DOE/R4/10491--T1

10451
NC-77

Construction and Installation of Low-cost Energy-conservation Devices on Existing Residential Structures

FINAL REPORT

DOE/R4/10491--T1

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SUMMARY OF PROJECT

Through the Neighborhood Housing Services, Incorporated of Charlotte, a series of hands-on workshops and a demonstration site was provided to enable residents of the Plaza-Midwood Neighborhood to build and install a variety of low-cost, durable, small scale, energy conservation systems. This experiential approach enabled homeowners to apply specific technologies to their own homes. These cost effective measures were designed to encourage both self reliance and the use of renewable resources. The weekend projects included protected entry, numerous moveable window insulation devices, solar air collector/greenhouse, window greenhouse and water storage tubes.

The building used for retrofit was the office for the Neighborhood Housing Services (NHS), a non-profit corporation formed to help revitalize residential structures and maintain the economic, racial, and social character of existing neighborhoods. The particular neighborhood involved was Plaza-Midwood and covers approximately a 2 square mile area. The neighborhood housing stock is of the 1910-1940 variety with the pre-dominate architectural style being bungalow frame, having 1000 to 1900 square feet in area. The neighborhood is a racially integrated one, with about 70% of the residents being homeowners. An estimated 1700 housing units are in this area. The NHS office presently serves as a resource center for area residents who need loans and/or construction assistance. Providing a continuing educational program is a function of this organization. The Grant provided a significant contribution as a resource for energy conservation minded residents. A resource room displaying procedures and diagrams for the various projects in this proposal was established. Additional resource literature was provided and used by local residents.

R E P O R T

PROJECT OBJECTIVES:

1. Demonstrate the construction and installation of low-cost energy-conservation devices on an existing residential structure.
2. Develop a Resource Center for on going community use.

APPROACH:

Through a series of hands-on workshops a variety of energy conservations devices were introduced to area residents. Particular attention was paid to the problems involved in design and retrofit since use was for existing structures. There was concern for maintaining architectural integrity which became obvious once two projects in particular were finished. A protected entry or air lock entry was constructed on the front of the demonstration building. Incorporated in the construction were two french doors fixed as side panels and an operable combination storm door. Many residents who use the building regularly were not aware that this had been added to the front of the building. Both the eye appeal and the function of the air lock provided a stimulus for people who had been giving thought to energy conservation. The solar air collection/greenhouse on the other hand lacked the sensitivity to architectural blending. A foundation was constructed and a translucent double polyethylene film was used to cover a frame made from metal conduit. This was quite functional as a supplemental heat source and very inexpensive. It did however receive notice. People who commented basically did not like the plastic look. Those residents who installed solar rooms on their homes went ahead and spent the extra money for a rigid frame and glass construction. Although unforeseen, there was wisdom in an incongruous expenditure.

The largest attendance for projects came during the workshops where moveable window insulation devices were installed. These were items made from insulation board, shades, quilts and polyethylene. There were only two commercial demonstrations using Warm Window and Window Quilt. The ease of their operation was duplicated by the hinged shutter which is a variation of the pop in shutter both of which can be built at far less the cost of the commercially made units. Beside each unit was data written on a 5 x 7 index card indicating materials used, cost, features, and approximate R-value.

The units installed were: (1) Fixed Thermax Shutters, (2) Pop in Thermax Shutters, (3) Hinged Thermax Shutters, (4) Sealed Edge Heavy Duty Shade, (5) Window Quilt by Appropriate Technology Corporation, and (6) Warm Window by the Warm Window Corporation. All but the commercial units are described in William Langdon's book Moveable Insulation. (see Appendix)

The Solar Storage Tube and the Solar Water Heater workshops were unattended. These units are described in the appendix. We advertised and had a fair attendance on most workshops but these did not make. The weather could have accounted for it. See "Recommendations" for additional discussion.

A Three Way Window Box from the Mother Earth News and a Resource Room were added to the rear of the building. The window box created much interest which helped get people to stop by who had not heard about the project. The Resource Room became very obvious once folks stopped and came in. The room was supplied with brochures, magazines, books and print outs on the various items in the building. The 5 x 7 index cards posted by each of the projects also made reference to the room for additional information. This has provided a readily available resource for those interested in energy conservation.

