(1) I-1500

Prepared for:

DOE/CS/30632-1

U.S. Department of Energy

January 1982

ASSISTANT SECRETARY, CONSERVATION
AND RENEWABLE ENERGY
PASSIVE & HYBRID SOLAR DIVISION
UNDER CONTRACT NO. DE-AC02-81CS30632

MASTER

PROJECT SUMMARIES

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Prepared for:

JANUARY 1982

U.S. Department of Energy

DOE/CS/30632-1

ASSISTANT SECRETARY, CONSERVATION
AND RENEWABLE ENERGY
PASSIVE & HYBRID SOLAR DIVISION
WASHINGTON, D.C. 20585

PROJECT SUMMARIES

DOE/CS/30632--1

DE82 011196

PREPARED BY:
BURT HILL KOSAR RITTELMANN
WASHINGTON, D.C. 20001
UNDER CONTRACT NO. DE-AC02-81CS30632

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TABLE OF CONTENTS

DOE PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

In the spring of 1979, the U.S. Department of Energy, Chicago Operations Office, launched the Passive Solar Commercial Buildings Program to investigate, demonstrate and promote on a broad scale the possible role of passive solar technologies in meeting the heating, cooling and lighting energy requirements of commercial buildings. Specifically, the objectives of this DOE program are the following:

- To stimulate the reduction of energy consumption of new and existing commercial buildings through the effective use of energy conservation and passive solar design techniques.

- To support the design and implementation of exemplary and prototypical passive solar commercial buildings.

- To identify the cost and performance of passive systems in commercial buildings.

- To provide information and data for the purpose of identifying user requirements for needed passive design tools and for validating existing passive design tools.

- To demonstrate the practical and architecturally pleasing opportunities of passive system use in commercial buildings.

The 23 projects participating in this program comprise the largest known data base for evaluating the energy performance and cost of passive solar commercial buildings. The wide range of building types includes offices, retail establishments, educational facilities, public service facilities, community and visitor centers, and private specialized-use facilities, located throughout the United States.

The DOE Passive Solar Commercial Buildings Program involves three phases of implementation: Phase I-Design, Phase II-Construction, and Phase III-Evaluation and Instrumentation. The following support team is providing technical and management assistance to DOE throughout these program phases: Booz·Allen & Hamilton, Burt Hill Kosar Rittelmann Associates, Sizemore/Floyd Associates, Bickle/CM and W. I. Whiddon & Associates.

In Phase I, a logical progression of design reviews were held to successfully guide the design teams through the design phase. Prior to beginning the actual solar design, the design teams identified the major energy problems of their projects. The predesign analysis of a non-solar "base case" served as a benchmark for the comparison of energy performance and cost in subsequent solar designs. The resulting solar designs were reviewed by a panel of "Technical Experts" during scheduled group schematic review meetings. These experts, each a recognized leader in his/her discipline, were Sarah Harkness (Architectural Integration), Larry Bickle (Systems Integration), Bruce Hunn (Analytical Approaches), Bill Lam and Steve Selkowitz (Lighting), and Dick Rittelmann and Mike Sizemore (Heating and Cooling).

The major purpose of the reviews was to ensure that schematic designs effectively integrated strategies addressing passive cooling, lighting and heating with each other, with the building, and with the auxiliary mechanical and lighting systems. This review method provided valuable feedback to designers at a stage in design when the greatest opportunities exist for saving energy. The matrix graphically shows the passive solar strategies employed in the designs which emerged during Phase I of the DOE Passive Solar Commercial Buildings Program.

At the request of design teams, interim design reviews were held with the Technical Monitor assigned to the particular project, during which additional design and technical assistance was provided. Project progress and documentation, which had been rigorously maintained throughout the design phase, were given a final assessment in a final design review held at the designer's office.

Phase II involves the actual construction of the Phase I designs. DOE's criteria for incorporating passive solar features includes: addressing the building's major energy requirements; making a positive contribution to the aesthetic character of the design; integration with the mechanical, lighting and other support systems, and demonstration of "technical validity." In addition the cost of the passive features must be reasonable as measured by life cycle cost analysis.

In Phase III of this program, the buildings constructed in Phase II will be evaluated to determine the effects of the passive solar features on occupant performance and building energy consumption. Three hypotheses are being investigated:

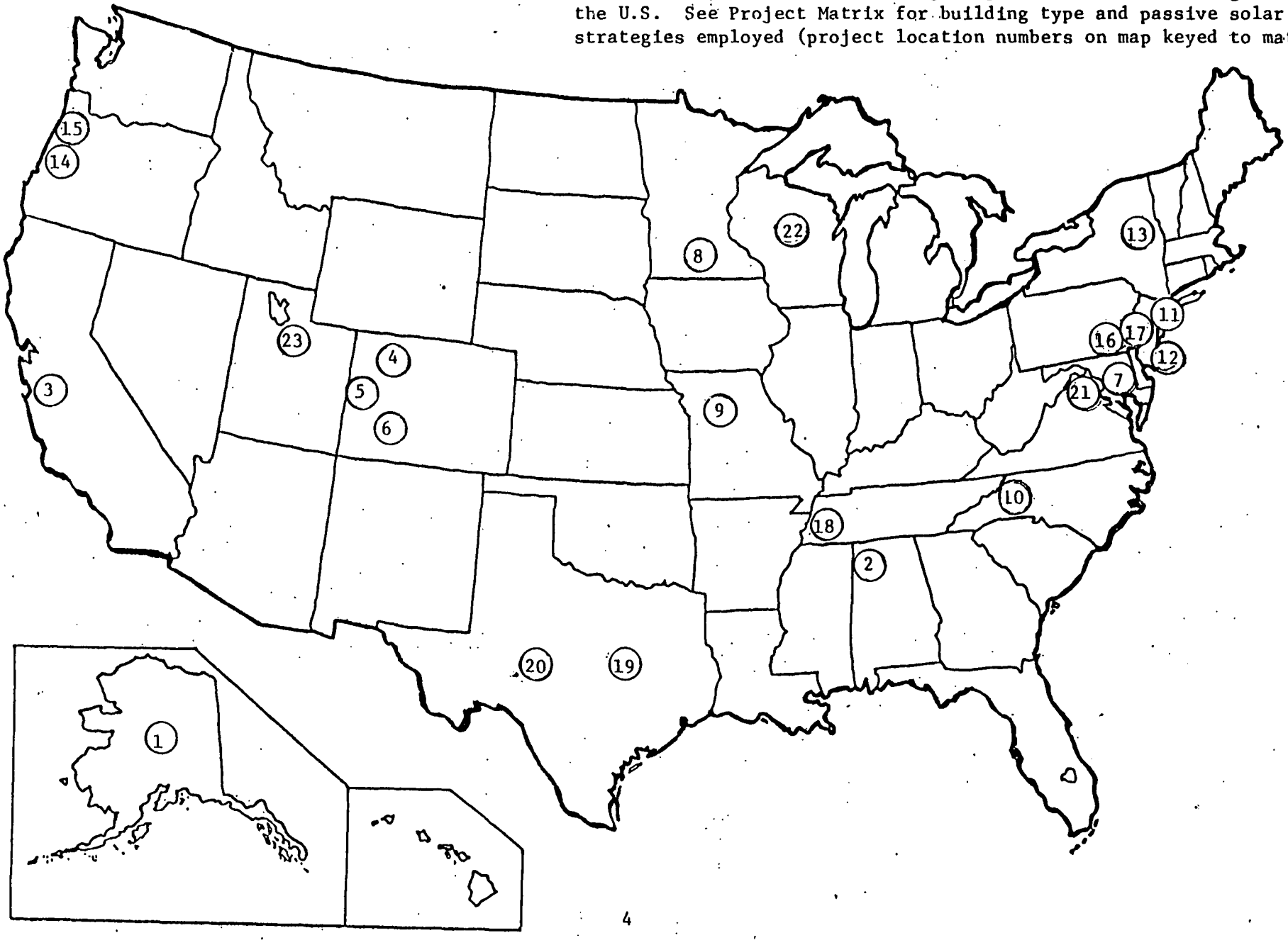
- The use of passive solar features reduces auxiliary fuel requirements for heating, cooling and lighting

- The actions of the occupants of the building can help to reduce building energy requirements

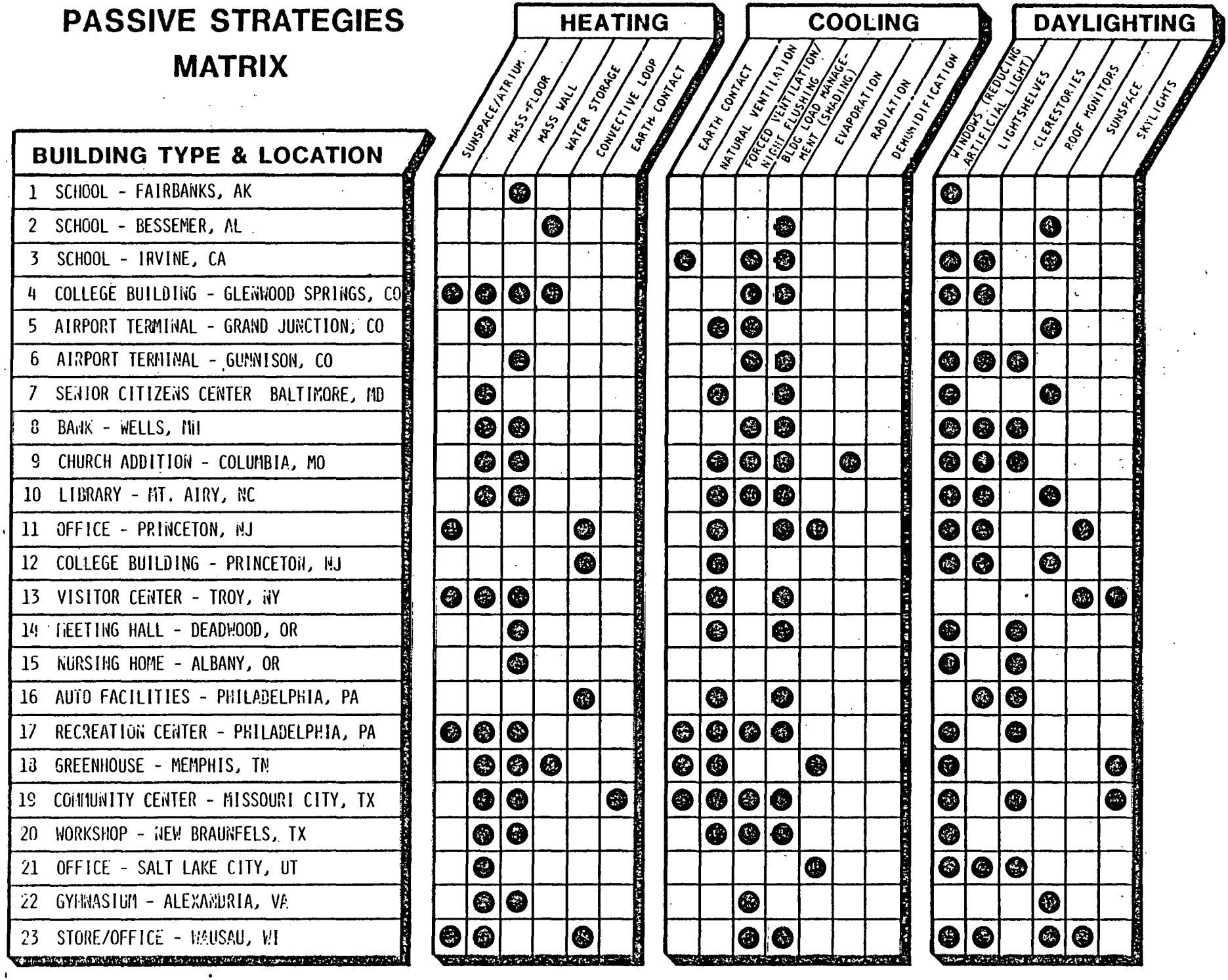
- The inclusion of passive solar features may enhance the ability of the building occupants to perform their job responsibilities.

The project teams and DOE will disseminate the results of the performance evaluation through articles in the news media and journals, as well as through professional and trade organizations.

PROJECT LOCATION MAP - The 23 projects participating in the DOE Passive Solar Commercial Building Program are located throughout the U.S. See Project Matrix for building type and passive solar strategies employed (project location numbers on map keyed to matrix).



PASSIVE STRATEGIES MATRIX



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D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Alaska D.O.T.
PROJECT NO. 321
LOCATION (CITY/STATE) Fairbanks, Ak
(NEW) RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE School
*CONDITIONED BLDG., S.F. 960
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER
FIRM Fairbanks North Star Bourough
STREET 520 5th Ave., P.O. Box 1267
CITY Fairbanks
STATE/ZIP Alaska 99701
TELEPHONE NO. (907) 452-4761
CONTACT _____

MECHANICAL ENGINEER
FIRM RAJ BHARGAVA Assoc.
STREET 301 E. Fireweed Lane
CITY Anchorage
STATE/ZIP Alaska 99501
TELEPHONE NO. _____
CONTACT _____

SOLAR DESIGNER
FIRM JS Strandberg Consulting Engineers
STREET P.O. Box 319
CITY Fairbanks
STATE/ZIP Alaska 99701
TELEPHONE NO. (907) 452-4810
CONTACT Jim Strandberg

BUILDING CONTRACTOR
FIRM ACE General
STREET 9 Mile Steed Highway
CITY Fairbanks
STATE/ZIP Alaska 99701
TELEPHONE NO. (907) 456-6541
CONTACT _____

ARCHITECT
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TELEPHONE NO. (907) 456-5780
CONTACT C.B. Bettisworth

INSTRUMENTATION TEAM
FIRM Institute of Water Resources
STREET University of Alaska
CITY Fairbanks
STATE/ZIP Alaska 99701
TELEPHONE NO. (907) 474-7987/7201
CONTACT Richard D. Seifert, George Mueller

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	August, 1981	August, 1982
PHASE III (EVALUATION)	August, 1982	Indefinite

(A) INSTRUMENTATION METHOD Automatic data logger/H.P.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Northwater, quarterly publication of Institute of Water Resources; State of Alaska newsletter; solar journal articles; renewable energy courses

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Department of Education and local population growth has greater need for new school.
- North Star Borough desires cost effective design solution for school.
- Site is good for passive solar/daylighting design.

DESIGN PROCESS KEY ISSUES:

- School is semi-remote, but with expected building monitoring tie-in.
- Design must be automatic and fail safe.
- Overheating considerations must be addressed.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Outside air cooling.
- Moveable/fixed shading devices and night insulation/light shelves control heat loss, cool, and reduce lighting energy consumption.

LESSONS LEARNED:

-

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Alaska D.O.T.
PROJECT NO. 321 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 14,344
CITY Fairbanks
STATE Alaska

COOLING DEGREE DAYS 52
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 767.8

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [X]
- DIRECT GAIN* [ ]
- INDIRECT GAIN* [X]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [ ]
- MASS WALL [X]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[ ] SOLAR DHW (SPECIFY)

[ ] OTHER (SPECIFY)

* See Definition Sheet

[ ] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [ ]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) Thermal shutters used as moveable shading devices [X]

[X] DAYLIGHTING

- WINDOWS [X]
- LIGHTSHELVES* [X]
- CLERESTORIES* [ ]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Alaska D.O.T.
PROJECT NO. 321 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS _____ BTU/SF-YR (REFERENCE) _____

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	84,706	$.72		x			Jim Strandberg 1/28/82
COOLING							"
LIGHTING	28,459	.37		x			"
DHW	13,586	.115					
(OTHER)							
TOTAL	126,751	$1.84					

CONDITIONED BUILDING 720 (S.F.)

TOTAL BUILDING ENERGY COSTS _____ ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Oil: $7.92/MMBTU ($1.10/gal) (Jim Strandberg, 1/28/82)
Electricity: $0.12/KWH

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Alaska D.O.T.
PROJECT NO. 321 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	25,186	$.21		x			Jim Strandberg 1/28/82
COOLING							
LIGHTING	5,322	.187		x			"
DHW	13,586	.115					"
(OTHER)							
TOTAL	44,094	$.51					"

CONDITIONED BUILDING 720 (S.F.)

TOTAL BUILDING ENERGY COSTS $934 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Oil: $7.92/MMBTU ($1.10/gallon) (Jim Strandberg, 1/28/82)
Electricity: $.12/KWH

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Oil boilers
Perimeter baseboard heating system with central fan system ventilation (constant volume)

*See Definition Sheet

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	59,520		54,086	5,434	Ph. I Report p. 78-80, 90
COOLING					
LIGHTING	23,137		8,908	14,229	Ph. I Report p. 78-80, 90
DHW	0		0		
(OTHER)					
TOTAL	82,757		62,994	19,663	

*ESTIMATED SAVINGS 65 %

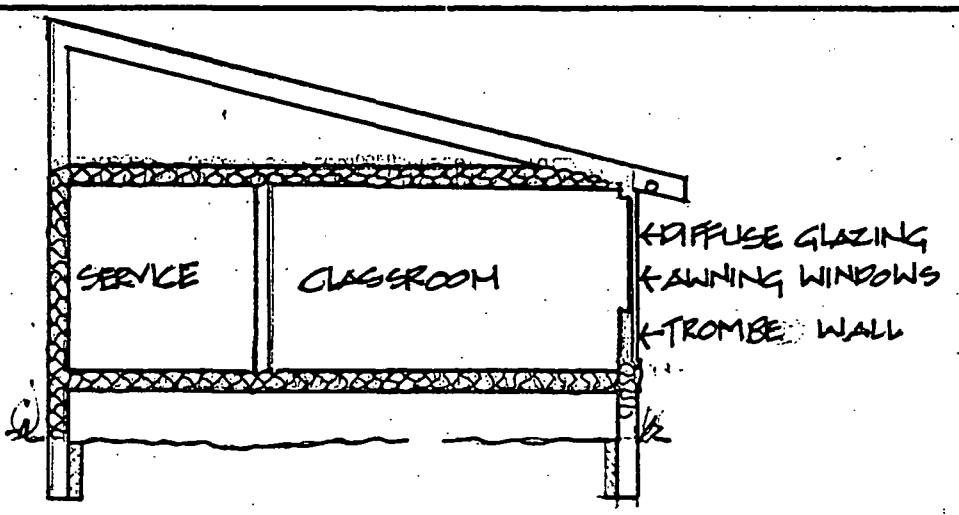
TOTAL CONSTRUCTION COST $ 50,000

*PASSIVE INCREMENTAL COST $ 3,600

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

Energy distribution systems (Fans, pumps) have been designed for maximum efficiency. Low static pressure ductwork with plenum returns are used throughout. Fluorescent dimming on classroom lighting. Strict occupancy scheduling used for all air distribution systems, all fan systems off on night cycle.

*See Definition Sheet



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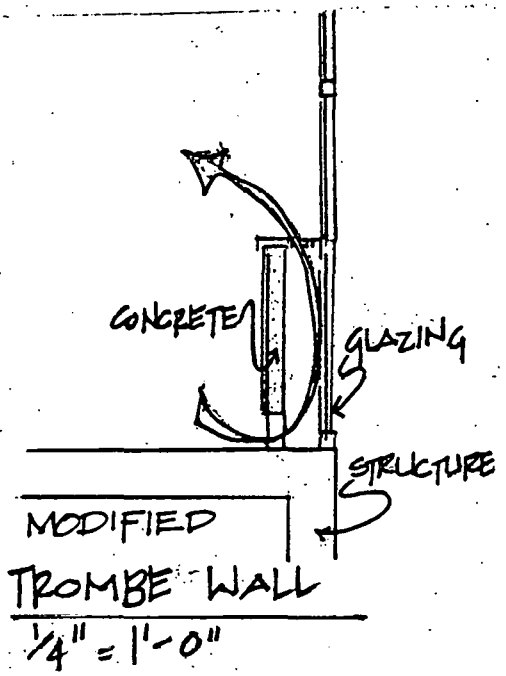
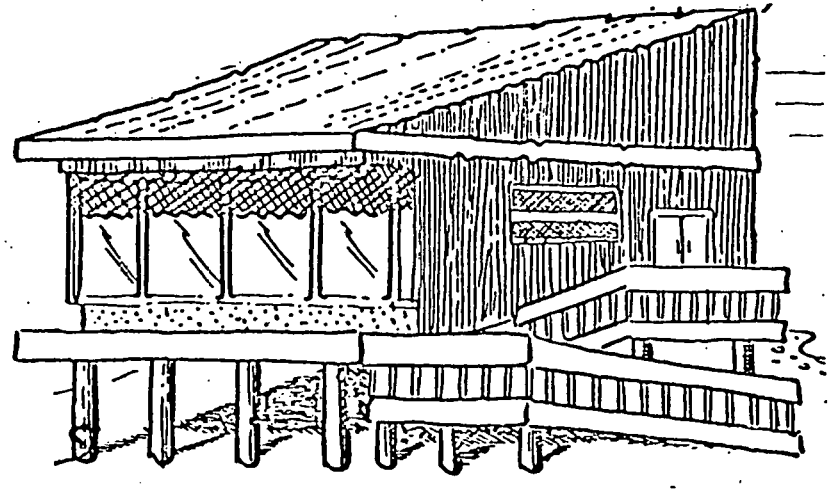


SOUTH ELEVATION



PERSPECTIVE

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Bessemer BUILDING TYPE School
PROJECT NO. 324 *CONDITIONED BLDG., S.F. 26,593
LOCATION (CITY/STATE) Bessemer, Alabama TOTAL S.F. (If Different) 26,593
NEW/RETROFIT/ADDITION (CIRCLE ONE) TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER
FIRM Bessemer Board of Education
STREET 412 17th Street, North
CITY Bessemer
STATE/ZIP Alabama 35020
TELEPHONE NO. (205) 424-9570
CONTACT Dr. Jack Hale, Superintendent

MECHANICAL ENGINEER
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STREET 1824 29th Avenue, South
CITY Homewood
STATE/ZIP Alabama 35209
TELEPHONE NO. (205) 870-4936
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CONTACT Mr. David Peacher

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CITY Birmingham
STATE/ZIP Alabama 35209
TELEPHONE NO. (205) 870-4610
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CONTACT Mr. David Peacher

INSTRUMENTATION TEAM
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*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	March, 1980	February, 1981
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Newspaper articles, open house, Birmingham AIA Tour, studied by Alabama Energy Commission.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Use passive solar in a school with substantial heating, cooling, and lighting loads.

DESIGN PROCESS KEY ISSUES:

- Building was already substantially designed and passive design could not introduce substantial changes; accelerated construction schedule
- Owner required passive features to be completely passive (no operable shades, etc.)

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Roof monitors to admit insolation for heating and daylighting; water tubes intercept the radiation, diffusing it for daylighting and storing heat for night time heating

LESSONS LEARNED:

- Project should achieve substantial savings with passive even with severe limits on possible architectural modifications

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Bessemer
PROJECT NO. 324 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 2844
CITY Birmingham
STATE Alabama

COOLING DEGREE DAYS 1928
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1344.7

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [ ]
- DIRECT GAIN* [ ]
- INDIRECT GAIN* [X]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [ ]
- MASS WALL [ ]
- WATER STORAGE [X]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]
- _____ [ ]

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

[ ] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [ ]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[X] DAYLIGHTING

- WINDOWS [ ]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [ ]
- ROOF MONITORS* [X]
- SUNSPACE [ ]
- SKYLIGHTS* [X]
- OTHER (SPECIFY) _____
- _____
- _____
- _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Bessemer
PROJECT NO. 324 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 34,000 BTU/SF-YR (REFERENCE) _____

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	12,300	.078	x				Phase I Final Report, page 7,9
COOLING	9,030	.110			x		"
LIGHTING	8,870	.107			x		"
DHW	Included in "other"	-					"
(OTHER)	2,910	.035					"
TOTAL	33,100	.330					Phase I Final Report, p. 7,9

CONDITIONED BUILDING 26,593 (S.F.) TOTAL BUILDING ENERGY COSTS $8,780 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

See page A-3.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Gas forced-air heating system.
Packaged single-zone roof-top air conditioning units. Fluorescent lighting.
Electric DHW.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Bessemer
PROJECT NO. 324 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	6790	.047	x				Phase I Report Page 27, 29
COOLING	7520	.091			x		"
LIGHTING	5170	.062			x		"
DHW							"
(OTHER)	2700	.033					"
TOTAL	22,180	.233					"

CONDITIONED BUILDING 26,593 (S.F.)

TOTAL BUILDING ENERGY COSTS 6197 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

See page A-3.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Gas forced-air heating system
Package single-zone roof-top air conditioning units.
Fluorescent lighting
Electric DHW

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Bessemer
PROJECT NO. 324 PAGE NO. 6

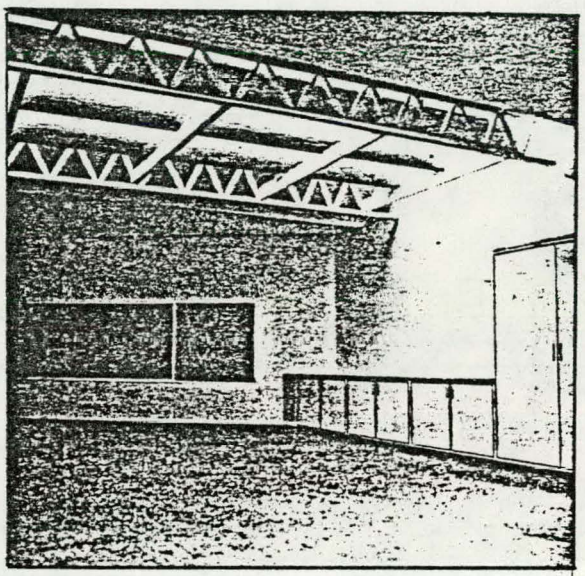
ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS =	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR) =	ENERGY CONSERVATION (BTU/SF-YR) +	PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING				
COOLING				
LIGHTING				
DHW				
(OTHER)				
TOTAL	11,120		11,120	

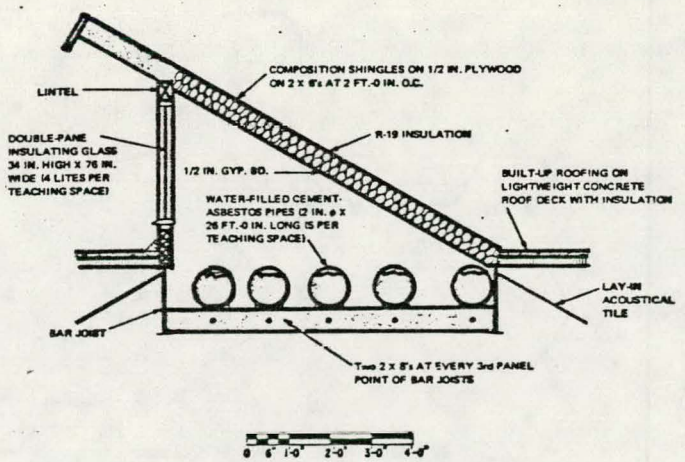
*ESTIMATED SAVINGS 33 %
TOTAL CONSTRUCTION COST $ 954,400
*PASSIVE INCREMENTAL COST $ 125,300

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

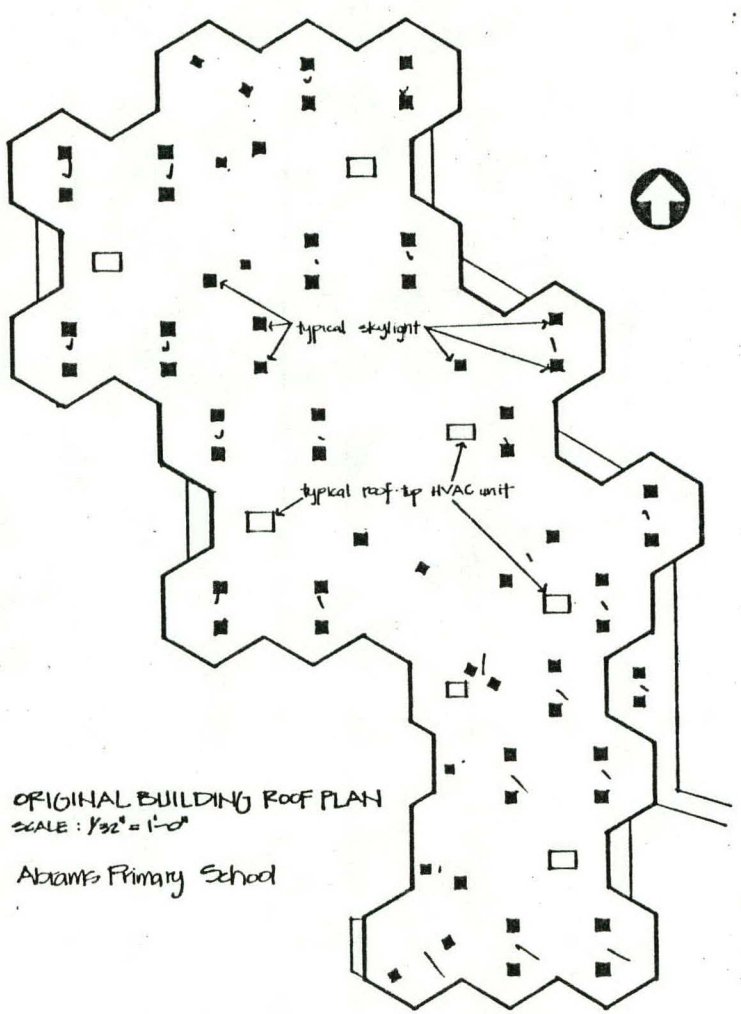
*See Definition Sheet



Typical Teaching Space

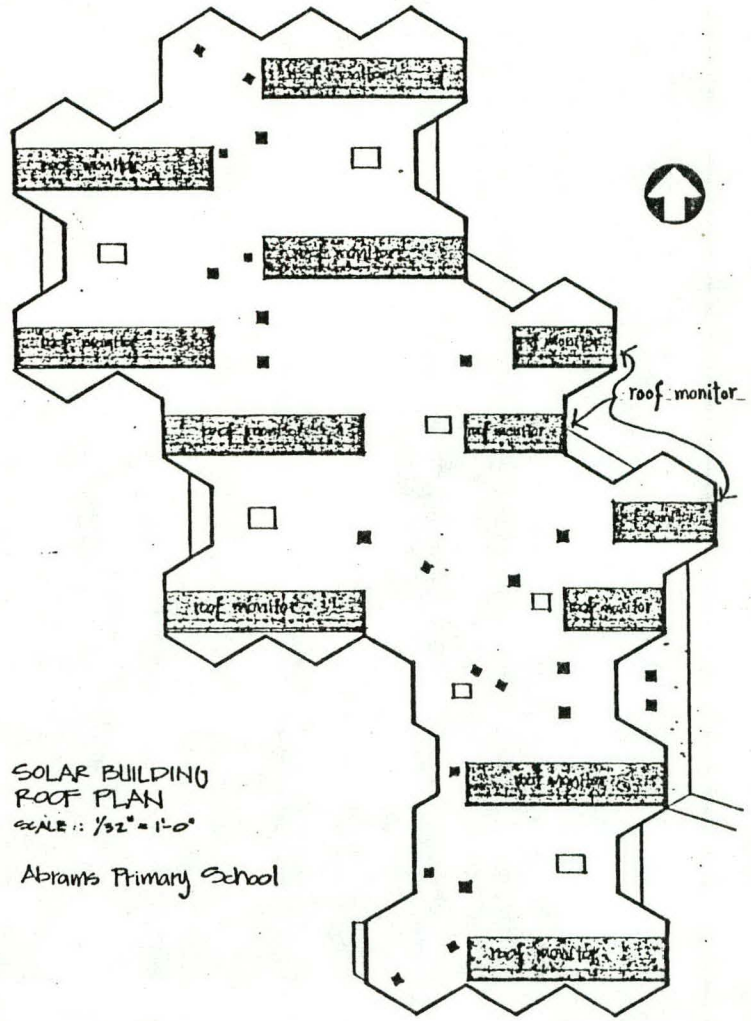


SOLAR 1 ROOF MONITOR/THERMAL STORAGE SCHEME



ORIGINAL BUILDING ROOF PLAN
SCALE : 1/32" = 1'-0"

Abrams Primary School



SOLAR BUILDING
ROOF PLAN
SCALE : 1/32" = 1'-0"

Abrams Primary School

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Irvine School . .
PROJECT NO. 341
LOCATION (CITY/STATE) Irvine, CA
(NEW) RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE School
BUILDING SIZE 43,000 S.F.*
TECHNICAL MONITOR Robert Mizell

KEY PERSONNEL

OWNER
FIRM Irvine School District
STREET 2941 Alton
CITY Irvine
STATE/ZIP California 92713
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CONTACT Dave King

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CONTACT John Baum

SOLAR DESIGNER
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CONTACT Owen J. McCaughey

BUILDING CONTRACTOR
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STREET 130 Centennial Way Suite C
CITY Tustin
STATE/ZIP California 92680
TELEPHONE NO. (714) 838-1980
CONTACT Owen J. McCaughey

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	March, 1982	January, 1983
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD Automatic Data Logger

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Integration of daylight & passive cooling strategies with building program.

