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REGION IV - 1981

FINAL REPORT

RALPH H. PECKWORTH

GRANT No. DE-FG44-81R410504

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ATLANTA, GA.

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Grantee: Ralph H. Peckworth Grant No. DE-FG44-81R410504

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U. S. Department of Energy
Appropriate Energy Technology Small Grants Program
Region IV - 1981

Ralph H. Peckworth

Grant No. DE-FG44-81R410504

Project Title: A SOLAR GREENHOUSE AND WARM ROOM WITH A SPIRAL
PIPING SYSTEM FOR HOT WATER AND A LOW-COST
BUILDING-CONSTRUCTION METHOD.

SUMMARY- This project involved the construction of two small buildings, each mounted on skids, so that, if desired, they could be moved to various sites to demonstrate the following energy proposals:

PROPOSAL # 1- (in larger 12' x 8' unit-see page 6 drawing)
The use of a combination greenhouse and warm room as an addition to an older house for an economical heating solution. Keeping only the warm room comfortable would conserve fuel. This unit, mounted on skids, was completed.

PROPOSAL #2- (housed in the above unit)
The use of PB (polybutylene) black flexible pipe as a solar water heating collector housed in the above solar area.
PROPOSAL #3- (in smaller 8' x 4' unit-see page 7 drawing)
The use of COST FREE BUILDING BLOCKS made from readily available recycled waste material, namely empty steel and tin cans, repacked in used corrugated cartons. These blocks, laid up into a wall, using glue instead of mortar, make an excellent core wall that can later be covered with protective surfacing, perhaps a rigid foam plastic surface.

PROPOSAL #1 (in larger 12' x 8' unit)

Many older homes, built when oil was cheap, are not adequately constructed or insulated. The cost of minimizing air infiltration and adding proper insulation to larger old homes will often exceed the cost of making a small addition consisting of a solar greenhouse combined with a warm room. Then, whenever the solar warm room provides comfortable free heat, the main house can be kept at a lower temperature, thus conserving fuel.

Many of these large older homes are comfortable and enjoyable during most of the year. By providing an energy efficient addition in which to ride out the winter cold spells, heating costs can be minimized, and the inherent value of the large house can be preserved.

The orientation of existing houses has been dictated by street and lot alignment. Use of a greenhouse and warm room addition to improve the solar orientation of the house can bring about great fuel savings.

The greenhouse and warm room areas as constructed and shown in Drawing *Page 6* were limited in size to insure their portability for demonstration purposes. In practice, the greenhouse and warm room should both be made larger, depending on personal needs and zoning restrictions. Detailed dimensioning of the units have therefore been omitted.

Many solar greenhouse designs call for a double layer of translucent plastic on the sloping outside south wall. The design shown here uses one outside layer of translucent plastic on the sloping outside wall and moves the second layer to the interior to serve as a vertical partition between the greenhouse area and the warm room. Thus the people needs of the warm room are separated from the moist requirements of the greenhouse, yet the warm room benefits from the solar effect in the greenhouse and the two layers of plastic.

Standard $3\frac{1}{2}$ " fiber glass insulation with kraft back up sheets were used in floor, roof, and both north and west walls. Excellent solar heat retainment was secured.

Aside from proving conclusively the energy conserving value of a greenhouse-warm room combination the unit served as the means of testing PROPOSAL #2 which involved the use of PB pipe in the construction of solar collectors.

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PROPOSAL #2

The use of PB (polybutylene) black flexible pipe in the construction of solar water heating collectors that will avoid the use of brazing, soldering, jointing, and other plumbing skills not possessed by the average homeowner.

This pipe appeared to be a solution since it possessed the following advantages:

- It is cheaper than copper.

- It can withstand freezing.

- It can be bent around corners without the use of joints.

- Long runs can therefore be made with one continuous length.

- The black colored pipe will absorb solar heat directly without recourse to an absorber plate.

The following two layouts of PB pipe were tried:

THE TEPEE COLLECTOR- An ascending continuous spiral of PB pipe was tried in the greenhouse unit. This arrangement proved impractical for the following reasons:

- It blocked off to great an area of the greenhouse from normal use.

- The slope necessary for thermosiphoning spaced the loops to far apart to be practical.

THE PANCAKE COLLECTOR- A close horizontally wound continuous spiral of PB pipe was located on a flat platform at the far end of the greenhouse area and continued into a sharply rising portion leading to the top of an elevated hot water tank. The other end of the spiral connects to the bottom of the water tank.