RECOMMENDATIONS:

The thrust of this project was educational. One of the first steps in education is awareness of a need to be educated on a given subject. If we were to do this project again we would start by offering energy audits to the community. The workshops we gave probably provided the solutions before people were aware of the problems.

BIBLIOGRAPHY

The Passive Solar Energy Book; Edward Mazria; Rodale Press; Emmaus, PA; 1979.

"Solar on a Shoestring", ("Mother Earth News"), #66, November-December 1980, p.80.

"The Trouble with Windows", (New Shelter), October, 1980. p. 26.

Moveable Insulation; William Langdon, Rodale Press; Emmaus, PA.; 1980.

Sponsor Manual: Community Solar Water Heating Workshop Program; Duncor, Inc.; Temple, Arizona.

A P P E N D I X

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October 31
9:00 - 12:00 A.M.

FIXED THERMAX SHUTTERS

Costing only a few dollars to make, these shutters are as much as 4 times more effective than storm windows. Decorate with fabric or wallpaper.

WORKSHOP #1B

October 31
1:00 - 4:00 P.M.

HINGED THERMAX SHUTTERS

&

SEALED EDGE HEAVY DUTY SHADE

Ever wanted to improve on an idea - now is your chance! We'll take the shutter you just made and make it easy to operate or the shade which may already be in your window and make it keep the cold out.

WORKSHOP #2

November 12
9:00 A.M. - 3:00 P.M.

PASSIVE SOLAR AIR COLLECTOR

This is an intro to passive solar with a collector being constructed to supplement your current heating system. (Bring something to eat cause thinking and working makes a body hungry!)

WORKSHOP #3

December 5
9:00 - 11:00 A.M.
1:00 - 3:00 P.M.

MORE MOVEABLE WINDOW DEVICES

Three moderate-costing devices with quick pay back on heat savings will be presented. (Afternoon session will be a repeat of the morning session.)

January 9
9:00 A.M. - 1:00 P.M.

AIR LOCK VESTIBULE

This double entry system reduces transfer both summer and winter. The trick is adapting it to your home.

WORKSHOP #5

January 30
9:00 A.M. - 1:00 P.M.

SOLAR STORAGE TUBES

Principles of solar storage is the basis for this event which incorporates Kalwall storage tubes.

WORKSHOP #6

February 13
9:00 A.M. - 1:00 P.M.

THREE WAY WINDOW BOX

-Heater, greenhouse and food dryer. We all learn on this one. Even though the instructor hasn't incorporated the very adaptable and practiced device to his home.

WORKSHOP #7

March 11
7:00 - 9:00 P.M.
March 13
8:00 A.M. - 5:00 P.M.

SOLAR HOT WATER HEATER

This requires some homework with an evening class on the Thursday before the actual workshop.

A unit designed as a build-your-own low cost system by Sunco, Inc. will be purchased and installed. This is a demonstration class. Additional assistance is available should you decide to purchase your own system.

ReUsable News by
Christopher D. Turner
Earth Studies Program
5/6/83

Appalachian State University
Boone, N.C. 28608
Phone 704-262-2176

Working with Windows

If you live in a reasonably well insulated house, most of your home's heat probably escapes through windows and around doors. Many people think the problem is solved when they add a storm window or Thermopane glass. In terms of insulating value, a window with a double layer of glass is still only 1/5 to 1/10 as well insulated as the wall that surrounds it. Hence, you would do well to consider window treatments to save on heating and cooling.

Rick Walker, with the Plaza/Midwood Neighborhood Housing Services of Charlotte, NC; organized a number of workshops designed to help people help themselves and their neighbors to better insulate their windows. NHS received an \$8,444 Appropriate Technology Small Grant from the Department of Energy in 1981 to do the workshops and demonstrations. While the workshops concluded some time ago, the resource center at the NHS house (1400 The Plaza) contains valuable reference books and a planning center where you can work on your personal strategy for saving energy and money.