DESIGN PROCESS KEY ISSUES:

- How to simplify passive strategies to achieve cost effective energy savings.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Manually switch lighting to save electricity
- Operable windows and clerestory exhaust fans for ventilation.

LESSONS LEARNED:

- Avoid expensive strategies with long paybacks; concentrate on one or two passive strategies designed to achieve most "accessible" energy savings.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Irvine School
PROJECT NO. 341 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 1867

CITY Irvine

STATE California

COOLING DEGREE DAYS 760

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1624.5

SUMMARY OF PASSIVE DESIGN

☐ SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* ☐
- DIRECT GAIN* ☐
- INDIRECT GAIN* ☐
- ISOLATED GAIN* ☐

SPECIFIC

- SUNSPACE/ATRIUM ☐
- MASS FLOOR ☐
- MASS WALL ☐
- WATER STORAGE ☐
- CONVECTIVE LOOP ☐
- EARTH CONTACT ☐
- OTHER (SPECIFY) _____ ☐

☒ SPACE COOLING

- EARTH CONTACT ☒
- NATURAL VENTILATION ☐
- FORCED VENT./NIGHT FLUSHING ☒
- BUILDING LOAD MANAGEMENT* ☒
- EVAPORATION* ☐
- RADIATION* ☐
- DEHUMIDIFICATION* ☐
- OTHER (SPECIFY) Structural cooling _____ ☒

☒ SOLAR DHW (SPECIFY)

Breadbox type

☒ DAYLIGHTING

- WINDOWS ☒
- LIGHTSHELVES* ☒
- CLERESTORIES* ☐
- ROOF MONITORS* ☒
- SUNSPACE ☐
- SKYLIGHTS* ☐
- OTHER (SPECIFY) _____ ☐

☐ OTHER (SPECIFY) _____

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Irvine School
PROJECT NO. 341 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 39,000 BTU/SF-YR (REFERENCE) Elementary School San Diego

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	3,360	.036	x		x		Final Report p. 27
COOLING	36,826	.679			x		"
LIGHTING	24,326	.449			x		"
DHW	1,613	.03			x		"
(OTHER) Misc.	1,075	.02			x		"
TOTAL	67,200	1.214					"

CONDITIONED BUILDING 43,000 (S.F.) TOTAL BUILDING ENERGY COSTS 52,202 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES (Reference Source, Page No.)

$18.5 / 10^6 BTU Electricity — Final Report p. 39

$.063/KWH

Gas Costs: 3.04 / 10^6 BTU — "

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Fluorescent lighting system; 2.6W/SF

HVAC water source heat pump w/backup gas boiler EER=10

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Irvine School
PROJECT NO. 341 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	255	.003	x		x		Final Report p. 121
COOLING	10,741	.200			x		"
LIGHTING	6,194	.114			x		"
DHW	1,372	.015			x		"
(OTHER) Misc.	980	.026			x		"
TOTAL	19,540	0.358					"

CONDITIONED BUILDING 43,000 (S.F.)

TOTAL BUILDING ENERGY COSTS $15,390 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity costs: $18.5/10^6 BTU

Gas Costs: $3.04/10^6 BTUH

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Lighting is fluorescent 1.6W/SF

HTG & AC is water source heat pump.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Irvine School
PROJECT NO. 341 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	3,105		-	3,105	Final Report p. 121 &27
COOLING	26,085		-	26,085	"
LIGHTING	18,132		-	18,132	"
DHW	241		-	241	"
(OTHER)	95		-	95	"
TOTAL	47,658		-	47,658	"

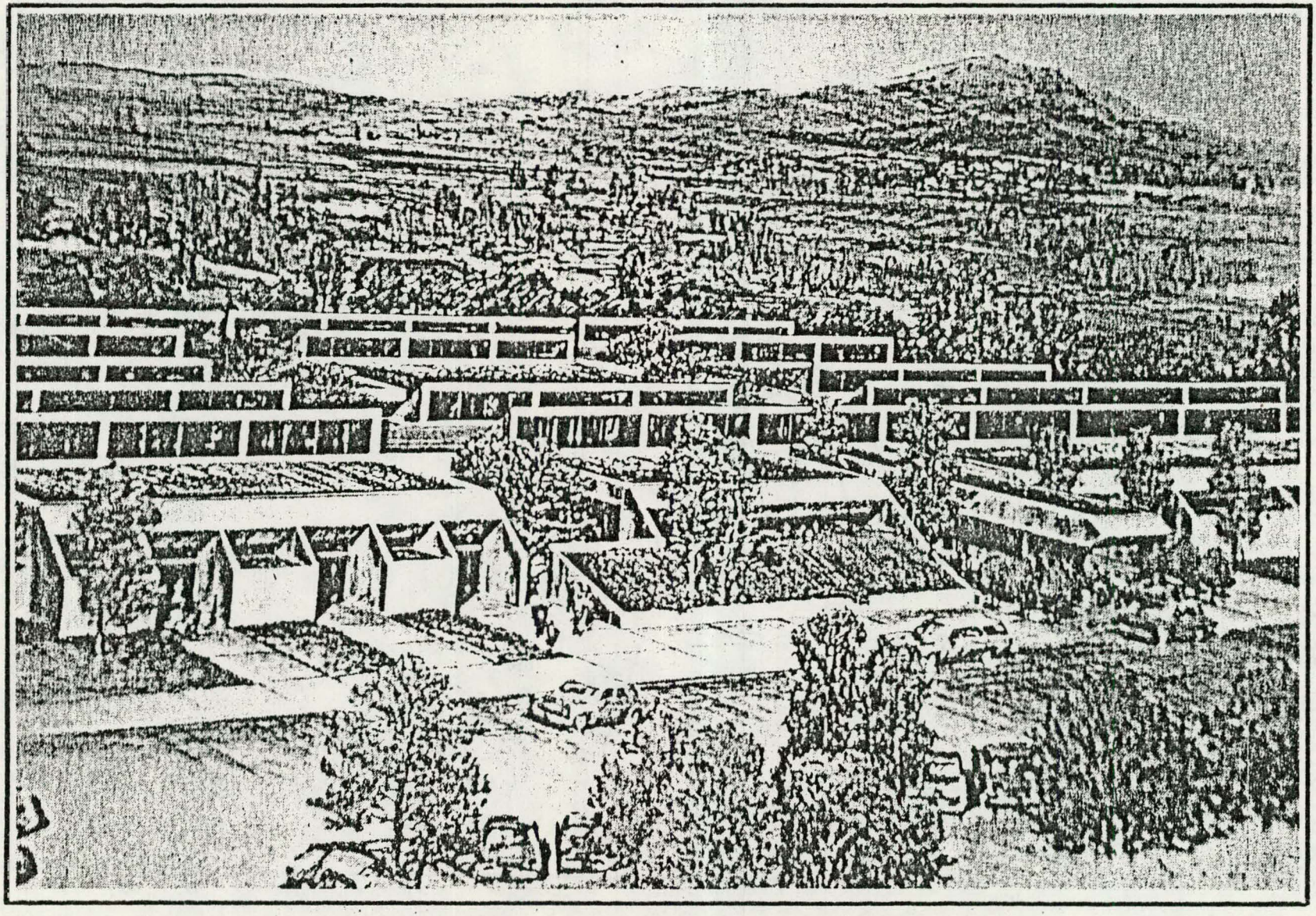
*ESTIMATED SAVINGS 71 %

TOTAL CONSTRUCTION COST $ 3,500,000

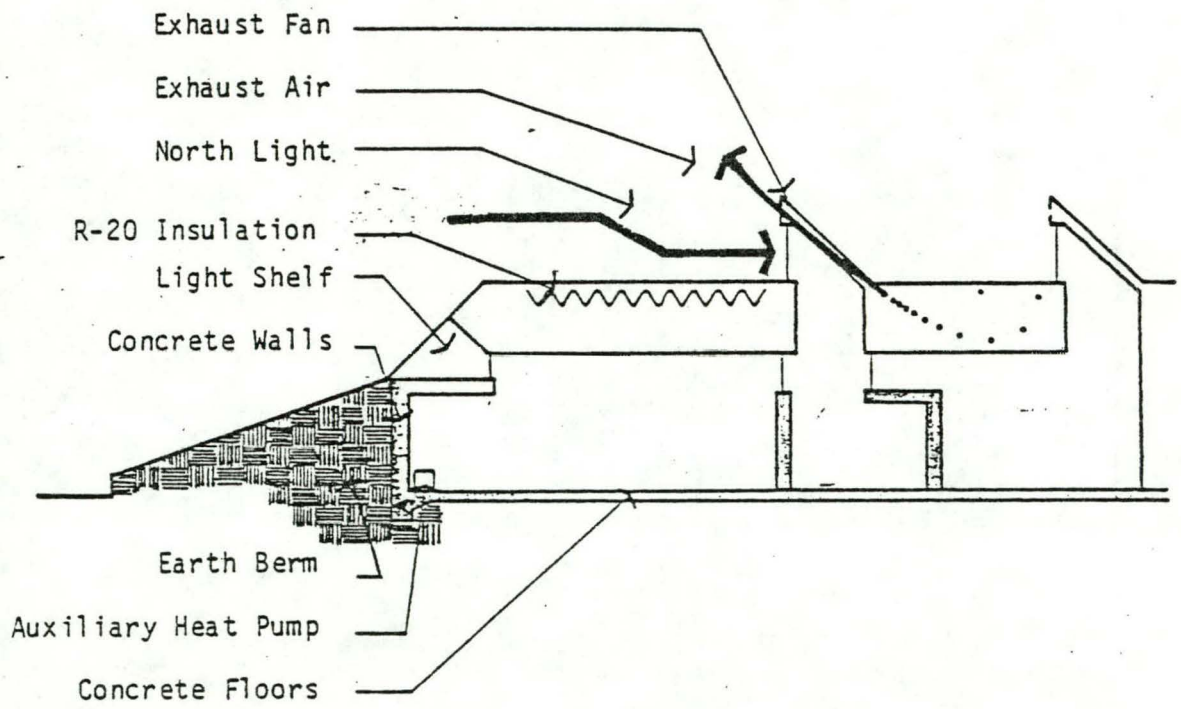
*PASSIVE INCREMENTAL COST $ 564,486

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



Rendering of Southwest Woodbridge Elementary School
(Viewed from the northeast)



SCHEMATIC DIAGRAM

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Colorado Mtn. College
PROJECT NO. 331
LOCATION (CITY/STATE) Glenwood Springs, CO
(NEW)/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE School
*CONDITIONED BLDG., S.F. 31,037
TOTAL S.F. (If Different) 31,870
TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER
FIRM Colorado Mountain College
STREET 182 West 6th Box 1367
CITY Glenwood Springs
STATE/ZIP Colorado 81601
TELEPHONE NO. (303) 945-8691
CONTACT F. Dean Lillie, Pres.

MECHANICAL ENGINEER
FIRM The Engineering Partnership, Ltd.
STREET 1414 Pearl Street
CITY Boulder
STATE/ZIP Colorado 80302
TELEPHONE NO. (303) 444-6038
CONTACT Jerry Novotny

SOLAR DESIGNER
FIRM Thermal Technology Corp
STREET Box 130
CITY Snowmass
STATE/ZIP Colorado 81654
TELEPHONE NO. (303) 963-3185
CONTACT Matt Crosby

BUILDING CONTRACTOR
FIRM Construction Management Consultant, Inc.
STREET Box 1550
CITY Basalt
STATE/ZIP Colorado 81612
TELEPHONE NO. (303) 927-3196
CONTACT Dieter Sander

ARCHITECT
FIRM Sunup
STREET Box 133
CITY Snowmass
STATE/ZIP Colorado 81654
TELEPHONE NO. (303) 927-3369
CONTACT Peter Dobrovolny

INSTRUMENTATION TEAM
FIRM
STREET
CITY
STATE/ZIP
TELEPHONE NO.
CONTACT

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	February, 1981	September, 1981
PHASE III (EVALUATION)	November, 1981	

(A) INSTRUMENTATION METHOD Chart recorder and sensors

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Professional design competitions, professional journals, local press, building tours

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Design an attractive, comfortable, energy efficient building, making maximum use of alternative energy sources

DESIGN PROCESS KEY ISSUES:

-

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Central atrium space for daylighting, distribution of heated/cooled air, and DHW preheat.
- Trombe walls and direct gain with moveable insulated shades

LESSONS LEARNED:

-

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Colorado Mtn. College
PROJECT NO. 331 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 5603

CITY Grand Junction

STATE Colorado

COOLING DEGREE DAYS 1139

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1658.7

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [x]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [x]
- MASS FLOOR [x]
- MASS WALL [x]
- WATER STORAGE [x]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____

Greenhouse [x]

[x] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____

_____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [ ]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____

_____

_____

_____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Colorado Mtn. College
PROJECT NO. 331 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 47,000 BTU/SF-YR (REFERENCE) Denver-Secondary School

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	56,868	.666			x		Phase I, Final Report, p. Add-19
COOLING	8,248	.097			x		"
LIGHTING	15,401	.180			x		"
DHW	3,254	.038			x		"
(OTHER) Fans	6,411 10,020	.074 .117			x		"
TOTAL	100,200	$1.17					"

CONDITIONED BUILDING 31,037 (S.F.) TOTAL BUILDING ENERGY COSTS 32,310 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity is provided at $11.72 per million BTU.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

All electric building. Resistance heating, compressor cooling, fluorescent lighting, resistance-heated DHW.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Colorado Mtn. College
PROJECT NO. 331 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	6,770	.079			x		Phase I Final Report, p. Add-19
COOLING	6				x		
LIGHTING	6,730	.079			x		
DHW	1,970	.023			x		
(OTHER) Fans	3,670 13,370	.043 .157			x		
TOTAL	32,520	.381					

CONDITIONED BUILDING 31,037 (S.F.) TOTAL BUILDING ENERGY COSTS 11,825 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity is provided at $11.72 per million BTU.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

All electric building - resistance heating, evaporative cooling, fluorescent lighting, resistance - heated DHW

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Colorado Mtn. College
PROJECT NO. 331 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	50,100			50,100	Phase I Final Report Add-19
COOLING	8,240			8,240	"
LIGHTING	8,670			8,670	"
DHW	1,280			1,280	"
(OTHER) Fans	2,740 -3,350			2,740 -3,350	"
TOTAL	67,680			67,680	"

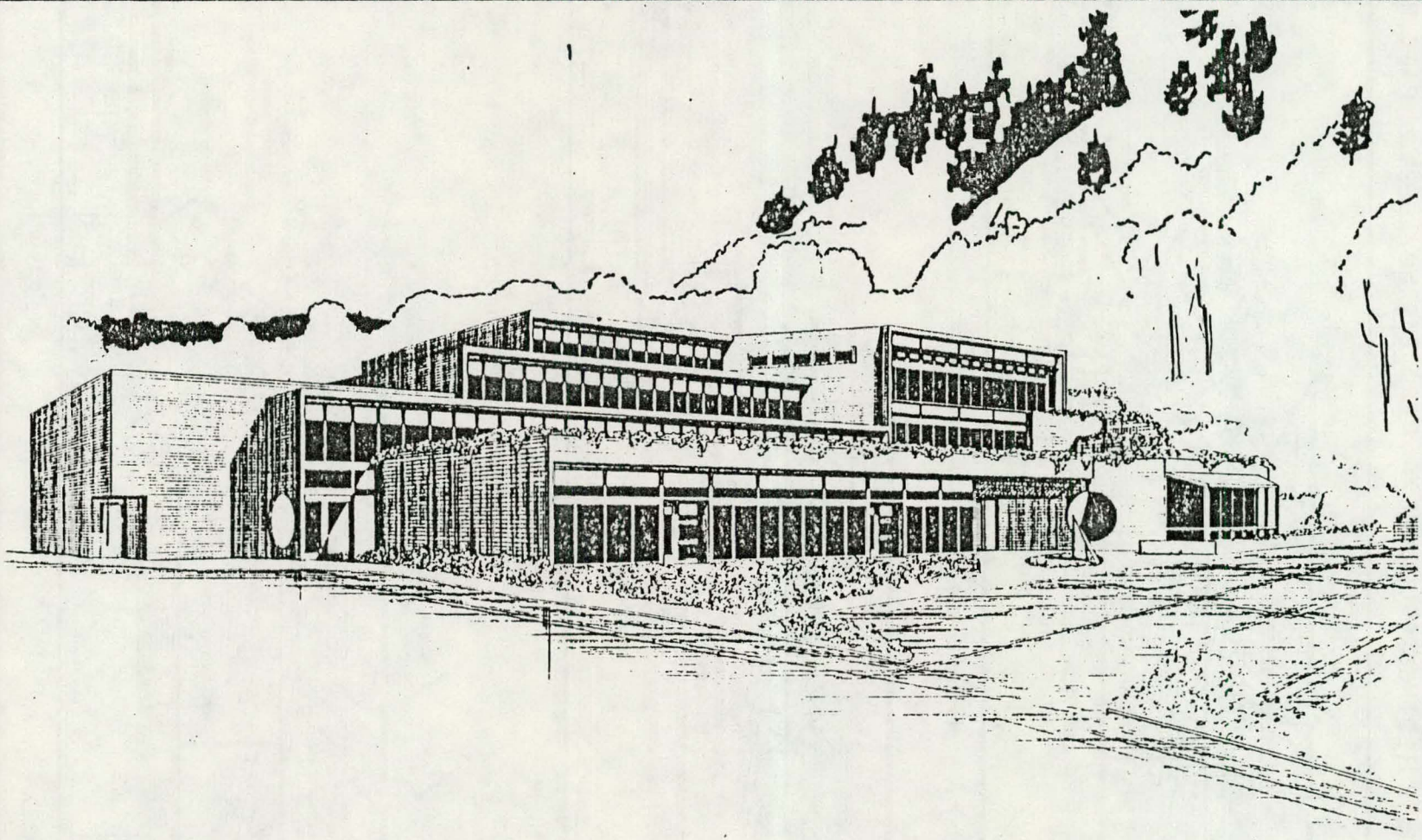
*ESTIMATED SAVINGS 68 %

TOTAL CONSTRUCTION COST $ 2,200,000

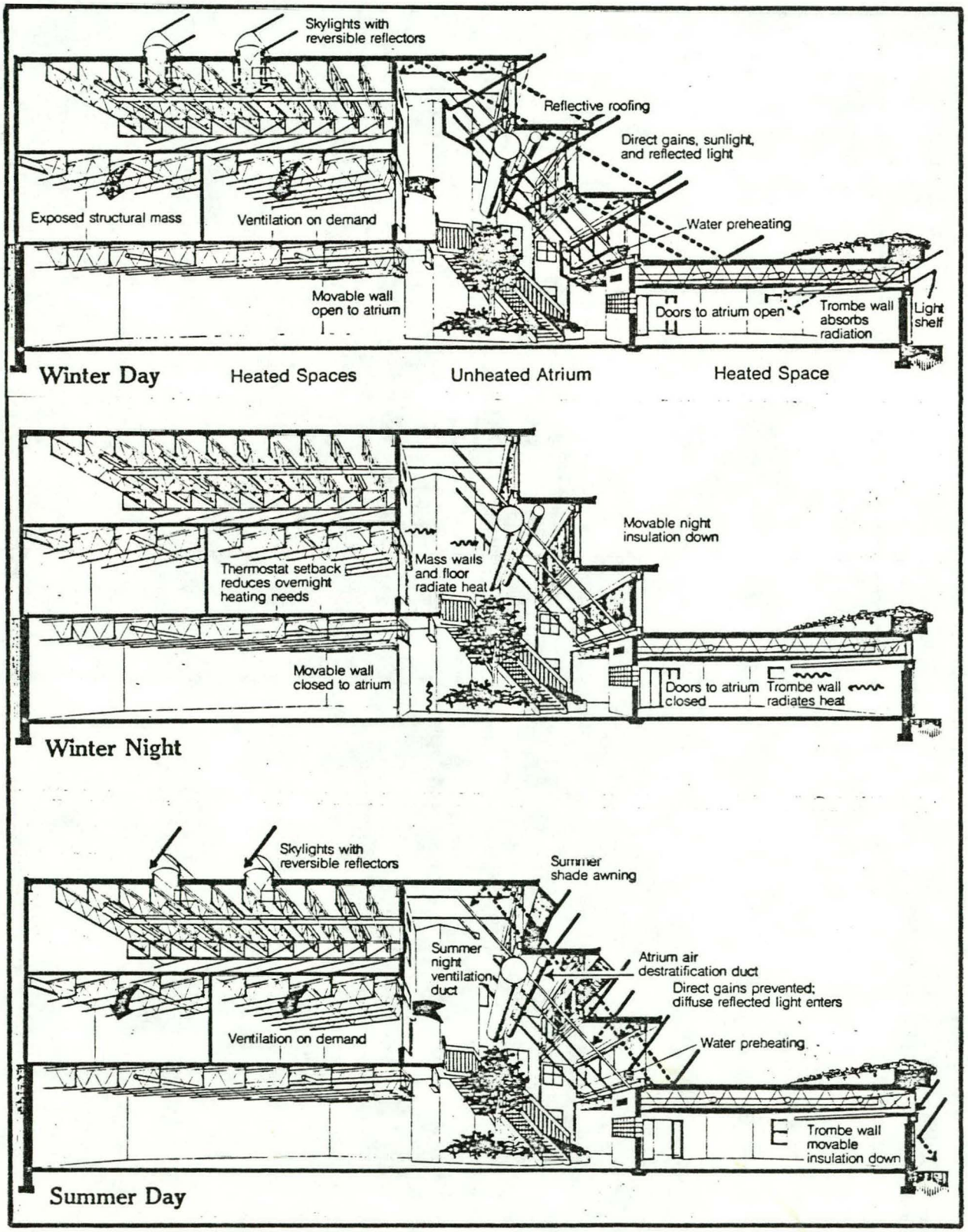
*PASSIVE INCREMENTAL COST $ 194,700

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



BLAKE AVENUE BUILDING
GLENWOOD SPRINGS, COLORADO
COLORADO MOUNTAIN COLLEGE



SEASONAL ENERGY STRATEGIES

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Walker Field . . BUILDING TYPE Airport

PROJECT NO. 360 *CONDITIONED BLDG., S.F. 66,700

LOCATION (CITY/STATE) Grand Junction, CO TOTAL S.F. (If Different) _____

(NEW) RETROFIT/ADDITION (CIRCLE ONE) TECHNICAL MONITOR William J. Fisher

KEY PERSONNEL

OWNER

FIRM Walker Field Authority
STREET _____
CITY Grand Junction
STATE/ZIP Colorado
TELEPHONE NO. (303) 243-3695
CONTACT Paul Bowers

MECHANICAL ENGINEER

FIRM Yoder Engineering Consultants
STREET 125 N. 8th Street
CITY Grand Junction
STATE/ZIP Colorado 81501
TELEPHONE NO. (303) 245-0148
CONTACT David Yoder

SOLAR DESIGNER

FIRM Dr. Jan F. Kreider, P.E.
STREET 1455 Oak Cir.
CITY Boulder
STATE/ZIP Colorado 80302
TELEPHONE NO. (303) 447-2218
CONTACT Jan Kreider

BUILDING CONTRACTOR

FIRM (not selected)
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

ARCHITECT

FIRM John Porter
STREET P.O. Box 806
CITY Grand Junction
STATE/ZIP Colorado 81501
TELEPHONE NO. (303) 245-2000
CONTACT J. Porter, J. Vickery

INSTRUMENTATION TEAM

FIRM Yoder Engineering
STREET 125 N. 8th Street
CITY Grand Junction
STATE/ZIP Colorado 81501
TELEPHONE NO. (303) 245-0148
CONTACT David Yoder

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	Under construction	
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) 50,000 brochures; slide show; media spots; local seminars and tours; papers at Technical Conferences.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- One large zone for most airport functions except airport departures.

DESIGN PROCESS KEY ISSUES:

- Penetrating daylighting & solar heat into north areas building orientation.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Clerestories for direct gain solar heating; heat collection duct located in clerestory space.
- Clerestories also provide daylighting.

LESSONS LEARNED:

- Simple, direct systems are more cost-effective.
- Daylighting design tools are able to calculate lighting levels, but unable to determine energy savings.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Walker Field
PROJECT NO. 360 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 5,603
CITY Grand Junction
STATE Colorado

COOLING DEGREE DAYS 1,139
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1,681

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- [ ] SUNTEMPERED*
- [x] DIRECT GAIN*
- [ ] INDIRECT GAIN*
- [ ] ISOLATED GAIN*

SPECIFIC

- [ ] SUNSPACE/ATRIUM
- [x] MASS FLOOR
- [x] MASS WALL
- [ ] WATER STORAGE
- [ ] CONVECTIVE LOOP
- [ ] EARTH CONTACT
- [ ] OTHER (SPECIFY) _____
- [ ] _____

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

[x] SPACE COOLING

- [ ] EARTH CONTACT
- [x] NATURAL VENTILATION
- [x] FORCED VENT./NIGHT FLUSHING
- [ ] BUILDING LOAD MANAGEMENT*
- [ ] EVAPORATION*
- [ ] RADIATION*
- [ ] DEHUMIDIFICATION*
- [ ] OTHER (SPECIFY) _____
- [ ] _____

[x] DAYLIGHTING

- [ ] WINDOWS
- [ ] LIGHTSHELVES*
- [ ] CLERESTORIES*
- [x] ROOF MONITORS*
- [ ] SUNSPACE
- [ ] SKYLIGHTS*
- [ ] OTHER (SPECIFY) _____
- _____
- _____
- [ ] _____

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Walker Field
PROJECT NO. 360 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 87,500 BTU/SF-YR (REFERENCE) Final Design Report p.144

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	27,871	0.091	x				Discussion with solar designer 11/23/81
COOLING					x		Evaporative cooling is anticipated
LIGHTING	16,251	0.179			x		Final Report p.155
DHW	1,169	0.004	x				
(OTHER) Fans Process	~~11,679~~ 8,636	0.113 0.028	x		x		
TOTAL	65,606	0.415					

CONDITIONED BUILDING 66,700 (S.F.) TOTAL BUILDING ENERGY COSTS 27,680 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Assume same as for solar building - (P. 5)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Assume same as for solar building (P. 5)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Walker Field
PROJECT NO. 360 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	21,319	0.069	x				Final Report p.18a & p. 145 Appendix 7
COOLING	-	-			x		Using evaporative cooling
LIGHTING	8,125	0.127			x		Final Report p.18a & p.145 Appendix 7
DHW	1,169	0.004	x				" "
(OTHER) Fans Process	11,574	0.112	x		x		" " Appendix 7
TOTAL	42,187	.31					" " Appendix 7

CONDITIONED BUILDING 66,700 (S.F.) TOTAL BUILDING ENERGY COSTS 20,677 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES Final Report p. 153
(Reference Source, Page No.)

