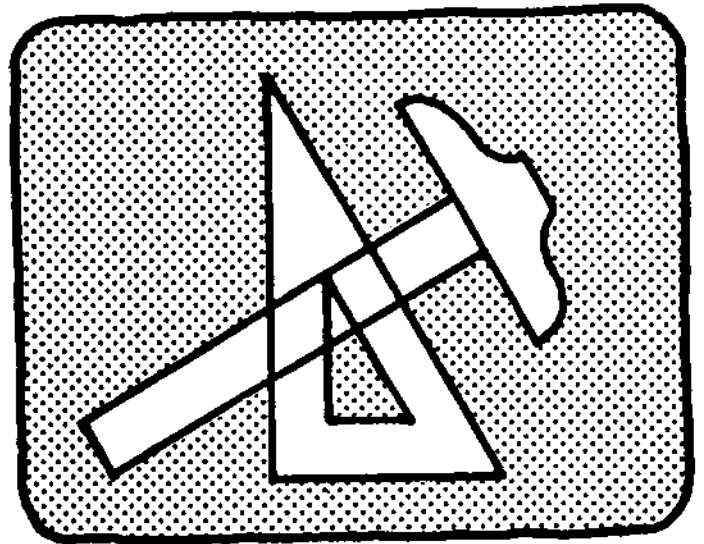
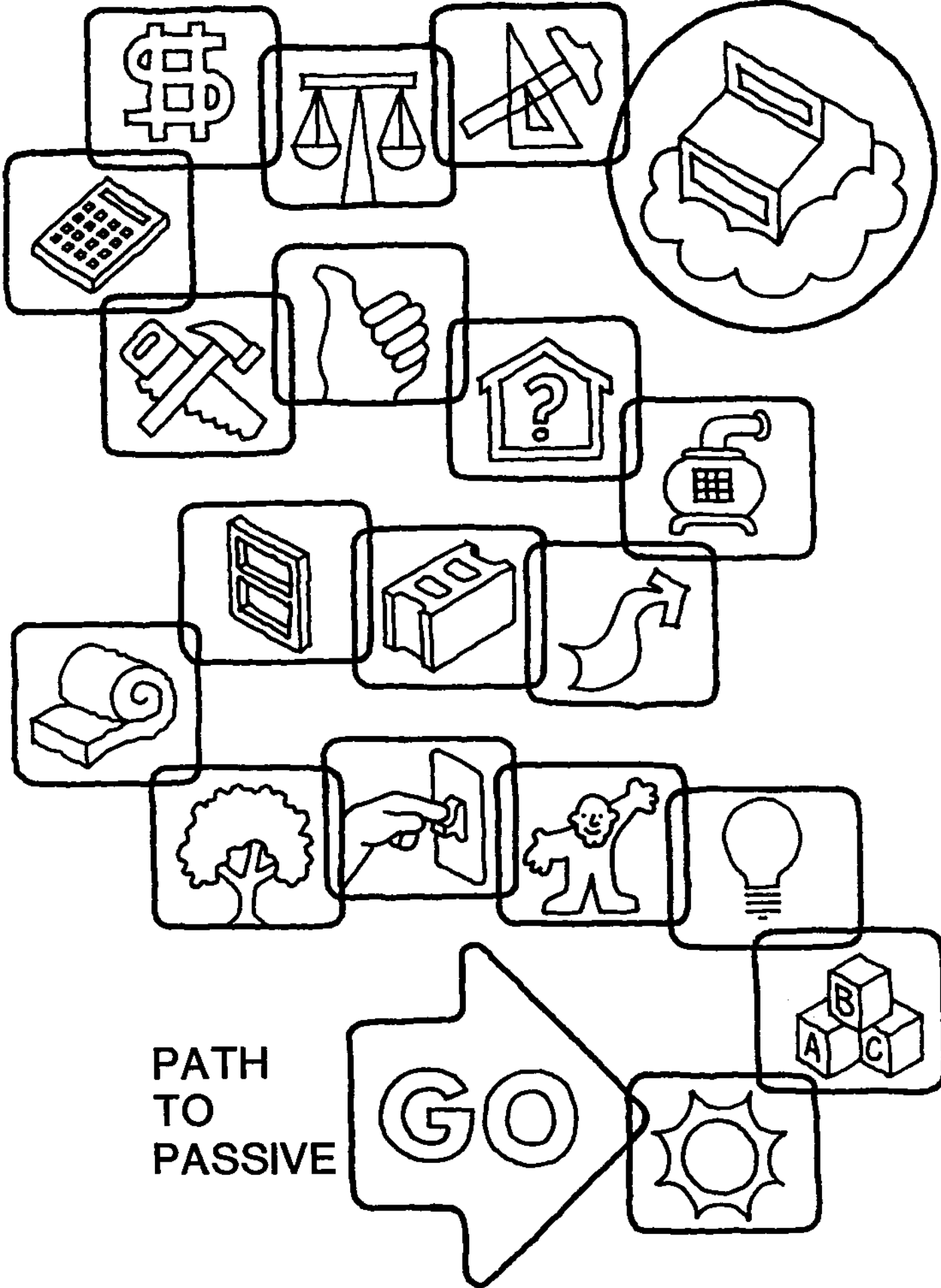