As of the end of the grant period this unit has not thermosiphoned and must be classed as a failure. The writer still feels that some variation of the pancake collector has great potential as a good solution to the search for a cheap solar collector and he expects to continue experimenting with it as long as the greenhouse-warm room unit remains at its present site.

For PROPOSAL #3 see page 4.

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PROPOSAL #3 (in smaller 8' x 4' unit)

The use of COST FREE BUILDING CORE BLOCKS made from recycled waste material found locally in every town in the country. Steel cans used for liquids, such as motor oil, anti-freeze, fruit juices, beer and cola, are emptied by merely piercing the top with an opener. With the rest of the top remaining an integral part of the can, these steel cans are very strong. If these cans are glued in position, inside a correctly sized carton, and the carton flaps glued shut, the cans and the carton will be bonded into a surprisingly strong but light weight unit. This unit will have standard dimensions and will support a good load in compression.

It will lend itself very readily into being laid up into a wall with an adhesive instead of mortar. Applying adhesive would be much easier for the unskilled worker and would also be faster than trowling mortar.

Such construction could be carried out by unskilled people, with no concern for costly losses, due to spoiled material. The building units would be light in weight, many of them large in size, so they would go up fast. A waterproof coating on both sides of a wall would be necessary. If moisture migration is prevented the wall will remain strong.

Even if the outside surface were rained on before protection had been provided, the cartons will retain their shape and dry out without serious damage.

The 8 foot long by 4 foot high wall of the small grant building is constructed of various size cans and cartons to demonstrate the versatility of the proposal. Included in this report is an index to the contents of each "container block" used in the wall. Symbols marked on the containers also indicate their contents. Both outside and inside views of the wall are shown in the drawings.

These cans and cartons are already on hand in every town in the country and are available at no cost other than their collection. In fact, these cans currently present a serious disposal problem so their collection for a useful purpose would be welcomed.

It is proposed that carton manufacturers, at the same time that they stamp their logos and strength specifications on the cartons, also indicate the cartons worth saving, and the can and carton combinations recommended for "box-can" construction. This would assist local communities and individuals in salvaging the appropriate waste materials.

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This demonstration wall of recycled material points up the following observations:

1. Many different combinations of cans and containers are possible.
2. In actual practice a user would do better by employing only one or two sizes of material to facilitate uniform lay up.
3. This type of construction would be best utilized as a core wall, over which a rigid foam coating could be sprayed. In such a case voids or openings left in the core, when filled with foam would help bond the foam surface to the core.
4. By using a patterned lay up as shown in the last drawing, the extra thick foam portions could be regularly spaced to secure the foam to the core.
5. The opposite wall of the container grant unit has a solar panel to high light the fact that this "can-box" construction could be used for a warm room addition.

CONCLUSION

By combining a greenhouse-warm room addition patterned after PROPOSAL #1 with non-solar walls made of the "can-box" core construction shown in PROPOSAL #3, the rural poor can secure a very economical addition to their existing homes which will conserve heating fuel for years to come.

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PROPOSAL #1

PLAN

ELEVATION

A hand-drawn floor plan of a room. The overall dimensions are 4' wide and 10' deep. The plan shows a room with a dashed rectangular area in the upper left corner, labeled 'BOX-CAN WALLS' with an arrow pointing to it. The room has a door on the right wall and a window on the left wall. The walls are indicated by solid lines, and the floor is indicated by dashed lines. The text 'BOX-CAN WALLS' is written in the center of the room.

TRANSLUCENT
PLASTIC —
(KALWAL)

4'x8'
PLYWOOD
REMOVABLE
COVER

Sym BOL	SIZE CAN	CONTENTS OR USE
	GAL	OIL CAN
	GAL	ANTI-FREEZE
	GAL	PAINT CAN
	QT.	OIL CANS
	14oz	FRUIT JUICE CAN
	QT.	TALL QT. CANS GRAPe JUICE - BODY, FLAV.
		BEER or COLA
	NO CANS	RIGID FOAM INSULATION
	NO CAUS	CORRUGATED PARTITIONS

SYM
BOL

SIZE
CAN

CONTENTS OF USE

GAL

OIL CAN

GAL

ANTI-FREEZE

GAL

PAINT CAN

Q.T.