Gas - $4.89/Million BTU (Assumes a fuel content of 840 BTU/CCF)
Elec. - $6.87 " " (includes electric demand changes); $0.026 KWH

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating/DHW plant rated @ 66% efficient in Appendix 7

Lighting HID, incandescent & fluorescent Final Report P. 34

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Walker Field
PROJECT NO. 360 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	6,552			6,552	
COOLING					
LIGHTING	8,126			8,126	Final Report p. 155
DHW					
(OTHER) Fans	105			105	
TOTAL	14,783			14,783	

*ESTIMATED SAVINGS 23 %

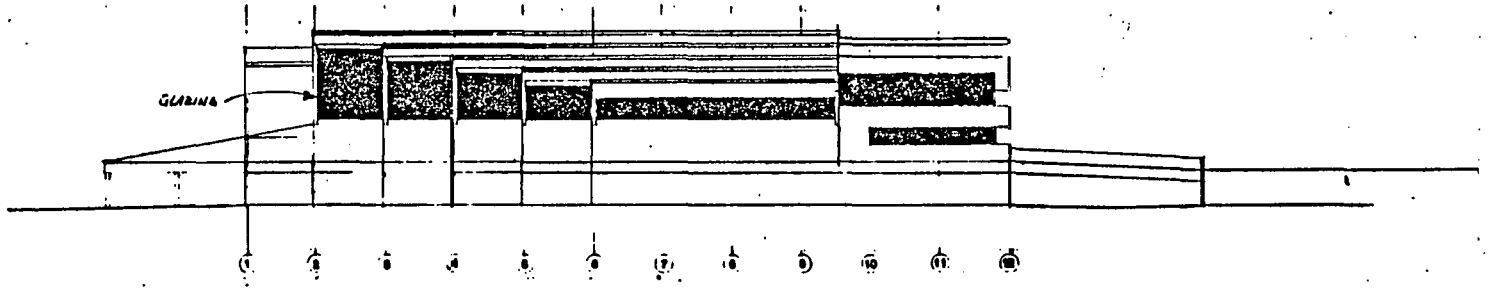
TOTAL CONSTRUCTION COST $ 5.2

*PASSIVE INCREMENTAL COST $ 219,435

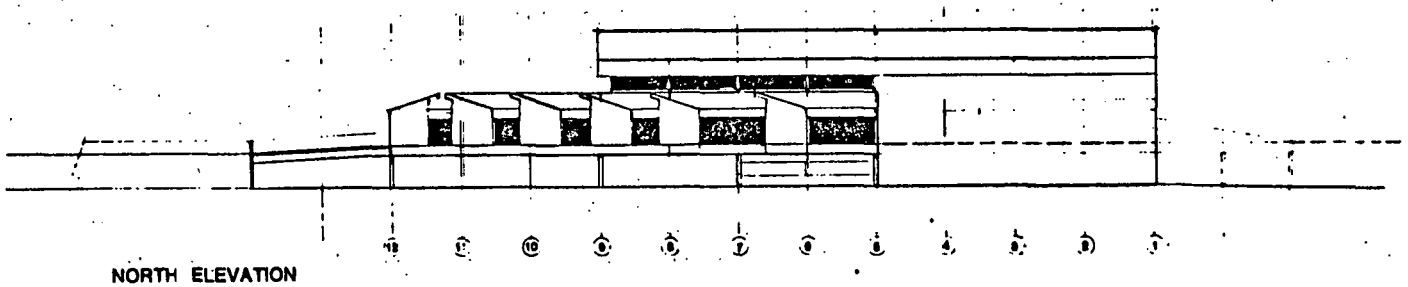
DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

Proposed ventilation system

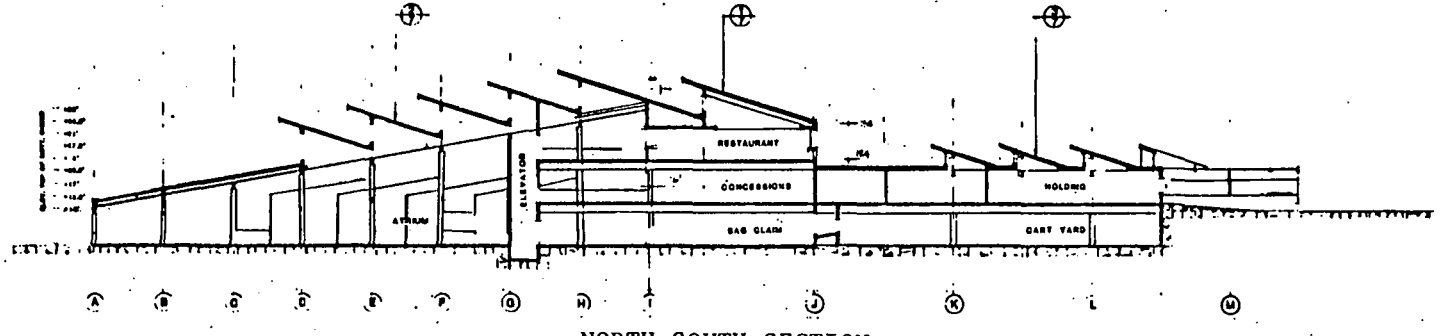
*See Definition Sheet



SOUTH ELEVATION



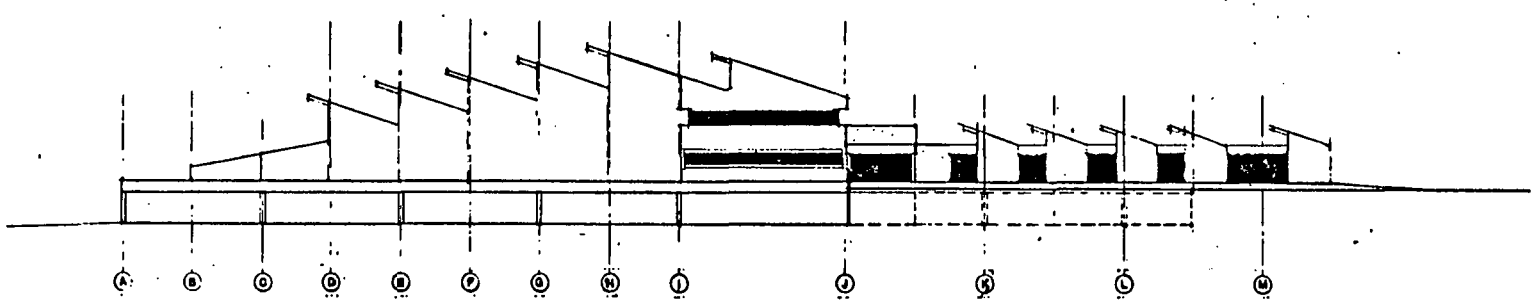
NORTH ELEVATION



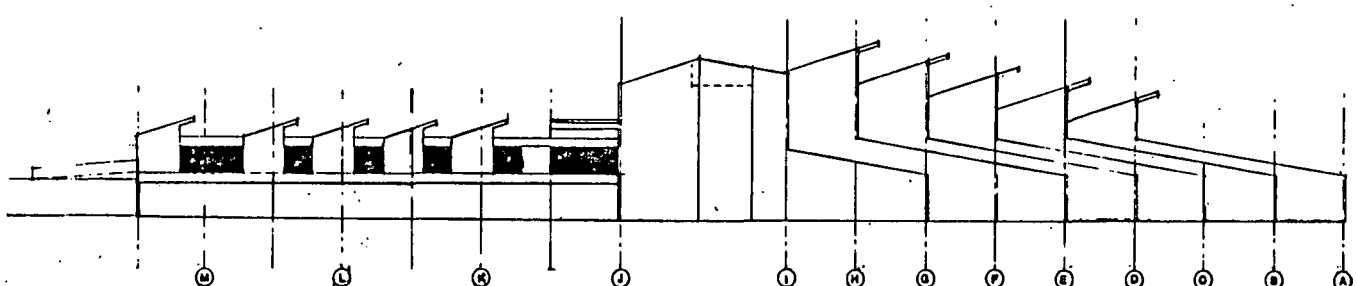
NORTH-SOUTH SECTION

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Walker Field
PROJECT NO. 360 PAGE NO. 8



EAST ELEVATION



WEST ELEVATION

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Gunnison Co. Airport
PROJECT NO. 339
LOCATION (CITY/STATE) Gunnison, CO
(NEW) RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Airport Passenger Terminal
*CONDITIONED BLDG., S.F. 8500
TOTAL S.F. (If Different) 9703*
TECHNICAL MONITOR Thomas Sayre

KEY PERSONNEL

OWNER
FIRM Gunnison County, Colorado
STREET 200 East Virginia Ave.
CITY Gunnison
STATE/ZIP Colorado 81230
TELEPHONE NO. (303) 641-4100
CONTACT Dorothy M. Johnson

MECHANICAL ENGINEER
FIRM Jim Ottmer
STREET P.O. Box 1128
CITY Boulder
STATE/ZIP Colorado 80306
TELEPHONE NO. (303) 442-3103
CONTACT Jim Ottmer

SOLAR DESIGNER
FIRM Dr. Jan Kreider, PE & Assoc.
STREET 1455 Oak Circle
CITY Boulder
STATE/ZIP Colorado 80302
TELEPHONE NO. (303) 447-2218
CONTACT Dr. Jan Kreider

BUILDING CONTRACTOR
FIRM Jiminez Construction Co.
STREET 115 S. 14th
CITY Gunnison
STATE/ZIP Colorado 81230
TELEPHONE NO. (303) 641-1114
CONTACT Joe Jiminez

ARCHITECT
FIRM Assoc. Arch. of Crested Butte
STREET 207 Elk Ave., Box 1209
CITY Crested Butte
STATE/ZIP Colorado 81224
TELEPHONE NO. (303) 349-5353
CONTACT Leon H. Waller

INSTRUMENTATION TEAM
FIRM Assoc. Arch. of Crested Butte
STREET 207 Elk Avenue, Box 1209
CITY Crested Butte
STATE/ZIP Colorado 81224
TELEPHONE NO. (303) 349-5353
CONTACT Leon H. Waller

*See Definition Sheet

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Gunnison County
PROJECT NO. 339 PAGE NO. 2

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	October 79	November 80
PHASE III (EVALUATION)	March 81	September 82

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) 7,500 brochures, slide show, media spots, graphics display in terminal, performance monitoring panel, tours, seminars, paper to passive solar conference.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Heating is key energy issue.
- Noise and jet fumes preclude operable glazing.

DESIGN PROCESS KEY ISSUES:

- Integration of passive system with conventional mechanical system.
- Construction of passive system in relation to whole.
- Esthetics.
- Detailing of mass wall with conventional wall.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Heating - Indirect gain through Thermal Storage Wall. Moveable insulates prevents nighttime heat loss
- Cooling - Moveable insulation in "down" position to prevent overheating or wall is used to induce ventilation
- Daylighting - High clerestory windows

LESSONS LEARNED:

- Daylighting analysis tools are nonexistent
- Moveable insulation systems need more development diversity.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Gunnison County
PROJECT NO. 339 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 9941
CITY Gunnison
STATE Colorado

COOLING DEGREE DAYS 6
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1681

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

SUNTEMPERED*	☐
DIRECT GAIN*	☒
INDIRECT GAIN*	☒
ISOLATED GAIN*	☐

SPECIFIC

SUNSPACE/ATRIUM	☐
MASS FLOOR	☒
MASS WALL	☒
WATER STORAGE	☐
CONVECTIVE LOOP	☐
EARTH CONTACT	☐
OTHER (SPECIFY) _____	
_____	☐

[ ] SOLAR DHW (SPECIFY)

_____

_____

[x] OTHER (SPECIFY) _____

Night setback

Buffer areas (baggage make-up), vestibules.

*See Definition Sheet

[x] SPACE COOLING

EARTH CONTACT	☐
NATURAL VENTILATION	☒
FORCED VENT./NIGHT FLUSHING	☒
BUILDING LOAD MANAGEMENT*	☒
EVAPORATION*	☐
RADIATION*	☐
DEHUMIDIFICATION*	☐
OTHER (SPECIFY) _____	
_____	☐

[x] DAYLIGHTING

WINDOWS	☒
LIGHTSHELVES*	☒
CLERESTORIES*	☒
ROOF MONITORS*	☐
SUNSPACE	☐
SKYLIGHTS*	☐
OTHER (SPECIFY) _____	
_____	
_____	
_____	☐

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Gunnison County
PROJECT NO. 339 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 87,500 BTU/SF-YR (REFERENCE) Used by Solar Designer for airports.

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	44,388	.344			x		Topical Report p. 2
COOLING							
LIGHTING	21,412	.166					Supplementary JFK Assoc. calc's.
DHW	0						
(OTHER)							
TOTAL	65,800	.510					

CONDITIONED BUILDING 8500** (S.F.) TOTAL BUILDING ENERGY COSTS $4335 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electric $7.74/MMBTU Topical Report p. 15

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Electric Boiler with fan coil distrib. - efficiency 100%
Electric lighting 1.5 w/sf (PON)

* See Definition Sheet
** Conditioned space

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Gunnison County
PROJECT NO. 339 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	26,247	.203			x		Topical Report p. 11
COOLING	No mechanical cooling.					n/a	PON
LIGHTING	13,060	.117					
DHW	0						"
(OTHER)	0						"
TOTAL	39,307	.320					

CONDITIONED BUILDING 8500 (S.F.) TOTAL BUILDING ENERGY COSTS $2720 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electric $7.74/million BTU - Topical Report, p. 15

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating - electric boiler and fan coil (PON)
Cooling - forced air ventilation
Lighting - 1.5 w/sf (PON)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Gunnison County
PROJECT NO. 339 PAGE NO. 6

ENERGY SAVINGS SUMMARY

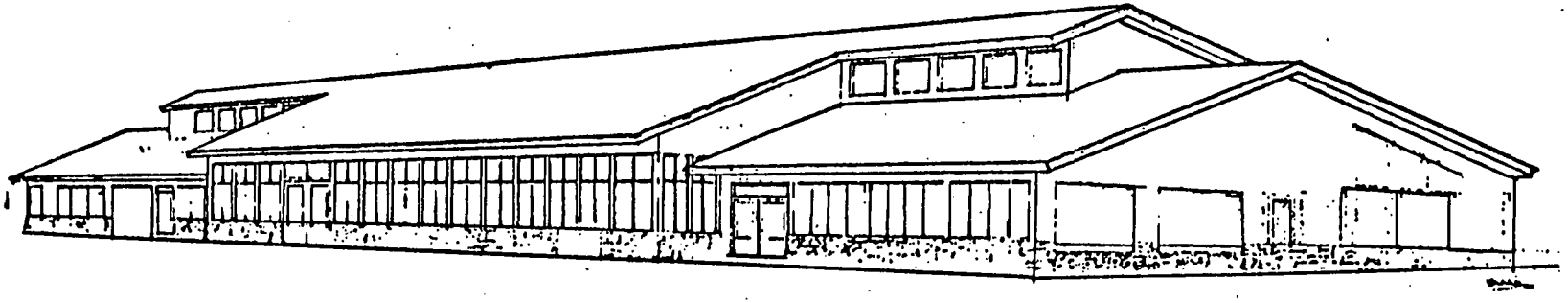
	GROSS ENERGY CONSUMPTION SAVINGS =	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR) =	ENERGY CONSERVATION (BTU/SF-YR) +	PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	18,117	-	18,117	Topical Rept. p. 1
COOLING	No mechanical A/C used			
LIGHTING	8,352		8,352	
DHW	0			
(OTHER)	0			
TOTAL	26,469		26,493	Topical Rept. p. 1

*ESTIMATED SAVINGS 41 %
TOTAL CONSTRUCTION COST $ 774,814.20
*PASSIVE INCREMENTAL COST $ 45,480

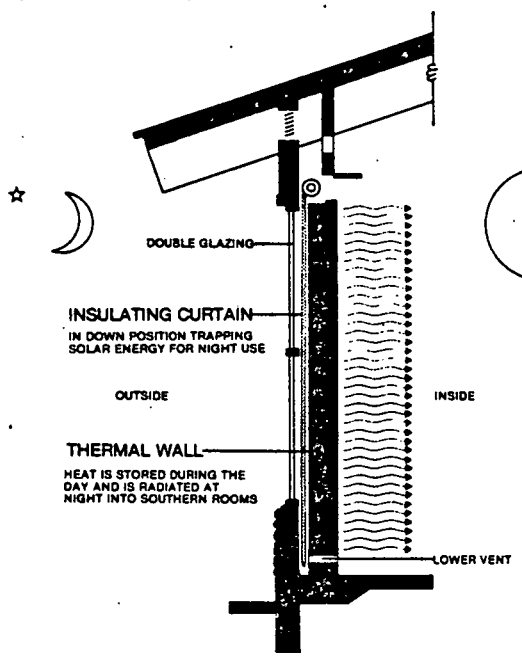
DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

Roof insulation and wall insulation exceed state energy code; double glazing w/R-10 NI; airlock entries; night setback; buffer areas' stratification control

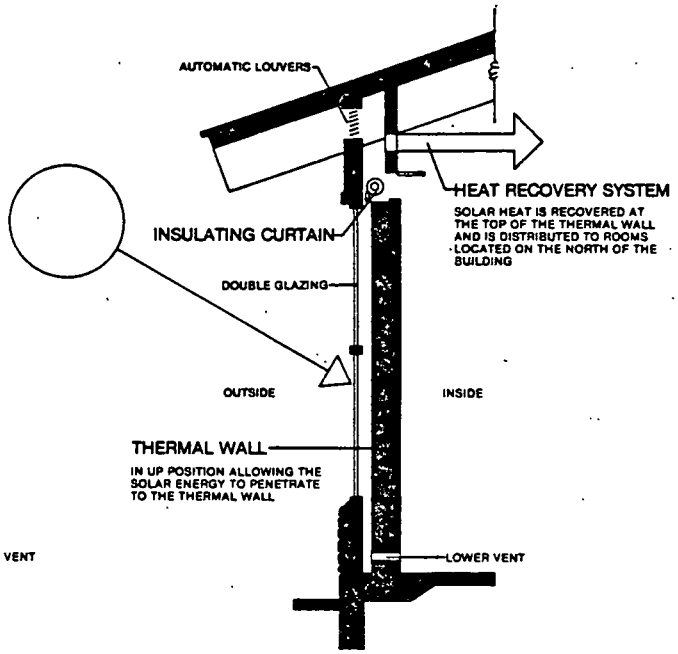
*See Definition Sheet



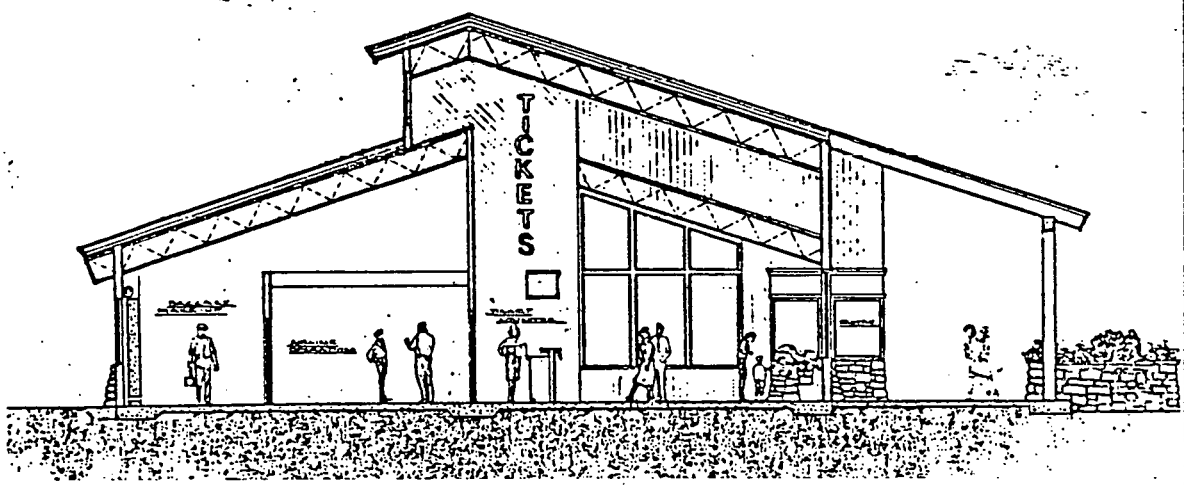
VIEW OF TERMINAL FROM SOUTHEAST



THERMAL WALL
NIGHT CYCLE



THERMAL WALL
DAY CYCLE



NORTHEAST SECTION - TICKET AREA

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Essex Dorsey Senior Center BUILDING TYPE Senior Citizen Center

PROJECT NO. 323 *CONDITIONED BLDG., S.F. 13,000

LOCATION (CITY/STATE) Baltimore, MD TOTAL S.F. (If Different) _____

NEW/RETROFIT/(ADDITION) (CIRCLE ONE) TECHNICAL MONITOR Bob Mizell

KEY PERSONNEL

OWNER

Baltimore County
FIRM Aging Programs and Services
STREET 611 Central Avenue
CITY Towson
STATE/ZIP Maryland 21204
TELEPHONE NO. (301) 494-2107
CONTACT Greg Mitchell

MECHANICAL ENGINEER

FIRM Mueller Associates
STREET 1900 Sulfur Springs Road
CITY Baltimore
STATE/ZIP Maryland 21227
TELEPHONE NO. (301) 247-5666
CONTACT Robert Hedden, PE

SOLAR DESIGNER

FIRM Peter D. Paul Architects
STREET 170 Fifth Avenue
CITY New York
STATE/ZIP New York 10010
TELEPHONE NO. (212) 741-8090
CONTACT Peter D. Paul

BUILDING CONTRACTOR

FIRM Peter D. Paul Architects
STREET 170 Fifth Avenue
CITY New York
STATE/ZIP New York 10010
TELEPHONE NO. (212) 741-8090
CONTACT Peter D. Paul

ARCHITECT

FIRM Peter D. Paul Architects
STREET 170 5th Avenue
CITY New York
STATE/ZIP NY 10010
TELEPHONE NO. (212) 741-8090
CONTACT Barbara Sandrisser
Bob Dolney

INSTRUMENTATION TEAM

FIRM _____
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	December 1981	December 1982
PHASE III (EVALUATION)	Spring 1983	Fall 1983

(A) INSTRUMENTATION METHOD Instrumentation, Behavioral & Perceptual Data

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) In preparation

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Daylighting & cooling are priorities--building form determined by these concerns.
- New structure to interrelate with two existing schoolhouses.
- The integrity of existing buildings to be kept.

DESIGN PROCESS KEY ISSUES:

- Keep with historical vernacular of the Victorian schoolhouses.
- Interrelation of passive solar strategies.
- Integration of energic, esthetic & functional elements.
- Designing to accommodate the special physical & pyschological needs of the elderly.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Daylighting - Narrow building has high ceilings, clerestory; open space between existing & new building; overhangs, awnings, plant shelves
- Cooling - large areas of operable sash; building set in a shaded place; well vented attic space; atrium/courtyard.
- Heating - south glazing, clerestories, vestibule, moveable insulation.

LESSONS LEARNED:

- Keep Passive Solar Designs simple & straightforward
- Use common sense
- Don't depend on standard data, such as weather data, to provide useful, relevant information.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Essex Dorsey Senior Center
PROJECT NO. 323 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4729
CITY Essex
STATE MD. (Schematic Report p. 35)

COOLING DEGREE DAYS 1108
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1215

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED*/Primary [x]
- DIRECT GAIN*/Secondary [x]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [x]
- MASS WALL [ ]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[x] SOLAR DHW (SPECIFY)

Passive - Batch type

[ ] OTHER (SPECIFY)

Atrium/court yard

increased perimeter

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [x]
- ROOF MONITORS* [x]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____ [ ]

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Essex Dorsey Senior Center
PROJECT NO. 323 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 64,000 BTU/SF-YR (REFERENCE) (Community Center) Washington, D.C.

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	48,000	0.4	x				Phase II Report (25 Sept.) P.7 Fig. 2
COOLING	20,000	0.35			x		"
LIGHTING	14,000	0.25			x		"
DHW	4,000	0.07			x		"
(OTHER)							"
TOTAL	86,000	1.07					"

CONDITIONED BUILDING 13,000 (S.F.) TOTAL BUILDING ENERGY COSTS 13,920 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Oil - $8.57/10^6/BTU
Elec. -$17.58/10^6 BTU
(no demand charge)

Phase II Report P. 4
(25 September)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Oil at 70% efficiency

HVAC/Lighting equipment not available at this time.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Essex Dorsey Senior Center
PROJECT NO. 323 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	32,000	0.27	x				Phase II Report (25 Sept.) P. 10
COOLING	2,500	0.05			x		"
LIGHTING	4,800	0.08			x		"
DHW	1,000	0.02			x		"
(OTHER)							
TOTAL	40,300	0.42					"

CONDITIONED BUILDING 13,000 (S.F.)

TOTAL BUILDING ENERGY COSTS 5460 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Oil - $8.57/MMBTU's
Elec. - $17.58/MMBTU's

Phase II Report P. 4
(25 Sept.)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Oil at 70% efficiency

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Essex Dorsey Senior Center
PROJECT NO. 323 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	16,000			16,000	Phase II Rept. (25 Sept.) P.11
COOLING	17,500			17,500	"
LIGHTING	9,200			9,200	"
DHW	3,000			3,000	"
(OTHER)					
TOTAL	45,700			45,700	"

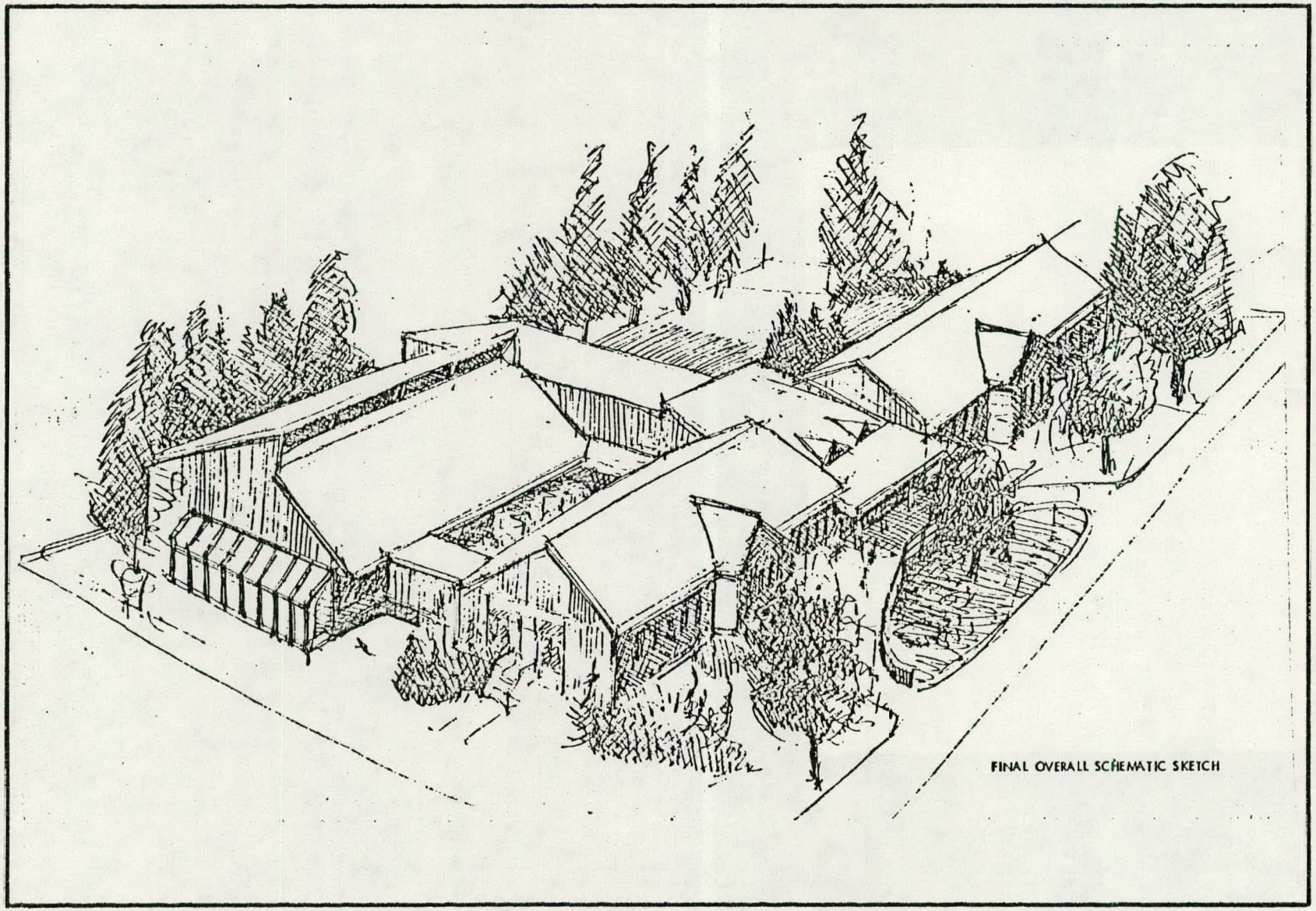
*ESTIMATED SAVINGS 50 %
TOTAL CONSTRUCTION COST $ 644,000
*PASSIVE INCREMENTAL COST $ 74,594

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Essex Dorsey Senior Center
PROJECT NO. 323 PAGE NO. 7



FINAL OVERALL SCHEMATIC SKETCH

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D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Security State Bank
PROJECT NO. 353
LOCATION (CITY/STATE) Wells, Minnesota
(NEW)/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Bank
*CONDITIONED BLDG., S.F. 11,012
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR R. Busch

KEY PERSONNEL

OWNER
FIRM Security State Bank of Wells
STREET 32 S. Broadway
CITY Wells
STATE/ZIP Minnesota
TELEPHONE NO. (507) 553-3805
CONTACT Mr. Pat Hart

MECHANICAL ENGINEER
FIRM Emmanuelson Podas, Inc.
STREET 6607 18th Avenue, South
CITY Minneapolis
STATE/ZIP Minnesota
TELEPHONE NO. (612) 866-8424
CONTACT Norm Podas, Paul Emanuelson

SOLAR DESIGNER
FIRM John Weidt Assocs., Inc.
STREET Lake Village Center ~~P.O. Box 401~~
CITY Chaska
STATE/ZIP Minnesota
TELEPHONE NO. (612) 448-6464
CONTACT John Weidt

BUILDING CONTRACTOR
FIRM Loeffel-Engstrand
STREET 612 11th Avenue South
CITY Hopkins
STATE/ZIP Minnesota 55343
TELEPHONE NO. (612) 935-0141
CONTACT Rich Kiemen

ARCHITECT
FIRM Gene E. Hickey & Assoc. Inc.
STREET 6950 France Avenue, South
CITY Edina
STATE/ZIP Minnesota 55435
TELEPHONE NO. (612) 920-1881
CONTACT Jon Thorstenson

INSTRUMENTATION TEAM
FIRM John Weidt Assocs., Inc.
STREET Lake Village Center P.O. Box 401
CITY Chaska
STATE/ZIP Minnesota
TELEPHONE NO. (612) 448-6464
CONTACT John Weidt

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	August 80	December, 81
PHASE III (EVALUATION)	September 80	June 83

(A) INSTRUMENTATION METHOD Automatic Data Logger/Apple Computer

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- To integrate a functional plan for a bank having specific needs with various passive solar features as well as integrating those features with each other.