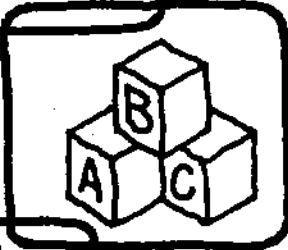
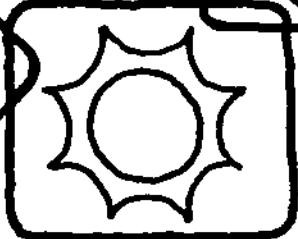
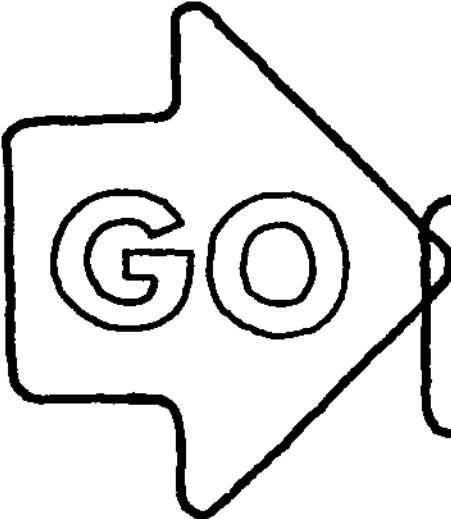
CHAPTER 8 SOLAR PROCESS

This chapter is an overview of the steps that should be taken in planning and building a passive solar home.





PATH
TO
PASSIVE



SOLAR PROCESS

The preceding chapters have discussed solar energy fundamentals, design ideas, passive solar systems, engineering, etc., and with this background it is possible to discuss the steps (FIG 8-1) that should be followed from a project's inception to living in the solar structure.

STEP 1: EDUCATION

In many extremely important ways, the design and construction of passive solar homes is significantly different from conventional residential design and construction. Therefore, the prospective owner of a passive solar home must become as knowledgeable as possible about what passive solar is and what it involves; what it can and cannot do; what the homeowner is qualified to handle; where and when he must or should rely on professionals; and how to deal knowledgeably with those professionals.

Thus, the solar process begins with information. Fortunately, much information is available. Reading this book is a good first step in the education process. Additional reading may be helpful, and a bibliography of recommended books is included in Appendix 7. Information may also be gathered at workshops, seminars, classes, conferences, etc., sponsored by, among others, the Nebraska Solar

Office, the Nebraska Energy Office, community colleges, universities, etc.

STEP 2: I WANT SOLAR !!

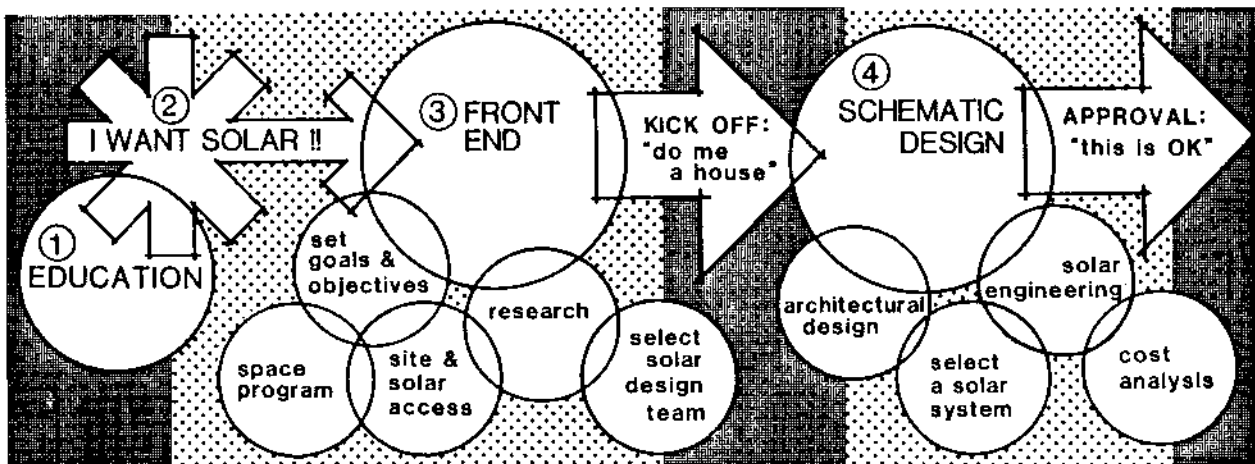
Once initial information has been gathered, the advantages and disadvantages of various passive solar and conservation strategies can be evaluated. This knowledge and a desire to build makes possible an informed commitment to build a passive solar home.

