here, solar radiation energy can contribute its share and thus, help to relieve petroleum as the main primary energy carrier. A survey of available solar radiation energy is followed by a description of the functional characteristics and solar collector design. In this context, the installation of solar collectors on flat roofs is very important as there are a lot of flat-roofed buildings. In solar techniques, flat roofs offer a number of advantages: east-west orientation, as is required for steep roofs, is not necessary; architectural advantages; no awkward reflection; easy assembly, etc. Model measurements on solar simulation equipment are reported. The measurements supplied basic data for the optimum design of collector-reflector systems.

ST79 30182 Solar Connection

Deal, D.W.
Alternative Sources Energy No. 20 p. 13-17 March 1976

Domestic solar applications are examined for the home. This includes a reservoir, solar oven, parabolic collector, solar umbrella, and a flat-plate collector. The reservoir was constructed and found to have a heat loss of 3:1 as compared to an insulated one. Verification of the thermosiphon principle indicated that the water particle made one complete cycle each 14 minutes. A solar oven was constructed with a reflector and bimetallic thermometer to check the temperature. On a typical day, the oven produces air temperatures of 175° F in an hour and heated water to 113° F in an hour. The solar umbrella attained temperatures of 25°C to 56°C. The flat-plate collector had the best capacities for heating water in an hour. It was 16 percent more efficient than the parabolic collector. A list of references for general solar energy information is included.

ST79 30183 Solar Energy For Health Care

Downey, G.W.
Modern Healthcare p. 18-26 Oct. 1975

The potential advantages of using solar energy for domestic ,c water and space conditioning in health care facilities are discussed at some length.

ST79 30184 Design of Active Solar Heating Systems

Duffie, J.A.; Beckman, W.A.
Inst. of Gas Tech., Symp. on Energy From the Sun Chicago, IL
A79-15860 Paper, 33 p. April 3-7, 1978

Active solar heating systems to supplement good structural design and passive techniques are discussed. Topics include descriptions of some solar heating systems, simulation methods for designing these systems, design of standard configuration systems by use of "short-cut" design methods, and economic criteria and methods for evaluating solar energy systems. Weather data and collector performance parameters are considered, and the use of F-charts is explained.

ST79 30185 Air Heating Collectors, Simplified

Elwood, L.A.
Alternative Energy Sources No. 32 p. 21-23 June 1978

Simple solar air heaters suitable for do-it-yourself construction are reviewed. Innovative solar absorber materials are discussed and some reference papers are mentioned.

ST79 30186 Theoretical Basis and Design for a Residential Size Solar Powered Ammonia-Water Absorption Air Conditioning System

Farber, E.A.; Morrison, C.A.; Ingley, H.A.; Shearer, D.N.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc., Elmsford, NY
A79-17479 p. 1535-1540 Jan. 16-21,1978 V 3 New Delhi, India

No abstract available.

ST79 30187 <u>Effect of Solar Buildings on Peak Load</u>

Feldman, S.L.; Wirtshafter, R.; Wessler, E.
Russel Sage Foundation, New York, NY
Electr. World V 189 No. 6 p. 150-152 March 15, 1978

The sensitivity of utility load curves to solar design, according to these authors, is fairly high. Because of the variations in ambient weather conditions, no general statement can be made regarding the impact of solar heating and cooling on electric utility load curves. Weather, the utilities' generation mix and load curves, and solar building designs determine solar impact on demand levels.

ST79 30188 <u>Effect of Off-South Orientation on the Performance of Flat-Plate Solar Collectors</u>

Felske, J.D.
MIT, Cambridge, MA
Solar Energy V 20 No. 1 p. 29-36 1978

This study investigates the collector performance and optimum tilt as functions of the off-south angle, collection temperature, number of glass covers, and the relative amounts of direct and diffuse radiation. It was found that the yearly energy collection for for a given collector tilt is insensitive to the off-south angle and that, in some cases, it actually improves with increasing azimuthal angle. It was also found that for a given azimuthal angle, an optimum collector tilt exists which is between 3 and 10^{o} less than the latitude. Calculations were based on New York City weather.

ST79 30189 <u>Solar Contracting Requisites for Roofing</u>

Field, R.
ERDA Office of Internal Review, Washington, D.C.
RIBA J. V 54 No. 5 p. 10-14 May 1977

In order to sell solar systems, it is necessary to be able to calculate storage area, design crigeria, and the payback period. Prior to the installation of the solar system, insulation, and other energy conservation measures should be taken. The collector should face southwest or south and be unshaded. A well-insulated tank is necessary for a water system. The advantages of air and liquid systems for various uses are described. Installation is described with an emphasis on good flashing and sealing practices for the various pipework connections. Maintenance of the collectors varies according to the area. When the roofer decider to reroof a house with solar collectors, he should take the following precautions: (1) remove the collectors during the job to reduce breakage; and (2)tape any open pipes to keep debris from entering the solar systems. Resterilization of the water system is required as well as roofing and sealing around the pipes.

ST79 30190 <u>Controls for Heat Reclaim With Thermal Storage Coupled With Solar Heating</u>

Filson, F.E.Jr.
Am. Soc. of Heating, Refrig., and Air Cond. Engnrs. Annual Mtg, Albuquerque, NM
ASHRAE Trans. V 84 Pt. 2 p. 381-386 June 25-29, 1978 A79-16420

The paper describes a field-erectable heat pump system of chilled water type with an automatic temperature control system which uses three-way bypass or diverting valves, heat sensors, limit controls, and thermostats. By the installation of a solar system, convertor, circulating pump, and a closed-loop system, it is possible to add additional tank temperatures to the system. Diagrams illustrating different system configurations are presented.

ST79 30191 <u>Solar Energy in the United Kingdom</u>

Flack, D.
Bldg. Serv. Engng. V 44 No. 5 p. A16-A18 Aug. 1976

It is argued that with current technology solar heating of homes in the United Kingdom has no future unless there can be developed a cheap, reasonably efficient collector system costing between 1/5 and 1/10 of current systems, plus a cheap storage system with minimum storage capacity of about one week. Economic arguments are presented demonstrating that cheap collector systems are necessary to compete with fossil fuels, and without the storage systems, solar systems will be absolute nonstarters in the days of nuclear/electrical energy. Alternative applications are considered for solar energy such as swimming pool heating and refrigeration.

ST79 30192 Will a Solar Home Save You Money?

Frutkin, R.
Science Digest, Chicago, IL V 82 No. 5 p. 70-71 Nov. 1977

The author believes that a solar system will not save money and the three main reasons are insulation, initial costs, and annual savings. The author points out that by spending two to three percent of the construction costs for insulation, the homeowner can save up to 50 percent of the home heating bills. A solar system costing from $7000 to $10,000 will only save an additional 20 percent of the energy bill. A solar system for domestic hot water is considered expensive, even by ordinary standards. The rate structure of the fuel companies allows for large fuel consumption at fairly cheap rates. The author feels that until energy is no longer priced as a commodity, solar energy systems will not be economically feasible.

ST79 30193 Solar Heating of Buildings

Ghaswala, S.K.
Ind. Bldg. V 2 p. 33-38 Dec. 1954

No abstract available.

ST79 30194 Metal Hydride Solar Heat Pump and Power System/HYCSOS

Gorman, R.; Moritz, P.S.
AIAA and Arizona Solar Energy Res. Commission, Conf. on Solar Energy Tech. Status
Avail:AIAA, A79-13863 Phoenix, AZ Nov. 27-29, 1978 7 p.

The report presents the design, performance, and cost of a solar powered metal hydride heat pump and power system for use on a residence. The system design, which is limited by heat transfer, is optimized via an iterative computer program. The design process starts with optimizing the thermal transport properties of the hydride bed heat exchanger, then traces temperatures and pressures through the operating cycles. The coefficient of performance (COP) of the overall system is then determined from the thermal losses due to cycling the hydride beds and due to the auxiliary power consumed by freon pumps and air moving fans. The system, using high-temperature solar collector input at 210 to 280° F, provides heating with a COP of approximately 1.0 and cooling with a COP of approximately 0.6, and electrical power during spring and fall, all for a cost comparable to a solar absorption cooler.

ST79 30195 Solar Collector Storage Panel

Graham, L.; Stice, J.
Am. Soc. of Mech. Engnrs., Winter Annual Mtg., San Francisco, CA
Avail:AIAA, A79-19844 Dec. 10-15, 1978 9 p.

The solar collector storage panel is described. This rotating passive heating system combines thermal storage and insulation in a panel which resembles a large flat shutter or Venetian blind. Materials that melt at temperatures slightly above room temperature are used for thermal energy storage. The panels are placed directly behind a window and within a room to be heated, and the procedures for controlling heat loss and room temperature by rotating, opening, and closing the panels are described. Test results for prototype panels and preliminary results of computer simulation are considered.

ST79 30196 You Can Build NASA's Low-Cost Solar Heating System

Gross, G.
Popular Science V 212 No. 2 p.106-108 Feb. 1978

Information is presented concerning the general specifications, materials, and cost for a solar space heating system designed by NASA for use in homes as a supplement to existing heating systems.

ST79 30197 Optimum Insulation With Internal and Solar Heat Gains

Hagen, D.L.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc., Elmsford, NY; Res. supp'd by Univ. of Minnesota
Avail:AIAA, A79-17490 Jan. 16-21, 1978 New Delhi, India p. 1657-1661

A generalized degree day method is developed which includes internal and solar heat gains by means of a variable balance temperature. This requires only the expected solar energy and the means and standard deviations of the temperatures through the year. Equations for the optimal insulation are formulated which fully incorporate solar collectors by the F-chart method. Simpler equations which retain the gross effects are also developed. Economic optimums are similar to conventional calculations, but two to three times greater than typical installations. Auxiliary energy use, however, may be half or less than that expected from conventional calculations. Energetic optimums are more than double current economic optimums. Equations for optimal collector area are appendixed.

ST79 30198 Solar Thermal Systems in the Milking Parlor

Hayden, M.B.; Thompson, P.D.
Genet and Manage Lab., Beltsville, MD
ASAE Winter Mtg., Chicago, IL Dec. 13, 1977
ASAE Tech. Paper no. 77-3539 p. 1-20

A full-scale solar heating system is now in operation at the USDA's milking parlor in Beltsville, Maryland. Proper application of current technology using easily available components and materials has been shown to significantly reduce energy demands upon conventional energy sources in the milking parlor, which is characterized by large and uniform energy expenditures. Roof-mounted solar collector panels convert sunlight to thermal energy. Stored as temperature increase of water in an outside tank, this energy is utilized to preheat well water supplied to supplemental electric water heating, and to aid in space heating in the milking pit area via floor or baseboard plate heaters and/or fan coil units. Additional energy is received from water warmed by the refrigeration condensers for the bulk milk tank cooling system. An extensive core of data has been accumulated on both system performance and on material durability.

ST79 30199 A Solar Energy System With a Dual-Source Heat Pump and Long-Term Storage

Hewitt, E.; Raman, K.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress V 1
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17312 Jan. 16-21, 1978 New Delhi, India p. 463-470b

The performance and economics of a solar energy system with a dual-source heat pump and long-term storage are discussed. Results are presented for the collector and storage sizing, and the variation of the life cycle costs as a function of the various system parameters. The special role of the collector performance and the price of electricity in determining the optimum range of collector and storage sizing are pointed out. The advantages of the type of solar-assisted system considered here are summarized.

ST79 30200 Heattube, A Universal Electrical Solar Heat Equipment For Building, Community, And Agricultural Purposes

Hoorn-Frens, D.
Sun: Mankind's Future Source of Energy, Proc. of the Int. Solar Energy Congr., V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17473 p. 1456-1469 Jan. 16-21, 1978 New Delhi, India

The design and principle of operation of a solar heat tube system for space heating are described. The tube is plastic, contains an electrical resistance element, and has a black semiconductor coating; the tube is a black body which absorbs solar radiant energy leading to an increase in the temperature of the water circulating through the tube.

ST79 30201 NMSU: Casa Del Sol of the Future

Horak, H.L.
New Mexico State Univ., Las Cruces, NM
23rd IES Annual Tech. Mtg. and Expo.: Environ. Tech. '77 Los Angeles, CA
CONF-770415 p. 151-156 April 24, 1977

A solar heated and cooled experimental residence has been built on the campus of New Mexico State University. The house is of energy conserving design, of southwestern architectural style, and has an integrated solar system. A computer model has been developed for the thermal performance of the house and solar system. It is composed of two basic parts, a house load and a mechanical system heat balance section. The load section determines the heat conduction through the walls and roof using a one-dimensional transient finite different technique. The interior heat, infiltration, and filter loads are calculated from empirical relations. The load imposed by incident sunlight on any of the outside surfaces of the house is determined by a separate subprogram. The mechanical system model solves heat balance equations for each component of the solar system simultaneously. This is accomplished for each time increment and uses a Runge-Kutta integration technique. A comparison has been made of the operational predictions of the analytical model with the actual design that was developed and built. The existing system was designed based on typical engineering. The model study indicates that the existing system was sized well at very nearly the optimum for this climatological region.