DESIGN PROCESS KEY ISSUES:

- Priority was given to daylighting and passive heating assuming the primary goal of providing an extremely tight and well-insulated building envelope would be met.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Natural daylighting incorporated in three major zones. Lower glass in secure zone; clerestory glass in public and confidential zones.
- Control is provided by awnings and ventian blinds.
- High velocity air ducts serve as sun, sound control baffles and mounting surfaces for ambient lighting.

LESSONS LEARNED:

- The program requirements indicated that the design emphasis be redirected from high mass trombe wall approach to a low mass "thermos bottle" approach.

CLIMATE

HEATING DEGREE DAYS 8158

CITY Minneapolis

STATE Minnesota

COOLING DEGREE DAYS 585

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1170

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL

SUNTEMPERED*	[X]
DIRECT GAIN*	[X]
INDIRECT GAIN*	[ ]
ISOLATED GAIN*	[ ]

SPECIFIC

SUNSPACE/ATRIUM	[ ]
MASS FLOOR	[X]
MASS WALL	[X]
WATER STORAGE	[ ]
CONVECTIVE LOOP	[ ]
EARTH CONTACT	[ ]
OTHER (SPECIFY) _____	
_____	[ ]

[ ] SOLAR DHW (SPECIFY)

_____

_____

[X] OTHER (SPECIFY) Low mass highly insulated "thermos bottle" building skin

_____

*See Definition Sheet

[X] SPACE COOLING

EARTH CONTACT	[ ]
NATURAL VENTILATION	[ ]
FORCED VENT./NIGHT FLUSHING	[X]
BUILDING LOAD MANAGEMENT*	[X]
EVAPORATION*	[ ]
RADIATION*	[ ]
DEHUMIDIFICATION*	[X]
OTHER (SPECIFY) _____	
_____	[ ]

[X] DAYLIGHTING

WINDOWS	[X]
LIGHTSHELVES*	[ ]
CLERESTORIES*	[X]
ROOF MONITORS*	[ ]
SUNSPACE	[ ]
SKYLIGHTS*	[ ]
OTHER (SPECIFY) _____	
Light baffles	
_____	
_____	[X]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Wells Bank
PROJECT NO. 353 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 51,000 BTU/SF-YR (REFERENCE) DOE/CS-0119 small office, Minneapolis

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	38,657	0.12	x				Phase I Final Report I-5
COOLING	12,710	0.27			x		"
LIGHTING	22,940	0.50			x		"
DHW	290	0.01			x		"
(OTHER) Fans	5,830	0.13			x		"
Misc.	4,750	0.10			x		
TOTAL	85,177	1.13					"

CONDITIONED BUILDING 11,012 (S.F.) TOTAL BUILDING ENERGY COSTS 12,440 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Gas: $3.06/million BTU
Electric: $21.94/million BTU

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)
Phase I I.5

Cooling - electric condenser @ C.O.P. = 2.25
Heating - Gas @ 70% efficiency

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Wells Bank
PROJECT NO. 353 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	14,147	0.05	x				Phase I Report P. I-5
COOLING	3,000	0.07			x		"
LIGHTING	2,420	0.05			x		"
DHW	210	0.01			x		"
(OTHER) Fans Misc.	4,000 4,800	0.09 0.10			x		"
TOTAL	28,577	0.37					"

CONDITIONED BUILDING 11,012 (S.F.) TOTAL BUILDING ENERGY COSTS 4,074 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Gas: $3.06/million BTUs

Electric: $21.94/million BTUs (same as base case)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Cooling - electric condenser @ C.O.P. = 2.5
Heating - gas @ 75% efficiency

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Wells Bank
PROJECT NO. 353 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	24,510			24,510	Phase I Report P. I-5
COOLING	9,710			9,710	"
LIGHTING	20,520			20,520	"
DHW	80			80	"
(OTHER) Fans Misc.	1,830 (-50)			1,830 (-50)	"
TOTAL	56,600			56,600	"

*ESTIMATED SAVINGS 66 %

TOTAL CONSTRUCTION COST $ 704,250

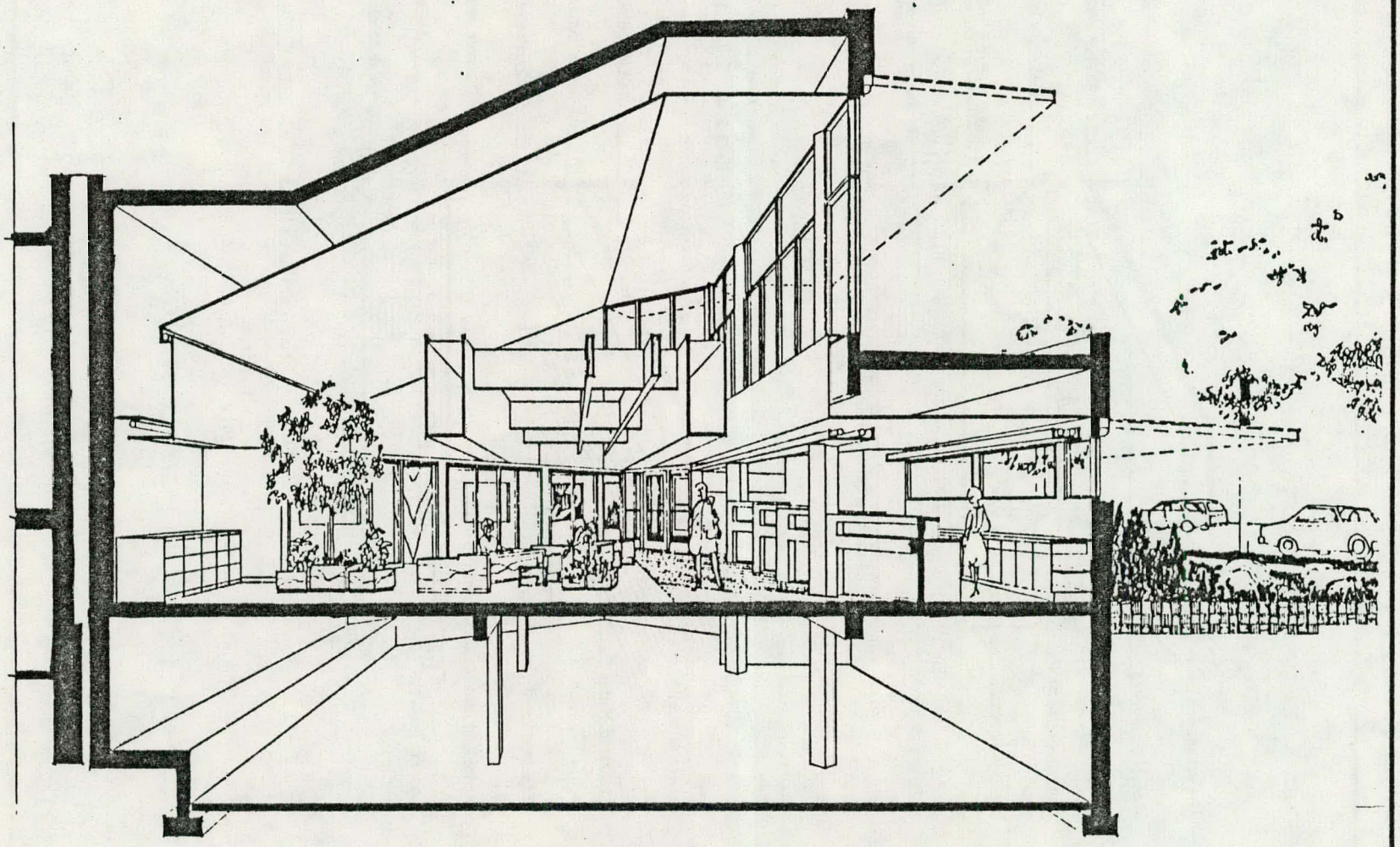
*PASSIVE INCREMENTAL COST $ 145,288

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

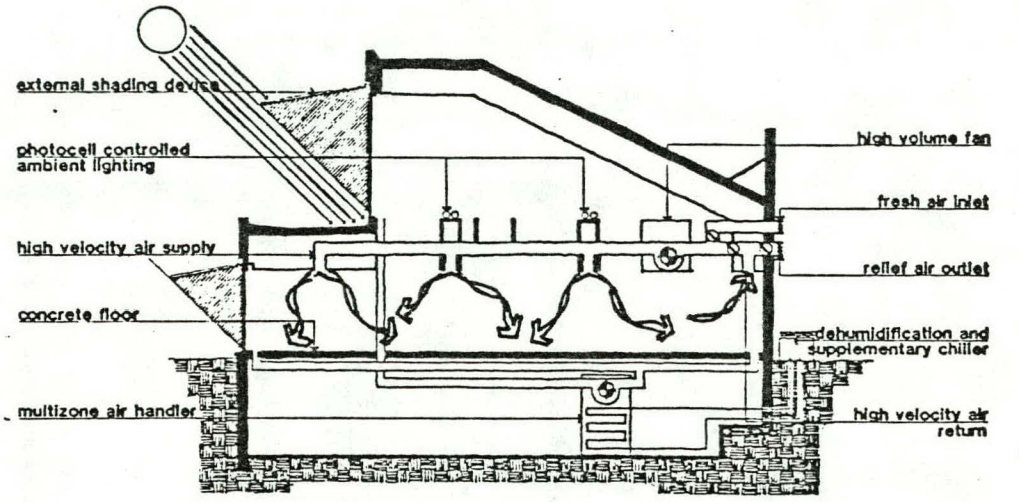
*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Wells Bank
PROJECT NO. 353 PAGE NO. 7

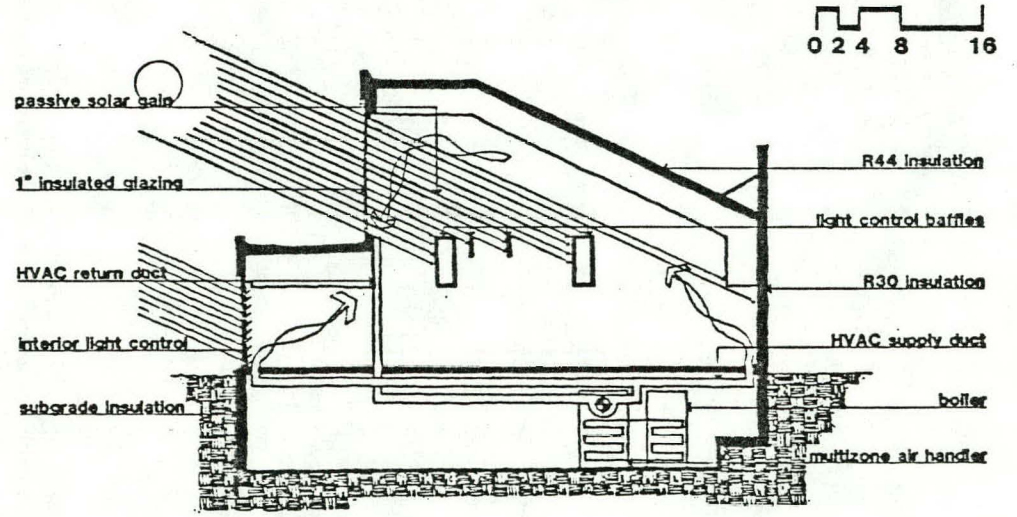


SECTIONAL PERSPECTIVE



COOLING

0 2 4 8 16



HEATING

SYSTEMS SECTIONS

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME: Community United Methodist Church
PROJECT NO.: 334
LOCATION (CITY/STATE): Columbia, MO
NEW/RETROFIT/(ADDITION) (CIRCLE ONE)

BUILDING TYPE: Educational
*CONDITIONED BLDG., S.F.: 5493
TOTAL S.F. (If Different): --
TECHNICAL MONITOR: Thomas Sayre

KEY PERSONNEL

OWNER
FIRM: Community United Methodist Church
STREET: 1600 W. Broadway
CITY: Columbia
STATE/ZIP: Missouri
TELEPHONE NO.: (314) 445-6131
CONTACT: William H. Miller

MECHANICAL ENGINEER
FIRM: Malicoat-Winslow Engrs., Inc.
STREET: 5649 Clearview Road
CITY: Columbia
STATE/ZIP: Missouri
TELEPHONE NO.: (314) 875-1300
CONTACT: Carroll Winslow

SOLAR DESIGNER
FIRM: Peckham & Wright Architects
STREET: 1104 E. Broadway
CITY: Columbia
STATE/ZIP: Missouri
TELEPHONE NO.: (314) 449-2683
CONTACT: Nicholas Peckham

BUILDING CONTRACTOR
FIRM: Reinhardt Construction Co.
STREET: 627 North Rollins
CITY: Centralia
STATE/ZIP: Missouri
TELEPHONE NO.: (314) 682-5505
CONTACT:

ARCHITECT
FIRM: Peckham & Wright
STREET: 1104 E. Broadway
CITY: Columbia
STATE/ZIP: Missouri 65201
TELEPHONE NO.: (314) 449-2683
CONTACT: Nicholas Peckham

INSTRUMENTATION TEAM
FIRM: Community United Methodist Church
STREET: 1600 W. Broadway
CITY: Columbia
STATE/ZIP: Missouri
TELEPHONE NO.: (314) 445-6131
CONTACT: William H. Miller

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	June, 1980	July, 1981
PHASE III (EVALUATION)	10/81	10/82

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Brochure on solar & conservation measures, mailing of 4000 brochures, tours (approx. 50), slide presentation, articles

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Minimize heating, lighting and cooling costs without substantial budget increases.

DESIGN PROCESS KEY ISSUES:

- Lowest $/BTU-YR. desired

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

-

LESSONS LEARNED:

- Elements that combine heating, lighting, and ventilation are most effective.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME C.U.M.C.
PROJECT NO. 334 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 5081
CITY Columbia
STATE Missouri

COOLING DEGREE DAYS 1269
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1327.6

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

SUNTEMPERED*	☐
DIRECT GAIN*	☒
INDIRECT GAIN*	☐
ISOLATED GAIN*	☐

SPECIFIC

SUNSPACE/ATRIUM	☒
MASS FLOOR	☒
MASS WALL	☒
WATER STORAGE	☐
CONVECTIVE LOOP	☐
EARTH CONTACT	☐
OTHER (SPECIFY) _____	
_____	☐

[ ] SOLAR DHW (SPECIFY)

_____

_____

[x] OTHER (SPECIFY) _____

Lumar window insulation

_____

_____

*See Definition Sheet

[x] SPACE COOLING

EARTH CONTACT	☒
NATURAL VENTILATION	☒
FORCED VENT./NIGHT FLUSHING	☒
BUILDING LOAD MANAGEMENT*	☒
EVAPORATION*	☐
RADIATION*	☐
DEHUMIDIFICATION*	☐
OTHER (SPECIFY) _____	
_____	☐

[x] DAYLIGHTING

WINDOWS	☒
LIGHTSHELVES*	☒
CLERESTORIES*	☒
ROOF MONITORS*	☐
SUNSPACE	☐
SKYLIGHTS*	☐
OTHER (SPECIFY) _____	
_____	
_____	
_____	☐

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME C.U.M.C.
PROJECT NO. 334 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 40,000 BTU/SF-YR (REFERENCE) Elementary School

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	106,060	0.265	x				Chart 13 Memo 4/14/81 Bob Busch to Caroll Winslow
COOLING	1110	0.013			x		"
LIGHTING	3890	0.046			x		"
DHW	940	0.002	x				"
(OTHER)	420	0.005			x		"
TOTAL	112,420	$0.331					"

CONDITIONED BUILDING 5493 (S.F.) TOTAL BUILDING ENERGY COSTS 1818 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Natural Gas	$2.50	(Final Report, Phase I pg. 8)
L.P. Gas	6.00	
Fuel Oil	6.30	
Electricity	13.20	

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Heating @ 70% efficiency
DHW @ 50% efficiency — Chart 13, memo Bob Busch to Carol Winslow 4/14/81

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME C.U.M.C.
PROJECT NO. 334 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	3080	.008	x				"Aux. Energy Req." memo Bob Busch to Caroll Winslow
COOLING	720	.009			x		Memo sited above 4/14/81
LIGHTING	1950	.026			x		"
DHW	940	.002	x				"
(OTHER)	---	---					"
TOTAL	6,690	.045					"

CONDITIONED BUILDING 5493 (S.F.)

TOTAL BUILDING ENERGY COSTS $247 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES

(Reference Source, Page No.)

Natural Gas	$2.50	
L.P. Gas	6.00	(Final Report, Phase I, pg. 8)
Fuel Oil	6.30	
Electricity	13.20	

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating 70% efficiency (Aux. energy req. memo Bob Busch to Carol
DHW 50% efficiency Winslow 4/14/81)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME C.U.M.C.
PROJECT NO. 334 PAGE NO. 6

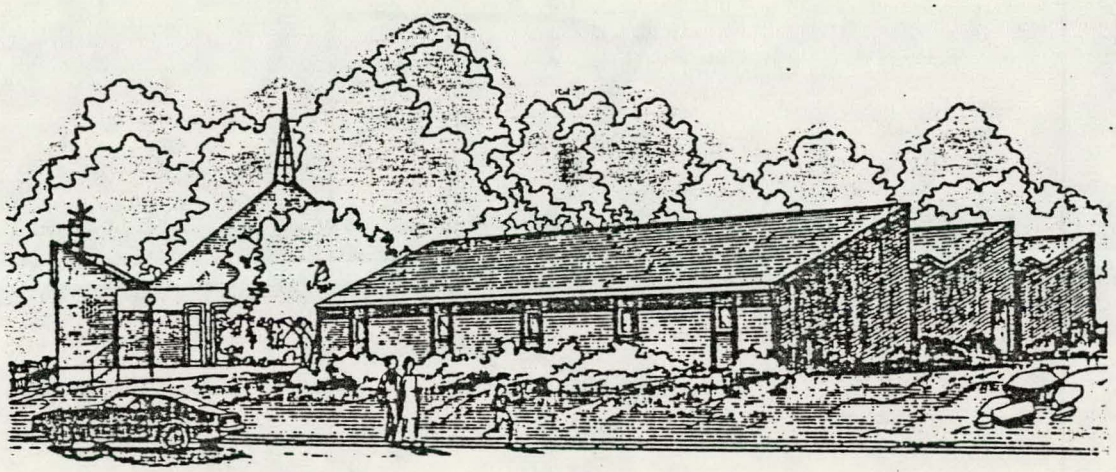
ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	102,980			102,980	Memo Bob Busch to Caroll Winslow
COOLING	390			390	"
LIGHTING	1940			1940	"
DHW	0			0	"
(OTHER)	420			420	"
TOTAL	105,730			105,730	"

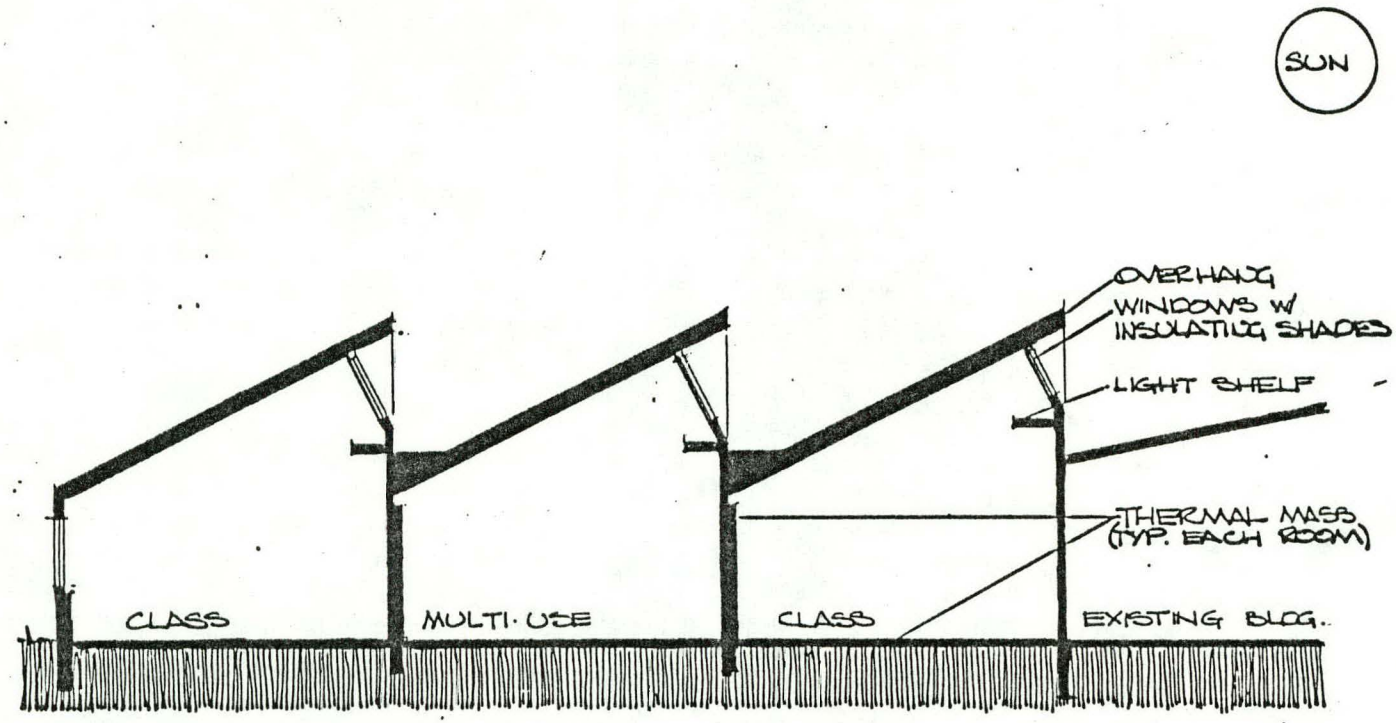
*ESTIMATED SAVINGS 86.3 %
TOTAL CONSTRUCTION COST $ 302,000
*PASSIVE INCREMENTAL COST $ 64,325

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



RENDERING FROM PROMOTIONAL BROCHURE



FINAL DESIGN: SECTION

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME: Mt. Airy Library
PROJECT NO.: 329
LOCATION (CITY/STATE): Mt. Airy, NC
(NEW)/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE: Library
BUILDING SIZE: 13,450 S.F.*
TECHNICAL MONITOR: Robert Mizell

KEY PERSONNEL

OWNER
FIRM: City of Mount Airy
STREET: P.O. Box 70
CITY: Mount Airy
STATE/ZIP: North Carolina 27030
TELEPHONE NO.: (919) 786-6208
CONTACT: Tom Webb

MECHANICAL ENGINEER
FIRM: J.N. Pease Associates
STREET: P.O. Box 18725
CITY: Charlotte
STATE/ZIP: North Carolina 28218
TELEPHONE NO.: (704) 376-6423
CONTACT: Bill Sanders

SOLAR DESIGNER
FIRM: Ed Mazria & Associates
STREET: P.O. Box 4883
CITY: Albuquerque
STATE/ZIP: New Mexico 87196
TELEPHONE NO.: (505) 243-9639
CONTACT: Marc Schiff

BUILDING CONTRACTOR
FIRM: John S. Clark, Inc.
STREET: Post Office Box 1246
CITY: Mt. Airy
STATE/ZIP: N.C. 27030
TELEPHONE NO.: (919) 789-9131
CONTACT: Joe B. Hennings

ARCHITECT
FIRM: Ed Mazria & Associates/ J. N. Pease Associates
STREET: P.O. Box 18725
CITY: Charlotte
STATE/ZIP: North Carolina 28218
TELEPHONE NO.: (704) 376-6423
CONTACT: Gary Morgan/Ed Mazria

INSTRUMENTATION TEAM
FIRM: J. N. Pease Associates
STREET: P.O. Box 18725
CITY: Charlotte
STATE/ZIP: North Carolina 28218
TELEPHONE NO.: (704) 376-6423
CONTACT: Gary Morgan, Bill Sanders

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	January 1981	April 1982
PHASE III (EVALUATION)	April 1982	April 1983

(A) INSTRUMENTATION METHOD Automatic data logger.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Newspaper & magazine articles, lectures and speeches

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Integration of daylighting & other passive techniques with programatic requirements.
- Utilize existing views to the south
- Preserve existing vegetation
- Minimize site grading

DESIGN PROCESS KEY ISSUES:

- Development of daylighting scheme to complement the architectural design.
- Create high lighting levels in reading areas

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Automatic heating/cooling change over
- Automatic optimized warm up cycle
- Manual operable windows for cross ventilation

LESSONS LEARNED:

- Clerestory flashing & details were complicated
- Incremental cost must be justified to the owner
- Establishing energy design goals early on is important

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mount Airy
PROJECT NO. 329 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 3971

CITY Mount Airy

STATE North Carolina

COOLING DEGREE DAYS 1133

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1,344

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [x]
- MASS WALL [x]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) Automatic insulated shades in multi-purpose room [x]

[x] SOLAR DHW (SPECIFY)

Active solar DHW

[ ] OTHER (SPECIFY)

* See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [x]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [ ]
- ROOF MONITORS* [x]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mount Airy
PROJECT NO. 329 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 43,000 BTU/SF-YR (REFERENCE) Small office; Raleigh

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	4,593	.06			x		Final Report Chapter 8 p.65
COOLING	6,556	.08			x		"
LIGHTING	35,786	.44			x		"
DHW & Equipment	1,273	.02			x		"
(OTHER) HVAC Fans	7,485	.09			x		"
TOTAL	55,693	.69					"

CONDITIONED BUILDING 13,450 (S.F.) TOTAL BUILDING ENERGY COSTS 9,280 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity costs: $12/10^6$ BTU
$.0412/KWH

Final Report
Chapter 8
p. 65

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Air-to-air heat pumps; COP = 2.5
Fluorescent lighting

Final Report
Chapter 8
p. 66

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mount Airy Library
PROJECT NO. 329 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	1,681	.02			x		Final Report Chapter 8 p.65
COOLING	3,456	.04			x		"
LIGHTING	6,443	.08			x		"
DHW	566	.01			x		"
(OTHER) HVAC	5,170	.06			x		"
TOTAL	17,315	.21					"

CONDITIONED BUILDING 13,450 (S.F.)