Not only does the resource center have publications you can use there, but many of the various types of window treatments are used on the house for you to see for yourself. Each window treatment or device has a 5 x 7 inch information card placed next to it detailing the cost to produce the item and the R-value it will yield. The higher the R-value, the

better the insulating ability. One of the best books on the subject, Moveable Insulation by William Langdon, for Rodale Press of Emmaus, Pennsylvania in 1980, can be found at most libraries including the resource center at NHS. Langdon resides in Asheville where he is well known as a passive solar architect. A number of the window treatments Langdon wrote about were incorporated in the Neighborhood Services workshops, and can be seen at their office. Some are quite inexpensive and easy to make; whereas others are more expensive and more complicated.

The edge sealed pop-in shutter can be made without much fuss and can result in quadrupling the insulating value of a double-glazed window. Basically, the window consists of a piece of insulating board such as Thermax with a cover on each side and framed around the edge with either wood, or vinyl clad foam. You put magnetic strips on the window and on the panel with compression foam gaskets between the strips. Then you merely place the pop-in-panel over the window and let the magnetic strips hold it in place. You can decorate the shutter with the coverings you choose. Some people make works of art out of their shutters so that when they are not in the window they mount next to the window on the wall.

Another version of the pop-in-shutter is the hinged shutter. Rick Walker has a large shutter on the window behind his desk. Since the window faces north, Rick keeps the shutter closed most of the winter and has a decorative covering facing him. In the warmer months, Rick opens the shutter and uses it as a bulletin board.

A number of commercial window treatments are available such as Window Quilt which is a system that you can have installed in your home or build yourself as a kit. The Window Quilt is an insulated roll-down shade which rolls down in a track on the edges to seal off infiltration.

Another commercially available system operates like a roman shade and is called Warm Window. This system claims an R-value of over 7, due to the many dead air spaces in its structure and its mylar vapor barrier.

For a free publication on movable insulation types, call TVA toll-free at 1-800-251-9242 and ask for their movable insulation brochure.

The Earth Studies Program produces ReUsable News with funding by the Department of Energy, and Appalachian State University and administration by the North Carolina Energy Division.

AIR LOCK VESTIBULE

An air lock vestibule or double entry is designed to reduce heat loss in the winter and also reduce the replacement of cool indoor air during the summer. The air lock's basic design includes interior and exterior doors used to trap a still air space between them so that only a small quantity of unheated or uncooled air in the entry is exchanged with the exterior air.

In planning and building an air lock vestibule or double entry it is necessary to pay particular attention to the following information:

1. The air lock spaces should be designed to maintain the architectural integrity of the structure.
2. The air space must be sealed properly to increase the efficiency.
3. The air space should be structured to meet the existing code or safety restrictions.
4. The air lock space design should be functional as well as efficient space.
5. Select materials suitable for the specific project.

Each air lock vestibule or double entry will vary in design, measurement, amount and type of material needed, and the length of time needed to complete the project. This variation is due to the many different architectural designs. The NHS air lock vestibule located at the front of the office can serve as a model of the design and purpose of a still air space.

WINDOW INSULATION SHUTTERS

FIXED THERMAX SHUTTERS

Location: Room 4 (See Floor Plan)

NHS has utilized the fixed thermax shutter on the north side of the house on french doors leading from the living room. The fixed shutter is placed permanently on the window or french doors by screws or can be mounted by twist clips. The shutters can also add a decorative appeal to any room by attaching coordinated fabric, wall paper or contact paper to the thermax. There are several variations of the fixed shutters which are described below.

The wood edge fixed shutter is the most expensive of the variations. The materials needed to construct wood edge fixed shutters are:

thermax	white pine with 3/8" "U" channel 3/4"x1 1/8"
3/8" foam weather strip tape	glue (spray type)
3D finishing nails	decorative fabric (optional)

Construction procedures are as follows:

1. measure window jamb opening accurately,
2. subtract 1/8" for foam weather stripping,
3. subtract an additional 3/4" for wood,
4. mark the deminsions on the thermax to maintain accuracy of cut, cut thermax with straight edge or square,
5. cut decorative covering to exact size and attach to the thermax side facing the room interior.

