

Passive Solar Design

A Short Bibliography for Practitioners

October 1978

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U.S. Department of Energy
Assistant Secretary for Conservation
and Solar Applications
Office of Conservation and Solar Applications

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Washington, D.C.

Prepared for:
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Assistant Secretary for Conservation
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PREFACE

Passive solar energy has the potential to reduce significantly the energy requirements for buildings in virtually every part of the United States over the next 2-5 years. To realize this potential the U.S. Department of Energy (DOE) has initiated a Passive Solar Program. Its objective is to significantly reduce the nation's use of nonrenewable energy sources through the application of passive solar energy. This will be accomplished by accelerating the development and utilization of passive solar heating, cooling, and process systems. The Passive Solar Program consists of two major areas: Technology Development and Technology Utilization. Technology Development incorporates physical studies and materials development, product development, and systems development. Technology Utilization includes commercialization readiness assessments, technology transfer, stimulation of technology delivery capability, and stimulation of market demand.

Recent studies regarding an assessment of the readiness of passive technology for commercialization have indicated the following principle conclusions:

- ° Technical readiness for passive solar heating has been demonstrated for a variety of designs, climates, and building types. Low maintenance and high reliability are key characteristics.
- ° Economic readiness for passive solar heating has been demonstrated in residential and commercial building applications. Already in 1978, passive solar heating compares favorably on a life-cycle basis with electric space heating in nearly all parts of the United States, with oil in most places, and with (regulated) gas in some places. Passive solar heating is generally predicted to be more economical on a life-cycle basis than active solar heating for the same delivered BTU (at low solar fractions).
- ° Although development of some specialized products would be helpful, most materials, manufactured products, and construction methods needed for commercialization are now commonly employed in building construction without serious environmental, net energy, or institutional drawbacks to be anticipated from their expanded use.
- ° The major barriers to commercialization are surmountable through an effective passive solar commercialization program.

While there is much activity underway throughout the United States in passive solar heating and cooling, these techniques are still not generally incorporated into most new and existing buildings. This lack of passive buildings may be generally traced to:

- ° The building industry's lack of awareness and understanding of present and possible passive solar applications.
- ° A lack of quantitative basis for evaluating design decisions such as estimating costs and performance.

- Presently higher first costs than conventional building design and construction.
- Artificially low fuel prices.

A key element in the commercialization of passive solar is the ability of the building community to effectively integrate passive solar approaches into the normal design process. The lack of marketable passive solar building designs and design tools was identified as an important obstacle to commercialization. The goals of commercialization will be met when passive solar design is accepted as 'standard practice' by both professionals and building trades. In other words, when common materials and passive solar products are combined in such a way as to maximize the benefits of environmental resources (e.g. sun, wind, earth, etc.) in the design of the building. Consequently, a key strategy is to develop various design tools which lead to development of designs and construction of buildings using passive techniques.

Built upon a foundation of research and development, the main structure of the commercialization effort is education and information dissemination. Education of the consumer will stimulate demand for passive solar systems. Education of the key participants in the building industry (designers, builders, developers, lenders, etc.) and expansion of existing professional design and trade organizations' education and information programs will greatly stimulate near-term use.

Part of this program involves the production of documents on passive solar concepts to increase the availability of information to designers and others in order to increase the professional capability to design passive buildings.

Aside from the present one these documents include:

- Passive Solar Design: An Extensive Bibliography
Produced by the AIA Research Corporation for DOE;
available from U.S. Government Printing Office.
- Survey of Monitored Passive Solar Buildings
Produced by AIA Research Corporation for DOE;
available from U.S. Government Printing Office.
- Passive Design Handbooks
Under production for DOE; availability not yet known.
- Survey of Passive Solar Buildings
Produced by the AIA Research Corporation for the U.S. Department of Housing & Urban Development; available from AIA Publications Fulfillment, 1735 New York Avenue N.W., Washington, DC 20006.
- Regional Guidelines for Building Passive Energy Conserving Homes
Produced by the AIA Research Corporation for the U.S. Department of Housing & Urban Development; available from the National Solar Heating & Cooling Information Center, PO Box 1607, Rockville, MD 20850.

- ° Passive Solar Heating and Cooling Conference and Workshop, Albuquerque, NM, May 18-19, 1976. Proceedings. Available from National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161. 355 p. \$10.50 (paper).
- ° 2nd National Passive Solar Conference, University of Pennsylvania, Philadelphia, March 16-18, 1978. Passive Solar: State of the Art. 3 vols. Available from Mid-Atlantic Solar Energy Association, 2233 Gray's Ferry Avenue, Philadelphia, PA 19146. \$20.00 (paper).
- ° 3rd National Passive Solar Conference, San Jose, CA, January 9-14, 1979. Proceedings; availability not yet known.