TOTAL BUILDING ENERGY COSTS 2,825 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity costs: $12/10^6$ BTU
$.0412/KWH

Final Report Chapter 8 p. 65

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Air-to-air heat pumps; COP = 2.5

Fluorescent & incandescent task lighting

Final Report Chapter 8 p. 66

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mount Airy Library
PROJECT NO. 329 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS =	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR) =	ENERGY CONSERVATION (BTU/SF-YR) +	PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	2,912		2,912	Final Report Chapter 8 p. 65
COOLING	3,100		3,100	"
LIGHTING	29,343		29,343	"
DHW	707		707	"
(OTHER)	2,315		2,315	"
TOTAL	38,378		38,378	"

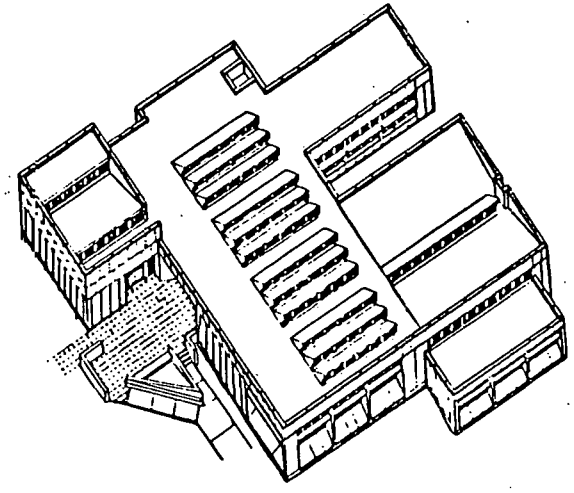
*ESTIMATED SAVINGS 69 %

TOTAL CONSTRUCTION COST $ 1,300,000

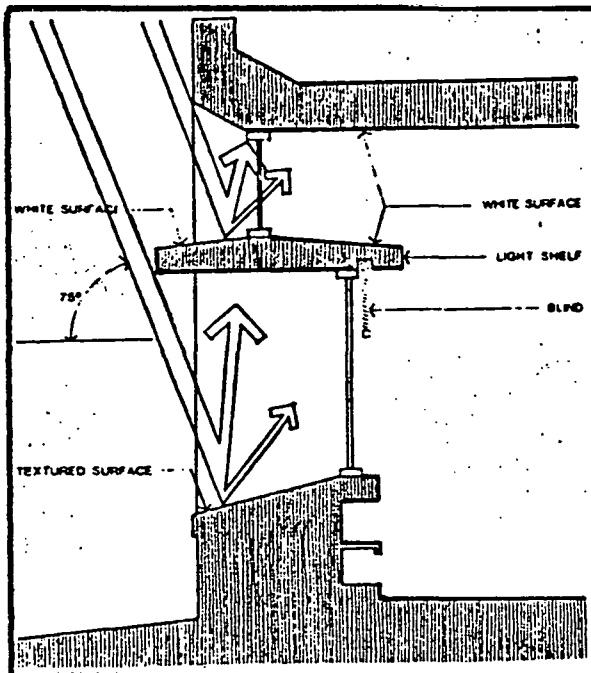
*PASSIVE INCREMENTAL COST $ 215,000

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet

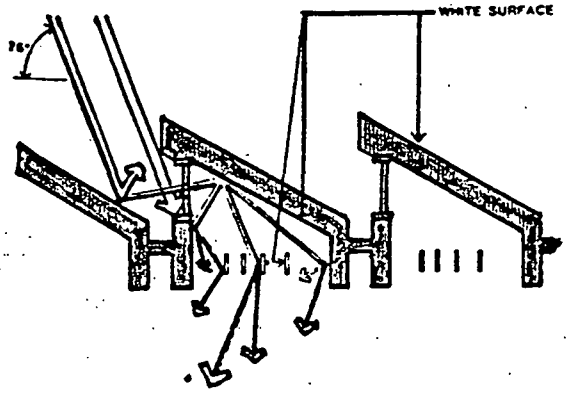


AXONOMETRIC



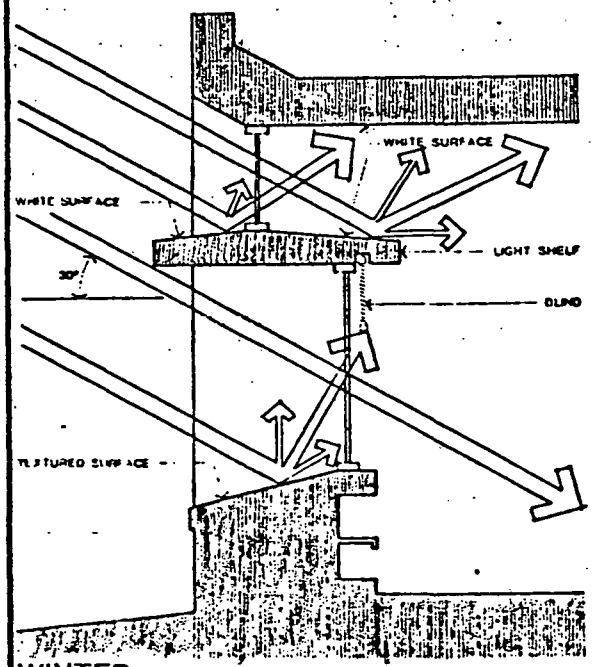
SUMMER

south glazing: reading room



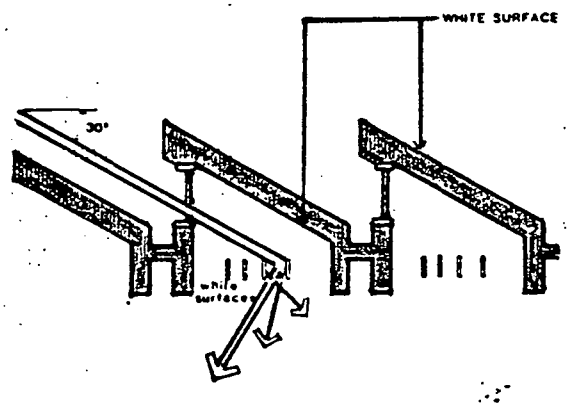
SUMMER clear day

typical clerestory



WINTER

south glazing: reading room



WINTER clear day

typical clerestory

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Princeton Park

PROJECT NO. 348

LOCATION (CITY/STATE) Princeton, N.J.

(NEW) RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Office

*CONDITIONED BLDG., S.F. 64,000

TOTAL S.F. (If Different) 75,250

TECHNICAL MONITOR William J. Fisher

KEY PERSONNEL

OWNER

FIRM Princeton Professional Park
STREET 2303 Whitehorse-Mercerville Rd
CITY Mercerville
STATE/ZIP New Jersey 08619
TELEPHONE NO. (609) 587-2900
CONTACT Mike Glogoff

MECHANICAL ENGINEER

FIRM
STREET
CITY
STATE/ZIP
TELEPHONE NO.
CONTACT

SOLAR DESIGNER

FIRM Princeton Energy Group
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP New Jersey 08540
TELEPHONE NO. (609) 921-1965
CONTACT Lawrence L. Lindsey

BUILDING CONTRACTOR

FIRM The Karnell Group
STREET 202 12th Street
CITY Piscataway
STATE/ZIP NJ 08854
TELEPHONE NO. (201) 968-1547
CONTACT Thomas W. Smith

ARCHITECT

FIRM Harrison Fraker/Short & Ford
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP New Jersey 08540
TELEPHONE NO. (609) 921-1960
CONTACT Harrison Fraker, Jr.

INSTRUMENTATION TEAM

FIRM Princeton Energy Group
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP NJ 08540
TELEPHONE NO. (609) 921-1965
CONTACT Lawrence Lindsey

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	August 81	August 82
PHASE III (EVALUATION)	September 82	October 83

(A) INSTRUMENTATION METHOD Automatic Data Logger/A.K.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Solar Age Magazine, July '81; PA News Report, Feb. '81; AIA Journal, Jan. '81

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- One story, modular office space organized along an atrium
- Atrium size and form designed to optimize passive heating, daylighting and ventilation
- Code restrictions on atriums (Final Report, p. 8)
- Using building form in most flexible way, particularly for daylighting (p.8).

DESIGN PROCESS KEY ISSUES:

- Cost effectiveness of passive solar and energy conservation within a five (5) year payback
- Reinterpret relationship between workplace and nature by creating an office garden environment of "loft" spaces, atrium and gardens
- Building form and envelope as a filter (Final Report, p. 8)

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER):

- Heating - indirect collection in atrium, with storage in rockbed slabs for night
- Daylighting - atrium distributes light to interior by (1) lightshelf and translucent panels in ceiling (2) open clerestory; lighting controls are adjustable **

LESSONS LEARNED:

- Using atrium to address heating, cooling and daylighting - triples the return

**Cooling - natural venting through atrium; load reduction by evaporation from daytime roof spraying; air circulated in metal roof during spraying, cooling stored in rockbed

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Princeton Park
PROJECT NO. 348 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4,980

CITY Princeton

STATE N.J.

COOLING DEGREE DAYS 968

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1312 (Trenton, NJ)

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [X]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [X]

SPECIFIC

- SUNSPACE/ATRIUM [X]
- MASS FLOOR [X]
- MASS WALL [ ]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) Rock bed
- _____ [X]

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

[X] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [X]
- BUILDING LOAD MANAGEMENT* [X]
- EVAPORATION* [X]
- RADIATION* [X]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) Rock storage bin
- _____ [X]

[X] DAYLIGHTING

- WINDOWS [X]
- LIGHTSHELVES* [X]
- CLERESTORIES* [ ]
- ROOF MONITORS* [ ]
- SUNSPACE [X]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____
- _____
- _____
- _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Princeton Park
PROJECT NO. 348 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 47,000 BTU/SF-YR (REFERENCE) Large office building - Newark

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	33,448	0.98			x		Final Report p. 24 & 34
COOLING	15,204	0.44			x		"
LIGHTING	21,285	0.53			x		"
DHW	2,281	0.06			x		"
(OTHER)	4,561	0.13			x		"
TOTAL	76,778	2.14					"

CONDITIONED BUILDING 64,000 (S.F.) TOTAL BUILDING ENERGY COSTS 136,960 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electric - Heating/cooling $29.30/million BTU
Lighting costs are different from other electric costs, since detailed demand calculations were figured into costs, whereas heating/cooling costs consider average demand figures.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Heating - air to air (split system) package heat pumps - C.O.P. 1.77
Final Report p. 24
Cooling - heat pump - C.O.P. 2.2; Final Report p. 24
Lighting - standard flourescent fixtures (2.36 W/SF)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Princeton Park
PROJECT NO. 348 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	3311	0.10			x		Final Report P. 24 & 34
COOLING	1204	0.04			x		"
LIGHTING	4665	0.23			x		"
DHW	1354	0.04			x		"
(OTHER) Equip.	4364	0.13			x		"
TOTAL	14,898	0.54					"

CONDITIONED BUILDING 64,000 (S.F.)

TOTAL BUILDING ENERGY COSTS 34,560 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electric - heating/cooling $29.30/MMBTU, $.10/KWH
Lighting costs reflect detailed demand charge analysis, whereas heating/cooling consider an average demand charge rate.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating - air-to-air (split system) package heat pumps
Lighting - standard flourescent fixtures; double switching (all off, ½ on, fully on)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Princeton Park
PROJECT NO. 348 PAGE NO. 6

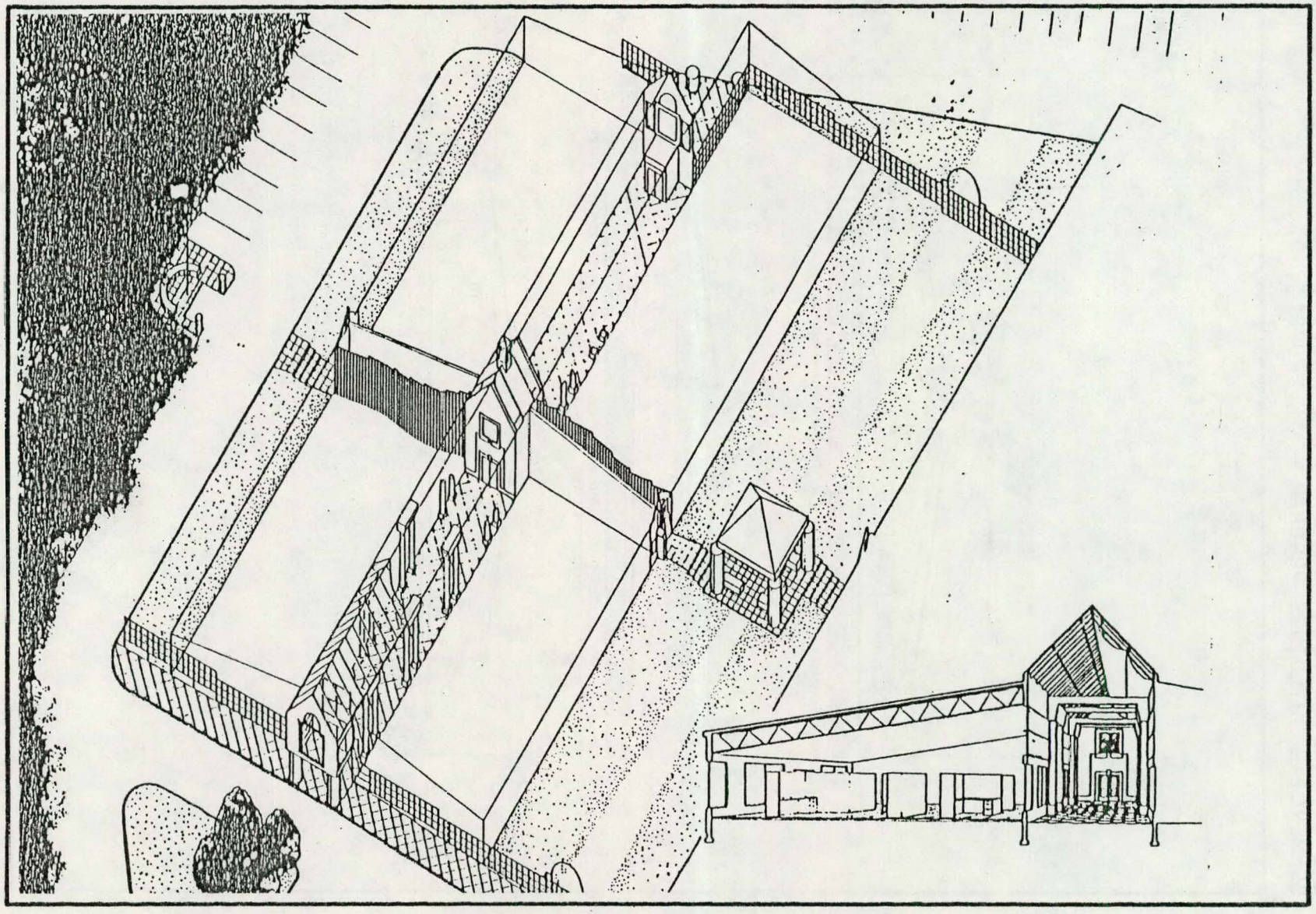
ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	30,137			30,137	Final Report P. 24 & 34
COOLING	14,000			14,000	"
LIGHTING	16,620			16,620	"
DHW	927			927	"
(OTHER)	197			197	"
TOTAL	61,880			61,880	"

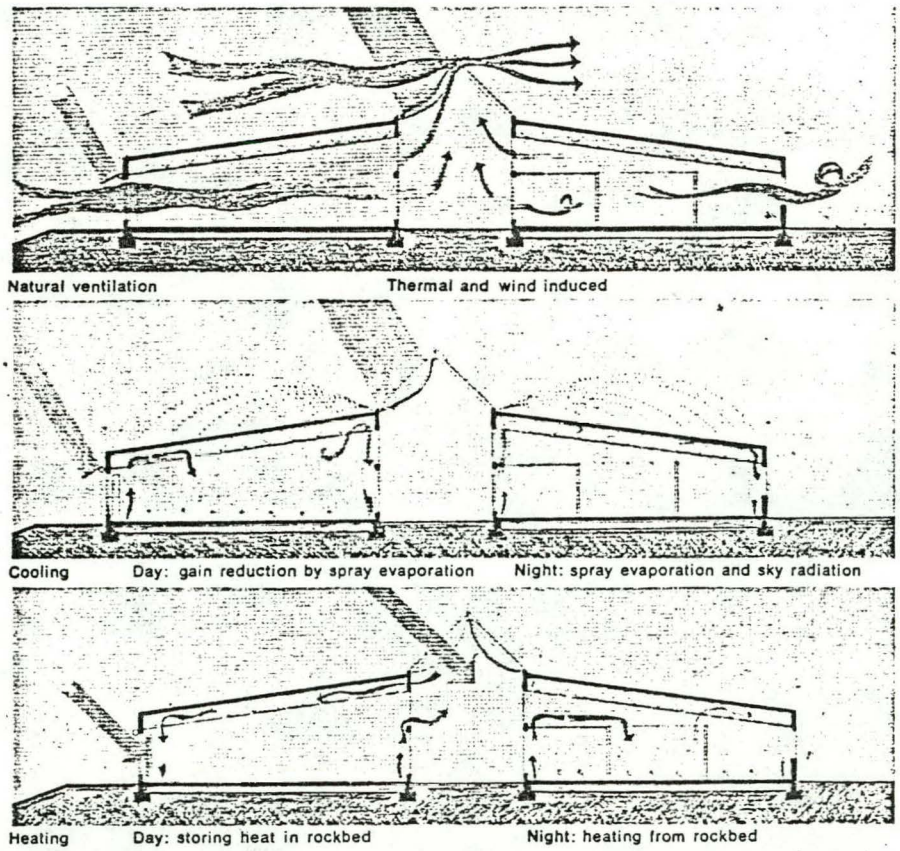
*ESTIMATED SAVINGS 80 %
TOTAL CONSTRUCTION COST $ 3.55 million
*PASSIVE INCREMENTAL COST $ 514,750

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



AXONOMETRIC AND SECTIONAL PERSPECTIVE



PASSIVE STRATEGIES SECTIONS

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME School of Architecture & Urban Planning
PROJECT NO. 346
LOCATION (CITY/STATE) Princeton, NJ
NEW (RETROFIT) ADDITION (CIRCLE ONE)

BUILDING TYPE College Building
*CONDITIONED BLDG., S.F. 13,585
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR William J. Fisher

KEY PERSONNEL

OWNER
Office of Physical Planning
FIRM Princeton University
STREET MacMillan Building
CITY Princeton
STATE/ZIP New Jersey 08540
TELEPHONE NO. (609) 452-3503
CONTACT Jon Hlafter

MECHANICAL ENGINEER
(not selected)
FIRM _____
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

SOLAR DESIGNER
FIRM Harrison Fraker Architects
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP New Jersey 08540
TELEPHONE NO. (609) 921-1965
CONTACT Harrison Fraker, Jr.

BUILDING CONTRACTOR
FIRM (not selected)
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

ARCHITECT
FIRM Harrison Fraker Architects
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP New Jersey 08540
TELEPHONE NO. (609) 921-1965
CONTACT Harrison Fraker, Jr.

INSTRUMENTATION TEAM
FIRM Princeton Energy Group
STREET 575 Ewing Street
CITY Princeton
STATE/ZIP NJ 08540
TELEPHONE NO. (609) 921-1965
CONTACT Lawrence L. Lindsey

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	November, 1982	January, 1983
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD: Automatic Data Logger, A.K.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Cost effective ways of reducing energy consumption, by improving thermal and luminous environment.

DESIGN PROCESS KEY ISSUES:

- Aggressive energy conservation measures with selective, simple direct gain heating and daylighting strategies.
- Understanding energy behavior of existing building and then recognize energy opportunities.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER):

- Direct gain - 2 story thermosyphon collector supplies heated air to adjacent spaces.
- Light shelves are incorporated in direct gain collector
- Roof monitors - "Sky Caps" provides direct gain heating and daylighting.

LESSONS LEARNED:

- Combining passive heating and daylighting is cost effective.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME SAUP
PROJECT NO. 346 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4980
CITY Princeton
STATE NJ (ASHRAE System Guide)

COOLING DEGREE DAYS 968
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1304.7 (Trenton, NJ) Univ. Wisconsin Data Book

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [x]
- MASS FLOOR [ ]
- MASS WALL [ ]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [x]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[ ] SOLAR DHW (SPECIFY)

[ ] OTHER (SPECIFY) _____

* See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [ ]
- ROOF MONITORS* [x]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME SAUP
PROJECT NO. 346 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 48,000 BTU/SF-YR (REFERENCE) Secondary School (Trenton, NJ) Energy Budget Level, DOE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	121,351	0.72				steam	89,800÷74 per Draft Report, pp. 14,18
COOLING	-	-					
LIGHTING	36,950	0.57			x		Draft Report p.18
DHW	-	-					
(OTHER)	-	-					
TOTAL	158,301	1.29					Draft Report p.18

CONDITIONED BUILDING 13,585 (S.F.) TOTAL BUILDING ENERGY COSTS 17,525 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Steam $7.99/million BTU (1981 figures) Draft Report p.4
Electric $15.53/million BTU (electric @ .05¢/kwh)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Central Oil-fired steam plant-74% overall power plant efficiency (per Elmer Frye, employee)
Lighting - fluorescent fixtures; efficiency not included

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME SAUP
PROJECT NO. 346 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	58,200	0.37					Draft Report p.14 43,070 ÷ .74 Draft Report p.18
COOLING							
LIGHTING	16,628	0.26					Draft Report p. 14 & 18
DHW							
(OTHER)							
TOTAL	74,828	0.63					" " "

CONDITIONED BUILDING 13,585 (S.F.) TOTAL BUILDING ENERGY COSTS 8,559 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Heating - steam - $7.99/Million BTU Draft Report p. 4
Electric - $15.33/Million BTU (0.5¢/kwh) " "

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Oil fired central steam plant - 74% overall plant efficiency
Lighting efficiency not included in above calculation

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME SAUP
PROJECT NO. 346 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	63,200		36,900	26,300	Draft Report p. 18a
COOLING					
LIGHTING	20,300		3,300*	17,000	Draft Report p. 18a
DHW					
(OTHER)					
TOTAL	83,500		40,200	43,300	

*ESTIMATED SAVINGS 53 %

TOTAL CONSTRUCTION COST $ 117,000

*PASSIVE INCREMENTAL COST $ 72,000

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

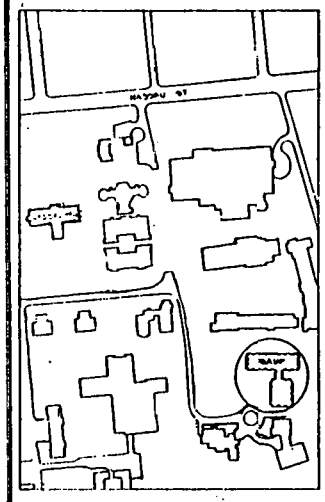
. Cavity wall insulation (Blown cellulose fiber) filling existing cavity wall space
. Movable night insulation (window quilt)
* Breaking out energy conservation savings is difficult since effects are so interrelated.

*See Definition Sheet

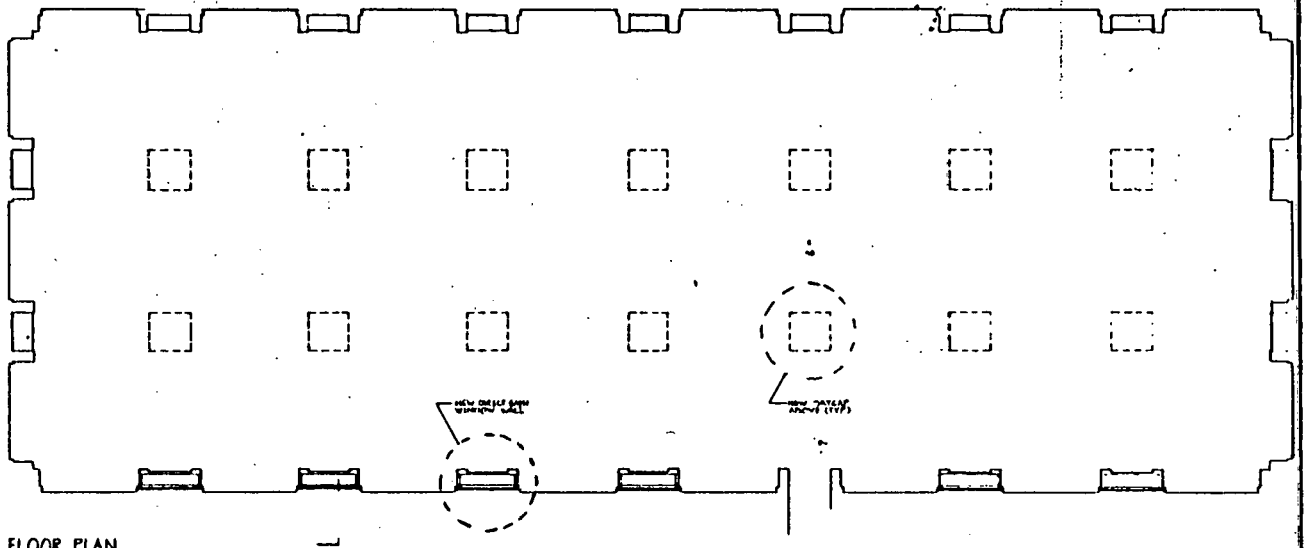
D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

School of Architecture
& Urban Planning

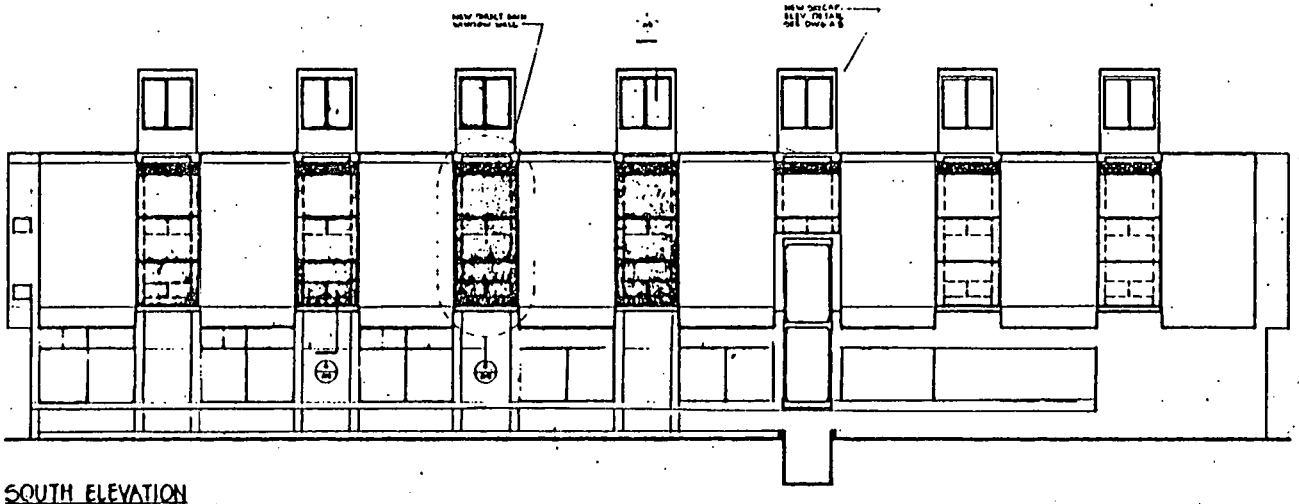
PROJECT NAME
PROJECT NO. 346 PAGE NO. 7



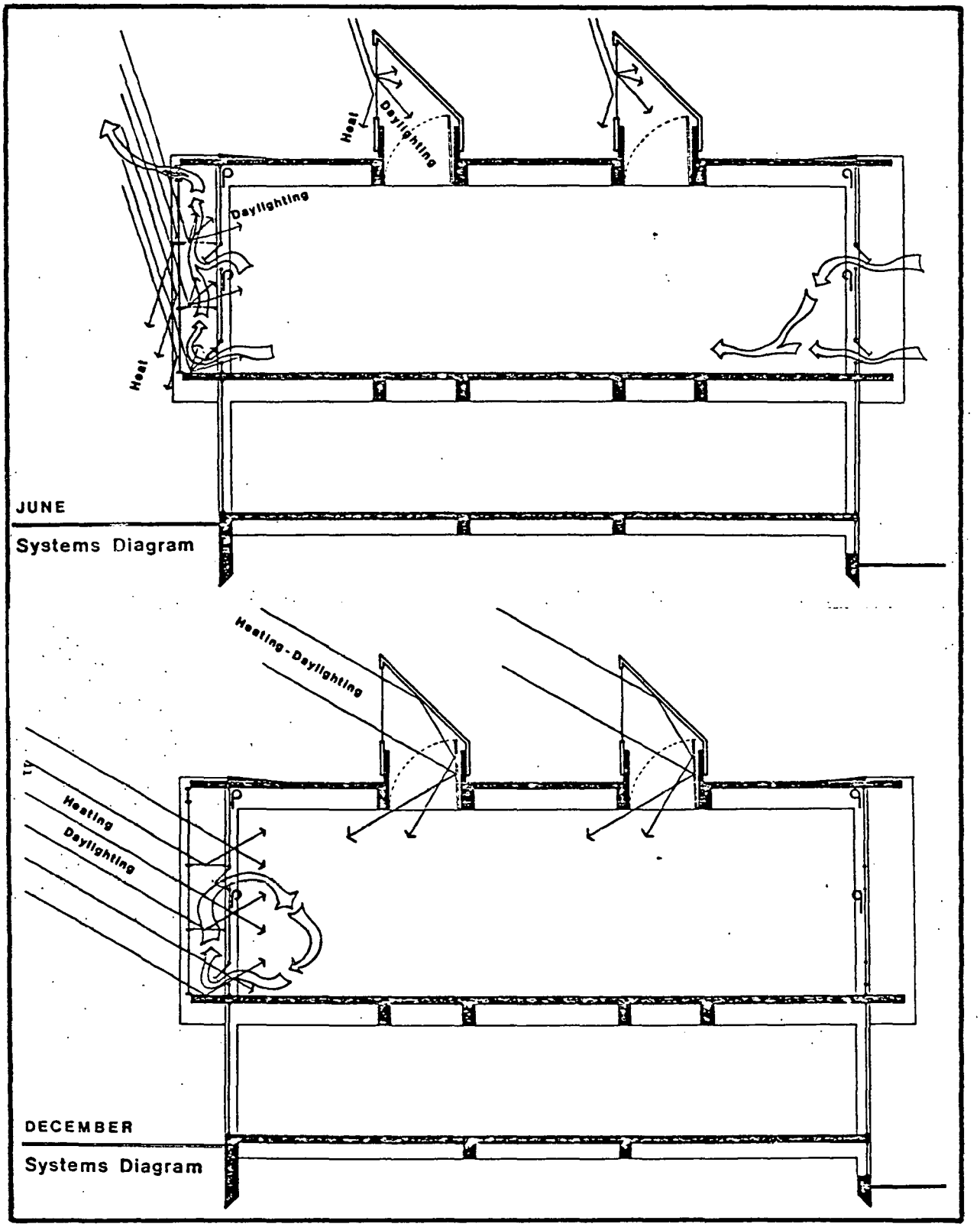
SITE PLAN



FLOOR PLAN



SOUTH ELEVATION


Heat
Daylighting
Daylighting
Heat
JUNE
Systems Diagram
Heating - Daylighting
Heating
Daylighting
DECEMBER
Systems Diagram

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME RPI Visitor Center
PROJECT NO. 350
LOCATION (CITY/STATE) Troy, N.Y.
(NEW)/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Visitor Center
*CONDITIONED BLDG., S.F. 4316
TOTAL S.F. (If Different) 5211
TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER
FIRM Rennselaer Polytechnic Institute
STREET 110 - 8th Street
CITY Troy
STATE/ZIP New York
TELEPHONE NO. (518) 270-6606
CONTACT Richard E. Scammel

MECHANICAL ENGINEER
FIRM Londe-Parker-Michels
STREET (R.P.I.)
CITY St. Louis
STATE/ZIP Missouri
TELEPHONE NO. (314) 725-5501/892-1400
CONTACT Tim Michels

SOLAR DESIGNER
FIRM R.P.I., Mech. Eng. School
STREET
CITY Troy
STATE/ZIP New York
TELEPHONE NO. (518) 220-6546
CONTACT J.A. Tichy

BUILDING CONTRACTOR
FIRM Zandri Construction Corp.
STREET 62 Canvas
CITY Cohoes
STATE/ZIP New York
TELEPHONE NO. (518) 237-1411
CONTACT

ARCHITECT
FIRM Center for Arch. Research
STREET R.P.I.
CITY Troy
STATE/ZIP New York
TELEPHONE NO. (518) 270-6461
CONTACT Walter M. Kroner

INSTRUMENTATION TEAM
FIRM R P I
STREET
CITY Troy
STATE/ZIP New York
TELEPHONE NO. (518) 220-6546
CONTACT John Tichy

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	May 1980	February 1981
PHASE III (EVALUATION)	February 1981	

(A) INSTRUMENTATION METHOD Automatic data logger/A.K.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Descriptive brochure for visitors, building tours, publication in solar trade magazines.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Build passive into a visitors' center which is also a 24-hour campus police headquarters.
- Substantial heating and lighting load, mild cooling load.