To construct the wood frame, after covering the thermax with fabric:

1. cut the U channels to length mitre connections at each end,
2. sand and finish, assemble around thermax and apply weather stripping to outside edge of shutter and install in window.

Tape edge fixed thermax shutter is less expensive than using wood as a edge. The materials for the tape edge are the same as those listed above with the exception of duct tape. The tape is used rather than the white pine. Construction procedures are as follows:

1. measure window jamb opening accurately,
2. subtract 1/8" for foam weather stripping,
3. mark deminsions on thermax,
4. cut thermax to size with straight edge or square,
5. tape edges,
6. cut decorative covering to exact size,
7. glue covering to side facing room interior,
8. apply weather stripping to outside edge of shutter and install in window.

The fixed card board shutter variation is a definite way to economize. Rather than using thermax, three (3) or four (4) pieces of cardboard can be glued together with the same effect. The instructions for constructing the shutter would be the same as listed above.

Tools needed to build the fixed shutter variations are:

saw	tape measure
miter box	hammer
square or straight edge	sponge or paint brush
utility knife	

MOVEABLE THERMAX SHUTTERS

POP - IN SHUTTERS

Location: Room 1, 7 (See Floor Plan).

The Pop - In Shutter is another type of thermax insulation window treatment. The Pop - In shutter is basically designed to conform to the glass size rather than the entire window as found in the fixed shutter. The shutter can be left in place or removed and stored away at the appropriate time.

The NHS office has two variations of the pop - in shutter. A wood edge shutter has been measured to fit the window jamb and actually pops in the window and seals against the jamb. The other variation is a tape edged shutter measured to fit on the glass panes. The shutter is sealed with magnetic clips attached to panes. In creating the tape edged shutter the upper and lower panes must be measured separately and a thermax shutter attached to both areas. The disadvantage of the pop - in shutter utilizing magnetic clips is that it clutters the face of the window trim with magnetic strips.

The materials needed for the pop - in shutter are basically the same as the fixed shutter with exception of the magnetic clips needed to seal the shutter to the glass. The tools needed are the same as listed under fixed shutters.

HINGED SHUTTERS

Location: Room 5 (See Floor Plan)

Hinged thermax shutter is similar to the fixed shutter, except the hinged shutter allows more functional flexibility. The shutter can be opened to allow light when appropriate but closed to maximize the insulating efficiency. The hinged shutter can be opened but does not have to be physically removed from the window like the pop - in shutter designs. There are two basic variations of the hinged shutter. The NHS office has utilized the side hinged thermax shutter that is measured to fit the entire window and does not fold as it is opened. Another variation is the side-hinged shutter or bifold that folds as it opens. This variation is measured for the entire window but is made in half and joined together in the center of the window and opens from the center. The variation used at NHS opens from the side but does not fold.

The materials needed for the construction of the hinged thermax shutters are the same as the fixed and pop - in shutters with the exception of the following necessary items:

hinges	screws and latches
self closing shutters	

The latches could actually be made like those found in room 5 of the NHS office.

GROUND FLOOR

East

SECOND STORY

North

South

$\frac{1}{8}'' = 1'$

1/8

11'

1400 THE PLAZA

MOVEABLE WINDOW INSULATION DEVICES

The purpose of window insulation devices is to reduce the air infiltration and convection of heat through windows. Window areas in older homes account for 30% - 50% of the home's total heat loss. The NHS Office has utilized three different varieties of the interior moveable window insulation devices. Following is a brief description of all three:

WINDOW QUILT

Location: Room 2 (See Floor Plan)

The window quilt is an attractive insulating window shade that shuts out cold and seals in heat. The window quilt installed in the NHS Office is placed on the west side of the house. The window quilt used is commercially produced by the Appropriate Technology Corporation and is noted for its R4.25 to 5.15 insulating quality. It is easy to install, operate and maintain. The quilt can be raised and lowered at will. The main disadvantage of the window quilt is its cost. More information on the window quilt is available in the NHS Resource Room.