INTRODUCTION

The purpose of this bibliography is to provide design practitioners with a core of sources for informing themselves about passive design. It should be used as a basic resource. It is intended to give practitioners ready access to good materials on topics relating to the use of passive heating and cooling techniques. Rather than listing all articles, it provides a substantial sampling of the information available at the time of publication. Since the field is changing rapidly, new publications are appearing all the time. However, the present document will lead to a general understanding of the state of the art. More detailed research can be pursued using "Passive Solar Design: An Extensive Bibliography."

The bibliography is divided into twenty subject-matter categories, with entries listed alphabetically according to author in each category. As with any cataloguing system, the categories are somewhat arbitrary and the assignment of particular entries to specific subject matter categories is likewise somewhat arbitrary. Therefore, if the first category consulted does not yield a reference on the desired subject, two or three related categories should be consulted. The books and articles listed will, of course, readily lead to additional sources.

COSTS, ECONOMICS, POLITICS

KEYWORDS: TAX; INSTALLED COSTS; PHILOSOPHY; LAW

- Fraker, Harrison, Jr., and William L. Glennie. "A Computer Simulated Performance and Capital Cost Comparison of 'Active vs. Passive' Solar Heating Systems." Passive Solar Heating and Cooling Conference and Workshop, Albuquerque, NM, May 18-19, 1976. Proceedings. Washington, D. C.: U. S. Government Printing Office, 1977, p. 254-269. Available from National Technical Information Service, U. S. Dept. of Commerce, Springfield, VA 22161. 355 p. \$10.50 (paper)
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- International Solar Energy Society, American Section, Annual Meeting, Denver, CO, August 28-31, 1978. Proceedings. 2 vols. Available from American Section, International Solar Energy Society, Inc., P.O. Box 1416, Killeen, TX 76541. \$60.00 (paper) Partial contents:
- Abrash, M., P. Sullivan, and R. Wirtshafter. "The Economic Tradeoffs between Active and Passive Solar Heating and Energy Conservation on Residential Buildings." v. 2, p. 543-548.
- Roach, Fred, Scott Noll, and Shaul Ben-David. "The Comparative Economics of Passive and Active Systems: Residential Space Heating Applications." v. 2, p. 537-542.
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- Goodnight, Jill A. "Survey of State Solar Incentive Legislation." v. 3, p. 727-731.
- Knowles, Ralph L. "Solar Ethics: Urban Form." v. 3, p. 840-849.
- Nichols, Wayne. "Marketing the Passive Solar Home." v. 3, p. 704-709.

State Solar Legislation. National Solar Heating and Cooling Information Center, P. O. Box 1607, Rockville, MD 20850, 1977, 2 p.

DESIGN CONCEPTS

KEYWORDS: DESIGN AIDS; COMPUTER: SIMULATION AND ANALYSIS; GEOMETRY; CALCULATIONS; SYSTEMS TESTING: CRITERIA, INSTRUMENTATION, NUMERICAL ANALYSIS

Baer, Steven. Sunspots: Collected Facts and Fiction. Zomeworks Corporation, P. O. Box 712, Albuquerque, NM 87103, 1977, \$4.00 (paper)

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Duffie, John A., and William A. Beckman. Solar Energy Thermal Processes. John Wiley & Sons Inc., 605 Third Avenue, New York, NY 10016, 1974, 386 p., \$19.00 (hard)

Eccli, Eugene, editor. Low-Cost, Energy-Efficient Shelter for the Owner and Builder. Rodale Press, Inc., 33 East Minor Street, Emmaus, PA 18049, 1976, 408 p., \$10.95 (hard), \$5.95 (paper)

Energy: AIA Energy Notebook; an Information Service on Energy and the Built Environment. Publications Fulfillment, American Institute of Architects, 1735 New York Avenue, N. W., Washington, D. C. 20006, 1975 - (#5-PEN) 12-month service, \$120.00; renewal, \$90.00 (#5-PER) (looseleaf)

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Palmiter, Larry, Bill Caswell and Bob Corbet. "Measured and Modeled Passive Performance in Montana." v. 2, p. 59-63.

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Leckie, Jim, et al. Other Homes and Garbage; Designs for Self-Sufficient Living. San Francisco: Sierra Club Books, 1975. Available from Charles Scribner's Sons, Book Warehouse, Vreeland Avenue, Totowa, NJ 07512. 302 p., \$9.95 (paper)

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Partial contents:

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Balcomb, J. Douglas, et al. "A Simple Empirical Method for Estimating the Performance of a Passive Solar Heated Building of Thermal Storage Wall Type." v. 2, p. 377-389

Calthorpe, Peter. "The Farallones Institute Study of Five Passive and Hybrid Space Heating Systems." v. 2, p. 298-304.

