INTRODUCTION

All of us are experiencing the problem that this book can help to ease: the rising cost of energy. The fuel bills for heating our homes and businesses are steadily rising every winter with no end in sight; and more and more of our income is required to maintain the level of comfort to which we have become accustomed. Weatherizing your house by caulking, weatherstripping and adding insulation is a sure way to reduce your energy use and make your house more comfortable. Another approach is to replace an inefficient furnace or water heater with a more efficient one. You can also change to a cheaper fuel. Presently, gas and wood are typically cheaper fuels than oil and electricity. Sacrifice is yet another way to lower heating costs and is the approach many low- or fixed-income families must choose. Wearing sweaters and coats indoors and washing in cold water are reality for many people who are faced with a heat-or-eat situation.

Yet no matter how much you conserve or sacrifice, if you live where it is cold in the winter, some heat must be added to your house for it to be reasonably comfortable. We can look to the sun to produce this heat at a reasonable cost.

The purpose of this book is to help you avoid the high cost and unnecessary complexity of commercially manufactured solar air heaters by showing you how to build your own attractive, durable, low-cost collectors that deliver just as much heat as commercial systems costing over three times as much. Solar air heaters are easy to build, and hundreds of owner-built collectors have been used successfully nationwide, but some deliver a lot more heat than others. Most of the do-it-yourself installations we have inspected would work a lot better if only one or two things had been done differently. By presenting the basic principles involved and some of the mistakes made by others, we hope to help you build a troublefree, efficient and cost-effective solar heater.

Site- Built Collectors in the San Luis Valley

Most of the information in this book is the result of the practical experience of do-it-yourself collector builders in Colorado's San Luis Valley. This high mountain valley has more owner-built collectors per capita than anywhere else in the world and is often described as the most solarized place in the United States. The San Luis Valley is a natural place for a

Both the San Luis Valley Solar Energy Association and the Solar Energy Association of Northeast Colorado (especially member Vern Tyron) provided valuable assistance during the completion of this work.

I'd like to extend a special thanks to the individuals who spent many hours reading rough drafts and who offered their suggestions and comments: my father, John Kornher; long-time friend Jed Davis; solar contractor Mark Randall; hyrdoelectric enthusiasts Doug and Sue Bishop; solar consultant Bob Dunsmore; low-cost solar builders Arnie and Mario Valdez; and my business partner, Rick Roen.

A special thanks goes also to Nancy Wilkie, who made sense out of the second draft, and to Pat Todaro, who spent many late nights typing the majority of the manuscript.

The staff of Rodale Press has been instrumental in making this a well-organized, accurate and readable book, and to Rodale's hard-working editors I'd like to extend my thanks: to Joe Carter for his technical expertise and great job of editing and to Margaret J. Balitas for her organizational abilities and patience with a first-time author.

Photo 0-1: This vertical collector, one of the first built in the San Luis Valley, is shown in the late spring partially shaded by eaves. After ten years of use, the fiberglass glazing has yellowed and is in poor shape. The wooden trim is also falling apart, but the collector still delivers a lot of usable heat to an insulated crawl space.

grass-roots solar boom since the region is very cold and very sunny in the winter. Low income levels, high fuel costs and several weeks of subzero weather forced many families to seek an alternative to expensive propane heating. They found it with low-cost, site-built air-heating collectors.

In 1972 and 1973 the first of many systems were installed in the valley. They were designed by]. K. Ramstetter and built by his son-inlaw, Bill North. The early "North" collectors were glazed with corrugated fiberglass, had wooden frames and baffles and used corrugated aluminum roofing for the absorber surface. Most of them were mounted vertically on south-facing walls and were used for space heating only. The heated air was blown into an insulated crawl space or directly into the house. Many systems costing under $300 reduced heating bills by 50 percent and paid for themselves within two winters. News of their success rapidly spread and farmers and ranchers throughout the valley began installing their own, easy-to-build systems onto homes, shops and outbuildings.

As with any new technology, innovations in collector design appeared everywhere. Changes in the original design were made; some were improvements, others mistakes. All of the systems built provided heat, but some gave much more than others.