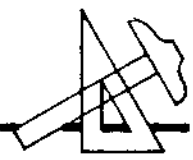
STEP 3: FRONT END

With an affirmative decision to proceed, the "front end" work begins. This work includes selecting a solar design team, conducting specialized research, setting goals and objectives, establishing a space program for the house, and choosing a site.

Unless the homeowner is a design professional with solar experience, he should obtain the services of a solar consultant or architect with solar experience. These professionals play an important role in setting project goals and objectives, site selection, and preliminary design.

The information gathering process, which should continue throughout the course of





the project, would at this stage include research such as visiting an existing passive solar home. These visits give the potential passive solar homeowner a chance to understand the architectural features, to check the quality of construction, and to get a feeling for the ambiance of solar living.

The goals and objectives of the design must be established early in the process. For example, the goals and objectives of Herbie's home discussed in Chapter 5 would be to provide their family of 4 with a passive solar home of 1000 sq ft, with construction costs not to exceed \$65,000.

Once the goals and objectives have been determined, the space plan can be determined. The space plan is a list of individual spaces such as the living, kitchen and dining areas, bedrooms and bathrooms, and the desired size of each.

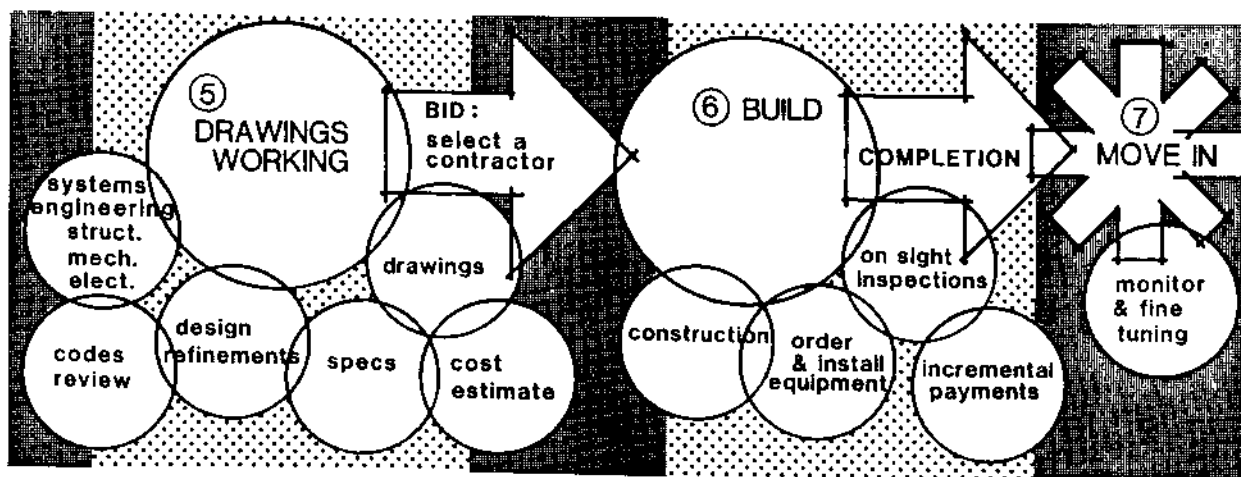
Because a passive solar home is site specific (i.e., it must be designed specifically for its particular site and site conditions), site selection is a very important initial step in the solar process. Considerations in site selection include lot size, views, noise, vegetation, climate, soil conditions, and local zoning and building codes.

One of the most important considerations in selecting a site is whether or not provisions have been made or can be made for solar access: does the proposed collection area receive adequate sunlight; is legal protection for continued solar access assured through restrictive covenants or easements, or would it be possible to obtain solar easements from surrounding landowners?

STEP 4: SCHEMATIC DESIGN

When the owner is satisfied with the goals and objectives of the project, the professional design team -- i.e., those individuals with the requisite knowledge and experience to design a successful passive solar home -- can begin the task of designing the passive solar house.