ST79 30202 Performance Comparison Between Flat-Plate and Moderately Concentrating Solar Energy Collectors

Howell, J.R.; Bannerot, R.B.; Elliott, D.G.; Reber, J.
Univ. of Houston, Houston, TX
J. Energy V 1 No. 6 p. 329-339 Nov.-Dec. 1977

The object of this work has been to evaluate the potential of trapezoidal grooves as thermal energy collectors. In particular , can they outperform a "comparable" flat-plate collector. It is apparent that an advantage can be established for the grooved collector if both the following criteria are met: (1)a large fraction of the insolation entering the groove's aperture must strike the thermal energy collectors at the base of the groove; and (2)a significant reduction in thermal energy loss from the receiver must be realized. The work discussed represents the first step in analyzing the groove's success in meeting the second criterion.

ST79 30203 Solar Heat Pump Systems: An Analysis

Hurley, J.P.
Solar Heat. Cool. V 3 No. 3 p. 21-25 June 1978

A brief review of the heat pump system is given. The use of a solar-assisted heat pump and the use of a heat pump assisted solar heating system are discussed. Both systems employ the use of a swimming pool.

ST79 30204 Solar Economics Comes Home

Hyman, M.Jr.
Solar Heat Corp., Arlington, MA
Tech. Review V 80 No. 4 p. 29-35 Feb. 1978

The sun can supply most of the heat needed by a home through the long New England winter, but costs are high. The author includes a diagram of the solar heating system that was used.

ST79 30205 Conditions For Solar Heating Systems in Sweden

Isfaelt, E.
KTH, Stockholm, Sweden
Tek. Medd. V 3 No. 1 p. 102-111 1975 In Swedish

The solar energy at ground level in Sweden is estimated to 1000 kWh/m^2, year. For heating of buildings by solar energy, solar collectors with direct heating of water has been found most suitable. Tables are given showing the solar energy absorbed by a plane solar collector in different points of the compass and against a horizontal plane in Stockholm. The requirement of heat for an ordinary house has been compared to the available solar energy. For the whole year it was found that the energy is sufficient but for middle and north Sweden, stored heat has to be used approximately from October to March.

ST79 30206 Result of Cooling Operation of Yazaki Experimental Solar House "One"

Ishibashi, T.
Yazaki Buhin Co., Umeda, Japan
Solar Energy V 21 No. 1 p. 11-16 1978

The author stresses that one of the important factors for designing solar houses is to examine the most economic combination which is called optimum design between solar collector area and storage volume for the required energy demand. The result of experimentation described gives the fundamental data for completing the computer simulation program that is effectively usable for designing a solar house.

ST79 30207 Refrigerated Solar Heating

Jones, R.; Ottaviano, V.B.
Domestic Engng., Heat Vent. V 230 No. 4 p. 48-51 Oct. 1977

The use of solar collectors is discussed in conjunction with a water-cooled heat pump. The cost of the installed system is around $1600. Fewer square feet of collector space are needed since the ambient temperature is utilized. Lower collector temperatures remove the need for glazing resulting in reduced reradiation losses. Systems were installed in Dallas and Denver. In Denver, the solar system had a booster coil added, bringing the total cost of the system up to $2200. This system was usable for commercial purposes where the water is heated to a temperature of 120° F or less. Expected performance charts are included for the Dallas and Denver locations. The total solar contributions for the two locales are also indicated in a chart.

ST79 30208 Space Heating With Solar All-Air Systems; CSU Solar House II

Karaki, S.; Loef, G.O.G.; Armstrong, P.R.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc. Elmsford, NY Res supp'd by US DOE and Sheet Metal, Air Cond. Industry
Avail:AIAA, A79-17467 p. 1398-1402 Jan. 16-21, 1978 New Delhi, India

Solar House II at Colorado State University is provided with a system comprising a 68.4 m^2 double-glazed, nonselective solar air heater; a 16.5-metric-ton pebble-bed heat storage bin; a solar hot water heat transfer coil; auxiliary natural gas heaters for space heating and hot water; an air distribution system; an evaporative cooler; an automatic control system; and fully instrumented data recording equipment. During the partial 1975-1976 heating season, the system provided 35,500 MJ of heat from the solar system, which was 71 percent of the total load for the period recorded. During the heating season from November 3, 1976 through May 16, 1977, the system provided 50,600 MJ of heat, which was 73 percent of the total load.

ST79 30209 A Thermic Controller for a Thermic Diode Solar Panel

Khandani, S.M.H.; Buckley, S.B.
ASME, Winter Annual Mtg. San Francisco, CA
Avail:AIAA, A79-19841 6 p. Dec. 10-15, 1978

The purpose of the study was to design a thermic controller using stored heat to warm the interior of the buildings. The controller operates to maintain the interior temperature of the building at an arbitrary set point. The controller design was theoretically investigated and modeled; a computer simulation verified the theoretical model. An experimental model was built which simulated the actual building heating situation. The experimental model verified the assumption of the theoretical analysis. The accuracy of the controller allowed the simulated building's temperature to be held within ± 3° F of the desired set point.

ST79 30210 Goosebrook: Solar is Ready When You Are

Kassler, H.; Daprato, R.
Total Environ. Action
Solar Age V 2 No. 12 p. 20-27 Dec. 1977

The public's attitudes toward solar energy and conservation can be witnessed in the popularity and success of the solar heating development operations in Goosebrook, New Hampshire, and Helmet, California. In Goosebrook, a house that was designed to combine solar power, energy conservation, and use of as few nonrenewable resources as possible, received federal funding and was sold in just four day. In Helmet, homes designed to utilize solar space and water heating were readily accepted by an interested public and eager home buyers. The design, financing, and construction of the Goosebrook house and the engineering, installation, and financing problems of Helmet are detailed.

ST79 30211 Tinkering With Sunshine

Kidder, T.
Atl. Mon. p. 70-83 Oct. 1977

Some of the outstanding people in the field of solar energy and general energy conservation are discussed. Examples of people upgrading the current solar technology are given. A survey of people manufacturing and inventing new equipment for solar systems, photovoltaic, technology, and costs are also mentioned. Wind energy and wind equipment, as well as the people interested in this field are also discussed.

ST79 30212 Solar Heating Performance of the Toshiba Solar House No. 1

Koizumi, H.; Kawada, Y.; Murasaki, H.; Itoh, T.; Matsui, K.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17465 p. 1387-1392 Jan. 15-21, 1978 New Delhi, India

Toshiba Solar House No. 1 is a two-story prefabricated residence, which was completed in October 1975 in Kawasaki, with a solar air heating system including a 48 m^2 air heating collector roof, a 17-ton rock bed thermal storage, and a forced air distribution system, in addition to a solar water heating system for hot water supply. In order to ascertain the feasibility of using the present solar heating systems, practical living tests were performed during the heating season of 1975-1976, with a successful high heating performance.

ST79 30213 Construction and Profitableness of Solar Auxiliary Devices in Existing Heating Systems, Part 1

Krinninger, H.
Fachhochschule Muenchen, Germany, F.R., Fachbereich Versorgungstechnik
Sanit.-Heizungstech. V 42 No. 10 p. 805-809 Oct. 1977 In German

The possible use of solar energy for industrial water preparation and room heating with resulting fuel savings of up to 50 percent has already been successfully tested in a series of new systems. The inclusion of solar auxiliary devices in existing heating systems is a different matter. How present heating systems can be equipped with solar auxiliary devices and how economical such devices are is investigated.

ST79 30214 Construction and Profitableness of Solar Auxiliary Devices in Existing Heating Systems, Part 2

Krinninger, H.
Fachhochschule Muenchen, Fachbereich Versorgungstechnik, Germany, F.R.
Sanit.-Heizungstech. V 42 No. 11 p. 905-910 Nov. 1977 In German

The possible use of solar energy for industrial water preparation and room heating saving fuel up to 50 percent has been successfully tested in a series of new systems. The inclusion of solar auxiliary devices in existing heating systems is a different matter. How present heating systems may be equipped with solar auxiliary devices and how economical this auxiliary equipment is is investigated. Part 1 dealt with fundamentals for calculation; Part 2 deals with systems tested.

ST79 30215 System Circuits for Solar Devices

Krinninger, H.
Tech. Bau. V 8 No. 6 p. 577-588 1977 In German

Examples are discussed in the article as to how one can connect a solar system to an existing heating system which serves as house and warm water heating. The supply of swimming pools is also discussed. Finally, the question of additionally using a heat pump is discussed.

ST79 30216 Solar Energy For Office and Plant Starts to Heat Up

Kuzela, L.
Ind. Weekly V 195 No. 1 p. 61-65 Oct. 10, 1977

The solar energy equipment industry is plagued by a lack of central information sources and industrial development standards. Such data as building lifetimes and local sun availability are needed, since solar systems must be tailored to specific locations. ERDA has been funding demonstration projects with a budget of $13.6 million, but the cost factor remains a significant obstacle to solar equipment development. Three reasons solar systems are so costly are the large amounts of insulation required, large quantities of the correct solar panels needed, and great amounts of insulation required. Despite the problems, new technologies are being developed and California is setting up a solar energy hardware information distribution program.

ST79 30217 Considerations of Solar Tracking

Landskov, H.
Delavan Electronics, Phoenix, AZ
Solar Engng. V 2 No. 7 p. 24-27 July 1977

Considerations in the design of solar tracking systems are discussed. Pointing accuracy, sensor angle and frequency response, mechanical backlash, mechanical inertia, and motor selection are treated. A sensor device employing two phototransistors in a bridge circuit is described. Calculation methods for determining design parameters are explained. A design example is worked out.

ST79 30218 Focused Solar Collector Analysis With Axially Varying Input Due to Shadowing From Adjacent Collectors

Lee, D.O.; Schimmel, W.P.Jr.
Sandia Laboratories
AIChE Symp. Ser. V 73 No. 164 p. 181-185 1977

The effect of individual collectors shadowing one another on the performance of a solar collector matrix was studied. Hourly and seasonal variations of the solar input are considered. In the analysis, the shadows of the ITH collector by its three nearest collectors to the east, southeast, and south in the period before solar noon is reviewed. The coordinate system for the ITH collector refers to a system that is fixed to the earth's surface. A modified axial temperature differential analysis was used to obtain the energy extraction rate and the collector fluid temperature rise for a typical flat-plate collector (9' x 12'). The collector field is assumed to be located in Albuquerque, New Mexico. It was generally found that the output decreases with increasing tilt angle. Shadowing for a 9' x 12' spacing is greatest at 45° tilt. The maximum output occurs at noon June 21 using that particular data. Moderate degradation occurs at the collector tilt of 35° and almost none at all for 25°, except at noon. Results show that shadowing plays an important role in the spacing and sizing of collector fields.

ST79 30219 Sensor Locations in Solar Systems

Lewis, R.Jr.; Carr, J.B.
Solar Heat. Cool. P. 21-23 Dec. 1977

Guidelines for location and use of thermal sensors in solar heating and hot water systems are discussed. Differential, upper temperature limit, and freeze protection sensing are explained. A detailed discussion of sensor location in solar water heaters and solar collectors is presented. Modes of operation of temperature controls are described for solar systems.

ST79 30220 Sun House With Multipurpose Collectors

Loebbecke, W.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 3 No. 2 p. 21 1978 In German

A report is given on the application of solar energy to building heating and warm water heating. The erected house is designed so as to greatly reduce the energy consumption, so that the solar system and heat pump are a sufficient supply. The investment costs were 4000 DM more than that of a common oil-firing system.

ST79 30221 Hybrid Air-to-Water Solar Collector Design

Loth, J.L.; Palmer, G.M.
Intersoc. Energy Conversion Engng. Conf., 13th San Diego, CA
Soc. of Automotive Engnrs., Inc. Warrendale, PA
Avail:AIAA, A79-10174 pl 1608-1613 Proc., V 2 Aug. 20-25, 1978

A large, inexpensive, lightweight grooved Foamglas solar collector assembly has been designed and installed at WVU. Six different collector construction techniques are applied. The six types are connected in parallel to allow independent thermal performance testing. An automated data logger collects performance data from all six types of collectors simultaneously and at preselected intervals. All collectors discharge the hot air to a single header. The air is then ducted through a blower, several electric heater elements, and then through three A-coils. Water is pumped through these air conditioning evaporator A-coils to obtain domestic hot water heating. The test objectives are to determine the most cost-effective area ratio between the solar collectors and that of the A-coils, and the total hybrid system thermal performance.