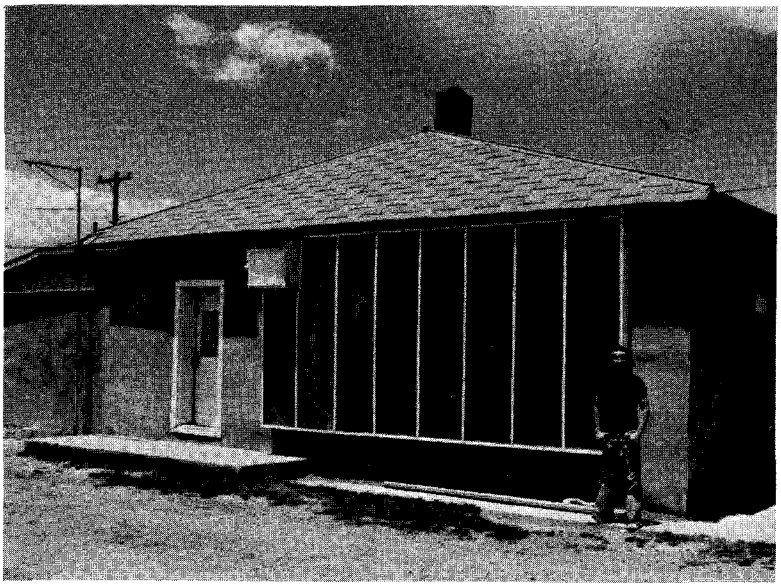

Photo 0-2: People in the San Luis Valley began building site-built installations to reduce their fuel bills long before tax credits popularized collector construction. This older, owner-built system was constructed from corrugated aluminum roofing material and flat fiberglass glazing. A wall-mounted blower delivers air directly into the house.

In 1976 and 1977 the newly formed San Luis Valley Solar Energy Association began collecting the best design ideas and providing advice to people to help them build efficient, durable and cost-effective systems. Some of the design improvements included reducing the size of the airflow cavity, using a flat rather than a corrugated absorber plate and using metal for the collector frame and baffles. As some of the first North collectors began to age, it became obvious that even the best fiberglass wasn't a permanent glazing material. Nowadays, collectors are more often glazed with tempered glass. Older collectors also began to lose their seals and leak air, so improved sealing techniques were developed. These improvements increased the cost of construction slightly but resulted in much more durable and efficient collectors.

Lately, homeowners have been building bigger systems that provide a larger percentage of their heating needs, and systems with rock storage for nighttime use have become popular, especially in new construction. More do-it-yourselfers also use their space-heating systems for preheating hot water in the summer or design and build systems to heat water yearround. Nearly everyone in the San Luis Valley is enthusiastic about solar heating, and collector building is still booming. Several businesses now

offer commercial systems and are doing a brisk business among the more affluent, but for those folks looking for thrifty heat and the satisfaction of doing their own installation, site-built air heaters are still the first choice.

The benefits of building your own collector are not restricted to rural residents. The city or suburban dweller can easily utilize the ideas presented in this book to design and build a system for his house.

Can You Build a Collector?

If you can finish out a room in the basement, weatherize your house or put in a patio, you can build some type of collector. Building the various collector designs presented in this book requires widely different levels of skill. The passive window box and TAP collectors are quite simple, but still require a dedication to detail. A large active air-heating system is much more complex, requiring no small amount of how-to savvy and a dedication not only to detail but also to what will probably be a longterm project. You'll find no exotic tools or construction techniques are required, and your tool box probably contains every tool you will need. Materials for the low-cost systems described in this book are all locally available or can be easily located.

Working with metal is a new experience for many do-it-yourselfers, but it need not be worrisome. All of the metal used in the construction of air collectors is lightweight and can be worked with simple hand tools. You may be surprised how easily the pieces go together.

Building your own solar system is a project that can be undertaken in the evenings and on weekends since most of the work can be done in stages. Depending on the type and size of system you're building, you could be looking at just a few days' work or many, possibly very many evenings and weekends. The bigger the project, the more planning becomes essential. It is, for example, a good idea to add more elaborate air distribution schemes, a hot water preheat system or rock thermal storage later, after the collector is already installed and providing heat.

The advantage of building your own system is that you can get just what you want. Nobody knows your house as well as you do, and with the ideas presented in this book, you, better than anyone else, can design a system to fit your needs. The authors of this book have retrofitted many different systems and have found that homeowners, with very little previous knowledge of solar heating, have come up with at least half of the good ideas that were incorporated into their own systems. With few exceptions, owner-builders have been very satisfied with their systems and are among the strongest proponents of solar heating.

The do-it-yourselfer must be willing to invest a considerable amount of time in building a system. About 100 hours are required to build a

simple lOO-square-foot collector system, but it can be enjoyable and satisfying work as well as economically rewarding. It is a true thrill to turn on the blower and feel that first blast of solar-heated air.

But Collectors Are So Ugly

It's true that a collector isn't cedar tongue-and-groove siding, a freshly painted white picket fence or a stained glass window. One greenhouse builder we know refers to collectors as "unsightly black squares" in his sales literature. But as energy prices continue to soar, collectors "look" more and more attractive. A collector can be absolutely beautiful on a winter day when it's sending all that heat into your house.