DESIGN PROCESS KEY ISSUES:

- To achieve a full integration of conventional HVAC equipment with the building's passive features.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER):

- Sunspace with night insulation on the south side of the building to provide space heating, daylighting and some space cooling.
- Skylights with reflectors for daylighting central corridor.

LESSONS LEARNED:

- Reduction in energy costs of 60% can be achieved with passive, even in a relatively cold climate.

CLIMATE

HEATING DEGREE DAYS 6887

CITY Albany

STATE New York

COOLING DEGREE DAYS 572

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1066

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [X]
- INDIRECT GAIN* [X]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [X]
- MASS FLOOR [X]
- MASS WALL [X]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [X]
- OTHER (SPECIFY) _____ [ ]

[ ] SOLAR DHW (SPECIFY)

[ ] OTHER (SPECIFY) _____

* See Definition Sheet

[X] SPACE COOLING

- EARTH CONTACT [X]
- NATURAL VENTILATION [X]
- FORCED VENT./NIGHT FLUSHING [X]
- BUILDING LOAD MANAGEMENT* [X]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[X] DAYLIGHTING

- WINDOWS [ ]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [ ]
- ROOF MONITORS* [ ]
- SUNSPACE [X]
- SKYLIGHTS* [X]
- OTHER (SPECIFY) _____
- _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME RPI Visitor Center
PROJECT NO. 350 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 44,000 BTU/SF-YR (REFERENCE) Small office

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	30,900	.45			x		Phase I Final Report, p. 43
COOLING	4,700	.07			x		"
LIGHTING	13,700	.20			x		"
DHW	1,800	.025			x		"
(OTHER)	1,600	.023			x		"
TOTAL	52,700	$ .77					"

CONDITIONED BUILDING 4316 (S.F.) TOTAL BUILDING ENERGY COSTS $3320 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

All energy provided by electricity at $ .05 per kwh or $14.65/$10^6$ BTU

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

Resistance heating and electric air conditioning

Flourescent lighting

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME RPI Visitor Center
PROJECT NO. 350 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	7,600	.111			x		Phase I Final Report, p. 43
COOLING	720	.011			x		"
LIGHTING	3,290	.049			x		"
DHW	1,270	.019			x		"
(OTHER) HVAC	4,590	.067			x		"
TOTAL	17,470	.257					"

CONDITIONED BUILDING 4316 (S.F.)

TOTAL BUILDING ENERGY COSTS $1,110 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

All energy provided by electricity at $ .05 per kwh or $14.65/$10^6$ BTU.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Resistance heating and electric air conditioning.

Flourescent lighting.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME RPI Visitor Center
PROJECT NO. 350 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	23,300			23,300	Phase I Report P. 43
COOLING	3,980			3,980	"
LIGHTING	10,410			10,410	"
DHW	530			530	"
(OTHER)	-2,990			-2,990	"
TOTAL	35,230				"

*ESTIMATED SAVINGS 67 %

TOTAL CONSTRUCTION COST $ 382,846

*PASSIVE INCREMENTAL COST $ 81,895

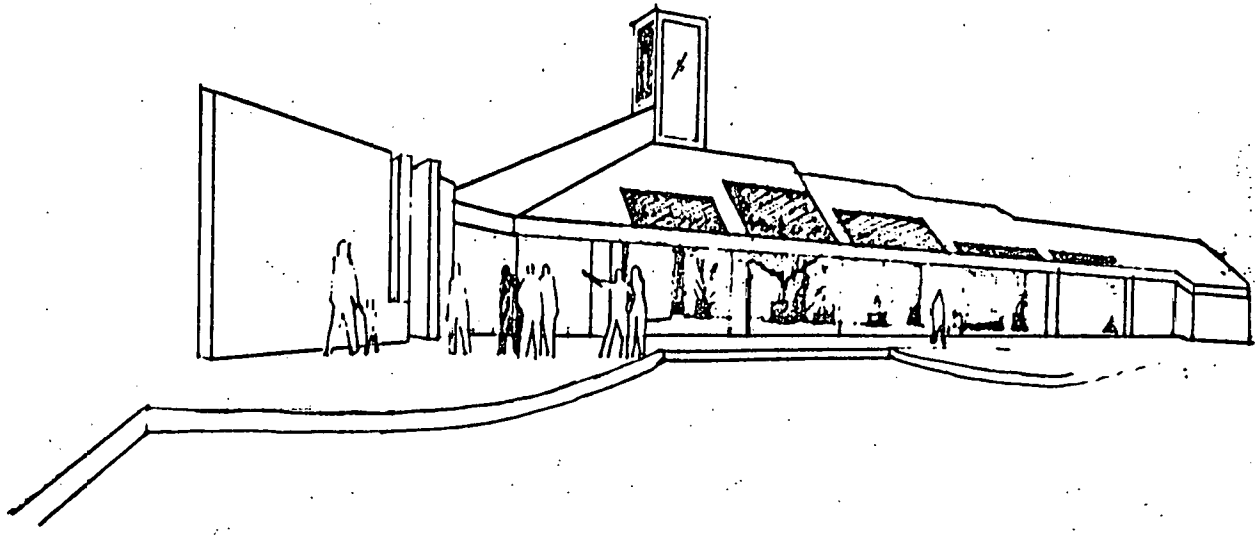
Ph. 2/3 Rep't., Tech. Vol., P. 8-9.

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

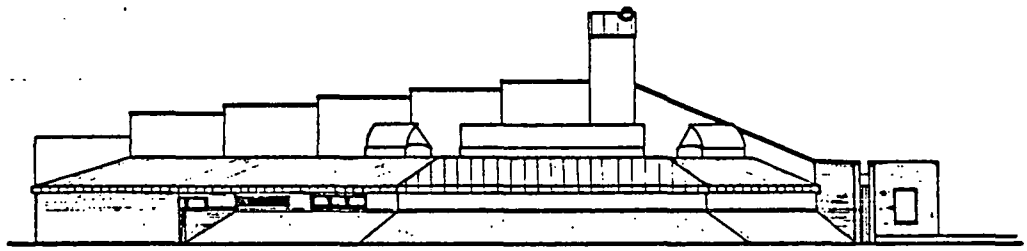
*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

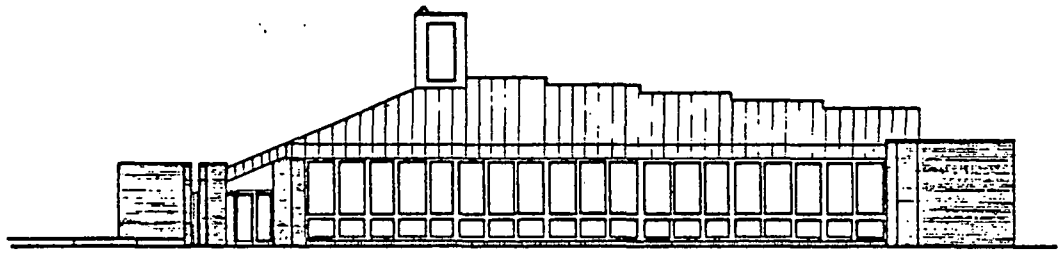
PROJECT NAME R.P.I Visitors Center
PROJECT NO. 350 PAGE NO. 7



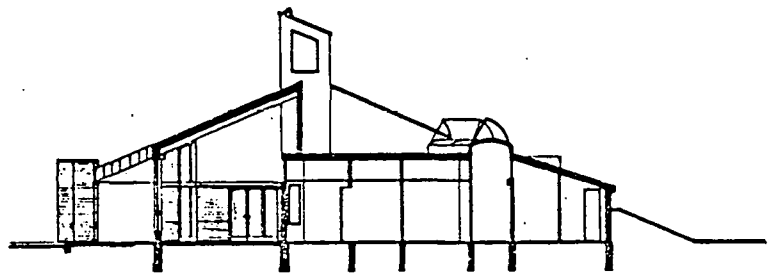
PERSPECTIVE



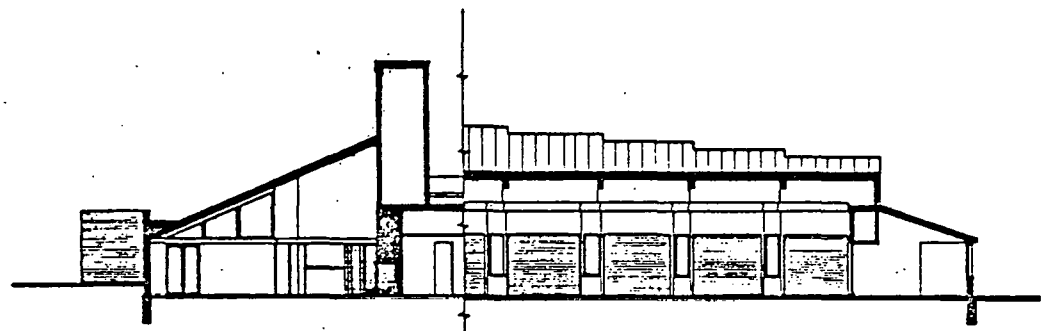
north



south



north-south section



east-west section

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Deadwood Creek
PROJECT NO. 336
LOCATION (CITY/STATE) Deadwood, OR
NEW/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Firehall and meeting hall
*CONDITIONED BLDG., S.F. 2635
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR Fisher

KEY PERSONNEL

OWNER
FIRM Deadwood Creek Services
STREET P.O. Box 15
CITY Deadwood
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 964-3140
CONTACT Bill Cirino

MECHANICAL ENGINEER
FIRM _____
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

SOLAR DESIGNER
FIRM Equinox Design, Inc.
STREET P.O. Box 30085
CITY Eugene
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 345-6161
CONTACT G.Z. Brown

BUILDING CONTRACTOR
FIRM (Deadwood Creek Services)
STREET P.O. Box 15
CITY Deadwood
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 964-3140
CONTACT Bill Cirino

ARCHITECT
FIRM John S. Reynolds
STREET P.O. Box 30085
CITY Eugene
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 345-6161
CONTACT John S. Reynolds

INSTRUMENTATION TEAM
FIRM Deadwood Creek Services
STREET P.O. Box 15
CITY Deadwood
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 964-3140
CONTACT Bill Cirino

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)		September, 1983 (second building)
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Local press releases, articles for architectural and construction magazines.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Design a passive building for a small but very active community.
- Building to be as energy-independent as possible.

DESIGN PROCESS KEY ISSUES:

- Design an energy-conserving building using public meetings as the primary design organization.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- South-facing glazing with thermal mass walls and shades, shutters.
- Cross-ventilation cooling.
- Clerestories for heating and lighting.

LESSONS LEARNED:

-

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4851
CITY Salem
STATE Oregon

COOLING DEGREE DAYS 230
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1127.2

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [ ]
- DIRECT GAIN* [X]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [X]
- MASS WALL [X]
- WATER STORAGE in trombe [X]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[X] SOLAR DHW (SPECIFY)

Active Solar

[ ] OTHER (SPECIFY) _____

[X] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [X]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [X]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[X] DAYLIGHTING

- WINDOWS [X]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [X]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

* See Definition Sheet.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 4A

BASE CASE BUILDING PROFILE*

BEPS 37,000 BTU/SF-YR (REFERENCE) Community Center; Portland

MEETING HALL	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING							
COOLING							
LIGHTING							
DHW							
(OTHER)							
TOTAL							

CONDITIONED BUILDING 2555 (S.F.)

TOTAL BUILDING ENERGY COSTS _____ ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 4B

BASE CASE BUILDING PROFILE*

BEPS _____ BTU/SF-YR (REFERENCE) _____

FIRE HALL	AUXILIARY FUEL REQUIREMENTS					REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING							
COOLING							
LIGHTING							
DHW							
(OTHER)							
TOTAL							

CONDITIONED BUILDING _____ (S.F.)

TOTAL BUILDING ENERGY COSTS _____ ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 5A

SOLAR BUILDING PROFILE

MEETING HALL

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	23,700 (wood)	-0-				x	Phase I Report, p. 32, 48
COOLING	-0-	-0-					"
LIGHTING	6,700	.037			x		"
DHW	2,700	.015			x		"
(OTHER)	2,200	.013			x		"
TOTAL	35,300	.065					"

CONDITIONED BUILDING 2555 (S.F.)

TOTAL BUILDING ENERGY COSTS $166 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity available at 1.9¢ per kwh or $5.57/MMBTU (Phase I Report, p. 49).
Wood for heating provided at no out-of-pocket cost.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating by wood stove. No mechanical cooling. Incandescent lighting.
DHW provided by an active solar system and electric resistance heating.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 5B

SOLAR BUILDING PROFILE

FIREHALL

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	19,100	.116			x		Phase I Final Report, p. 49
COOLING	-0-	-0-					"
LIGHTING	3,100	.019			x		"
DHW							
(OTHER)							
TOTAL	22,200	.135					"

CONDITIONED BUILDING 950 (S.F.)

TOTAL BUILDING ENERGY COSTS $128 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity available at 1.9¢ per kwh or $5.57/MMBTU (Phase I Report, p. 49)
Wood for heating provided at no out-of-pocket expense.

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Electric resistance heating. No mechanical cooling. Incandescent lighting.

*See Definition Sheet

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING					
COOLING					
LIGHTING					
DHW					
(OTHER)					
TOTAL					

*ESTIMATED SAVINGS _____ %

TOTAL CONSTRUCTION COST $ 197,500

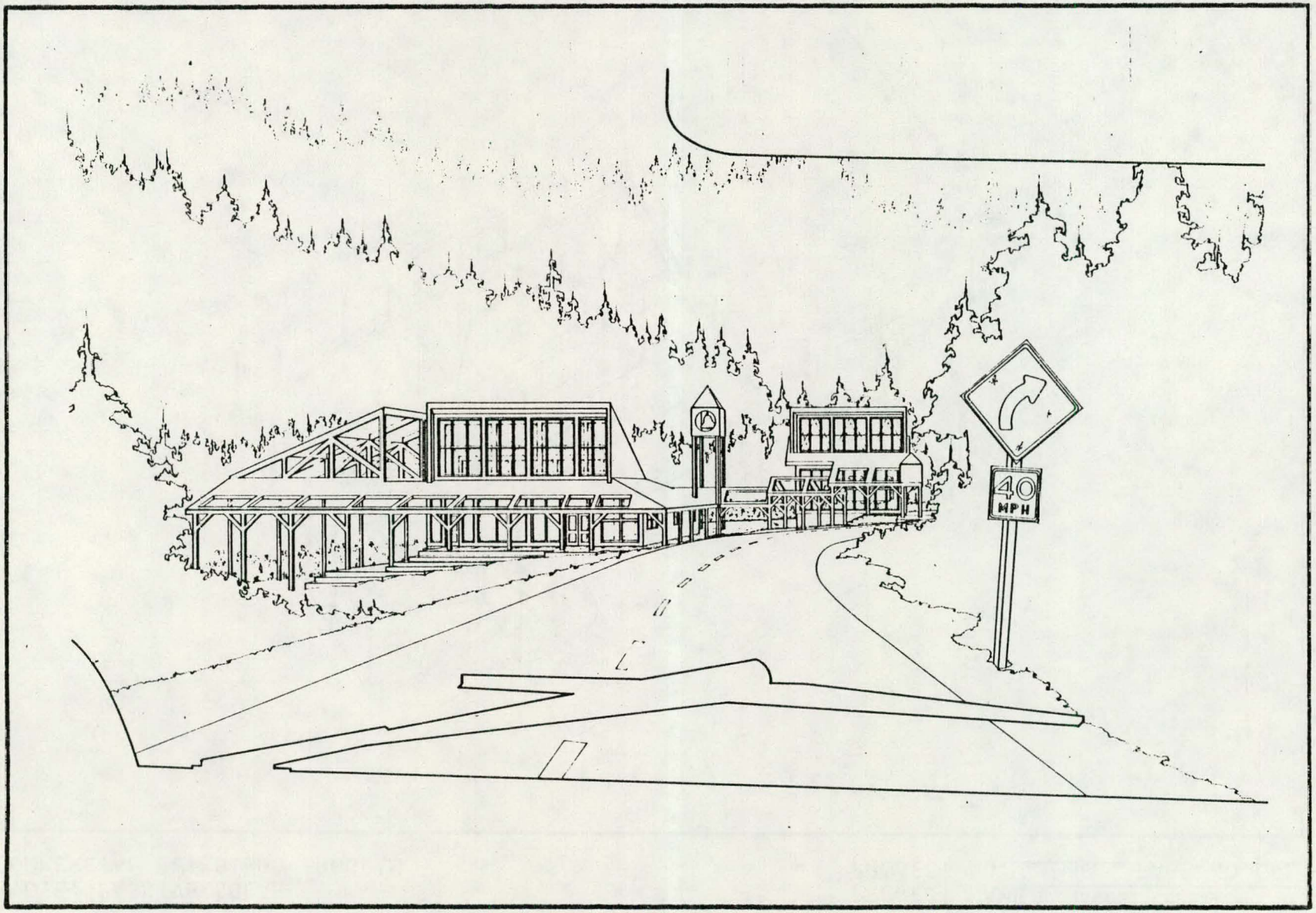
*PASSIVE INCREMENTAL COST $ 47,930

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet

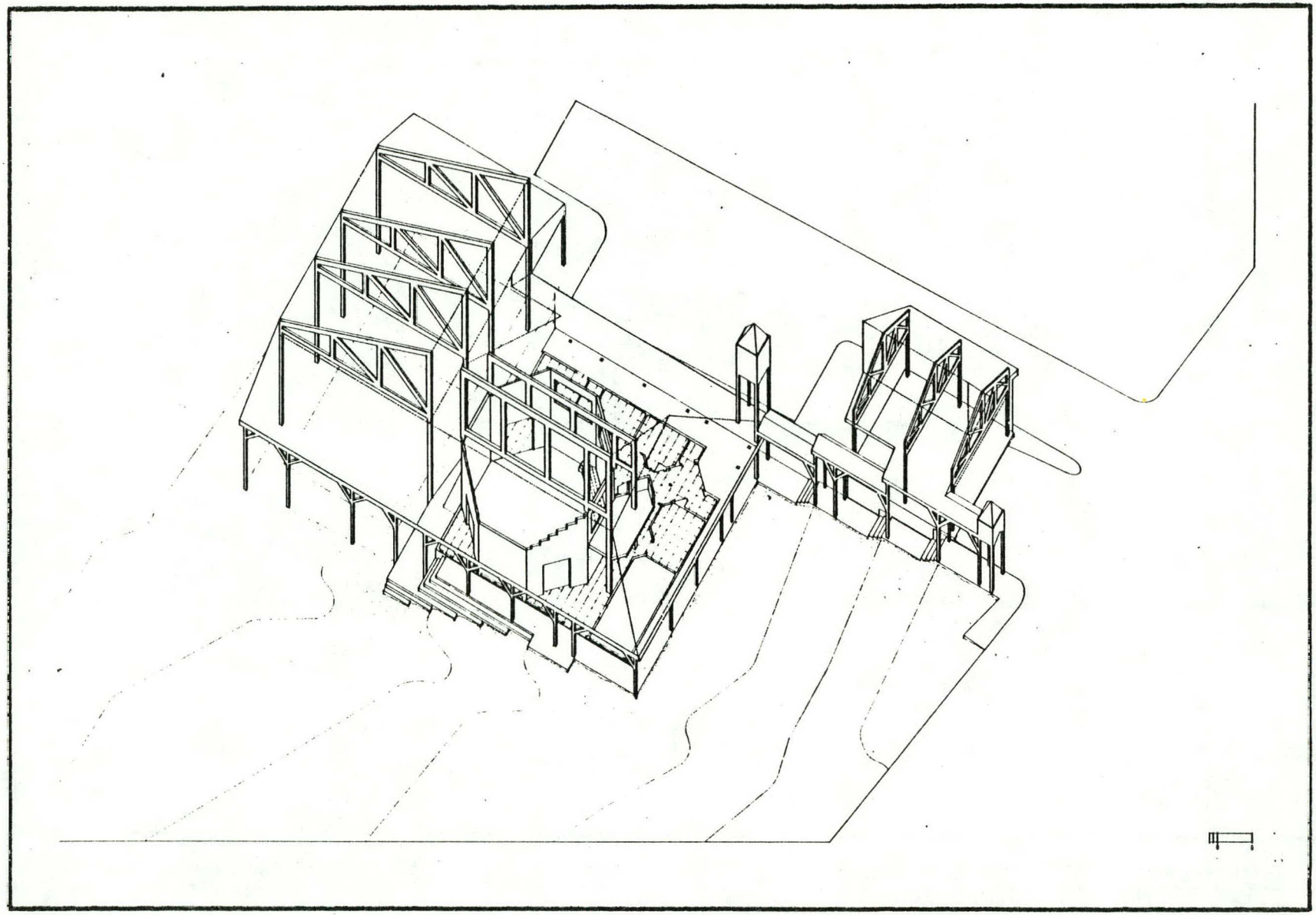
D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 7



D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Deadwood Creek
PROJECT NO. 336 PAGE NO. 8



D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Mennonite Home
PROJECT NO. 345
LOCATION (CITY/STATE) Albany, OR
NEW/RETROFIT/(ADDITION) (CIRCLE ONE)

BUILDING TYPE Health Care Facility
*CONDITIONED BLDG., S.F. 35,000
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR Thomas Sayre

KEY PERSONNEL

OWNER
FIRM Mennonite Home
STREET 5353 S.E. Columbus
CITY Albany
STATE/ZIP Oregon 97321
TELEPHONE NO. (503) 928-7232
CONTACT Wilbur Kennel

MECHANICAL ENGINEER
FIRM Long, Maxwell & Assoc.
STREET 11835 S.W. Greenburg
CITY Tigard
STATE/ZIP Oregon
TELEPHONE NO. (503) 639-3135
CONTACT Ed Long

SOLAR DESIGNER
FIRM M. Steven Baker
STREET 695 Emerald
CITY Eugene
STATE/ZIP Oregon 97403
TELEPHONE NO. (503) 683-5927
CONTACT Steve Baker

BUILDING CONTRACTOR
FIRM Kennel Construction
STREET 6543 Seven Mile Lane, S.E.
CITY Albany
STATE/ZIP Oregon 97321
TELEPHONE NO. (503) 928-7401
CONTACT Wilbur Kennel

ARCHITECT
FIRM Thomas W. Merril
STREET 321 SW 6th
CITY Albany
STATE/ZIP Oregon
TELEPHONE NO. (503) 926-0905
CONTACT _____

INSTRUMENTATION TEAM
FIRM _____
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	September 79	August 80
PHASE III (EVALUATION)	January 81	January 83

(A) INSTRUMENTATION METHOD Automatic Data Logger/H.P.

(B) INFORMATION DISSEMINATION
(ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

•

DESIGN PROCESS KEY ISSUES:

•

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

•

LESSONS LEARNED:

•

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mennonite Home
PROJECT NO. 345 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4792
CITY Portland
STATE Oregon

COOLING DEGREE DAYS 299
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1066.8

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [x]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [ ]
- MASS WALL [x]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[x] SOLAR DHW (SPECIFY)

Active (Sunworks system augmented by reflector)

[x] OTHER (SPECIFY)

Night insulation (trombe wall)

*See Definition Sheet

[ ] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [ ]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [x]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mennonite Home
PROJECT NO. 345 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 58,000 BTU/SF-YR (REFERENCE) Portland, Oregon - Nursing Home

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING							
COOLING							
LIGHTING							
DHW							
(OTHER)							
TOTAL							

CONDITIONED BUILDING _____ (S.F.)

TOTAL BUILDING ENERGY COSTS _____ ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mennonite Home
PROJECT NO. 345 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING							
COOLING							
LIGHTING							
DHW							
(OTHER)							
TOTAL							

CONDITIONED BUILDING _____ (S.F.)

TOTAL BUILDING ENERGY COSTS _____ ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mennonite Home
PROJECT NO. 345 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING					
COOLING					
LIGHTING					
DHW					
(OTHER)					
TOTAL					

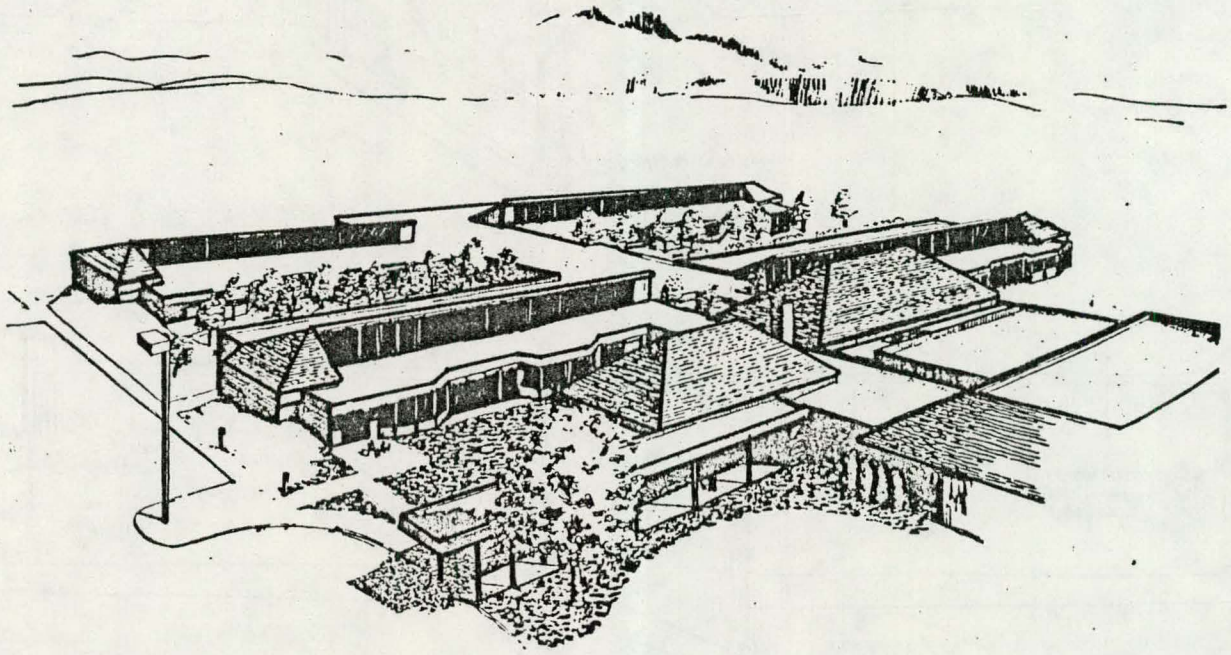
*ESTIMATED SAVINGS _____ %

TOTAL CONSTRUCTION COST $ _____

*PASSIVE INCREMENTAL COST $ _____

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

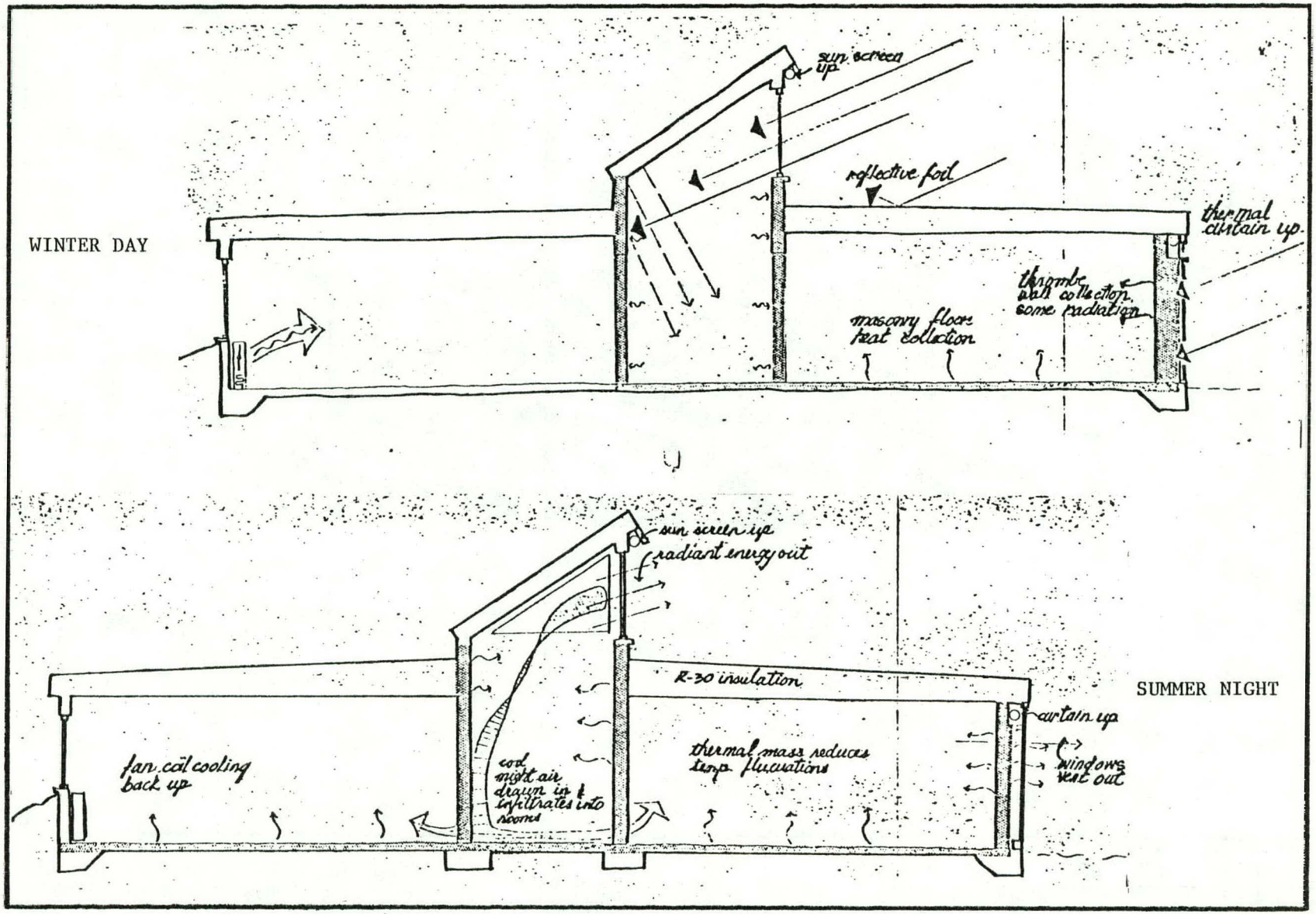
*See Definition Sheet



PERSPECTIVE

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Mennonite Home
PROJECT NO. 345 PAGE NO. 8



D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME City of Philadelphia BUILDING TYPE Garage

PROJECT NO. 330 *CONDITIONED BLDG., S.F. 57,000

LOCATION (CITY/STATE) Phila., PA TOTAL S.F. (If Different) 57,000

NEW (RETROFIT) ADDITION (CIRCLE ONE) TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER

Dept. of Public Property
FIRM City of Philadelphia
STREET Rm. 1650 Municipal Serv Bldg
CITY Philadelphia
STATE/ZIP Pennsylvania 19107
TELEPHONE NO. (215) MU6-2850
CONTACT James McKay, Richard Tustin

MECHANICAL ENGINEER

FIRM
STREET
CITY
STATE/ZIP
TELEPHONE NO.
CONTACT

SOLAR DESIGNER

FIRM Charles Burnette & Assoc.
STREET 234 South 3rd Street
CITY Philadelphia
STATE/ZIP Pennsylvania 19106
TELEPHONE NO. (215) 925-0844
CONTACT Charles Burnette, Ph.D., AIA

BUILDING CONTRACTOR

FIRM
STREET
CITY
STATE/ZIP
TELEPHONE NO.
CONTACT

ARCHITECT

FIRM Charles Burnette & Assoc.
STREET 234 South 3rd Street
CITY Philadelphia
STATE/ZIP Pennsylvania 19106
TELEPHONE NO. (215) 925-0844
CONTACT Charles Burnette, Ph.D. AIA

INSTRUMENTATION TEAM

FIRM Charles Burnette & Assoc.
STREET 234 South 3rd Street
CITY Philadelphia
STATE/ZIP Pennsylvania 19106
TELEPHONE NO. (215) 925-0844
CONTACT Charles Burnette, Ph.D., AIA

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	September 1981	March 31, 1982
PHASE III (EVALUATION)	- March 31, 1982	March 31, 1983

(A) INSTRUMENTATION METHOD Automatic data logger-AK

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Articles for publications directed to city officials, other articles for solar and building magazines, local media. Solar Age, May 1981; AS/ISES Solar in Cities Symposium, May, 1981

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Retrofit older large commercial building with passive, energy-saving features to reduce operating costs.