ST79 30222 Prediction of Average Collector Efficiency From Climatic Data

Lunde, P.J.
Center for the Environ. and Man, Inc., Hartford, CT
Solar Energy V 19 No. 6 p. 685-689 1977

Mathematical techniques are used to show how specially developed average climatic information can be used to predict in a single step the average solar collector efficiency at a particular location over a day or longer if the basic collector parameters available from a collector performance curve.

ST79 30223 Seasonal Solar Collector Performance With Maximum Storage

Lunde, P.J.
Center for the Environ. and Man, Inc., Hartford, CT
ASHRAE J. V 19 No. 11 p. 55-59 Nov. 1977

An integrated form of the basic solar collector heat balance equations is derived which permits use of average temperature and insolation data to determine seasonal performance when the average solar temperature is known. Typical collector performance is presented graphically for the case of finite storage and constant storage temperature for a variety of collector operating conditions. Use of the integrated collector equation makes possible a calculation of monthly and annual solar collector performance.

ST79 30224 Performance Analysis and Cost Optimization of a Solar Assisted Heat Pump System

MacArthur, J.W.; Palm, W.J.; Lessmann, R.C.
Honeywell, Inc., Energy Resource Center, Minneapolis, MN
Solar Energy V 21 No. 1 p. 1-9 1978

A solar assisted heat pump system with a conventional backup unit was simulated for a 93 m^2 house in Rhode Island using quasi-dynamic computer models. The performance of the system as a function of collector area and thermal storage volume was evaluated to determine the fraction of the space heating and domestic hot water load that was supplied by the solar assisted system. This information was used to compute the payback time, based on cumulative costs, for each variation of the system's parameters when compared to a conventional system. The optimal combination of system components which had a payback time less than the mortgage life was determined.

ST79 30225 Home Heating Conservation Alternatives and the Solar Collector Industry

Magnas, H.; Stoll, R.; Walton, H.
Mon. Energy Review p. 2-0 March 1976

This article discusses analyses of 20-year costs for retrofitting single-family residences with increased amounts of insulation and solar energy systems. The results of this study indicate that the heating load of the "average" single-family dwelling with 2½ inches of ceiling insulation can be reduced up to approximately 35 percent by adding enough ceiling insulation to equal 10 to 12 inches and installing storm windows and doors. This is for a home in an area with solar radiation characteristics similar to those of Washington, D.C. Twenty-year life cycle cost analyses show that water and space heating via solar collector systems compete favorably with conventional electrical heating systems, but not with conventional gas or oil heating systems, except in regions of the country where there are extremely high fossil fuel prices. If solar collectors were mass produced, the competitive advantage might increase because of cost reductions. The level of manufacturing activity in the solar collector industry, based on FEA surveys, is also discussed in this report. There are indications of a 400 percent increase in the production of medium-temperature flat-plate solar collectors during 1975. Continued rapid expansion will have to occur before solar collectors will have an appreciable impact on the country's total consumption of fossil fuels.

ST79 30226 Cooling Applications of Thermic Diode Panels

Manzano, J.J.; Buckley, S.B.
Am. Soc. of Mech. Engnrs., Winter Annual Mtg. San Francisco, CA
Avail:AIAA, A79-19842 10 p. Dec. 10-15, 1978 Res. Supp'd by US DOE

A theoretical study of the feasibility of using thermic diode panels to cool large buildings shows promising results. Semi-empirical correlations and heat transfer equations are combined to produce a mathematical model which is implemented into a computer program. Weather data, geometry, and physical parameters are used as inputs to the model in order to simulate the system's performance. The data generated by the computer is correlated in terms on nondimensional parameters which simplify the design task. Good performance was obtained for shopping centers in the American southwest, where cooling is needed during much of the year.

ST79 30227 Solar Energy For Residential Housing

Martin, J.H.
Inst. of Gas Tech., Chicago, IL
Energy From the Sun Symp. IGT Chicago, IL
Avail:AIAA, A79-15857 Paper, 22 p. April 3-7, 1978

An attempt is made to evaluate the feasibility of using energy conservation and solar energy harvesting to produce thermal comfort in residential housing. Attention is given to questions of economic feasibility, the quality of life feasibility, aspects of institutional feasibility, guidelines concerning the use of appropriate building surfaces, energy valves and storage, and a sample solution. The evaluation shows that carefully conceived energy conservation and harvesting of solar energy for residential buildings is very attractive economically, aesthetically, and institutionally. It is found that energy conservation will provide a cost recovery of at least 28 percent/year now and probably greater than 65 percent/year five years from now. Energy conservation and solar harvest together will provide a cost recovery of at least 12 percent a year now and probably greater than 25 percent five years from now. The considered measures can reduce energy purchases for housing by 85 percent.

ST79 30228 Performance Evaluation of the New Mexico State University Solar House

Matzkanin, R.L.; Mancini, T.R.
ASME, Winter Annual Mtg. San Francisco, CA
Avail:AIAA, A79-19840 9 p. Dec. 10-15, 1978 Res supp'd by Energy Res. Board of NM

The design features, operating principles, and performance of the liquid-type solar heating and cooling system in the New Mexico State University Solar House are described. The performance is evaluated for part of the 1977-1978 heating season. The system components include exchangers and pumps and controls; the control system includes manual overrides in all modes of operation. Operation of the heating system is initiated by the demand signal from a conventional thermostat set by the occupants of the house. Data on solar radiation and ambient temperature are presented. The heating loads, collector array performance, and the energy delivered to storage are plotted. Also discussed are the operational costs of pumps and fans, along with system operation at low storage temperatures.

ST79 30229 Energy Efficiency Will Feature Transplanted Town: TVA Moves Flood-Prone Southwest Virginia Community to a New Site

McDonald, D.C.
Tennessee Valley Authority, Knoxville, TN
Public Power V 36 No. 4 p. 58,60 1978

The Tennessee Valley Authority (TVA) has relocated residents of flood-plagued Clinchport, Virginia in the newly created town of Thomas Village. TVA purchased all flood-damaged buildings in Clinchport and provided $2 million for the relocation project. With no help from other federal agencies, TVA was assisted by the Lenowisco Planning District Commission in finding suitable land five miles from Clinchport. Thomas Village was carefully planned as a demonstration of energy conservation, with all houses meeting high-efficiency standards that take advantage of solar heat and windbreaks.

ST79 30230 A Solar Energy System For Space Heating and Space Cooling

McNamara, T.J.
Annual 4th Conf. on Energy Rolla, MO Oct. 11-13, 1977
Avail:Univ. of Missouri-Rolla, A79-14686 p. 187-196

The paper discusses a retrofit space heating and cooling solar energy system planned for the Museum of Science and Industry in Chicago, Illinois. The installation, designed to provide 50 percent of the museum's energy requirements, is regulated by two separate free-standing control panels. The heating of air is effected by hot water heating coils; cooling is effected by circulating chilled water from the absorption unit to cooling coils. The structural support can withstand 100 mph wind speeds and 13 lbs ft^2 snow load. The collector array has 442 collector units arranged in 13 rows. The installation is designed for a 45^{o} plane with the horizontal which yields the most efficient energy collection throughout the year.

ST79 30231 How One Engineer Uses Solar Energy in Different Ways

Meckler, G.
Sershon Meckler Assoc., Washington, D.C.
Spec. Engng. V 38 No. 3 p. 92-97 Sept. 1977

Developed as a method of reducing summer solar heat gains, the thermal louver has been used to reduce annual energy use in large, glass-curtainwall office buildings. Solar heat gain in these buildings is typically 40 percent of the total air conditioning load. The goal of the louver's original design concept was removal of up to 85 percent of the solar gains, thus significantly reducing summer air conditioning costs. Also inherent in its design is the ability to take winter solar gains and distribute this heat to cooler parts of the building, so that it is able to reduce summer gains and supplement winter heating. The louvers mount inside the building, adjacent to perimeter glass areas. The blades are made from extruded aluminum and have a hollow center core through which water is circulated. The blades are connected to concealed manifolds that in turn are connected to the water transfer system. Also described is a chemical dehumidification system which is unique in that it makes use of solar energy at temperatures much lower than that required for absorption refrigeration. It therefore can use solar augmentation for a higher percentage of the cooling season.

ST79 30232 Solar Energy and Large Building HVAC Systems: Are They Compatible?

Meckler, M.
ASHRAE J. V 19 No. 11 p. 43-50 1977

This article is an evaluation of solar heating and cooling for large buildings. Important factors in the analysis are construction materials, massing, orientation, fenestration, functional use, and the occupancy cycle. Large buildings designed with energy conservation features become more attractive for solar heating and cooling systems. Storage and weight requirements must be checked to ensure a maximum thermal capacity within a minimum volume for the HVAC requirements during peak periods. The value of the fuel being used in the building should relate to the work demanded from the energy. For higher temperature requirements, concentrating collectors can be utilized. Studies show solar powered heat pumps are technically more desirable than direct heat exchangers for heating applications. The Rankine cycle is explained and suggested as a means of utilizing the wasted heat from the condenser, therefore increasing the efficiency of the cycle. It is also operated as a selective power system for use and storage of excess electricity. Further energy savings are attained from the proposed SPHRACS system. The SPHRACS was designed to make the solar powered Rankine cycle more economically feasible for large building systems. The single-duct reheat system is illustrated and explained for solar cooling and heating. The ceiling induction unit is explained also for heating and cooling; however, there is no control for humidity. The use of plenum heat availability during the winter is questioned. Rankine heat flow paths are diagrammed. Rankine drive trains function for power transmission from the chiller compressor or the storage of excess electricity.

ST79 30233 Combined Water Thermal Storage: Heat Exchanger System

Melroy, P.; Spencer, D.L.
Kirkwood Community College, Cedar Rapids, IA
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 485-487 Dec. 5, 1977

No abstract available.

ST79 30234 The Solar Heating and Cooling Commercial Demonstration Program at Marshall Space Flight Center: Some Problems and Conclusions

Middleton, R.L.
NASA, Marshall Space Flight Center, Huntsville, AL
15th Space Congress, Proc. Cocoa Beach, FL
Avail:Canaveral Council of Tech. Soc's p. 3-36 to 3-54 April 26-28, 1978

The origin and evolution of the Solar Heating and Cooling Commercial Demonstration Program by the Department of Energy and the Marshall Space Flight Center activities supporting this program from its conception are defined and discussed. Problems are summarized in the design and financial areas. It is concluded that the program has significantly assisted the creation of a viable solar testing and cooling industry. The cost effective procedures evolving from the program are expected to make a major contribution to reducing the effective life cycle cost of solar installation.

ST79 30235 Boosting the Performance of Solar HVAC Systems by Improving Component Interactions

Newton, A.B.
Inst. of Gas Tech., Chicago, IL
IGT Symp. on Energy From the Sun, Chicago, IL
Avail:AIAA, A79-15851 13 p. Paper April 3-7, 1978

The paper focuses on those components which are used a little differently in the optimized solar system than they are in the usual conventional system. Major items considered are the storage system, the cooling equipment, the cooling tower, and the air handlers. More specifically, building load pattern, component performance profiles, storage reactions, piping and ducting, air handler response, sink temperature ambient range, collector performance map, control strategy, local insolation and cloud patterns, and system response are stressed. The discussion points to the importance of recognizing the performance characteristics of all components of solar heating and air conditioning systems, and of providing control strategy to optimize the interactions between components. Necessary steps for improved operation and reduced initial cost of solar heating and cooling systems are mentioned.

ST79 30236 Solar Energy and Economic Considerations

Miller, J.F.
ASHRAE J. V 19 No. 11 p. 40-42 Nov. 1977

This article explains the uses of comparative economic analysis for conservation of natural resources in the design of a typical HVAC system. Computer programs are used to show the payback period of solar systems. The results of computer analysis of 35 solar energy projects are summarized. The customer's choices in the solar system are reviewed. Domestic hot water was the main solar supplement in the different projects. Some of the factors that affected the payback period were geography, the building use, the solar controls, and oversale of collector areas. Adjustment of building parameters may assist in reducing cost expenditures. Certain "rules of thumb" that were used in the past are no longer valid. Former specifications used for sizing have proved invalid. The best method for evaluation is the computer simulation method. The author also suggests that people stop thinking of collectors in terms of dollars per ft^2. The author feels that the most efficient selection depends upon the solar application and the system that delivers the most BTUs per dollar.