ROMAN SHADE

Location: Room 4 (See Floor Plan)

The roman shade is an attractive insulating device that incorporates a vapor barrier, insulating material and side clamp strips to maximize the energy saving capabilities. The roman shade utilized in the NHS Office is on the west side of the house in the living room. The roman shade serves a dual purpose. Not only does it provide insulation, it also provides a decorative window dressing. The shade can be raised and lowered as necessary. Detailed information on the construction and installation of the roman shade can be found in the NHS Resource Room. The roman shade is less expensive than the window quilt.

COMMERCIAL WINDOW SHADE

Location: Room 3 (See Floor Plan)

A regular commercial window shade can be retrofitted with the use of magnetic night clips to shut out cold and seal in heat. In room three (3) of the NHS Office, window shades have been utilized. A magnetic night clip has been secured along the side of the window. A small strip of wood also has a magnetic clip attached to one side. The shade is sealed into place along its side. This energy savings alternative is much less expensive than either the roman shade or the window quilt. It also shows the adaptability to homeowners of existing window dressing to energy saving devices.

SOLAR STORAGE TUBES

Solar Storage Tubes are passive solar in nature and are designed to take advantage of the sun without any mechanical components. The tubes are used to gain heat and store thermal energy in a designated area of the home. The tubes use an indirect method of heat gain and energy storage - that is the sun heats up the water stored in the tubes and stores that heat which becomes thermal energy. The indirect method of solar heat gain and the storage of thermal energy is more effective than the direct method. The most important reason is that the sun does not always shine and that thermal storage is there even if the sun doesn't shine.

There are different materials used in the design of the solar storage tubes.. There is also a variety of methods in which the tubes can be utilized. The different materials and methods can be used in new home construction and some methods can be easily adapted to retrofit an existing structure. The tubes must be placed in an area best suited to gain maximum heat from the sun - that is the tubes should be placed on the south side of the structure.

Following is a brief description of the different materials that can be used to make solar storage tubes:

- A. Galvanized barrels or drums - The barrels are relatively low in cost and can be obtained easily and used in building retrofit. The disadvantage of barrels or drums as storage tubes are:
 - 1. barrels will corrode, spring leaks and need to be replaced.
 - 2. barrels are bulky and could not be easily adapted for use on the interior of a home,
 - 3. barrels do not come in a variety of sizes and therefore will not be easily adaptable as other materials.
- B. Fiberglass non-pressurized cylinders - The cylinders are produced by different companies and brand names. The company most familiar to this agency is Kalwal. The major disadvantage of the cylinders is the initial cost as compared to the barrels. The advantages are:
 - 1. there are a wide selection of diameters and heights available to complement any new structure or retrofit of an existing structure.
 - 2. corrosion-free fiberglass construction,
 - 3. self-supporting containers require only a flat, level floor,
 - 4. easy to install or remove.
- C. Concrete tubes (tanks) - These poured concrete tanks are usually placed in the ground rather than the interior of the structure. The disadvantages of this medium as a storage tube are:
 - 1. the cost is high,
 - 2. difficulty in insuring their long-term water tightness,
 - 3. concrete is permeable and develops cracks.

D. Plastic sheets or bags - These plastic sheets or bags will not stand alone - that is they must be enclosed in frames. The advantages are:

1. low cost,
2. lightweight wood or metal frames can be used as support,
3. durable.

The disadvantages are:

1. not as easily adaptable to the interior of a structure as other designs.

Neighborhood Housing Services is utilizing a solar tube designed and made by One Design, Inc. The tubes are warranted and are easily incorporated into new construction or retrofitted into south facing walls. One major advantage is the cost and weight of the unit. The basic concept of solar tubes can be designed in variety of ways. Please find examples below:

- A. The tubes can be designed to free stand filled with water in an interior room of an existing structure or new structure.
- B. Tubes can be placed into the ground and filled with water.
- C. Tubes can be placed between wall studs in the structure.
- D. Tubes can be placed along the south or north wall of a solar greenhouse.
- E. Tubes on the market today can be purchased in black or translucent.

