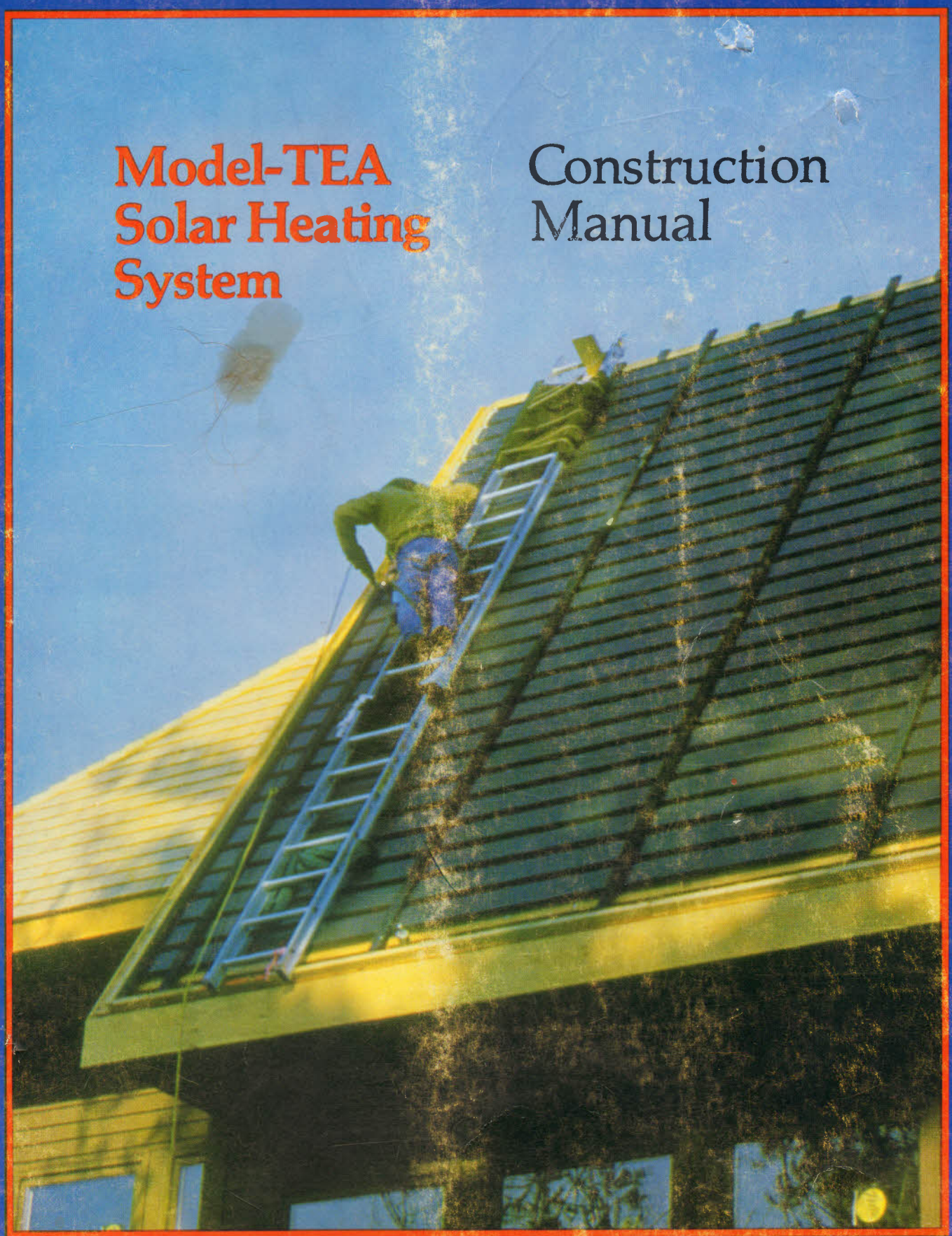
# Model-TEA Solar Heating System

# Construction Manual



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Supported by United States Department of Energy, Solar Heating and Cooling Research and Development Branch

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**Cover Photo:** Jennifer A. Adams
**Text Photos:** Jennifer A. Adams
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**Total Environmental Action, Inc.**
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# Preface

This construction manual provides complete plans and step-by-step instructions for building the MODEL-TEA Solar Heating System. The manual also contains a wealth of information on development of the design, solar basics, materials analysis, and engineering of solar systems. The MODEL-TEA Solar System is integrated into the building on site, and performs as well as commercially manufactured systems, but at roughly one-half the cost. The on-site assembly allows for a tremendous savings in materials, since the building itself performs the function of many materials normally included in an installed commercially manufactured collector panel.