Holton, John K. "Critical Performance Standards for Passive Solar Buildings." v. 2, p. 294-297.

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Niles, Philip. "A Simple Direct Gain Passive House Performance Prediction Model." v. 2, p. 534-538.

Taff, D. C., et al. "Active vs. Passive Systems: A Design Rationale for the Selection of Passive Systems Based on a Comparative Study of Efficiency, Capacity, Economics and Thermal Network Analysis." v. 3, p. 828-835.

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DESIGN EXAMPLES

KEYWORDS: WHOLE CASES; CONCEPT ASSESSMENT; INSTRUMENTED RESULTS;
GENERAL CASE DESCRIPTIONS

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- Passive Solar Heating and Cooling Conference and Workshop, Albuquerque, NM, May 18-19, 1976. Proceedings. Washington, D. C.: U. S. Government Printing Office, 1977. Available from National Technical Information Service, U. S. Dept. of Commerce, Springfield, VA 22161. 355 p. \$10.50 (paper). Partial contents:
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- Shore, Ronald. "Pitkin County's Airport Terminal...or...Where Did All the Natural Gas Go?" p. 129-131.
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- Wilson, Thomas C. "Two Recently Completed Trombe Wall Retrofits." v. 1, p. 76-80.

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- Shurcliff, William A. Solar Heated Buildings: A Brief Survey. 13th and final edition. 19 Appleton Street, Cambridge, MA 02138, 1977, 306 p., \$12.00 prepaid (paper)
- Skurka, Norma, and Jon Naar. Design for a Limited Planet: Living with Natural Energy. Ballantine Books, Inc., Westminster, MD 21157, 1976, 215 p., \$5.95 (paper)
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WEATHER, CLIMATE, INSOLATION

KEYWORDS: SOLAR GAIN AVAILABILITY; MICROCLIMATE; OPTIMUM GAIN ANGLES; SITING FOR OPTIMUM GAIN; ATMOSPHERE EFFECTS; SKY PROPERTIES

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KEYWORDS: ZONES OF COMFORT (TEMPERATURE, HUMIDITY); CLOTHING; HUMIDITY; MODES OF OPERATION

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GREENHOUSES

KEYWORDS: DETACHED; GREENHOUSE-HOUSE COMBINATIONS

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- Fisher, Rich, and Bill Yanda. The Food and Heat Producing Solar Greenhouse. Santa Fe, NM: John Muir Publications, 1976, 161 p. Available from Book People, 2940 Seventh Street, Berkeley CA 94710. \$6.00
- Maes, Reed E. "A Large Scale Northern Climate Solar Garden." International Solar Energy Society, American Section, Annual Meeting, Denver, CO, August 28-31, 1978. Proceedings. 2 vols. Available from American Section, International Solar Energy Society, Inc., P. O. Box 1416, Killeen, TX 76541. \$60.00 (paper v. 1, p. 10-16.
- National Passive Solar Conference, 2nd, University of Pennsylvania, Philadelphia, March 16-18, 1978. Passive Solar: State of the Art. 3 vols. Available from Mid-Atlantic Solar Energy Association, 2233 Gray's Ferry Avenue, Philadelphia, PA 19146. \$20.00 (paper)
Partial contents:
- Kolstand, Charles. "Economics of Attached Solar Greenhouse for Home Heating - A preliminary Assessment." v. 3, p. 822-826.
- Mazria, Edward, and Steven Baker. "Noti Solar Greenhouse: Performance and Evaluation." v. 1, p. 190-196.
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AGRICULTURE

KEYWORDS: BARNS AND SHEDS; CROP DRYING

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- "The Solar Energy Society Survey of Research on Applications of Solar Energy to Agriculture, Horticulture, Animal Husbandry, and Forest Products." Solar Energy. v. 9, no. 2, April/June 1965, p. 87-94.
- A Survey of Solar Agricultural Driers. Brace Research Institute, Macdonald College, Ste. Anne de Bellevue, Quebec, Canada 80A 1C0, 1976, 144 p., \$9.00 (paper)

GLAZING

KEYWORDS: ASSEMBLIES; MATERIAL PROPERTIES; SKYLIGHTS, CLERESTORIES;
DAYLIGHTING; GENERAL ASPECTS OF FENESTRATION; DIRECT GAIN; SEALANTS

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