DESIGN PROCESS KEY ISSUES:

- Building was more skin-dominated than typical commercial building.
- System design choices limited in the case of an existing building with only weekday occupancy.
- Skin area of building dictated minimum cost solution.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Heating by solar radiant panel on back of insulating replacement window; new gas fired radiant task heating back up
- Daylighting - Light shelves incorporated into replacement window furnace
- Reflective roof insulation assists existing roof monitor
- Cooling - Natural ventilation and summer only venting of solar window furnace

LESSONS LEARNED:

- Direct solar radiant panels can provide inexpensive task heating in large volume buildings.
- Air intrusion through large doors opening to large occupied spaces is a subject needing research.
-

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME City of Philadelphia
PROJECT NO. 330 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4864
CITY Philadelphia
STATE Pennsylvania

COOLING DEGREE DAYS 1103
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1168.7

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [x]
- DIRECT GAIN* [ ]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [ ]
- MASS WALL [ ]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____

Window furnace [x]

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____

_____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [ ]
- ROOF MONITORS* [x]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____

_____

_____

_____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME City of Philadelphia
PROJECT NO. 330 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 51,000 BTU/SF-YR (REFERENCE) Phila., PA Gyms

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	201,000	1.59		x			Phase I Final Report, p. 29-35, as corrected by Charles Burnette, December, 1981.
COOLING	100	.002			x		"
LIGHTING	8,000	.175			x		"
DHW	2,400	.009	x				"
(OTHER)	18,500	.175	x		x		"
TOTAL	230,000	1.95					"

CONDITIONED BUILDING 57,000 (S.F.) TOTAL BUILDING ENERGY COSTS 111,150 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity: .075/kwh or $21.97/MMBTU
Gas: .38/ccf or $3.80/MMBTU
Oil: $1.09/gal. or $7.90/MMBTU

Phase I Final Report, P. 34

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating by oil-fired steam system. Window AC for office only. DHW heated by gas. Lighting by fluorescent, mercury vapor, and incandescent units.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME City of Philadelphia
PROJECT NO. 330 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	43,800	.167	x		x		Phase I Final Rep't., p. 32 & 35
COOLING	100	.002			x		"
LIGHTING	4,300	.094			x		"
DHW	1,900	.007	x				"
(OTHER)	18,500	.174	x		x		"
TOTAL	68,600	.444					"

CONDITIONED BUILDING 57,000 (S.F.)

TOTAL BUILDING ENERGY COSTS $25,300 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity: $.075/kwh or $21.97/MMBTU
Gas: $ .38/ccf or $3.80/MMBTU
Oil: $1.09/gal. or $7.90/MMBTU

Phase I Final Report, p. 34

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating by gas infrared radiant, forced air systems (100% and 75% efficiencies, respectivly), and electric infrared radiant system (100% efficiency). Lighting by flourescent, mercury vapor, and incandescent system. Gas heated DHW (83% efficiency)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME City of Philadelphia
PROJECT NO. 330 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	157,200		143,400	13,800	Phase I Final Report
COOLING					"
LIGHTING	3,700		3,700		"
DHW	1,100		1,100	not considered	"
(OTHER)					"
TOTAL	162,000		148,200	13,800	"

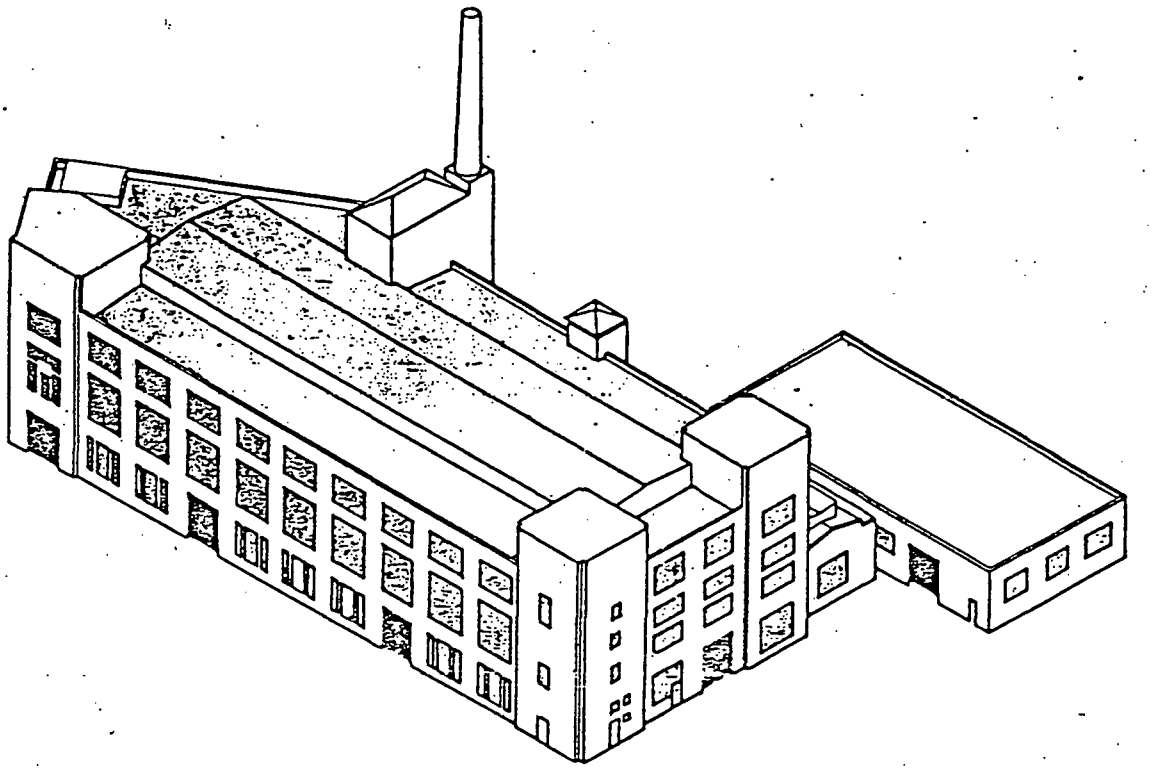
*ESTIMATED SAVINGS 70 %

TOTAL CONSTRUCTION COST $ 398,200

*PASSIVE INCREMENTAL COST $ 150,000

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



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D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Shelley Ridge Program Ctr. BUILDING TYPE Assembly

PROJECT NO. 338 *CONDITIONED BLDG., S.F. 5681

LOCATION (CITY/STATE) Phila., PA TOTAL S.F. (If Different) _____

(NEW) RETROFIT/ADDITION (CIRCLE ONE) TECHNICAL MONITOR Robert Mizell

KEY PERSONNEL

OWNER
FIRM Girl Scouts of Greater Philadelphia
STREET 1411 Walnut Street
CITY Philadelphia
STATE/ZIP Pennsylvania 19102
TELEPHONE NO. (215) 564-4657
CONTACT Judith Helder

MECHANICAL ENGINEER
FIRM Burt Hill Kosar Rittelmann Assoc.
STREET 400 Morgan Center
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CONTACT Dave Linamen

SOLAR DESIGNER
FIRM Burt Hill Kosar Rittelmann Assoc.
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STATE/ZIP Pennsylvania 16001
TELEPHONE NO. (412) 285-4761
CONTACT David F. Hill

BUILDING CONTRACTOR
FIRM _____
STREET _____
CITY _____
STATE/ZIP _____
TELEPHONE NO. _____
CONTACT _____

ARCHITECT
FIRM Bohlin Powell Larkin Cywinski
STREET 182 N. Franklin Street
CITY Wilkes-Barre
STATE/ZIP Pennsylvania 18701
TELEPHONE NO. (717) 825-8756
CONTACT Frank Grauman

INSTRUMENTATION TEAM
FIRM Burt Hill Kosar Rittelmann Assoc.
STREET 400 Morgan Center
CITY Butler
STATE/ZIP Pennsylvania 16001
TELEPHONE NO. (412) 285-4761
CONTACT Faruq Ahmed/Dave Hill

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	January 1981	July, 1982
PHASE III (EVALUATION)	July, 1982	July, 1983

(A) INSTRUMENTATION METHOD Automatic data logger/A.K.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Integration of solar features with programmed building functions.
- Use of solar features for educational purposes.

DESIGN PROCESS KEY ISSUES:

- Selection of base building performance
- How to simplify solar features.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Seasonally adjust shading to minimize unwanted heat gain.
- Operate night insulation to retain solar heat.
- Operate vent fans daily to dump unwanted heat gain.
- Operate ceiling fans daily to provide air movement.

LESSONS LEARNED:

- Relatively thin thermal mass ($\approx$ 4") is most economical.
- Simplification of solar features is critical to cost-effectiveness.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Girl Scouts
PROJECT NO. 338 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 4864

CITY Philadelphia

STATE Penn.

COOLING DEGREE DAYS 1103

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1168.7

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [x]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [x]
- MASS FLOOR [x]
- MASS WALL [x]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[x] SOLAR DHW (SPECIFY)

Active solar DHW

[ ] OTHER (SPECIFY) _____

[x] SPACE COOLING

- EARTH CONTACT [x]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [x]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Girl Scouts
PROJECT NO. 338 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 42,000 BTU/SF-YR (REFERENCE) DOE Phil. (Community Centers)

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	37,700	.828			x		Phase I Final Report 131
COOLING	230	.030			x		"
LIGHTING	15,300	.200			x		"
DHW	4,300	.057			x		"
(OTHER)							
TOTAL	57,530	1.115					"

CONDITIONED BUILDING 5681 (S.F.) TOTAL BUILDING ENERGY COSTS 6,334 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity costs: = $22/MMBTU — Final Report p. 35

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Electric resistance heat COP= 1.0

HID Fluorescent & Incandescent Lighting

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Girl Scouts
PROJECT NO. 338 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	27,460	.603			x		Phase I Final Report p. 130
COOLING	360	.008			x		"
LIGHTING	6,580	.145			x		"
DHW	1,180	.027			x		"
(OTHER)							
TOTAL	35,580	0.783					"

CONDITIONED BUILDING 5681 (S.F.)

TOTAL BUILDING ENERGY COSTS 4,448 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity costs: = $22/MMBTU — Final Report p. 35

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Electric resistance heat COP = 1.0

HID Fluorescent & incandescent lighting

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Girl Scouts
PROJECT NO. 338 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	10,300			10,300	Final Report p. 130 p. 131
COOLING	300			300	"
LIGHTING	8,700			8,700	"
DHW	3,100		3,100 (Active Solar)		"
(OTHER)					
TOTAL	22,400		3,100	19,300	"

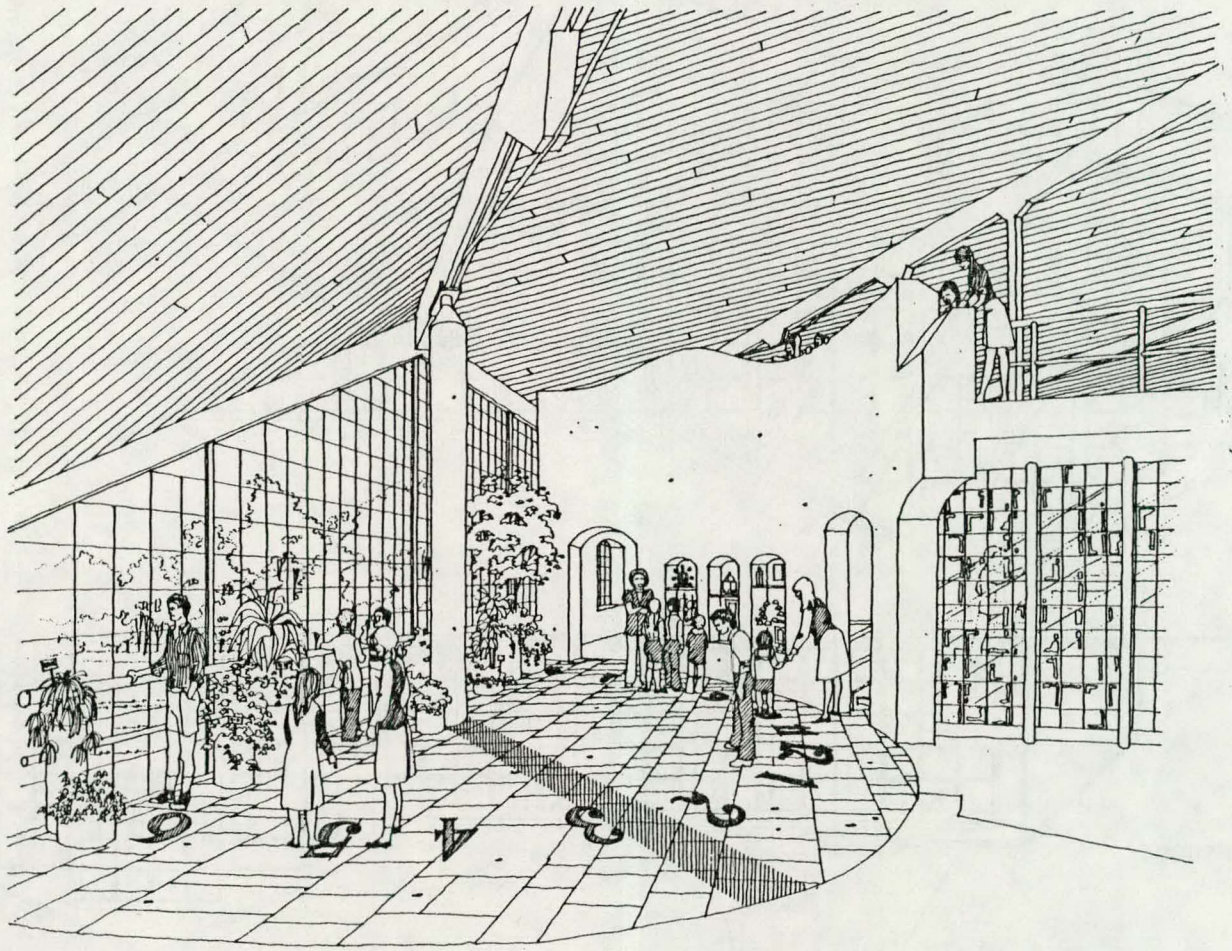
*ESTIMATED SAVINGS 38 %

TOTAL CONSTRUCTION COST $ 489,600

*PASSIVE INCREMENTAL COST $ 55,845

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

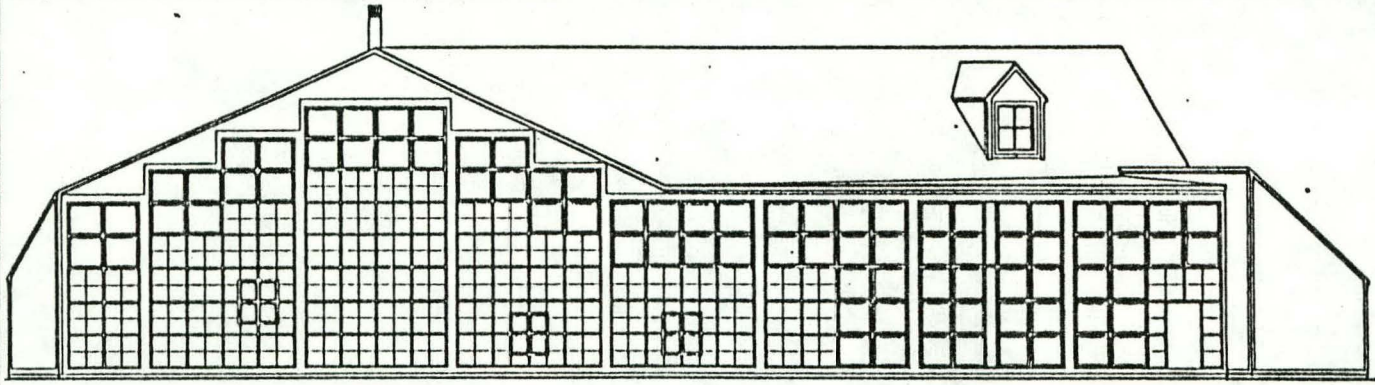
*See Definition Sheet



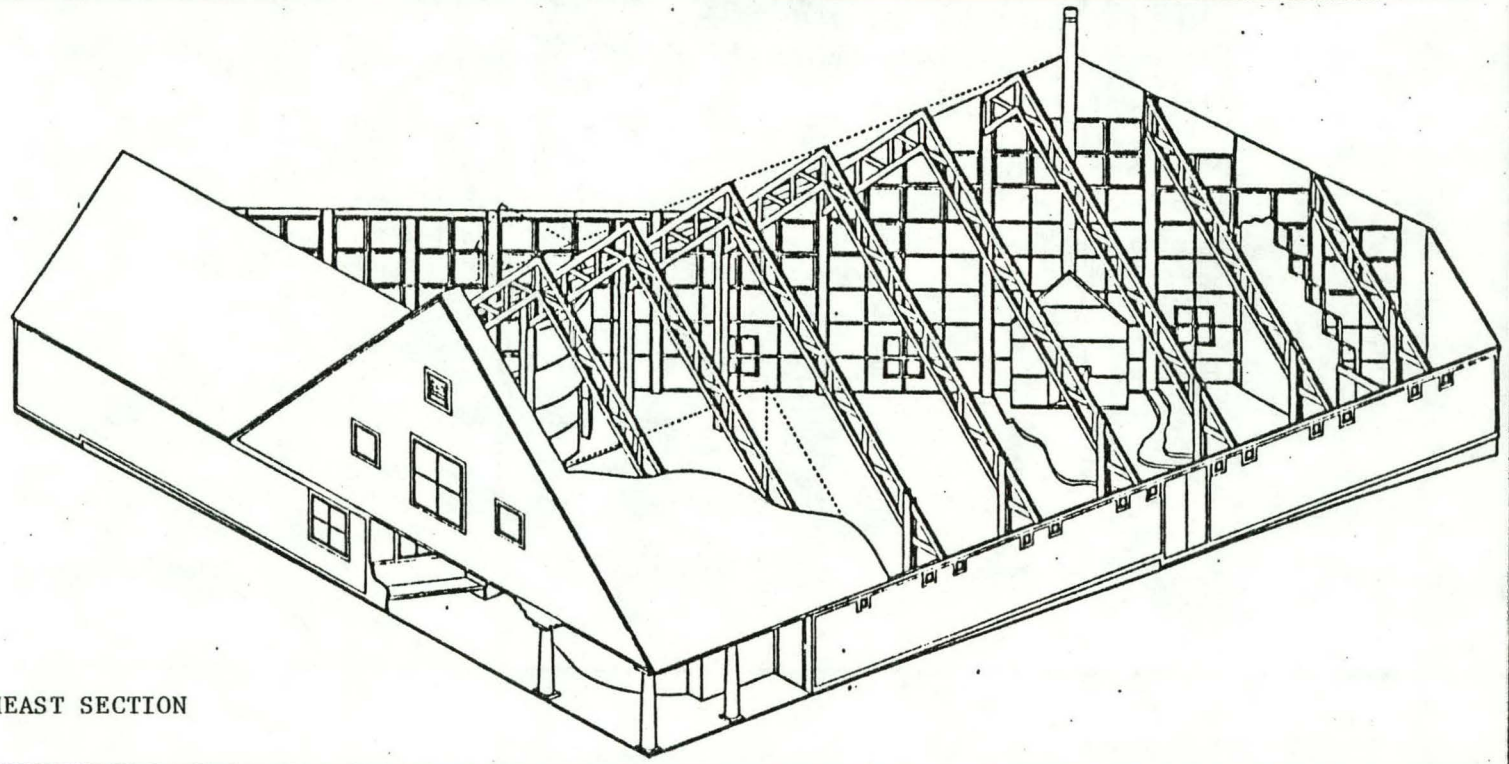
INTERIOR PERSPECTIVE

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Girl Scouts
PROJECT NO. 338 PAGE NO. 8



SOUTH ELEVATION



NORTHEAST SECTION

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Touliatos Greenhouse
PROJECT NO. 359
LOCATION (CITY/STATE) Memphis, TN
(NEW)/RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Commercial Greenhouse
*CONDITIONED BLDG., S.F. 5,000
TOTAL S.F. (If Different) _____
TECHNICAL MONITOR Robert Mizell

KEY PERSONNEL

OWNER
FIRM Plato Touliatos
STREET 2020 Brooks Road
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STATE/ZIP Tennessee 38116
TELEPHONE NO. (901) 346-8065
CONTACT Plato Touliatos

MECHANICAL ENGINEER
FIRM John Jameson
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CITY Atlanta
STATE/ZIP Georgia
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CONTACT _____

SOLAR DESIGNER
FIRM Plato Touliatos
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CONTACT Plato Touliatos

BUILDING CONTRACTOR
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INSTRUMENTATION TEAM
FIRM Plato Touliatos
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STATE/ZIP Tennessee 38116
TELEPHONE NO. (901) 346-8065
CONTACT Plato Touliatos

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	September 1981	February 1982
PHASE III (EVALUATION)	February 1982	February 1983

(A) INSTRUMENTATION METHOD Data Logger

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Develop low energy building form with optimum environment for plant growth.

DESIGN PROCESS KEY ISSUES:

- Maintain high light levels during spring, summer & fall without overheating & without major heat loss.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER):

- Open windows & vent sash to provide natural ventilation.
- Operate organic blower to circulate heat derived from biomass.
- Operate fan jet to minimize stratification.

LESSONS LEARNED:

- Traditional solar configuration with low summer light levels is not optimum for plant growth.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Touliatos Greenhouse
PROJECT NO. 359 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 3226

CITY Memphis

STATE Tennessee

COOLING DEGREE DAYS 3029

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1365.9

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [x]
- MASS WALL [x]
- WATER STORAGE [x]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____

Biomass [x]

[ ] SOLAR DHW (SPECIFY)

N/A

[x] OTHER (SPECIFY) Fertilizer production from catfish aquaculture (heat also a by-product).

* See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [x]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [ ]
- BUILDING LOAD MANAGEMENT* [ ]
- EVAPORATION* [x]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____

_____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [x]
- CLERESTORIES* [x]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [x]
- OTHER (SPECIFY) _____

_____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Touliatos Greenhouse
PROJECT NO. 359 PAGE NO. 4

BASE CASE BUILDING PROFILE* Double Poly Greenhouse

BEPS Not available BTU/SF-YR (REFERENCE) _____

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	60,000	.274	x				Draft Final Report Chapter 1
COOLING	3,564	.050			x		"
LIGHTING	10	.00014			x		"
DHW/ Water Pump	178	.002			x		"
(OTHER) Air Circulation	3,717	.052			x		"
TOTAL	67,469	.378					"

CONDITIONED BUILDING 5000 (S.F.) TOTAL BUILDING ENERGY COSTS 1,890 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

$14/10^6$ BTU Draft Final Report Chapter 1

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Gas fired unit heaters COP= 0.65

Incandescent lighting

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Touliatos Greenhouse
PROJECT NO. 359 PAGE NO. 5

SOLAR BUILDING PROFILE

Note: Heating costs are electricity for organic fan.

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING & Organic	31,250	.035			x		Final Report p. 110
COOLING							
LIGHTING	10	.00014			x		"
DHW	-	-					"
(OTHER) Air Circulation	2,060	.029			x		"
TOTAL	33,320	.064					"

CONDITIONED BUILDING 5000 (S.F.)

TOTAL BUILDING ENERGY COSTS 320 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES

(Reference Source, Page No.)

$14/10^6$ BTU ($.047/KWH) — Final Report p. 9

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Backup Htg. is woodstove

Lighting is incandescent.