Solar storage tubes are good ways to gain heat from the sun and store thermal energy. The tubes can be utilized in or out of the structure.

THREE WAY WINDOW BOX

The window box or sun box is a passive solar system and like other passive systems it is fairly simple in design and mechanism and produces no hazardous by products. The window box is designed to be installed in an existing south facing window.

The three way window box constructed at the Neighborhood Housing Services' workshop is designed to function efficiently in three areas. The areas are as follows:

1. The box provides indoor access to a well ventilated greenhouse for houseplants or spring starts.
2. The box also provides a spacious food dryer with a supplemental solar collector.
3. Finally, the three way box acts as a simple passive solar heater.

This three way window box not only functions efficiently in the three areas mentioned but each area of capability tends to be most often required during a different season. . . a fact that could keep the investment busy all year round.

There is a variety of ways to go about building a window box and a variety of materials that can be used. Following are a few helpful hints for the process:

It is most important that the builder measure exactly the portal where the box is to be attached. There are many different standard window sizes so dimensions will vary; it is also important to caulk around the window box once it is in place to prevent any unnecessary infiltration; also one section of flashing set across the upper junction of the wall and box will provide added insurance against any moisture leaks; if the window design uses a supplemental heater, the builder may choose to remove it during the sultry summer months.

The passive solar window box can be a useful low cost device in conserving energy. The advantages are:

1. Relatively low cost to construct.
2. Simple to construct.
3. The three way window box combines the basic concepts of the passive solar greenhouse, passive solar collectors, and solar dehydrators into one design.
4. The box can be used as a food source, heat source and a food dryer.
5. Depending upon the materials used, the box could last for any number of years.
6. The materials needed to build a window box are easily found at local retailers.
7. The time involved in the construction process is minimal.

Please find attached a detailed view of a three way window box designed and constructed by Mother Earth News. The diagram will offer an example of one way to construct a three way window box.

MOTHER'S THREE-WAY WINDOW BOX: EXPLODED VIEW

PASSIVE SOLAR AIR COLLECTOR/GREENHOUSE

Location: Adjacent to Room 1 (See Floor Plan)

The "passive" solar room has been tested for it's effectiveness under the auspices of the Department of Energy for four (4) years. During the testing period the solar room demonstrated the lowest cost per solar BTU of any other space heating system on the market. Typical fuel savings ranged from thirty dollars (\$30.00) to sixty dollars (\$60.00) a month.

The "passive" solar room installed on the south side of the NHS office is a commercially available kit and can be purchased from Solar Resources, Inc. Although, packaged kits are sold commercially individuals can make up a solar room for about half the prices listed below:

PRICES FOR SOLAR ROOM® COLLECTOR KITS

SOLAR ROOM® LENGTH	COLLECTOR AREA (SQUARE FEET)	LIST PRICE	40% FEDERAL TAX REBATE AVAILABLE	HOMEOWNER'S COST AFTER REBATE
12'	132	\$ 820	\$368	\$ 552
16'	176	1040	416	624
20'	220	1100	464	696
24'	264	1200	512	768
28'	308	1400	560	840
32'	352	1520	608	912
36'	396	1640	656	984
40'	440	1780	704	1056

PRICES AND SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Materials needed for the passive solar room are:

foundation materials
twin skin polyethylene
entrance and exit structures

framing structure
small blower

The commercial kit includes:

polyethylene
framing structures

small blower

Not included in the kits are the foundation materials and entrance/exit structures.

Individuals choosing to make up the solar room can purchase all the materials locally. The polyethylene (Monsanto 302) can be purchased in rolls from Seedman's of Charlotte. The framing structure used can be either 3/4" electrical conduit or wood. The structure installed on the south side of the NHS house used electrical conduit. Foundation for the solar room can be made of wood, cement block or other foundation material such as brick. The basic design of the room could actually do without a foundation much like the commercial greenhouse. The advantage of using a foundation is the permanance of the structure. The flooring used in the NHS solar room is gravel; however, concrete, brick, face brick, or dirt could be used. The advantage of using gravel, concrete or brick is the retention of heat. As the sun shines into the room the gravel, concrete or brick heats up and later releases that stored heat. Black barrels are also used in the NHS solar room for their

heat storage capability. Although, these barrels are optional their value for heat storage is tremendous.