ST79 30237 Solar: It's In the Near Future

Miskell, J.T.
Energy, Stamford, CT V 3 No. 2 p. 7-9 Spring 1978

This status report on solar energy suggests that the market for solar technology is expanding and will proceed in the private sector regardless of whether there are federal incentives. Solar water and space heating are economically feasible in many geographic locations, and some colder areas are discovering its advantages over expensive imported fuels. With major corporations joining the small manufacturers, prospects for adequate financing and product distribution have improved. Basic designs are combining active and passive energy recovery in the greenroom concept. Architecture schools and building materials manufacturers are developing new designs and products to broaden the solar technology market. Among the new equipment is a concentrating collector that rotates with the sun and shuts down at night.

ST79 30238 Trends Emerge, But Solar Design Still Open

Mungovan, J.A.
Modern Meteorol. V 33 No. 10 p. 22-24,26 Nov. 1977

Different companies that supply materials for solar collectors are competing in the solar market. Many solar manufacturers feel that single-family installations will only be a small part of the future market for solar and that heat recovery systems have a much greater market potential than solar. However, since solar collectors for space heating and hot water are presently available, the materials industry is concentrating its efforts there. A review of the products displayed at the SEIA Annual Meeting reveals a variety of materials currently being used in solar collectors. Characteristics of three materials (aluminum, copper, stainless steel) are reviewed.

ST79 30239 Experimental Study on House Cooling and Heating With Solar Energy Using Flat-Plate Collector

Nakahara, N.; Miyakawa, Y.; Yamamoto, M.
Ohbayashi-Gumi, Ltd., Tokyo, Japan
Solar Energy V 19 No. 6 p. 657-662 1977

The project described aims at developing the technology to utilize solar energy for heating, cooling, and hot water supply on the basis of various technologies for energy conservation in buildings. For the first step of this project, a solar heating and cooling system with flat-plate collectors and absorption refrigeration machine was installed. An outline of the system and operating results are presented.

ST79 30240 An Analytical and Experimental Study of Pumped Solar Water Heaters

Nimmo, B.; Pearce, J.; Clark, W.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY Res. supp'd by Florida Solar Energy Center and US Navy
Avail:AIAA, A79-17389 p. 907-911 Jan. 16-21, 1978

This paper describes and presents the results of an analytical and experimental study of forced circulation solar water heaters. A transient computer model which allows for fluctuating insolation and ambient temperature, as well as draw off of hot water at random times, has been developed. The system model has been sucessfully used to predict the performance of an installed forced circulation solar water heater under "in use" condition conditions. New experimental data for such a system are presented. They include environmental operating conditions, such as insolation and ambient temperature, as well as hot water load draw off. Results are shown for predicted and experimental collector inlet and outlet temperatures. The percent load carried by solar energy each day of a week of operation is also given.

ST79 30241 Some Steps To Solving Solar System Problems

Orlowski, H.
Travis-Brown and Assoc., Dallas, TX
Solar Engng. Mag. V 3 No. 7 p. 31, 33-34 July 1978

Some installation problems experienced under the HUD program include leakage, air blocks, and operating deficiencies. Some problems and solutions are discussed under the broad categories of system design, collectors, collector mounting, storage, and piping, pumps, and valves.

ST79 30242 Principles of Solar Cooling and Heating

Parker, A.J.Jr.; Cassel, D.E.; Veziroglu, T.N.
Int. Symp.-Workshop on Solar Energy Cairo, Egypt
Avail:Univ. of Miami A79-16457 Symp. Lectures, p. 107-127 June 16-22, 1978

An overview of solar cooling and heating systems for buildings is presented from a practical engineering point of view. It is recommended that building cooling and heating requirements be satisfied at the lowest level of technology and that passive solar energy systems and energy conservation be appoied before active energy systems. The three major types of active systems--water heating, space heating, and space cooling--are discussed. The simple payback economic analysis is shown to be an adequate method for initial system selection considerations. Several thermal analysis methods are discussed, with the F-chart program recommended as a good choice for hot water and space heating systems.

ST79 30243 A Report on the Various Heat Collection and Heat Storage Systems Evolved Under the Solar Energy Program at B.I.T.S.

Patel, J.S.; Raghunath, B.K.; Tewary, V.K.; Pande, G.D.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17423 p. 1115-1130 Jan. 16-21, 1978

This paper is a report on the various heat collection and heat storage systems evolved at BITS. The paper reports the performance of flat-plate collectors heating a low boiling organic liquid as an adjunct to BITS Solar Pump. Also given in the paper is an economic alternative to a conventional solar water heater. Further, methods for space heating and cooling are discussed. Possibility of combining a collector and concentrator to achieve higher temperatures and to be able to raise steam is also investigated.

ST79 30244 The ClearView Solar Collector System and Associated One and Two-Stage Evaporative Cooling, Interim Results

Peck, J.F.; Thompson, T.L.; Kessler, H.J.; Hodges, C.N.
AIAA and Arizona Solar Energy Res. Commission, Conf. on Solar Energy Tech. Status
Avail:AIAA, A79-13860 7 p. Nov. 27-29, 1978 Phoenix, AZ

The ClearView Solar Collector is being developed in response to a need for a transparent, site-built, wall-mounted, hot-air type solar collector. It uses dark Venetian blinds or heat absorbing glass to absorb insolation, thus allowing windows to be placed wherever desired along the south wall. Both passive (natural energy flow) and active (fan driven) forms have been devised. Heat is either stored in the mass of the home or in a rock bed. Summer cooling is accomplished either by ordinary evaporative cooling or by the more powerful two-stage evaporative cooling. Auxiliary heating can be accomplished by simple low-cost devices that heat the entire home. Some forms may be retrofitted onto many existing homes. A 10° F temperature fluctuation in a double brick home (no wall insulation) using a retrofitted hybrid ClearView Solar Collector was recorded. Data on two-stage evaporative cooling taken during the summer of 1978 shows that typical daily output temperatures are between 65 and 72° F during both very hot and very humid weather conditions.

ST79 30245 Controls for Residential Solar Heating

Peltzman, E.S.
ASHRAE Annual Mtg., Albuquerque, NM June 25-29, 1978
ASHRAE Trans. V 84 Pt. 2 p. 367-371 A79-16418

Solar heating systems require controllers which can provide one or more of the following functions: differential thermostat (on-off or proportional), freeze control (motor or valve), high set (motor or valve), auxiliary heat, and adjustable maximum storage temperature. The present paper describes several control types for use in residential solar heating and domestic hot water systems. These include: (1)solar assisted hot water system; (2)solar assisted hot water system for freezing areas; (3)pool and spa heating; (4)hot water and space heating. Some economic considerations are presented.

ST79 30246 Low-Temperature "Ambient-Plus" Solar Collectors

Pemberton, E.V.; Remick, C.D.
Wilfred Laurier Univ., Waterloo, Ontario
ASHRAE J. V 20 No. 1 p. 57-59 Jan. 1978

The authors attempt to show that ambient-plus collectors can be very efficient, with low cost and least complexity of manufacture, and that these collectors should be considered as real contenders in the solar heating arena.

ST79 30247 Heat Pumps With Low Temperature Collectors

Puntus, J.
Sonnenenergie-Tech. V 3 No. 2 p. 22-23 March-April 1978 In German

No abstract available.

ST79 30248 Heat Production and Distribution in Buildings With Solar Energy and Heat Pumps

Raetz, K.; Bofinger, H.
Tech. Bau V 8 No. 3 p. 267-269 1977 In German

Types of solar collectors efficiency independant of construction and insolation are described. The efficiencies of compressors and Stirling-type heat pumps are given. Constructive and engineering measures with the target of dispensing with fossil or electric auxiliary heatings in solar heated systems are discussed. Broad applications of the heat pump principle with outside air as a heat source and with Stirling-type heat pumps, are described.

ST79 30249 Jet Impingement Solar Air Heater

Rask, D.R.; Mueller, L.J.; Pejsa, J.H.
AIAA and Arizona Solar Energy Res. Commission Conf. on Solar Energy Tech. Status
Avail:AIAA, A79-13861 12 p. Nov. 27-29, 1978 Phoenix, AZ

The development of a flat-plate solar air heater based on a jet impingement concept as the absorber plate-to-air stream heat transfer mechanism is discussed. A prototype model has been evaluated to determine the effect of varying jet array parameters. These results are compared to a baseline parallel plate collector. An increased absorber plate-to-air stream heat transfer coefficient is observed to increase performance. The jet impingement concept increases the collector Y-intercept efficiency relative to the baseline parallel plate collector by about 13 percent and by 32 percent at a typical space heating. Recommendations are made for an optimum jet configuration, collector flow feed, and regarding construction materials.

ST79 30250 Heating Gives Off Dosed Heat: When Low-Temperature Heating Systems are Installed, Conventional Radiators Can be Used

Reichmann, H.H.
VDI (Ver. Dtsch. Ing.) Nachr. V 32 No. 2 p. 4 Jan. 1978 In German

The article is concerned with thoughts on the efficient use of heating energy for buildings. The use of solar energy and of heat pumps is also discussed in this context. More economical energy consumption can be reached by using low-temperature heating systems. Designs of systems of this kind are discussed, while taking into consideration the use of conventional radiators. Decisive for the success of a heating system is that it gives off cosy heat. The influence of wall temperature and the distribution of the temperature in the room on cosiness is discussed.

ST79 30251 Control of Solar Energy Systems, Heat Storage, and Heat Utilization

Rettich, G.
German Solar Energy Forum, 1st Hamburg, W. Germany Proc., V 2
Avail:Deutsche Gesellschaft fuer Sonnenenergie p. 117-130 A79-13630 Sept. 26-28, 1977

The paper reviews various aspects of the application of automatic control to solar heating systems. Consideration is given to the choice of reference values for determining the best type of control, to the choice of control (modulated or on-off), and to the determination of safety factors for solar collector cycles. Particular attention is given to control of the heat storage and heat utilization regimes of the solar system.

ST79 30252 Efficiency of Low-Temperature Solar Collectors

Rhodes, R.O.
FAFCO, Inc., Menlo Park, CA
Solar Engng. V 2 No. 6 p. 31 June 1977

A slope-intercept method for determining the efficiency of solar collectors over a range of temperatures is described. Low and high-temperature collectors are compared over the range from 10° F to 60° F. Low-temperature collectors are more efficient than high-temperatures ones below 30° F, according to this analysis.

ST79 30253 Liquid Desiccant Solar Air Conditioner and Energy Storage System

Robison, H.I.
Intersoc. Energy Conversion Engng. Conf., 13th San Diego, CA
Avail:SAE, A79-10176 p. 1620-1622 Aug. 20-25, 1978 Proc., V 2

A liquid desiccant air conditioning system has been designed and is being constructed for testing. The absorbate chosen is water; the abrorbent is triethylene glycol. Shallow-well water removes sensible heat. Direct solar radiation reactivates the dilute sorbent solution as it flows down corrugated trickle collectors. Insolation is used for mass transfer and very little energy is lost to the ambient air stream as sensible heat. Parasitic losses are small as no blower is necessary in the regenerator and heat exchangers recover sensible heat absorbed by the glycol. A small, concentrated solution flywheel-storage system makes continuous operation possible.

ST79 30254 Liquid Sorbent Solar Air Conditioner

Robison, H.
Univ. of South Carolina, Conway, SC
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 437 Dec. 5, 1977

No abstract available.

ST79 30255 Our Daystar

Ross, M.
Oilways No. 3 p. 15-18 1977

The economics of solar energy conversion are discussed. It is estimated that solar space heating could become competitive with fuel oil or electric heat pump systems in 12 U.S. cities if the cost of installed solar heating can be reduced by 25 percent, if oil and natural gas prices increase, and if housing costs stabilize. Solar water heating systems are already a good buy in expensive energy areas. Initial costs for solar units designed to provide 40 to 70 percent of hot water requirements range from $1000 to $1500. For solar electricity to come into use, low-cost batteries must be developed which can produce more energy and store it longer than batteries available today. A solar cell system currently produces electricity for roughly $1 to $3/kWh, whereas a kWh from an electric utility costs an average of two to six cents. According to one estimate, the present cost of solar cell equipment in a house in Albany, New York which consumes 12,000 kWh/yr would be $180,000 for the cells and $27,000 for batteries and additional equipment.

ST79 30256 Economic Comparison Between Solar and Conventional Residential Air Conditioning in Miami, Florida

Rotolante, B.H.
Univ. of Miami, Coral Gables, FL
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 273-275 Dec. 5, 1977

No abstract available.