Using This Book

This book covers many different design options for air-heating collectors.

Solar installations are very site specific; that is, the site where they are installed usually determines the size and type of system that is most desirable. There is a great deal of variation among different installations, and presenting one option as the system would be very misleading. So

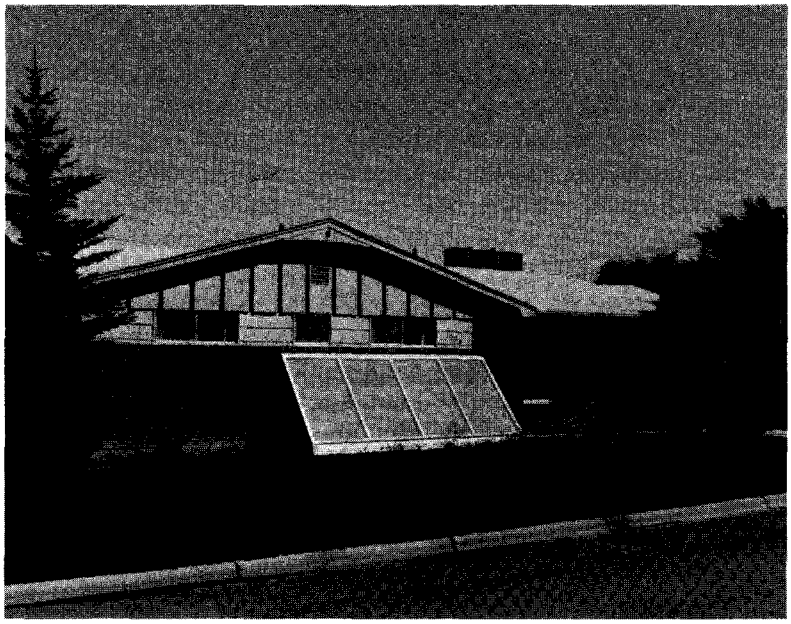

Photo 0-3: Site-built collectors mounted at a slant are becoming more popular because they can be used for water heating in summer as well as for winter space heating.

by describing several options, we aim to help you choose system features that will suit your specific needs. Also, we allow options regarding the selection of building materials, since some of the materials we recommend may be hard to obtain in your area.

The use of solar air-heating collectors is not the complete answer to our energy dilemma, but they do provide an immediate, nonpolluting solution. We can use the sun for heating without the environmental problems involved in burning fuels or disposing of nuclear wastes. In 50 or 100 years our descendants will be living in energy-efficient homes heated by the sun, and small collectors will be used, as they should be, for supplemental heat or for specialized uses. But our existing houses and apartments will be inhabited for a long time to come, and retrofitting them with solar collectors is an appropriate way to heat them. As fuel prices rise, more of you will be clearing the way on the south side of your houses to let the sun shine in. So let's get on with it. We agree with our solar guru, J. K. Ramstetter, when he says, "We need a million site-built systems installed in the next few years." It's up to you to make the most of this most cost-effective approach to solar heating.

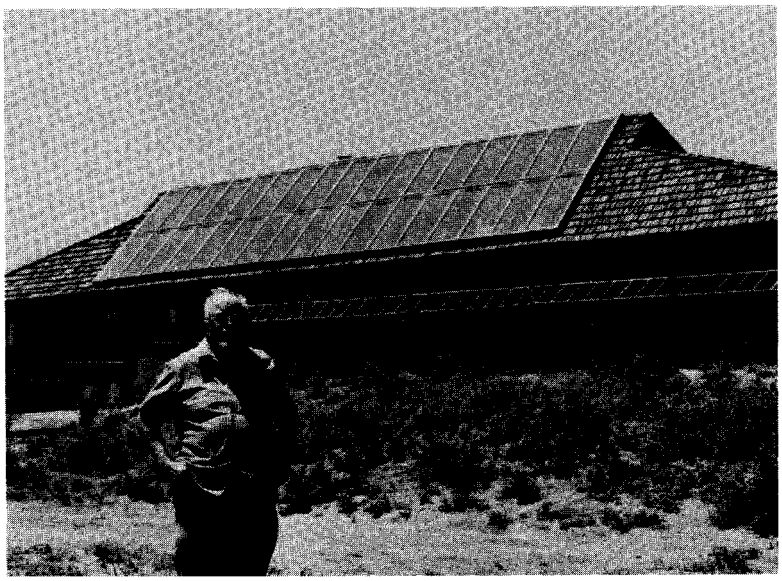

Photo 0-4: J. K. Ramstetter, the father of low-cost solar heating in the San Luis Valley, is presently exporting his know-how to the Denver suburbs. He designed and built this large, site-built system in Lakewood, Colorado.