The goal of the design phase is to create a proper blend of energy efficiency, aesthetic considerations, and cost limitations. During this phase, the owner's input and review is essential, and should include a healthy evaluation of alternative systems strategies. The final product of the design stage will be a visual description of the project including floor plans, elevations, sections, and three dimensional representations such as perspectives or scale models.



SOLAR PROCESS

An important element in the design process is the selection of the solar system or combination of systems that will be used in the home. In order to make an informed decision, the architectural designer must be well-versed in the use of passive solar fundamentals and other energy efficient strategies. The selection of a solar system should not be made on its solar performance alone but should also depend on initial design parameters and cost considerations.

Usually, heating and cooling systems engineering is left to the end of the design process. However, rising energy costs have dictated that energy performance studies be conducted very early in the design process. This input can have a dramatic effect on the visual character of the building by influencing the exterior surface to interior volume ratio, quantity and placement of glass, insulation requirements, types of building materials, and other design features.

When the basic design is completed, a preliminary cost analysis can be conducted. The cost analysis should include a preliminary estimate of construction costs as well as a prediction of annual energy costs.

When the schematic design has been completed and the owner has approved the design, the working drawings phase can begin.

STEP 5: WORKING DRAWINGS

During the working drawings phase, the professional team -- consisting of architects, engineers, consultants, and technicians -- will turn the basic design into a buildable solution. The final product will be in the form of drawings and specifications that contain the information necessary to bid and construct the building.

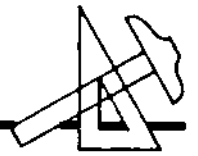
Structural, mechanical, plumbing, and electrical systems must be engineered during this phase to work in conjunction with the passive solar design. For example, if the project is to be earth sheltered, a structural engineer should be consulted to ensure the structural integrity of the building with regard to stresses caused by the earth load on or against it.

The working drawings phase should include a complete review of applicable building code requirements as well as energy code standards which may affect the structure. For example, a structural engineer's certification may be required on plans for an earth sheltered home before the building permit is granted.

Energy codes have been adopted in some cities to protect the consumer from the construction of energy inefficient buildings. These energy codes may limit the ratio of glass area to floor area. Most solar buildings would not satisfy the strict application of such codes, however, exceptions can be granted for passive structures by showing that the solar contribution to energy efficiency exceeds the energy savings of using smaller windows.

With the code review completed, design refinements can be made. The selection of interior finish materials should enhance solar system performance, e.g., thermal masses should have dark, non-reflective finishes, and light colors should be used on non-mass surfaces. Carpets should not be used over mass storage floors as this will greatly reduce the heat storage capacity of the floor.

Building specifications are written after design refinements have been made. These specifications describe the type and quality of materials and provide installation instructions.



Complete working drawings and specifications form the basis for a final cost estimate. If this final estimate exceeds the budget, the quality of materials can be lowered, the size of the building can be reduced, or a less expensive passive solar system can be incorporated.

STEP 6: BUILD

Selecting a builder before the design process begins can be very beneficial in assisting the designer and owner in choosing the most appropriate materials and details. If a builder has not been involved prior to completion of the working drawings phase, the building phase begins with the selection of a builder. Care must be taken in selecting the builder of a passive solar home because of the many new construction techniques and materials with which the builder must be familiar. This means that either the architectural plans must be more detailed than customary, or only builders with passive solar experience should be considered. All the planning will be for naught if the builder does not understand the purpose of the design features.

One way to select a builder is through competitive bidding. To be a valid process, selection by competitive bidding requires more detailed working drawings and specifications and this will increase the cost of the working drawings. It is possible, however, that this expense could be offset by a sufficiently low bid.

Periodic site inspections by the design team are recommended during the construction period to monitor progress and ensure that all details and techniques have been followed by the builder so that the predicted thermal performance of the building can be achieved.

STEP 7: MOVING IN

With the building completed and the owners moved in, the experience of living in a passive solar home can begin. To be successful, the passive solar home will require the active involvement of its occupants. An operations manual may be helpful in instructing or reminding the owners of particular steps that should be taken to ensure the superior performance and maximum benefit of their building. A manual might include such information as when to open and lower movable insulation, when to perform routine maintenance, etc.

The building performance should be monitored and records kept to see if results meet predictions. Desired data would include energy consumption, heating degree-days, solar insolation, etc. With sufficient monitoring data, an evaluation of performance can be made, and modifications of the original building or its operation can be considered.

Several example projects which are the result of the passive solar design and construction process are contained in the final chapter.