ST79 30257 Constructional Systems for Heat Recovery and Storage

Sabady, P.R.
Fi-Bau V 11 No. 3 p. 16-22 1976 In German

A report i[illegible] given on the historical development of energy saving buildings, as well as solar houses [illegible]ich were already built at the end of the 30's in America, Europe, and Japan. The principles of the systems are dealt with; they consist of solar collector, circuit, storer, and distribution circuit. The systems are subdivided and defined according to energy conversion, storage material, and heat transport medium. A total of eight systems and variants and their function are described, simultaneously giving data on the objects built. Finally, planning aspects for functionally correct buildings form, and for purposeful integration of collector surfaces, are presented.

ST79 30258 Design of Solar Heating System for Winter Heating of Buildings: A Case Study

Saini, J.S.; Mehrotra, R.K.; Gupta, C.P.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17486 p. 1603-1606 Jan. 16-21, 1978 New Delhi, India

This paper contains the complete design of a solar heating system for winter use for the administrative block of a large factory building. The building is to be heated only during the day when solar radiant energy is available; also, no provision for heating during long cloudy periods was made. Heating is accomplished with hot air coming from the collectors, then circulating through the rooms after the proper temperature attenuation. From the cost analysis, it was concluded that the solar heating system is technically feasible, although somewhat expensive in initial cost.

ST79 30259 Theoretical Principles of the Solar Energy Collector

Schoeck, P.
Hoval A.G., Vaduz, Liechtenstein
Sanit.-Heizungstech. V 41 No. 8 p. 99-502 1976 In German

To be competent to judge the technical and economic aspects of the usage of solar energy, an understanding of the physical interrelations which determine the conversion of solar energy into heat is necessary. The present paper tries to portray this in short form. It is confined to a treatment of the conversion of energy in the so-called collector, i.e., the article does not deal with technical problems of storage and control. Furthermore, the paper goes with standard values into the solar radiation available.

ST79 30260 Simple Solar Technology for Agriculture

Schulz, H.
Sonnenenergie V 3 No. 1 p. 10-17 Jan.-Feb. 1978 In German

The article summarizes papers read by the author on different occasions. The problems of solar energy utilization for winter heating, air drying of grain and hay is dealt with, as well as solar energy utilization for water heating. Ways to build a solar collector yourself are pointed out, and firms are mentioned from whom the necessary materials can be obtained. The article closes on a short survey of the best solar collectors and of the possibility of wind energy utilization.

ST79 30261 Acceleration of Solar Heating Application Via Improved Data Evaluation

Scoville, A.E.; Gillett, D.A.
Dynamics Res. Corp., Wilmington, MA
Conf. on Performance Monitoring Techniques for Eval'n of Solar Heating, Cooling Systems
CONF-780432 p. 35-38 April 3, 1978 Washington, D.C.

Growth of solar applications can be accelerated by adequate evaluation of accumulating data since certain problems can be ameliorated by comprehensive data base management and analysis. Progress resulting from more thorough engineering analysis is illustrated and methods of extracting definitive information from larger data bases are suggested.

ST79 30262 Economic Optimization of Heat Pump Assisted Solar Heating in Illinois

Shams, A.; Mass, E.A.
4th Annual Conf. on Energy Rolla, MO
Avail:Univ. of Missouri, Rolla Proc., 12 p. p. 258-269 Oct. 11-13, 1977

This study undertakes the task of determining the optimal mix of solar and heat pump forms of heating. By installing a solar heating system, a homeowner is considered to be an energy producer and thus, to apply the least costly methods used by firms in the competitive market for any given level of fuel conservation. The study will examine the simulated performances of air and liquid-circulating systems in conjunction with heat pumps, in parallel as well as combined fashion. Optimization is achieved by equating the present value of the cost of solar and heat pump heating systems at margin.

ST79 30263 Solar Absorption System For Space Cooling, Heating

Shwarts, I.; Shitzer, A.
ASHRAE J. V 19 No. 11 p. 51-54 Nov. 1977

Solar winter heating and cooling are considered the most promising prospects of solar energy utilization in the near future. The paper presents the feasibility of solar cooling and heating using the solar absorption system. Two mixtures in wide use for absorption cooling systems are NH_3-H_2O and H_2O-LiBr. The difference between the two compounds is that the lithium bromide is nonvolatile. The absorption system is capable of providing space cooling and is usually operated on waste heat or low-grade heat. There are two modes of operation for space heating with the absorption system. The first system operates with solar heat supplied to the evaporator and additional nonsolar heat supplied to the generator. The other system functions similar to a mechanical evaporation heat pump system. Flat-plate collectors or concentrating collectors can provide the energy necessary for the system. A thermodynamic analysis was performed for different ranges of the operation factors chosen to suit typical Israeli climate conditions. The system analysis shows that using the absorption system for space heating may effect up to 70 percent savings in energy requirements.

ST79 30264 Experimental Investigation on Solar House Heating in Northern India

Singh, P.; Naseri, M.A.J.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17495 p. 1686-1691 Jan. 16-21, 1978

No abstract available.

ST79 30265 Solar Controls and Control Modifications; New Century Town Homes, Vernon Hills, Illinois

Smeltzer, L.R.
ASHRAE Annual Mtg. Albuquerque, NM June 25-29, 1978
ASHRAE Trans. V 84 Pt. 2 p. 373-379 A79-16419

No abstract available.

ST79 30266 Flat Solar Collector, An Approach to its Evaluation

Sonnino, T.
Soreq Nucl. Res. Center, Yavne, Israel
Israel J. Tech. V 15 No. 3 p. 98-101 1977

The flat solar collector is the most widely used device for the utilization of solar energy, but its energetic and economic values are still debated. A preliminary energy and economic analysis is presented. The energy analysis indicates that the energy needed to produce one solar collector is equivalent to the electricity consumed by an electric water heater in roughly three months. The economic analysis indicates that the payback time for a solar collector varies from 5.5 to 7 7 years, according to the discount rate. The economic analysis form a national point of view indicates that the use of solar collectors for domestic purposes only could reduce electricity consumption in Israel by 10 percent. Considering the amount of energy that is used to heat water to temperatures below 100°C in medical and other public institutions, as well as in the other economic sectors, it may be concluded that the simple flat solar collector may save Israel millions of dollars and help alleviate the energy crisis.

ST79 30267 The El Camino Real Solar Cooling Demonstration Project

Sowell, E.F.; Othmer, P.W.; Smith, K.E.
ASHRAE Annual Mtg. Albuquerque, NM June 25-29, 1978
ASHRAE Trans. V 84 Pt. 2 p. 435-449 A79-16425 Res. supp'd by U.S. DOE

The El Camino Real Solar Cooling Demonstration Project involves the conversion of the existing air conditioning system of an elementary school building (the El Camino Real Elementary School in Orange County, California) to provide a large fraction of input energy from solar thermal collectors. The existing hot water loop, driving absorption chillers and heating c[illegible] is connected to the solar loop through a heat exchanger without storage. The [illegible] loop consists of approximately 465 m^2 of tubular glass collectors, a heat rejec[illegible] and the load-side heat exchanger. This paper describes the final design and its evolution, discusses analytical studies, and presents performance simulation results.

ST79 30268 Circumferential Variations of Bore Heat Flux and Outside Surface Temperature for a Solar Collector Tube

Sparrow, E.M.; Krowech, R.J.
Univ. of Minnesota, Minneapolis, MN
J. Heat Transfer V 99 No. 3 p. 360-366 Aug. 1977

An analysis is made of the heat transfer processes in a solar collector tube subjected to large circumferential heat flux variations on its outer surface. The analysis is carried out for a collector plate configuration in which the tubes are situated in embossments in the otherwise flat surface of the plate. The solar energy absorbed by the collector plate is conducted to the tubes and gives rise to large heat flux spikes at discrete circumferential locations on the outer surface of a tube. The two-region heat conduction problem encompassing the embossed portion of the collector plate and the tube is solved by a novel procedure which provides closed form solutions of high numerical accuracy. The influence of system dimensions, thermal properties, and tube bore convection is examined by means of five dimensionless parameters of which the biot number was found to be the most important. The results showed that for realistic dimensions and thermal properties of the plate and tube, circumferential variations in bore heat flux provided that the tube flow is laminar. For turbulent flow conditions, the variations in bore heat flux are substantially greater than for laminar flow.

ST79 30269 Coast Guard Saves Energy

Stabile, B.L.
Mil. Engng. V 70 No. 455 p. 161-163 1978

An energy conservation program implemented by the United States Coast Guard is described. Personnel education, retrofitting of a central boiler plant and steam distribution system, housing insulation, and the use of solar energy are discussed.

ST79 30270 Solar Heating for a Novel Dwelling Independent of Servicing Networks

Thomas, R.B.; Littler, J.G.F.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17492 p. 1667-1671 Jan. 16-21, 1978

The paper deals with the Autarkic House (constructed within the Autarkic Housing Project), which is disconnected from all servicing networks and which uses solar energy actively and passively for space and domestic hot water heating. Simulations show that a collector area of 8 m^2 on each of the east, west, and south roofs (slope of 30°) and of 10 m^2 on the south wall (slope of 75°), combined with storage volumes of 20 m^3 for space heating, 25 m^2 for domestic hot water, and 0.5 m^3 for domestic hot water preheating is adequate even for such poor years as 1962-1963. These volumes do not include the volume of insulation which is, however, approximately the same as the size of the store itself.

ST79 30271 Solar Assisted Heat Pump System for Heating and Cooling Residences

Tleimat, B.W.; Howe, E.D.
Univ. of California Berkeley, CA
Solar Energy V [illegible] No. 1 p. 45-54 1978

It is proposed that heating and cooling of the all-electric residence unit be accomplished by using a solar assisted heat pump system. The proposed system makes use of a conventional air conditioning unit which would be modified by fitting controls to reverse the flow of refrigerant for the heating mode and by changing the outdoor heat exchanger from refrigerant-to-air to refrigerant-to-water. Calculations were made for an existing residence unit for which the total energy input is known and to which the proposed solar assisted heat pump system is applied. An estimated cost of equipment and of its operation is compared with the cost of owning and operating fuel and electrically heated systems. The effect of a two-phase expander to replace the expansion valve in the refrigerant circuit has been theoretically investigated. It shows a significant energy saving.

ST79 30272 Energy Balance of an Interseasonal Collector-Storage Association for a Housing Development in the North of France

Torrenti, R.; Alexandroff, G.
C.E.A./CEN, Saclay, France
Comples-Rev. Int. Heliotech. p. 30-33 1975 In French

The parameters were studied determining the feasibility and the profit-earning capacity of a building heating solar project using water insulators and an interseasonal storage tank. The case of a group of 10 houses located in the north of France has been chosen and computations have been made including the following subroutines: determination of the amount of the energy needed for building heating and sanitary water heating (or preheating); that can be expected from the water insulators the whole year long (notions of "energetically equivalent groups of days," "reference sample years," ...); lost by the storage tank; and that can be drawn from the tank. The results of this study have led to lay stress on several "optimal" values of the couple (collecting surface-storage volume) depending on the amount of the contribution which is desired from the sun (even 100 percent) and to emphasize the many advantages of an interseasonal storage of solar energy.

ST79 30273 Solar Energy For Commercial Purposes

Turek, K.
Sueddeutsche Metallwerke GMBH, Walldorf, Germany, F.R.
Systems Exhibition Energy Within the Context of the Hanover Fair Hannover, F.R. Germany
Avail:NTIS, AED-CONF-78-155-045 CONF-7804102-16 p. 18 April 19, 1978 In German

The repor ·iv.s an outline of the physical fundamentals of solar energy utilization in mid-Europe ·oints out differences as compared to other regions of the world. Hints for promising .. ılready realized technologies are given. The technology is explained, in addition, with the aid of examples; in particular, for water heating and swimming pool heating. The use of heat pumps is also discussed.

ST79 30274 Comparison Between Simulation and Experiment of Solar Heating

Udagawa, M.; Kimura, K.I.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17461 p. 1364-1368 Jan. 16-21, 1978 New Delhi, India

A comparison between the measured and simulated results with one of the four solar heating systems set up at the experimental multi-family housing unit of Japan Housing Corporation is described. The floor panel heating system is combined with a water storage tank and an array of collectors mounted on the balcony and on the roof. Hour-by-hour simulation is made on unsteady state basis using the weather data obtained at the experiment site. The result of the comparison turned out satisfactorily for the solar heating system, though the total space heating load of the experiment was formed considerably higher than by simulation.