The MODEL-TEA was developed through an intensive two year research and development project at Total Environmental Action, Inc., supported by the United States Department of Energy, Solar Heating and Cooling Research and Development Branch. The purpose was to create a design for an active solar air heating system which was low cost, durable, attractive, and could be readily constructed by any experienced builder. To maximize use, the design had to be adaptable to either walls or roofs and to new or existing buildings. The need for such a system was clear. Commercially manufactured active systems for residential applications were too expensive to be very cost-effective. On the other hand, passive solar systems, though less expensive, could not be easily integrated on a large scale into many building types. TEA believed that an inexpensive active solar system could have a major impact on residential energy use nationwide.

The solar field is rapidly changing -- new materials and products quickly become available and the economic frame of reference is not constant. Since new developments may directly affect decisions and choices presented in this manual, we should all realize the importance of maintaining close contact with the forefront of the field. TEA has a strong belief in the importance of site-built active solar to residential energy use, and will endeavor to continue major research and development in this vital area.

At this point, however, a large part of the challenge shifts to you, the consumer. This construction manual supports our belief that the MODEL-TEA Solar System works, is cost-effective, and will provide an attractive option for many of the homes in our country. You must make it happen -- must dare to be the first in your area, so your neighbors can see for themselves. We need your comments, and your neighbor's comments. TEA has

tried to offer basically one design which is most suitable for a wide variety of needs, applications, and geographical areas. Necessarily, as in any complex project, compromises had to be made. Perhaps, for your particular application, you feel a design change is appropriate. We would appreciate any comments on design suggestions, problems, additions, or information that will help us provide better site-built designs to the public. We have enclosed a card at the back of the manual for this purpose.

Many people at TEA have contributed to the development of the MODEL-TEA. Peter Temple and Jennifer Adams were responsible for the writing and preparation of this construction manual, which is the final product of the entire project. Jennifer Adams prepared all the construction drawings, graphics, and wrote the chapters on step-by-step construction. Peter Temple wrote the remaining chapters and had overall responsibility for the manual.

The information and solar system design contained in the manual grew out of a series of two projects at TEA. The basic idea for the horizontal flow air collector was conceived by Charles Michal in 1975. Experience with several installations demonstrated that the collector was relatively simple to construct and provided good performance. Subsequently, a proposal was submitted to the Department of Energy to perform a detailed study of the collector materials and an investigation of the TEA design relative to other possible designs, to result in optimization of the site-built collector. Joseph Kohler was project manager of this first project and guided it through the original design decisions, theoretical analysis, construction of test modules, and analysis of experimental results. Peter Temple did much of the research in all phases, particularly in the materials study, and Jennifer Adams developed the collector construction details. This project resulted in a final collector design, with the exception of the glazing materials.

A second proposal was submitted to the Department of Energy to complete the collector design and develop a design for the accompanying air-handling and storage systems. This would allow a complete construction manual to be written, providing all necessary information for the installation of a full solar system. Peter Temple was project manager and principal investigator for this work and directed the glazing material tests, system design, and had overall responsibility for all final design decisions. Jennifer Adams had a major role in the final materials and glazing choices, and developed the design details for all versions of the collector. She provided valuable input on all the collector design decisions. Dan Lewis did the majority of the air-handling and control system development. He surveyed the state of the art, created the initial design alternatives, and optimized the final designs. Charles Michal and Paul Sullivan made significant contributions to major design decisions.

Other individuals, outside of TEA, made valuable contributions to the project. TEA would like to thank Jeremy Coleman, Ray Bliss, Al Converse, Michael Havey, and Vic Reno. TEA is also indebted to the Department of Energy for support of this work, and would particularly like to thank Kirk Collier, Steve Sargent, Mike Davis, and Chuck Bankston.

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P.L.T.
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