A grow bed is also used in the NHS solar room as a place for growing food stuff, green and/or flowering plants. There are several options in the design of the grow beds. The bed could be built at the front of the solar room or could actually be built over the storage barrels. If the builder so desired, a combination could be used to make more growing space. The door used on the NHS solar room is a used storm door; however, a framed polyethylene structure could also be used.

The "passive" solar room is designed to be a space heating system. It is essential in the design to have a window or windows that open adjacent to the solar room to allow for the air flow. The windows are then lowered from the top and raised from the bottom to allow for a natural convection to occur. Cold air enters through the bottom and is warmed and returned through the top space.

It is important to remember that the solar room is designed to be a space heating system utilizing the sun and it may not always provide all the heat needed. During the coldest days of winter the solar room may not be able to supply enough heat for itself. An auxillary heater may be used, or by leaving the windows open the heat from the house will be sufficient.

Below is a list of businesses that supply the materials needed to construct a "passive" solar room.

Regional Electric Supply
3621 Tryclan Drive
Charlotte, NC
527-6080

Holland Storm Sash Remodeling
5238 Ruth Drive
Charlotte, NC
568-0341

Carolina Solar
2809 Temple Lane
Charlotte, NC
563-0499

Sodveco Plant
Highway 27
Mount Holly, NC
827-9651

Solar Resources, Inc.
South Santa Fe Highway
Post Office Box 1848
Taos, New Mexico
(505) 758-9344

Seedman's Inc.
1730 North Tryon Street
Charlotte, NC
333-0196

Below are some general tips on the construction of a solar room/greenhouse:

- (1) The solar room or greenhouse should be twice as long as it is wide.
- (2) The space should be no more than eight (8) to ten (10) feet wide to maximize the heating effects.
- (3) Plan each step of construction as completely as possible. Determine and obtain materials for each step before beginning.
- (4) Prices vary greatly in shopping for materials, a few phone calls to competitive suppliers may provide substantial savings. Remember there is no set price on anything don't be afraid to bargain shop.

- (5) In all steps of construction, measure as accurately as possible. If in doubt, exceed the correct measurement rather than under cutting.
- (6) Most important if the builder is novice, don't hesitate to ask for advice.

In the solar room on the south side of the NHS office a blower is used. Following are two diagrams of the blower and blower installation and installation instructions.

FIGURE 7a. BLOWER AND BLOWER INSTALLATION

FIGURE 7. BLOWER AND BLOWER BRACKET INSTALLATION

FIGURES 7 & 7a BLOWER INSTALLATION

Referring to Figure 7, you will note that the blower mounting bracket is two pieces, "A" and "B". Blower bracket "A" is affixed to the inside of the end assembly with two wood screws. Blower Bracket "B" is inserted between the two layers of film. The inner layer of film is pulled downward until taut. While the inner layer of film is held taut, blower brackets "A" and "B" are joined, clamping the film in the bracket, using the wood screws supplied. The screws pass through the film but this will cause no problem.

The bottom edge of the inner layer of film is now pulled to the outside of the door end assembly and joined with the bottom edge of the outer layer of film. Both layers of film are now placed over the aluminum extrusion and inserted.

Using a sharp knife, you may now cut the film from the small hole in the blower bracket. The blower is installed on bracket "A" as shown in Figure 7.

Assuring yourself that all film is in place in the appropriate extrusions, you may now plug in the blower unit. The blower comes equipped with a three prong plug. Please be sure the extension cord is of the three conductor type and is properly grounded. The SOLAR ROOM will take 5 - 20 minutes to fully inflate, depending on size.

While the SOLAR ROOM is inflating, you may inspect the perimeter of the SOLAR ROOM where the top plate and end assemblies contact the house wall. Any spaces that would allow air to pass from the exterior should be sealed with foam-type weather stripping or a suitable caulking compound.