ST79 30275 Single Equivalent Decrement Factor and a Single Equivalent Lag for the Effects of Multiple Harmonics in Sol-Air Temperature Cycles

Ullah, M.B.; Longworth, A.L.
Robert Gordon's Inst. of Tech., Aberdeen, Scotland
Bldg. Serv. Engng. V 45 No. 8 p. 139-146 Nov. 1977

A method has been developed for the homogeneous building element (wall or roof) to take into account effectively the influences of the multiple harmonics present in the ambient heat source of Sol-Air temperature so that the maximum heat transfer rate will be as accurate as that given by the analytical solution involving a number of harmonics as is required for the proper representation of the Sol-Air temperature cycle.

ST79 30276 Metal Roof as Solar Absorber; Promising Concept for Low-Temperature Heat/Price Per Square Meter From DM 68

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 43-45 Nov. 1977 In German

A new concept for providing energy for supplying a house is described. Instead of the usual flat collectors, the whole roof is made of a metal sheet. The solar energy absorbed by the roof is conducted by a heat transfer medium and is either taken directly to underfloor heating or is taken to a ground store. The total system is coupled to a heat pump. The plant covers the complete heat demand of the house, which is 65,000 kWh/annum. The total annual power costs for the house with 410 m^2 of living space are DM 1,300.

ST79 30277 Solar Energy Use in Austria: State of the Art, Development and Application: Already More than 500 Plan:: in Operation

Urbanek, A.
Mitteilungsbl. Dtsch. Ges. Sonnenenergie V 2 No. 6 p. 13-23 Nov. 1977 In German

The article presents a survey of solar energy utilization activities in Austria. Up to the end of 1976, there were about 100 solar plants for water, swimming pool, and space heating in operation in Austria. By the end of 1977 it might be some 500. Details of promoted research programs and research institutes are supplemented by a number of plants already in operation. Meteorological data for Austria are presented.

ST79 30278 Solar Energy Utilization in Buildings

Urbanek, A.
Baumeister V 74 No. 7 p. 654-656 July 1977 In German

The article gives a survey of solar energy utilization in West Germany. On the basis of the West German energy balance, the utilization of solar energy for water heating, swimming pool heating, and the heating of buildings is described, including system combinations. Finally, problems of architecture and law are mentioned.

ST79 30279 Possibilities of Using Solar Energy For Domestic Space Heating and Hot Water Supply in Holland

Van Koppen, C.W.J.
Klimaatbeheersing V 3 No. 5 p. 194-203 May 1974 In Dutch

This paper illustrates simple domestic solar heating installation which proves that solar heating is a real possibility for Holland.

ST79 30280 Status of Solar Technology Development in the Federal Republic of Germany

Wallner, I.
Arbeitsgem Solarenerg E.V. Ase, Germany
Bulletin Sci. Aim V 90 No. 3 p. 191-198 1977

Governmental expenditures for solar energy have risen from 1.5 million DM in 1974 to 6 million DM in 1975 and 12 million DM in 1976. The financial ceiling foreseen in the program is 14 million DM per year. As of August 1976, a total of 24 solar energy projects were being subsidized by the federal government: three system studies; 15 projects on solar thermal conversion, solar houses and demonstration projects, complete systems, components; three projects on solar mechanical conversion for electricity and water pumping, two on photovoltaic conversion and one on photochemical conversion. Furthermore, a solar data collecting network will be established, consisting of a number of small stations set up in meteorologically typical regions.

ST79 30281 Integration of Evacuated Tubular Solar Collectors With Lithium Bromide Absorption Cooling Systems

Ward, D.S.; Duff, W.S.; Ward, J.C.; Lof, G.O.G.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17483 p. 1581-1585 Jan. 16-21, 1978 New Delhi, India

By surrounding the absorber heat exchanger component of a solar collector with a glass-enclosed evacuated space and by providing the absorber with a selective surface, solar collectors can operate at efficiencies exceeding 50 percent under conditions of $T/H_T = 75$ C m^2/kW (T = collector fluid outlet temperature minus ambient temperature, H_T = incident solar radiation on a tilted surface). The high performance of these evacuated tubular collectors thus provides the required high-temperature inputs (70 to 88 C) of lithium bromide absorption cooling units, while maintaining high collector efficiency. This paper deals with the performance and analysis of two types of evacuated tubular solar collectors integrated with the two distinct solar heating and cooling systems installed on CSU Solar Houses I and III.

ST79 30282 Poor Man's Experimental Solar Collector

Weldon, U.
Alternative Energy Sources No. 28 p. 18-21 Oct. 1977

A do-it-yourself solar collector experiment is described. A bread box type solar collector is constructed of cardboard, wood, aluminum foil, styrofoam, and 4 mil plastic sheet. Experiments in heating a 5-gallon bucket of water are discussed. Construction detail drawings and a bill of materials are presented.

ST79 30283 Cost Optimization of Solar Heating of Buildings in Northern Regions

Willcutt, G.J.E.Jr.; Hunn, B.D.; McSweeney, T.B.
Los Alamos Scientific Lab., Los Alamos, NM
Am. Soc. Mech. Engng. Paper no. 75-WA/SOL-, p. VP 1975

A detailed computer model has been developed to simulate the performance, on an hourly basis, and to optimize the cost of solar heated buildings in northern regions characterized by cold and/or cloudy climate. The present model includes improvements in the original model Canadian cities (Vancouver, B.C.; Edmonton, Alta.; Winnipeg, Man.; Ottawa, Ontario; and Fredericton, N.B.) for the years 1970 and 1971. For each simulated year the system cost is optimized as a function of collector size for representative values of the other system parameters (storage size, number of glazings, etc.). Annual combined solar/conventional system costs are determined with collector cost and conventional fuel cost as parameters. Comparison is made between the effects of the amount of insolation received, cloud cover, and severity of the heating demand on system performance and cost.

ST79 30284 Practical Solar Energy Systems For Farm Buildings

Wood, J.M.; Birchfield, J.L.
Georgia Inst. of Tech., Atlanta, GA
Tech. for Energy Conservation Conf. Washington, D.C.
CONF-7706140 p. 269-272 June 8, 1977

Collector designs discussed emphasize low-cost, on-site construction and low maintenance. The collectors are for animal shelters, agricultural drying, and greenhouses. A solar heated broiler house is shown with a passive solar heating system using a double-glazed plastic collector with a six-inch layer of black painted rocks over black polyethylene on a south-facing hillside. Two types of solar agriculture drying are discussed.

ST79 30285 Solar Houses in Japan

Yanagimachi, M.
J. Japan. Assoc. Domestic Sanitary Engng. p. 620-652 1960 In Japanese

No abstract available.

ST79 30286 Self-Supporting Active Solar Energy System

Zakhariya, R.
ASHRAE J. V 19 No. 11 p. 60-63 Nov. 1977

The solar energy system described in this article is composed of four parts: (1)heat collection, (2)power generation, (3)distribution, (4)forced circulation, and (5)storage. The various parts of the collector are explained with specific dimensions of the collector stated. Some of the advantages of the system include its simplicity and flexibility. It has the nonfreezing characteristic of the solar heat collector subsystem. It eliminates the need for a heat exchanger unit and has a rigidness and a longer life span than other collectors made totally from metal. The system is categorized in the high-temperature region and has patants pending.

ST79 30287 Solar Technician Program Glows Hot

Ziegler, P.M.
Worklife V 2 No. 10 p. 21-24 Oct. 1977

Fifteen Comprehensive Employment and Training (CETA) trainees were taught about solar heating systems at the School of Environmental Studies and Planning at Sonoma State College. Half of the trainees were women, two were from minority groups and one was disabled. Both the technical aspects of the solar energy and the business aspects were covered in the course. Specific job offers came from collector builders, installers, salespersons, drafters, office managers, consultants, and researchers. By the end of June 1977, the CETA trainees all were employed. The project will continue to train 15 individuals in the field of solar energy.

31,000 COMPUTER DESIGNS, MODELS, SIMULATIONS

ST79 31011 Commercial Building Unitary Heat Pump System With Solar Heating, Final Report, May 1, 1976-October 31, 1977

Syracuse Univ., Syracuse, NY
Avail:NTIS, COO-2979-2 p. 67 May 1978

A generalized dynamic computer program (SYRSOL) has been developed for the mathematical simulation of the thermal behavior of multi-zone solar heated buildings. The system modeled employs a series of water-to-air heat pumps connected in a closed-loop flat-plate liquid cooled solar collector, a water storage tank, and a cooling tower. Weather data are represented by sinusoids, which provide a convenient and economical alternative to to weather tapes. Results indicate that the use of sinusoidal functions for temperature and monthly average values for cloud cover is quite realistic and accurate. Temperature functions for 13 cities are presented. A preliminary analysis has been done of the feasibility of using solar energized desiccant dehumidification systems to reduce summer cooling loads. Service hot water production using a water-to-water heat pump from the storage tank is shown to be highly effective and idle solar collectors can be used directly to make service hot water in the summer. A new mathematical heat pump heating model, in which the COP increases linearly with the source water temperature, has been developed and incorporated into SYRSOL. The computer simulation capability has been extended from a heating season to an entire year. The results of some experiments, that have improved the COP of a heat pump, are also reported.

ST79 31012 Conference on Decision and Control, and Symposium on Adaptive Processes, 16th; Special Symposium on Fuzzy Set Theory and Applications, New Orleans, Louisiana; December 7-9, 1977, Proceedings, Volumes 1 and 2

Conf. and Symposia sponsored by IEEE, Piscataway, NJ
Avail:IEEE, A79-14957 V 1, 1301 p. V 2, 152 p.

Papers are presented on such topics as identification and estimation theory, estimation, and control problems in energy systems, adaptive processes in biomedical systems, game theory, stochastic control, man-machine systems, geometric methods in control theory, application of modern control, and estimation to aircraft systems, microprocessor-based climate control in solar heated buildings, and optimal control. Consideration is also given to the following: detection problems in naval systems, advanced automation, guidance and control of maneuvering reentry vehicles, pattern recognition, robotics, estimation and modeling in socioeconomic systems, stability and regulation, and theory and applications of fuzzy sets.

ST79 31013 Optimal Design of Seasonal Storage for 100 Percent Solar Space Heating in Buildings

Argonne Nat'l Lab., Argonne, IL
AAAS Mtg. -- Abstract cleared with title, "Is Zero Energy Growth Feasible in the Residential Sector," Sept. 22, 1977
Avail:NTIS, CONF-780228-2 p. 38 Feb. 1978

An analysis is presented of seasonal solar systems that contain water as the sensible heat storage medium. A concise model is developed under the assumption of a fully mixed, uniform temperature, storage tank that permits efficient simulation of long-term (multi-day) system performance over the course of the year. The approach explicitly neglects the effects of short-term (sub-daily) fluctuations in insolation and load, effects that will be extremely small for seasonal solar systems. This approach is useful for examining the major design tradeoffs of concern here. The application considered is winter space heating. The thermal performance of seasonal solar systems that are designed to supply 100 percent of load without any backup is solved for, under "reference year" monthly normal ground temperature and insolation conditions. Unit break-even costs of seasonal storage are estimated by comparing the capital and fuel costs of conventional heating technologies against those of a seasonal solar system. A rough comparison between the alternatives for more severe winters was made by examining statistical variations in winter season conditions over the past several decades.

ST79 31014 Pasole: A General Simulation Program for Passive Solar Energy

Los Alamos Scientific Lab., Los Alamos, NM
Avail:NTIS, LA-7433-MS p. 54 Oct. 1978

The Pasole Computer Program was developed to do simulations of passive solar heated buildings. Modeling is done using a general thermal network method that allows for heat sources and thermal storage. Sun position equations are used with a global-to-direct solar radiation correlation to develop solar heat sources from measured insolation data. Models of a particular class of south-mass-wall passive buildings have been developed and are described.

ST79 31015 Theoretical and Experimental Study of Liquid Storage Tank Thermal Stratification For a Solar Energy System, Semiannual Progress Report, September 1, 1977-February 28, 1978

Alabama Univ., Dept.of Mech. Engng., Huntsville, AL
Avail:NTIS, COO-4479-1 p. 29 1978

The effects of thermal stratification in a water storage tank on the performance of a hot water solar application are quantitatively studied by using the TRNSYS computer simulation code with a fully mixed and a fully stratified storage tank model. To minimize the cost of the experiment, the existing solar heating system is being used for the experimental study. Plans and diagrams of the facilities are shown and modifications are discussed.