OIL CANS

14oz

FRUIT JUICE CAN

1

Q7.

TALL QT. CANS
CONTAINING - 500X

④

BEER or COLA

NO
CANS

RIGID FOAM
INSULATION

④

NO
CAUS

CORRUGATED
PARTITIONS

OUTSIDE VIEW - BOX-CAN WALL

PROPOSAL #3

INDEX OF MAIN BOX-CAN WALL.

No.	TYPE OF CAN	SIZE CAN	SYM.	QTY. CAN	CONTAINER
1	OIL CANS	GAL		6	ORIGINAL
2	ANTI-FREEZE	"		6	"
3	OIL CANS	"		4	4 GAL. PAINT CARTON
4	PAINT CANS	"		4	" " "
5	FRUIT JUICE	14oz.		9	" " "
	TOMATO PINEAPPLE ORANGE GRAPEFRUIT ETC.				
6	FRUIT JUICE LARGE CANS	14oz.		14	OZALID PAPER
7	PAINT CANS	GAL		3	SEWING MACH. CARTON
8	RIGID FOAM PACKING	—		—	" " "
9	MISCELLANEOUS PACKING	GAL		3+	LANCE CARTON
10	FRUIT JUICE LARGE CANS	14oz.		9	MISC.
11	BEER & COLA CANS			6 cor	SHERWIN-WILLIAMS EXCELLO CARTONS
12	PARTITION BD. NO CANS	—		—	WINE CARTON
13	BEER CANS	12oz.		10	6 QT. PAINT CARTON
14	OIL CANS	QT.		4	Aerosol Spray PAINT CARTON
15	FRUIT JUICE LARGE CANS	14oz.		3	Lance-Rye TWIN CARTON
16	Witch Grape Juice Neat-Jung, Baby Ed.	Qt. Tall		4 cor	KAYLON PAINT CARTON
17	OIL CANS	Qt.		4 cor	CUT DOWN APPLE SAUCE CARTON
18	PARTITION BD. NO CANS	—		—	DYNAMO COLGATE DETERGENT PALM.
19	OIL CANS + SPACER	Qt.			PACKING CASE KD
20	FRUIT JUICE + BEE SPACERS	14oz.		3/2	PACKING CASE MO
21	FRUIT JUICE CANS	14oz.		3	LANCE CAPT.'S WAFERS
22	BEER & COLA CANS	—			MAXWELL HOUSE COFFEE CARTON
23	SPACER	—	—	—	MCKESSON ROBBINS DRUGS

INSIDE VIEW - BOX-CAN WALLPROPOSAL #3

INSIDE END WALL

INDEX OF END WALL SECTION

INDEX No.	TYPE OF CAN	SIZE CAN	SYM.	QUAN CANS	CONTAINER
24	#2 1/2 CAN	#2 1/2	(S)	4	BRACH CANDY CARTON
25	OIL CANS	QT.	(half-filled circle)	3	BRAKE SHOE "
26	OIL CANS	QT.	(half-filled circle)	4	AEROSOL S.P.
27	FRUIT JUICE	14oz	(quarter-filled circle)	3	LANCE CAPT. WAFERS
28	" "	"	(quarter-filled circle)	3	" " "
29	OIL CANS	QT.	(half-filled circle)	4	AEROSOL S.P.
30	" "	"	(half-filled circle)	"	" " "
31	OIL & PAINT	GAL.	(two circles)	3	APPLIANCE CARTON
32	OIL CANS	GAL.	(circle)	3	WINE CARTON (T)
33	RIGID FOAM INSULATION	-	(square with cross)	-	SEWING MACH. C.

COATED CORE WALL

CROSS-SECTION

LONGITUDINAL SECTION (L)

FINANCIAL SUMMARY

All labor on the project was performed at no charge by this grantee.

All transportation, hauling, conference, and travel charges were paid by grantee.

The following charges cover material, hardware, etc.

Cash payments:	Group A	\$24.58
	B	30.57
	C	64.17
	D	33.97
	E	87.00
	F	8.49
	G	<u>34.00</u>
		\$282.78
Deleted items not used:		<u>27.96</u>
Cash items charged to Grant		\$ 254.82
Check purchases charged to Grant; Checks 138 thru 161		<u>\$ 1283.13</u>
Grant Amount:		\$ 1200.00
Over run paid by grantee:		\$83.13

Ralph H. Peckworth.

April 28, 1983