SOLAR ROOM
Model RX1
September, 1979

Box 1377
TAOS, NEW MEXICO 87571
(505) 758-9344

37

GROUND FLOOR

SECOND STORY

North

South

$\frac{1}{8}'' = 1'$

28

West

1400 The Plaza

SOLAR WATER HEATER

The cost of heating water for a home can account for twenty percent (20%) or more of the home fuel bill. There are efficiency measures such as: thermostat setting, insulation, timer installation, sediment removal, and proper maintenance that can reduce the cost of heating water in a conventional system. Installing a solar water heater system will decrease the cost of heating water fifty percent (50%) to seventy five percent (75%). In a solar hot water system, the heat transfers fluid drawn from the solar collectors is run through a coil in a tank of water and heats it. Water is circulated through a second coil in the tank, heated and drawn off for domestic use. Hot water can also be preheated by circulating the water supply itself through the collector. A solar water heater system installed to supplement an existing system can reduce the workload of the conventional system and thus reduce the cost of heating water. There are a variety of commercial systems available with prices ranging from \$1500 to \$3000 for a good complete system installed.

The solar water heater system used by Neighborhood Housing Services for the workshop application is a Sunco, Inc. closed loop collector. This commercial system was selected by Neighborhood Housing Services because of the build-your-own low cost system design. The particular design is used to supplement an existing system. The solar heated water is circulated into the existing hot water system.

Although, there are many varieties of commercial systems available, the three basic designs are:

1. Open Loop Recirculation System: This design is used for the areas of the United States that have the mildest climates. This system design has the lowest initial cost and is used wherever freezes are infrequent. This system would be much less efficient in climates where freezes occur frequently.
2. Open Loop Drain Down System: This system is designed for any of the colder climates. A drain down valve drains the collector whenever the temperature reaches about 50°F and then refills them when the temperature reaches about 58°F.
3. Closed Loop Heat Exchange System: The closed loop system has a stand alone heat exchanger so that this design can be used to retrofit existing conventional systems.

The advantages of installing a solar water heater system are:

1. Reduction in the cost of heating water fifty percent (50%) to seventy five percent (75%).
2. North Carolina Residents are entitled to state personal income tax credit of twenty five percent (25%) of the cost of solar equipment and installation. This tax credit comes under the provisions of the "Energy Conservation Act of 1977".
3. Homeowners can receive a Federal Income Tax Credit of thirty percent (30%) on the first \$2000 and twenty percent (20%) on the next \$8000 until December 31, 1984 when purchasing solar equip-

ment.

4. The tax credits could cut the cost of a solar water heating system in half.

The disadvantages of installing a solar water heater system are:

1. The initial cost/lengthy payback period.
2. The technical complicity of installation for do-it-yourselfers..

The Solar Water Heater System can be complicated to install and there are a number of tools needed to complete the job. Please find attached an illustration of the closed loop retrofit to be used by Neighborhood Housing Services. Although, this particular illustration is for the Sunco, Inc. product, it will give a basic idea of the design of the heating unit. Also attached is a list of tools and materials needed to complete the installation of the Solar Water Heater System. Included is building permit information.

CL-1

CLOSED LOOP ELECTRIC RETROFIT

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D-12

Roof Slope	35°	40°	Desired Tilt 45°	50°	55°	60°
0/12	21%	24%	AS IS	29%	31%	33%
1/12	19%	22%	24%	26%	29%	31%
2/12	17%	19%	22%	24%	27%	29%
3/12	15%	17%	20%	22%	24%	27%
4/12	13%	15%	17%	20%	22%	25%
5/12	12%	14%	16%	18%	20%	23%
6/12	11%	12%	14%	16%	18%	21%
7/12	10%	11%	13%	15%	17%	19%
8/12	10%	10%	11%	13%	15%	17%
9/12	10%	10%	11%	12%	14%	16%
10/12	10%	10%	10%	11%	13%	15%
11/12	11%	10%	10%	10%	12%	14%
12/12	11%	10%	—	10%	11%	13%

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