ST79 31016 Stochastic Simulation Experiments on Solar Air Conditioning Systems

Anand, D.K.; Bazques, E.O.; Allen, R.W.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17474 p. 1498-1504 Jan. 16-21, 1978

Real weather data and stochastic weather models are used to simulate the performance of solar powered air-cooled and water-cooled air conditioning systems. The simulations include various parametric models for the absorption flow rates. System coefficient of performance, total insolation, and useful energy delivered using the joint probability density approach are found to be in good agreement with real data on daily, monthly, and seasonal bases. The present scheme reduces the data necessary for simulations in a local region, resulting in considerable savings in system simulation, both in terms of complexity and time. Any local region can be characterized by five or six constants and from 9 to 19 data sets.

ST79 31017 Stochastic Predictions of Solar Cooling System Performance

Anand, D.K.; Deif, I.N.; Allen, R.W.
Am. Soc. of Mech. Engnrs., Winter Annual Mtg. San Francisco, CA
Avail:AIAA, A79-19848 13 p. Dec. 10-15, 1978

A two-part stochastic (probabilistic) method for generating synthetic weather profiles is described that takes a large base of weather data and while retaining essentially the weather's history, compacts the information to a most convenient form for use in computer simulation. The first part is a purely statistical procedure in which a data base of weather is sorted out, and averages and standard deviations are calculated. The second part involves the development of an analytical model by using a least squares error technique for the data base of weather. The method provides reconstruction of the data in the form of a single day's weather information. It is applied to five U.S. cities with diversity in climate and geography. Comparison of stochastic and real weather results show that the stochastic weather method compares well with the real weather approach, but at much reduced cost and data handling.

ST79 31018 Radiation Cavity Solar Collector For High-Temperature Applications

Antoniak, Z.I.; Palmer, H.B.
Pennsylvania State Univ., University Park, PA
Concentrating Solar Collector Conf. Atlanta, GA
CONF-770953 p. 2.79-2.84 Sept. 26, 1977

A 1.5 m long experimental model of a previously proposed high-temperature solar concentrator-collector in which argon is employed as a working fluid was studied. The effect of using a selective absorber in place of the graphite absorber reported on earlier was investigated. No measureable gain in efficiency was observed. A computer model of this system which takes into account most of the influential variables has been formulated. It yields temperature profiles that normally agree with the experimental data at all axial positions within ca. 10°C. This good agreement permits the formulation of a second computer model of the full-scale device with confidence. The effect of various parameters has been investigated in an optimization study of the full-scale collector.

ST79 31019 A Parametric Investigation on Flat-Plate Solar Collectors

Arafa, A.; Fisch, N.; Hahne, E.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress
Pergamon Press, Inc. Elmsford, NY
Avail:Bundesministerium fuer Forschung und Tech. p. 917-923 Jan. 16-21, 1978
New Delhi, India

In the present work, the thermal behavior of a solar collector is investigated for steady and unsteady state working conditions. A model is developed describing the collector by means of a set of partial coupled differential equations for fin, pipe, fluid, cover plates, and insulation. The temperature distribution as a function of position and time is achieved by solving this set of equations numerically. Different parameters which influence the collector performance are thoroughly examined. The results show that a collector design is strongly dependent on the material used and the weather conditions if an optimal thermal efficiency is to be obtained. A single node is not adequate to such simulations. The comparison of experimental results to predicted values for different collector types based on the present analyses shows a maximum average deviation of five percent for collector efficiency and 2°K for fluid temperature.

ST79 31020 Energy Performance of Solar Walls: A Computer Analysis

Arumi, F.; Hourmanesh, M.
Univ. of Texas, Austin, TX
Energy Bldg. V 1 No. 2 p. 167-174 Oct. 1977

This paper illustrates how the computer model for the dynamic energy response of buildings (DEROB) can be used successfully to model the performance of passive solar systems when integrated into a specific structure, and it also suggests possible variations of the Trombe - Michel wall for its adaptation in climates like the one in central Texas. DEROB is a fully dynamic research program that has been in operation since 1973 and it includes full thermal coupling among the constituent rooms of a building as well as a spectroscopic analysis of glass. This capability permits the direct use of the program for the analysis of solar walls by treating the space between the glass and the absorbing surface as a chamber thermally coupled to the occupied space via the heat storage "chamber" in the wall and operable air ducts. Various wall configurations are analyzed and classified according to their net annual performance.

ST79 31021 Large-Aperture Radiant Solar Energy Concentrators

Baum, I.V.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17452 p. 1303-1307 Jan. 16-21, 1978 New Delhi, India

The relation between the maximum concentration factor and the number and form of facets of a paraboloid mirror used for solar energy concentration is analyzed. The three-step approach begins by describing, in terms of differential geometry, the ray deflections associated with a facet system approximating an ideal paraboloid reflector. Then the formation of the receiver irradiation field is represented by a statistical model, and integration over the surface of a large number of facets is replaced by integration over the paraboloid surface; possible ray deflections are averaged in the procedure. Two effects can then be characterized. One involves the effect of the number of facets on the concentration factor, and the other is the effect of reflector aperture on approximation accuracy at a given number of facets.

ST79 31022 On the Method of Stochastic Time Series For the Characterization of the Stability of Solar Insolation

Benard, C.; Body, Y.; Wirgin, A.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 1
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17299 p. 338-345 Jan. 16-21, 1978 New Delhi, India

A stochastic function time analysis is used to establish the characteristics of a given climate for the purpose of implementing an appropriate thermal collection storage system. The stochastic input is represented as the time stochastic series which is the total solar intensity on a horizontal unity surface integrated over 24 hours. Eleven years of data (1964-1974) are considered for Trappes, France (49° S and 3300 m altitude). Time stability analysis and time sequence probability estimation are discussed.

ST79 31023 Numerical Study on Solar Energy Utilization for Water Heating on the Basis of A Test Reference Year for Berlin

Brunk, M.F.
Technische Univ. Berlin, Germany, F.R., Hermann-Rietschel-Institut Fuer Heizungs- und Klimatechnik
Hlh. Z. Heiz., Lueftung, Klim., Haustech. V 29 No. 4 p. 147-152 April 1978
In German

A mathematical model for a solar service water storage unit with forced circulation is investigated where per hour values of the climatic data of a test reference year for Berlin are used. For the consumer side, measured per hour values were used as load function. The investigation is based on a double-glazed nonselective flat-plate collector.

ST79 31024 Solar Heating and Ventilating by Natural Means

Bilgen, E.
Int. Symp.-Workshop on Solar Energy Cairo, Egypt
Avail: Univ. of Miami A79-16458 p. 129-155 June 16-22, 1978 Coral Gables, FL

A computer thermal simulation study performed for the Montreal region shows that natural air conditioning of buildings in Canada can be accomplished through the use of integrated solar collector storage units. South-facing vertical surfaces appear to be most suitable for this purpose, though other east and west facing vertical surfaces can be used in combination with the former. Solar energy utilization for the heating and ventilation of buildings by this method is found to be economically feasible and competitive with other energy sources.

ST79 31025 Design Optimization for Solar Array of Multiple Collector Types

Bradley, J.O.; Posner, D.; Bingham, C.E.
4th Annual Conf. on Energy Rolla, MO
Avail:Univ. of Missouri-Rolla A79-14677 p. 25-37 Oct. 11-13, 1977

Methodology is presented for optimizing solar arrays used for heating fluids from ambient to elevated temperatures. The optimal array consists of the appropriate combination of available collector types which delivers the most energy per dollar invested in the array. An example of optimization is presented and verified using computer simulation of numerous combinations of collector types.

ST79 31026 The Relationship Between Diffuse and Total Solar Radiation in Computer Simulation of Solar Energy Systems

Butera, F.; Panno, G.; Ruisi, G.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress New Delhi, India
Pergamon Press, Inc. Elmsford, NY
Avail:Consiglio Nazionale delle Ricerche A79-17304 p. 384-388 Jan. 16-21, 1978 V 1

No abstract available.

ST79 31027 Economic Use of Energy in Housing Construction, Model Simulations, Planning Aids

Christensen, S.
Stuttgart Univ., Germany
Fortschr.-Ber. VDI Z., Reihe 4 No. 38 p. 1-138 Jan. 1978 In German

A wide variety of measures, ranging from improvements in heat insulation to the installation of solar collectors, are investigated by means of which energy can be saved in multistory housing construction. In order to implement these improvements in practice, the economic advantage of each measure must be recognizable. This, however, must be considered over the entire lifetime of the housing. With the aid of investment calculus, the revenues resulting from saved heating energy and the expenses for increased heat insulation are compared, the capital return and the amortization of the additionally invested capital are determined, and a study is made of the financing of the additional investment for new construction and for the modernization of old buildings. In certain particular cases, it is shown that possibilities ranging from improvements in planning to more effective use of equipment exist for decreasing the energy requirements of multistory residential buildings.

ST79 31028 Simulation of a Small Solar Power Station

Cobble, M.H.; Smith, P.R.
New Mexico State Univ., Las Cruces, NM
Am. Soc. Mech. Engng., Paper no. 75-WA/SOL-, p. VP 1975

As a part of a joint effort between New Mexico State University and the National Research Center of Egypt to build a 5-kW solar electric generating plant, a numerical model of the system has been developed at NMSU. The model is capable of simulating the tracking solar collector, the solar boiler, the prime mover (whether it be a Rankine cycle, Brayton cycle, etc.), and the electrical generator. Various methods of energy storage, such as heat storage in a liquid, gravitational potential, etc., can be treated. The model is time dependent and the solar radiation and atmospheric conditions are generated within the simulation program as a function of time. An example of the use of the model is presented and consists of a simulation of a 1-kW electric generator driven by an open-cycle gas turbine. Solar energy is supplied to the turbine by a tracking cylindrical parabolic concentrator.

ST79 31029 Simple Procedure for Predicting Long-Term Average Performance of Nontracking Solar Collectors

Collares-Pereira, M.; Rabl, A.
Inst. of Gas Tech., Energy From the Sun Symp. Chicago, IL
Avail:ERDA, A79-15873 Paper, 13 p. April 3-7, 1978

In the present paper, the Liu and Jordan (1963) procedure for calculating long-term average energy collection of plate collectors is simplified and generalized for tracking and nontracking collectors. The only meteorological input needed is the long-term average daily total insolation on a horizontal surface, together with average ambient temperature. In order to obtain the useful energy collected, this meteorological input is multiplied by several factors which are given in analytical or graphical form. For illustration, the method is applied to a flat plate, a compound parabolic concentrator, and a tracking line focus parabolic reflector.

ST79 31030 Simulation and Design of Evacuated Tubular Solar Residential Air Conditioning Systems and Comparison With Actual Performance

Duff, W.S.; Leflar, J.A.
Sun: Mankind's Future Source of Energy; Proc. of Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17475 p. 1509-1513 Jan. 16-21, 1978

The paper describes a s study of the Colorado State University Solar House I (SHI) which ..s concentrate.. ..ailed modeling of the Corning evacuated tubular collector performance, the Arkla chiller performance, and the air conditioning load of the SHI. Several different operating system configurations were simulated including operation with and without cool storage, and with and without solar service hot water production. Results of the design and simulation study indicate that the design of a solar heating LiBr absorption cooling system should be simple and straightforward and not include cool storage.

ST79 31031 General Model for Predicting the Performance Characteristics of Planar Concentrating Systems

Edgecombe, A.L.; Clausing, A.M.
Univ. of Illinois, Urbana, IL
Concentrating Solar Collector Conf. Atlanta, GA
CONF-770953 p. 3.109-3.113 Sept.26, 1977

The specular reflector enhancement of flat-plate solar collectors is analyzed in this study. A mathematical model is developed and two key geometrical parameters are introduced in the analysis of the spatially averaged energy flux over the collector surface. The model allows these parameters to be determined as a function of the collector size and tilt, the reflector size and tilt, and the position of the sun. The key parameters, when time averaged over a period of interest, yield a relative measure of the direct beam component and the specularly reflected component of the total energy flux during the given period. The relative values of these two flux components are used in optimizing the reflector-collector system. Data gathered by computer simulation is presented as an example of determining an optimum system with respect to one of the system variables.

ST79 31032 Computer Simulation For a Solar Heating System

Eltimsahy, A.H.; Copass, C.H.
Univ. of Toledo, OH
Math. Comput. Simul. V 20 No. 2 p. 114-127 June 1978

In this paper a simulation model for a basic solar heating system which is suitable for control and optimization studies is developed. A model for flat-plate solar collectors using fluids for the heat transfer which allows the analysis of operation in great detail is presented. The simulation model for the solar collectors has also the characteristic that its inputs and outputs are quantities which are easily measurable in the real world. The effect of temperature stratification in the heat storage device model is considered by simulating two storage chambers of variable volume. The heat storage model requires relatively small time increments, a requirement which is not as stringent as that for the solar collectors. The tank's model primary variables are the easily measurable quantities of temperature and flow rates with the addition of volume as an internal variable. Weather, load, and control modeling is also presented.

ST79 31033 Computer Modeling of Solar Energy Collection

Farag, I.H.; Neville, M.
Univ. of New Hampshire, Durham, NH
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 633-635 Dec. t, 1977

No abstract available.

ST79 31034 Solar and Infrared Radiation Properties of Parallel Plate Honeycomb

Felland, J.R.; Edwards, D.K.
Univ. of California, Los Angeles, CA
J. Energy V 2 No. 5 p. 309-317 May 24, 1978

Three radiative transfer problems are solved for describing the thermal performance of parallel plate honeycomb arrays used to construct solar transparent insulated walls. First, solar transmittance is treated with scattering and polarization. Second, effective emittance (or passage transmittance) is derived for partially transparent wall materials. Third, the influence on the effective emittance of the reradiated energy contributed by the absorbed solar radiation is determined. Results are calculated for thin-walled glass and Mylar honeycombs. With the results, the engineer or architect can evaluate the merit of applying honeycombs to solar collectors, greenhouses, residences, and commercial buildings.

ST79 31035 A Theoretical Analysis of Solar Collector/Storage Panels

Fender, D.A.; Dunn, J.R.
AM. Soc. of Mech. Engnrs., Winter Annual Mtg. San Francisco, CA
Avail:ASME, A79-19843 9 p. Dec. 10-15, 1978

A theoretical model for the evaluation of the transient performance of a thermosyphon-type solar energy collection and heat storage (CS) panel is derived and analyzed. Use is made of an analytical method developed by Ostrach for analyzing fully developed natural convection in a vertical, symmetrically heated channel that is extended for use with numerically implicit boundary conditions involving glazing convection and radiation and explicitly determined wall heat conduction. A numerical simulation is used to establish CS panel operating characteristics and design criteria for performance optimization assuming the storage wall is insulated. Results indicate that low solar thermal efficiencies and hourly panel operating factors for the insulated wall are obtainable only during mild, sunny weather. The strong effects of ambient air temperature indicate the importance of cover design of this system.

ST79 31036 Computer Modeling of Heat Pumps and the Simulation of Solar Heat Pump Systems

Freeman, T.L.; Mitchell,J.W.; Beckman, W.A.; Duffie, J.A.
Univ. of Wisconsin, Madison, WI
Am. Soc. Mech. Engng. Paper no. 75-WA/SOL-, p. VP 19/[illegible]

A generalized ditigal computer model of a residential-[illegible]ze heat pump is described. The modeling strategy is to design or size the four major components in the vapor components in the vapor compression cycle to yield any desired designed condition performance. Once the system has been defined, the program is able to compute a

"performance map" of heat added and heat rejected at all possible combinations of inlet flow-stream conditions. The model is applied to the thermal performance simulation of several different solar heat pump heating and cooling systems using the modular simulation program, TRNSYS. Performance of "in-line" heat pump boosted solar systems which use solar energy storage as the heat source are compared to "parallel" systems where the heat pump acts only as an auxiliary and ambient air provides the source.

ST79 31037 Modelling of a Solar-Operated Absorption Air Conditioner System With Refrigerant Storage

Grassie, S.L.; Sheridan, N.R.
Univ. of Queens, Brisbane, Australia
Solar Energy V 19 No. 6 p. 691-700 1977

A detailed dynamic model of a solar air conditioning system is reported. The model, including the solar collector and cooling tower, is described in terms of design parameters. Ambient wet and dry bulb temperatures and solar radiation are the required inputs. System temperatures, energy flows, and coefficient of performance can be predicted. Careful attention is given to the evaporator model and the control of refrigerant flow. Typical performance results are discussed. Several recommendations for future investigations are made.

ST79 31038 Use of Planar Reflectors For Increasing the Energy Yield of Flat-Plate Collectors

Grassie, S.L.; Sheridan, N.R.
Dept. of Mech. Engng., Univ. of Queens, Brisbane, Australia
Solar Energy V 19 No. 6 p. 663-668 1977

A mathematical model to simulate the performance of flat-plate collector-reflector systems is presented. First the collector energy balance is modified to account for the reflected energy. Then, the exchange area for a diffuse reflector is obtained by integrating over both reflector and collector surfaces. For the specular reflector, the collector area exposed to reflected radiation is calculated from geometrical relations. Shading effects are also found from the system geometry. The model is used to predict the annual performance of a water heating system with several values of the reflector angle.

ST79 31039 Analysis and Design of Solar Buildings Using the Cal-ERDA Computer Programs

Graven, R.M.; Hunn, B.D.; Roschke, M.A.; Rosenfeld, A.H.; Cumali, Z.O.; Lokmanhekim, M.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 3
Pergamon Press, Inc. Elmsford, NY
Avail:DOE A79-17463 p. 1374-1377 Jan. 16-21, 1978

No abstract available.

ST79 31040 Augmented Solar Energy Collection Using Various Planar Reflective Surfaces: Theoretical Calculations and Experimental Results

Grimmer, D.P.; Zinn, K.G.; Herr, K.C.; Wood, B.E.
Los Alamos Scientific Lab., Los Alamos, NM
Avail:NTIS, N79-11494 39 p.

The use of different types of flat reflective surfaces to increase the collection of solar energy by flat collectors was investigated. Specular, diffuse, and combination specular/diffuse reflective surfaces are discussed. An attempt was made to describe the reflective properties of surfaces in more generalized terms than simple direct or simple diffuse. Most real surfaces possess a combination of specular-like and diffuse-like reflective surfaces as a combination of specular and diffuse-like reflectivities. The reflective properties of a given surface can be measured in the laboratory as a function of incident and reflected angles, and these measured reflective properties can be used in the computer model to predict the increase in collector performance with such a reflector. Predictions of system performance were made for various collector/reflector configurations and compared with the performance of an optimally oriented collector without a reflector.

ST79 31041 Computer Modeling of Flat-Plate Solar Heat Collectors

Hartman, T.L.; Pearce, J.B.; Clark, W.E.
Georgia Inst. of Tech., Atlanta, GA
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 241-243 Dec. 5, 1977

No abstract available.

ST79 31042 <u>Anticonvective Antiradiative Systems</u>

Herrera, R.; Albarez, I.S.; Hernandez, E.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY
Avail:Org'n of Am. States A79-17420 p. 1102-1106 Jan. 16-21, 1978

The development of solar collectors has become of great interest. The efficiency and cost have been reported. At the same time, with the widespread use of computers new methods to improve design characteristics have been used. In this paper, a computer model of a flat-plate collector with or without anticonvective-antiradiative system (honeycomb) is presented. The model can simulate a flat-plate collector with one or more covers and with or without selective surfaces. The test simulated is that proposed by the National Bureau of Standards (U.S.A.), where collector efficiency is plotted as a function of (Tp-Ta)/I (^{o} C m^2/W), where Tp and Ta are the absorber plate and ambient temperatures, respectively and I is the incident radiation. It is also possible to simulate a working day for the collector; however, in this case, some experimental data is needed as input data for the model.

ST79 31043 <u>Long-Term Performance of Solar Assisted Water Heating Systems</u>

Howarth, A.T.
Bldg. Serv. Engnrs. V 8 No. 45 p. 147-153 Nov. 1977

A computer simulation of the performance of solar assisted water heating systems has shown that daily total draw-off volumes and solar intensities are of greater importance than distributions of draw-off and sunshine. A method of predicting long-term performance using total draw-off volume and mean solar data is developed from the long-term energy balance. The method can be used for rapid assessment of economic viability of systems using flat-plate solar heat collectors.

ST79 31044 <u>Elements of a Bond Graph Simulation Language for Passive Solar Heating System Design</u>

Hubbard, M.; Brewer, J.W.
Am. Soc. of Mech. Engnrs., Winter Annual Mtg. San Francisco, CA
Avail:ASME, A79-19846 9 p. Dec. 10-15, 1978

Thermal modeling of passive solar heating systems using bond graphs is considered. Bond graph representations are given for two common heat transfer and storage processes for such systems; distributed heat capacitance and conduction in an arbitrarily shaped solid and radiativae heat transfer in an enclosure of diffuse gray surfaces. Average surface temperature is shown to be the principal variable in the formulation of thermal bond graphs. The implementation of the theory in an interactive minicomputer simulation language is discussed, including automation of: the generation of forcing inputs, normal mode calculation and truncation, and the derivation and solution of a system of differential equations.

ST79 31045 <u>Thermosyphon Analysis of a Thermic Diode Solar Heating System</u>

Jasinski, T.; Buckley, S.
MIT, Cambridge, MA
ASME Paper no. 77-WA/SOL- p. 1-8 1977

The thermic diode solar heating system is modeled and its behavior is understood and can be reasonably predicted. Various nonideal effects, such as a nonlinear collector temperature profile and collector surface shading, can be included in the model as deemed necessary. Although verification of the analysis was achieved by comparison with a small-scale laboratory experiment, extension to full-size panels under actual weather conditions is rather straightforward. Basic system operation is the same regardless of size, and therefore, one need only add a suitable model of the weather data. Uses of a model extended to the full-size panels are readily apparent. Obvious is the need to predict the yearly performance of the thermic diode system at various locations to use as a comparison to other traditional and solar heating schemes. In addition, the model can be used as an aid to optimize the performance of the thermic diode.

ST79 31046 Performance Prediction and System Sizing

Jastrzebski, C.Z.
2nd Energy Symp. on Solar Energy in Pittsburgh: Demonstration Programs and Plans
CONF-7706117 p. 122-134 June 1, 1977 Pittsburgh, PA

The design, optimization, and economic analysis of a solar system for domestic hot water as space heating for residence in western Pennsylvania are presented.

ST79 31047 Refined Model of Solar Space Cooling System

Jenks, R.L.; Kremheller, A.; Rogers, W.A.; Jones, R.W.
Univ. of Petroleum and Minerals, Dhahran, Saudi Arabia
Miami Int. Conf. on Alternative Energy Sources Miami Beach, FL
CONF-771203 p. 423-424 Dec. 5, 1977

No abstract available.

ST79 31048 A Microprocessor-Based Solar Controller

Johnson, G.R.
Conf. on Decision and Control; Symp. on Adaptive Processes, 16th; Special Symp. on Fuzzy Set Theory and Applications New Orleans, LA Proc., V 1 Dec. 7-9, 1977
Avail:IEEE, A79-14979 p. 336-340

This paper presents the development, analysis, and simulated experimentation with a discrete control algorithm for optimal control of a solar energy system for heating buildings. The contents include the mathematical formulation of the system and objective function, the solution technique, the microprocessor control system and its components, and the results of tests conducted using a control-driven dynamic simulation computer model to perform comparisons with conventional controls.

ST79 31049 Determination of Optimum Heat Storage Volumes and Conditions in Complex Heat Pump/Solar Systems

Khumtsariya, R.K.; Turkestanishvili, O.A.
Tr. Gruz. Nauchno-Issled. Inst. Energ. V 16 p. VP 1962 In Russian

No abstract available.

ST79 31050 Optimum Design Parameters of Horizontal Coaxial Cylinders for a Solar Energy Collector

Kunitomo, T.; Aizawa, K.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17444 p. 1259-1263 Jan. 16-21, 1978 New Delhi, India

In this paper, the optimum combinations of the design parameters of a solar collector system for thermal use of horizontal coaxial cylinders with a cylindrical parabolic mirror are discussed from the standpoint of energy, collector efficiency, and outlet temperature of a fluid. Heat balance calculation is carried out using the exact relations of simultaneous radiative, convective, and conductive heat transfer in the system.

ST79 31051 Design and Optimization of a Flat-Plate Collector for Cooling Application

Ladsaongikar, U.V.; Parikh, P.P.
Sun: Mankind's Future Source of Energy; Proc. of Int. Solar Energy Congress, V 2
Pergamon Press, Inc. Elmsford, NY
Avail:AIAA, A79-17419 p. 1092-1101 Jan. 16-21, 1978 New Delhi, India

The paper deals with optimization of design and operational parameters of a flat-plate collector for an output design temperature of 140°C for a continuous ammonia absorption system. The various parameters optimized are angle of inclination, number of glass plates, and the geometry of flow passages in the collector. The methods used for optimization are illustrated with specific examples. A nomogram is constructed for easy optimum design and evaluation of the performance of the collector for a given place and application. Collector efficiency factors are derived based on average collector temperature, contrary to the inlet temperature which has so far been used as the reference.