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Touliatos Greenhouse
PROJECT NO. 359 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	28,750			28,750	Final Report p. 110 Draft Report
COOLING	3,564			3,564	"
LIGHTING	-			-	"
DHW Water Pump	178			178	"
(OTHER) Air Circulation	1,657			1,657	"
TOTAL	34,149			34,149	"

*ESTIMATED SAVINGS 49 %

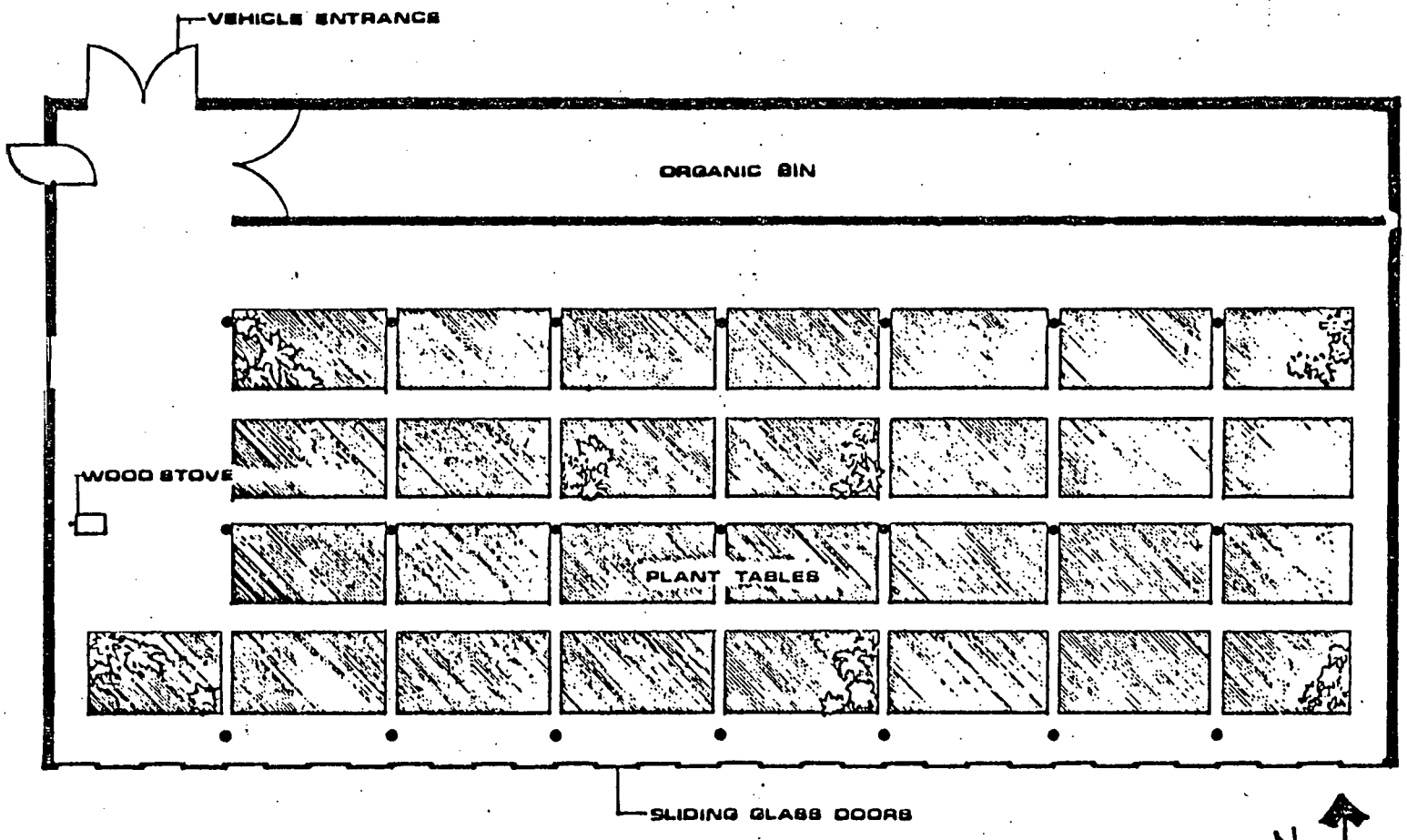
TOTAL CONSTRUCTION COST $ 60,000

*PASSIVE INCREMENTAL COST $ 40,000

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

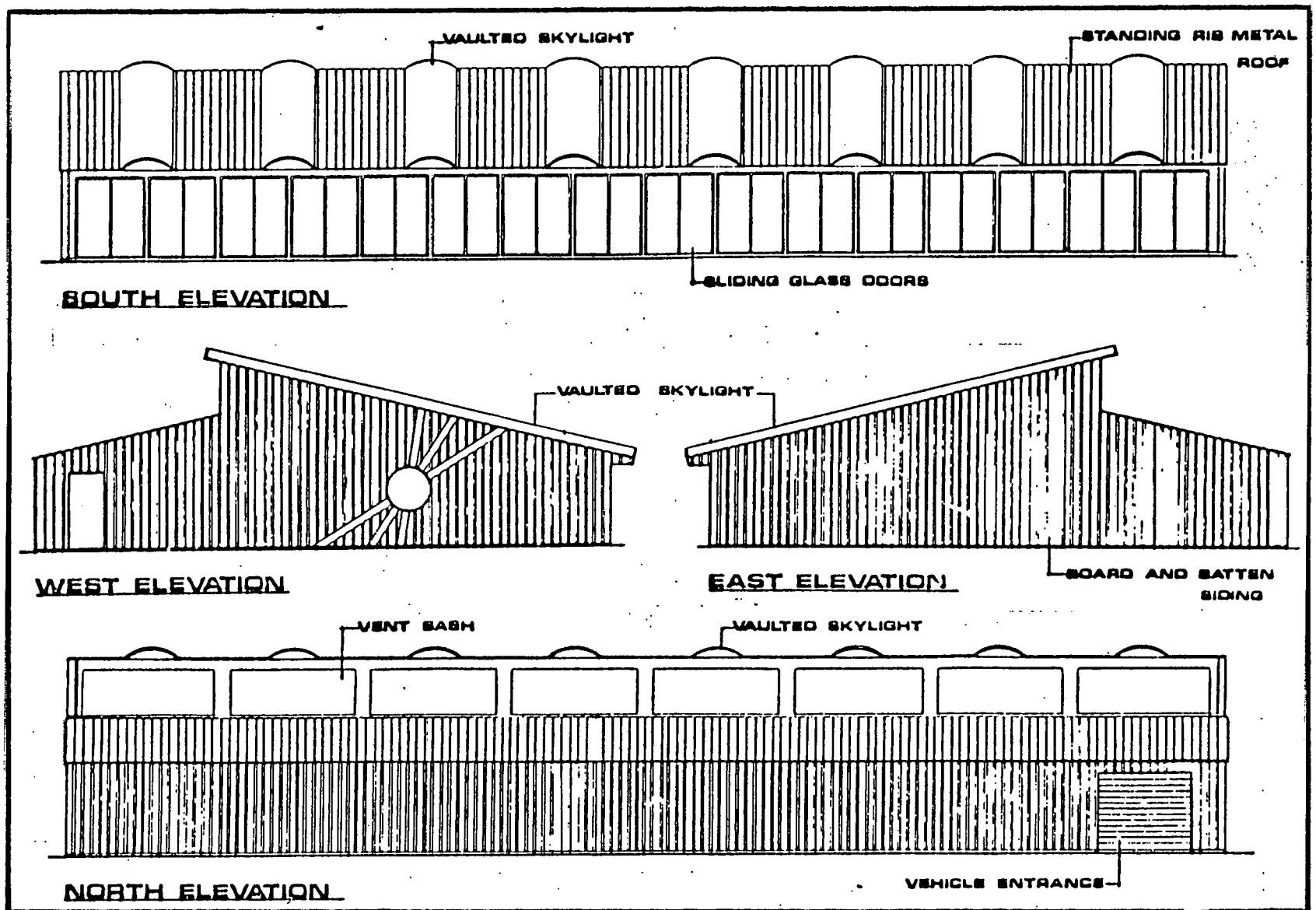
Catfish aguaculture/biomass used to generate heat and produce fertilizer

*See Definition Sheet



FLOOR PLAN
DOUBLE SHED

SCALE: 1/8" = 1'-0"


VAULTED SKYLIGHT
STANDING RIB METAL ROOF
SLIDING GLASS DOORS
SOUTH ELEVATION
VAULTED SKYLIGHT
WEST ELEVATION
VAULTED SKYLIGHT
BOARD AND BATTEN SIDING
EAST ELEVATION
VENT SASH
VAULTED SKYLIGHT
VEHICLE ENTRANCE
NORTH ELEVATION

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Willow Park
PROJECT NO. 361
LOCATION (CITY/STATE) Houston, TX
NEW / RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Assembly
*CONDITIONED BLDG., S.F. 4,130
TOTAL S.F. (If Different)
TECHNICAL MONITOR Thomas Sayre

KEY PERSONNEL

OWNER
FIRM Willow Park II Community Improvement Assoc.
STREET P.O. Box 103
CITY Missouri City
STATE/ZIP Texas 77459
TELEPHONE NO. (713) 497-2540
CONTACT Alvin T. Grant, Pres.

MECHANICAL ENGINEER
FIRM I.E.M. Associates
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STATE/ZIP Texas 77057
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CONTACT James Madget

SOLAR DESIGNER
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CITY Pt. Richmond
STATE/ZIP California 94801
TELEPHONE NO. (415) 236-7435
CONTACT Carl Bovill

BUILDING CONTRACTOR
FIRM Strang-Perrin-Newsam, Inc.
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CONTACT Warner Strang

ARCHITECT
FIRM Interactive Resources
STREET 117 Park Place
CITY Pt. Richmond
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CONTACT Dale Sartor

INSTRUMENTATION TEAM
FIRM Interactive Resources
STREET 117 Park Place
CITY Pt. Richmond
STATE/ZIP California 94801
TELEPHONE NO. (415) 236-7435
CONTACT Dale Sartor

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	March 81	August 81
PHASE III (EVALUATION)	August 81	August 82

(A) INSTRUMENTATION METHOD Submetering

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Paper for passive solar conference, school field trips

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Berming/low profile consistent with client's wishes.

DESIGN PROCESS KEY ISSUES:

- Prioritize opportunities for saving energy.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER)

- Lighting on 3 level switches and timers
- Natural ventilation spring and fall with ceiling fan assist
- Bathrooms heated, not cooled

LESSONS LEARNED:

- Flexibility of plan/compartmentalization of building important.
- Economic savings of earth berming are not easily quantifiable.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 1433
CITY Houston
STATE Texas

COOLING DEGREE DAYS 2889
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1351.1

SUMMARY OF PASSIVE DESIGN

[X] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [ ]
- DIRECT GAIN* [X]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [X]
- MASS WALL [X]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [X]
- OTHER (SPECIFY) _____ [ ]

[X] SOLAR DHW (SPECIFY)

Active solar DHW

[X] OTHER (SPECIFY)

Ceiling fans

[X] SPACE COOLING

- EARTH CONTACT [X]
- NATURAL VENTILATION [X]
- FORCED VENT./NIGHT FLUSHING [X]
- BUILDING LOAD MANAGEMENT* [X]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____ [ ]

[X] DAYLIGHTING

- WINDOWS [X]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [X]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [X]
- OTHER (SPECIFY) _____ [ ]

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 43,000 BTU/SF-YR (REFERENCE) San Antonio Community Center

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	1,280	.015			x		Final Report Phase I, Pgs. 8 & 9
COOLING	7,580	.089			x		"
LIGHTING	6,900	.081			x		"
DHW	2,420	.028			x		"
(OTHER)	-	-					-
TOTAL	18,180	0.213					"

CONDITIONED BUILDING 4130 (S.F.) TOTAL BUILDING ENERGY COSTS 880 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity $0.04/kwh = $11.71/MBTU

Overview Report (3/2/81) p. 8

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.)(Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	1020	.012			x		Final Report Phase I Pgs 10 & 11
COOLING	3340	.039			x		"
LIGHTING	1550	.018			x		"
DHW	240	.003			x		"
(OTHER)	-	-					-
TOTAL	6150	0.072					"

CONDITIONED BUILDING 4130 (S.F.) TOTAL BUILDING ENERGY COSTS 298 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity $0.04/kwh = $11.71/MBTU
Overview Report (3/2/81) p. 8

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	270			270	Final Report Phase I Pg. 10
COOLING	4,330			4,330	"
LIGHTING	5,350			5,350	"
DHW	2,180			2,180	"
(OTHER)	-			-	-
TOTAL	12,130			12,130	"

*ESTIMATED SAVINGS 66.3 %
TOTAL CONSTRUCTION COST $ 330,000
*PASSIVE INCREMENTAL COST $ 49,919

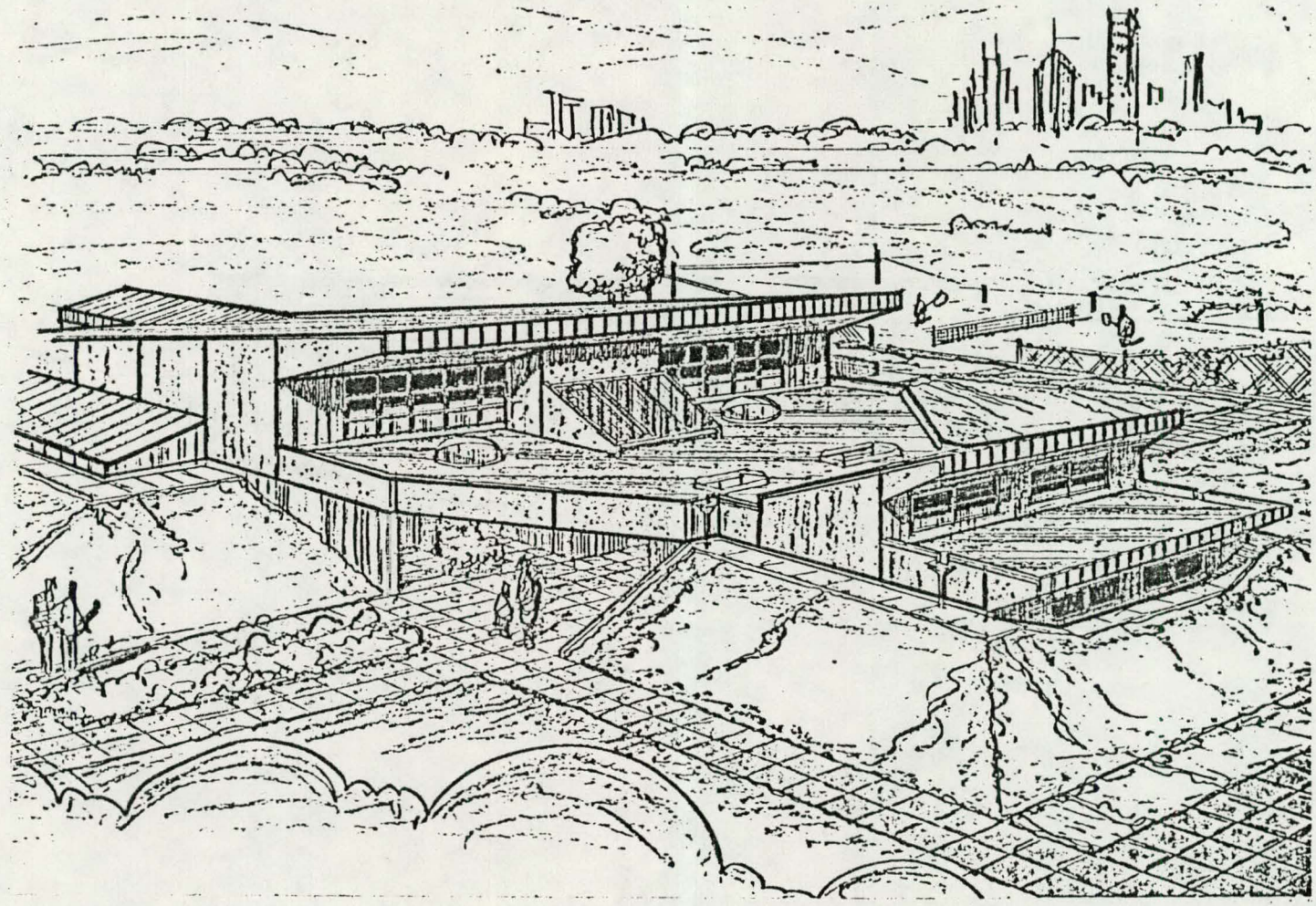
Project Cost Summary 1/6/81

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

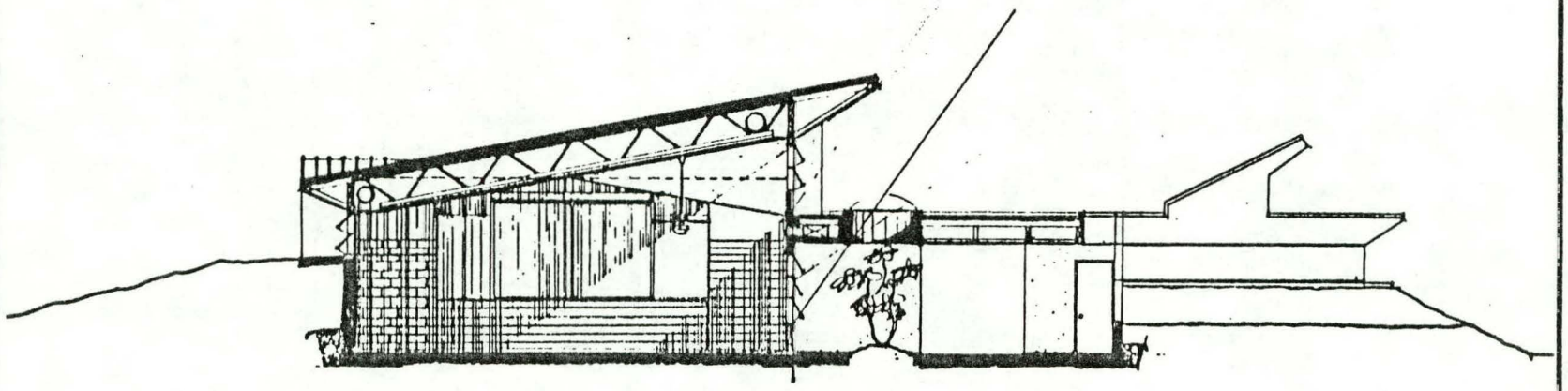
PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 7



PERSPECTIVE

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Willow Park
PROJECT NO. 361 PAGE NO. 8



SECTION

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Comal County . . BUILDING TYPE Educational

PROJECT NO. 333 *CONDITIONED BLDG., S.F. _____

LOCATION (CITY/STATE) New Braunfels, TX TOTAL S.F. (If Different) 4805

NEW (RETROFIT) ADDITION (CIRCLE ONE) TECHNICAL MONITOR Thomas Sayre

KEY PERSONNEL

OWNER

FIRM Comal County Mental Health/ Mental Retardation Center

STREET 158 W. Austin Street

CITY New Braunfels

STATE/ZIP Texas 78130

TELEPHONE NO. (512) 625-7724

CONTACT Mr. David M. Way

MECHANICAL ENGINEER

FIRM Lazcano Consulting Engineers

STREET 122 Madison

CITY San Antonio

STATE/ZIP Texas 78204

TELEPHONE NO. (512) 222-2480

CONTACT Manuel Lazcano

SOLAR DESIGNER

FIRM Southwest Research Institute

STREET 6220 Culebra Road

CITY San Antonio

STATE/ZIP Texas 78284

TELEPHONE NO. (512) 684-5111/2384

CONTACT Danny Deffenbaugh

BUILDING CONTRACTOR

FIRM _____

STREET _____

CITY _____

STATE/ZIP _____

TELEPHONE NO. _____

CONTACT _____

ARCHITECT

FIRM Joe Stubblefield, Architect & Planners, Inc.

STREET 120 Anstacia

CITY San Antonio

STATE/ZIP Texas 78212

TELEPHONE NO. (512) 735-5361

CONTACT Joe Stubblefield

INSTRUMENTATION TEAM

FIRM Southwest Research Institute

STREET 6220 Culebra Road

CITY San Antonio

STATE/ZIP Texas 78284

TELEPHONE NO. (512) 684-5111 ext. 2921

CONTACT Danny Deffenbaugh
Herb Treat

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR) (8/15/81)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	under construction	January 1, 1982
PHASE III (EVALUATION)	January 1, 1982	January 1, 1983

(A) INSTRUMENTATION METHOD Kaye Instruments Data Logger

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Open house, brochures, tours, lectures to South Texas building owners

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Integration of conservation strategies into an existing building.
- Redesign and reprogramming of spaces based on a change in building occupancy and use.

DESIGN PROCESS KEY ISSUES:

- Mass coupling/location of insulation inside or outside mass
- Exterior shading landscaping, overhang, roof reflectors
- Reflective roof vs. shaded roof
- Offensive vs. defensive cooling and heating strategy

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- HVAC shut down when building unoccupied
- Heating - destratify air through user controlled ceiling fans
- Cooling - Use of ceiling fan and natural ventilation by occupant
- Summer night cooling through natural ventilation
- Daylighting - user controlled task lighting.

LESSONS LEARNED:

- Defensive strategies most applicable in regard to architectural and cost constraints

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Comal County
PROJECT NO. 333 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 1570
CITY San Antonio
STATE Texas

COOLING DEGREE DAYS
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1499.0

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL
- SUNTEMPERED* [x]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [ ]
- ISOLATED GAIN* [ ]

SPECIFIC
- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [ ]
- MASS WALL [ ]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]
- _____ [ ]

[x] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

* See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [x]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [x]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____
- _____ [ ]

[x] DAYLIGHTING

- WINDOWS [x]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [ ]
- ROOF MONITORS* [ ]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) _____
- _____
- _____
- _____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Comal County
PROJECT NO. 333 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 45,000 BTU/SF-YR (REFERENCE) Secondary Schools, San Antonio

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	34,800	.117	x				Final Report Page 25, Figs.19 & 21
COOLING	19,400	.262			x		"
LIGHTING	7,100	.103			x		"
DHW	3,600	.012	x				"
(OTHER)	7,100	.103			x		"
TOTAL	72,000	.596					"

CONDITIONED BUILDING 4805 (S.F.)

TOTAL BUILDING ENERGY COSTS 2861.5 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity = $.046/KWH = $13.47/$10^6$ BTU (Final Report, pg. 3)

Gas = .335¢/CF = $3.35/$10^6$ BTU (Final Report, pg. 3)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

75% efficient gas water heater (Final Report, pg. 24)
75% efficient gas fired heaters (Final Report, pg. 17)
A.C. units with 2.2 C.O.P. (Final Report pg. 17)
Incandescent lighting (1 w/SF) (Final Report, pg. 24)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Comal County
PROJECT NO. 333 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	26,700	.07	x				Final Report Page 49
COOLING	11,550	0.156			x		"
LIGHTING	1,500	0.020			x		"
DHW	2,350	.012	x				"
(OTHER)	7,900	.104			x		"
TOTAL	50,000	.431					"

CONDITIONED BUILDING 4805 (S.F.)

TOTAL BUILDING ENERGY COSTS 2073 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity = $0.046/KWH = $13.47/$10^6$ BTU (final report, pg. 3)
Gas = 0.335¢/CF = $3.35/$10^6$ BTU (Final Report p.3)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

75% efficient gas water heater (Final Report)
75% efficient gas heaters (Final Report)
A.C. units with 2.2 C.O.P. (Final Report)
Incandescent, flourescent

*See Definition Sheet

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS =	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR) =	ENERGY CONSERVATION (BTU/SF-YR) +	PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	8,100		8,100	Pg. 4 & 5 Preceeding
COOLING	7,850		7,850	pages of this report
LIGHTING	5,600		5,600	"
DHW	1,250		1,250	"
(OTHER)	-800		-800	"
TOTAL	22,000		22,000	"

*ESTIMATED SAVINGS 30.5 %

TOTAL CONSTRUCTION COST $ 35,900

*PASSIVE INCREMENTAL COST $ 12,535

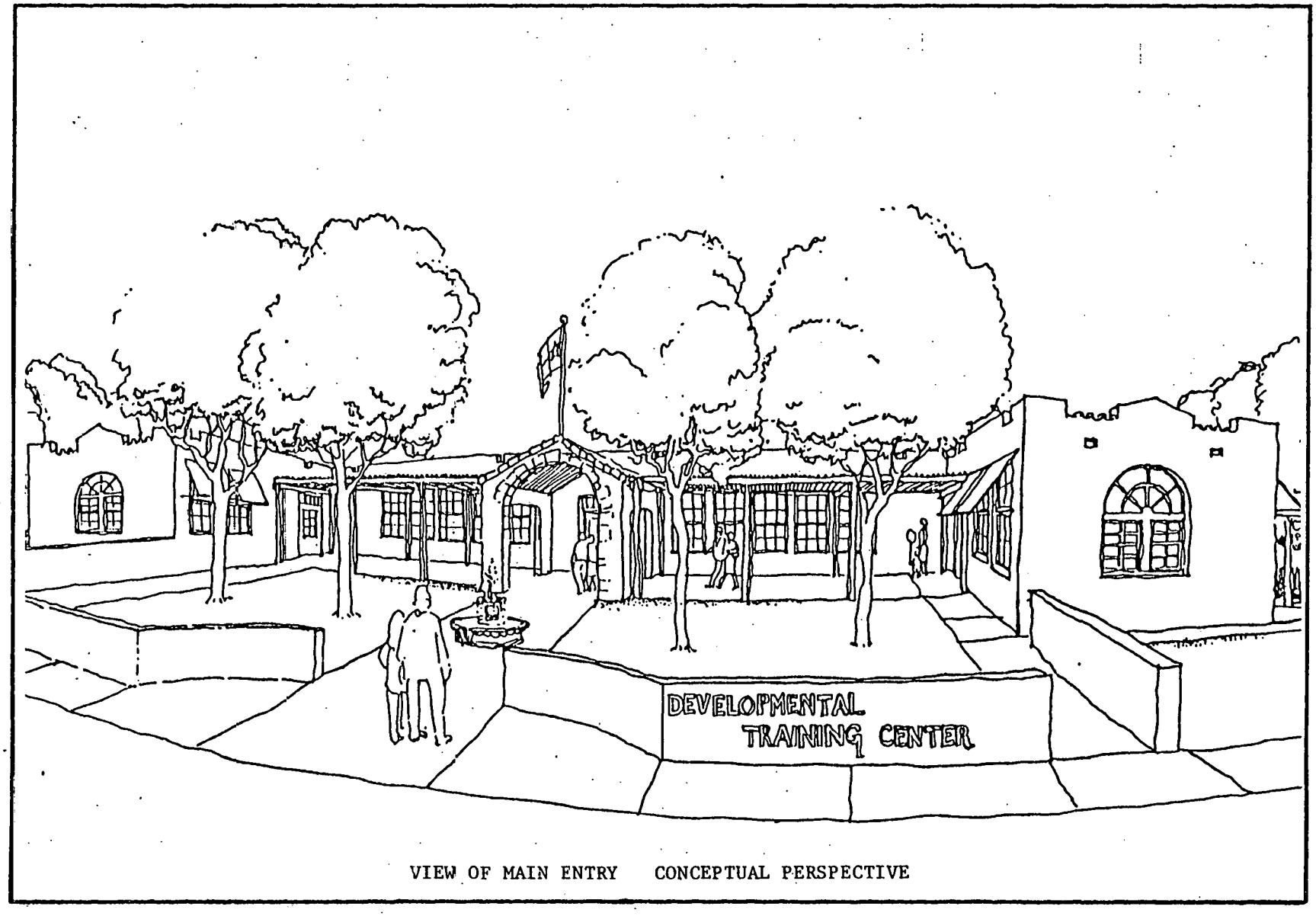
DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

Substantial additional savings may be achieved through use of a "conservative building temperature control strategy." Energy cost savings of $900/yr are possible but not included in this summary.

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Comal County
PROJECT NO. 333 PAGE NO. 7



VIEW OF MAIN ENTRY CONCEPTUAL PERSPECTIVE

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D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME Johnson Controls
PROJECT NO. 261
LOCATION (CITY/STATE) W. Valley City UT
(NEW) RETROFIT/ADDITION (CIRCLE ONE)

BUILDING TYPE Small Office & Warehouse
*CONDITIONED BLDG., S.F. 15,000
TOTAL S.F. (If Different) 15,000
TECHNICAL MONITOR Rockwell

KEY PERSONNEL

OWNER
FIRM Johnson Controls
STREET P. O. Box 423
507 E. Michigan St.
CITY Milwaukee
STATE/ZIP Wisconsin 53201
TELEPHONE NO. (414) 276-9200
CONTACT John Schade

*** MECHANICAL ENGINEER**
FIRM Van Borrum and Frank
STREET 1381 E. 2100 South
CITY Salt Lake City
STATE/ZIP Utah 84105
TELEPHONE NO. (801) 486-1348
CONTACT Howard Van Borrum
* Consulting M.E.

SOLAR DESIGNER
FIRM Donald Watson, FAIA**
STREET P.O. Box 701
CITY Guilford
STATE/ZIP Conn. 06437
TELEPHONE NO. (203) 453-6388
CONTACT Donald Watson

BUILDING CONTRACTOR
FIRM Brown-Foustz
STREET P.O. Box 2035
CITY Salt Lake City
STATE/ZIP Utah 84110
TELEPHONE NO. (801) 364-5638
CONTACT

ARCHITECT
FIRM Johnson Controls
P. O. Box 423
STREET 507 E. Michigan St.
CITY Milwaukee
STATE/ZIP Wisconsin 53201
TELEPHONE NO. (414) 276-9200
CONTACT Douglas Drake

INSTRUMENTATION TEAM
FIRM Johnson Controls
STREET
CITY West Valley City
STATE/ZIP Utah
TELEPHONE NO. (801) 487-6226
CONTACT Brent Neilson

*See Definition Sheet
** Fred S. Dubin, P.E., Dubin Bloome Assoc., 42 W. 39th St., New York, NY 10018, (212) 840-6700.

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	July 1981	December 1981
PHASE III (EVALUATION)	December 1981	

(A) INSTRUMENTATION METHOD Automatic data logger/Johnson Controls

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Tours, press conferences, promotional film, building and energy magazines, corporate advertising and publications.

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Develop a standard passive building design for future Johnson Controls branch offices.

DESIGN PROCESS KEY ISSUES:

- Reduce energy consumption from 103,000 BTU's per sq. ft. per year of existing buildings to 30,000.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- South-facing window with light shelf; roof monitor in middle of building for lighting with interior mass.
- Moveable insulation for south windows.
- Automatic controls for all operable passive features.
- Night venting, economizer cycle and evaporative cooling.

LESSONS LEARNED:

-

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Johnson Controls
PROJECT NO. 261 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 5981
CITY Salt Lake City
STATE Utah

COOLING DEGREE DAYS 927
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1603.1

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- [ ] SUNTEMPERED*
- [x] DIRECT GAIN*
- [ ] INDIRECT GAIN*
- [ ] ISOLATED GAIN*

SPECIFIC

- [ ] SUNSPACE/ATRIUM
- [x] MASS FLOOR
- [x] MASS WALL
- [ ] WATER STORAGE
- [ ] CONVECTIVE LOOP
- [x] EARTH CONTACT
- OTHER (SPECIFY) _____
- _____ [ ]

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

[x] SPACE COOLING

- [x] EARTH CONTACT
- [x] NATURAL VENTILATION
- [x] FORCED VENT./NIGHT FLUSHING
- [x] BUILDING LOAD MANAGEMENT*
- [ ] EVAPORATION*
- [ ] RADIATION*
- [ ] DEHUMIDIFICATION*
- OTHER (SPECIFY) _____
- _____ [ ]

[x] DAYLIGHTING

- [x] WINDOWS
- [x] LIGHTSHELVES*
- [ ] CLERESTORIES*
- [x] ROOF MONITORS*
- [ ] SUNSPACE
- [ ] SKYLIGHTS*
- OTHER (SPECIFY) _____

_____

_____

_____ [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Johnson Controls
PROJECT NO. 261 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS _____ BTU/SF-YR (REFERENCE) _____

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	41,900	.120	x				Final Report - Watson
COOLING	6,460	.062			x		"
LIGHTING	21,300	.412			x		"
DHW	700	.002	x				"
(OTHER) HVAC	2,090	.058			x		"
TOTAL	72,450	.654					

CONDITIONED BUILDING 14,884 (S.F.) TOTAL BUILDING ENERGY COSTS $9,734 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Final Report, Energy Design Process, Watson

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Gas forced-air heating with efficency = 0.7 compressor cooling with COP = 2.0 Lighting at 3w. per sq. ft. (Final Report, Energy Design Process, Watson)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Johnson Controls
PROJECT NO. 261 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	28,300	.081	x				Final Report – Watson
COOLING	6,990	.068			x		"
LIGHTING	10,700	.206			x		"
DHW	700	.002	x				"
(OTHER) HVAC	2,090	.058			x		
TOTAL	48,800	.415					"

CONDITIONED BUILDING 14,884 (S.F.)

TOTAL BUILDING ENERGY COSTS $6,177 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Energy Design Report by Donald Watson

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Gas forced-air heating with efficiency of .7
Evaporative cooling with C.O.P. of 2
Lighting at 1.5 w/sq. ft. (Energy Design Report by Watson)

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Johnson Controls
PROJECT NO. 261 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	13,600			13,600	Final Report-Watson
COOLING	- 530			- 530	"
LIGHTING	10,600			10,600	"
DHW, HVAC	-0-			-0-	
(OTHER)					
TOTAL	23,670			23,670	"

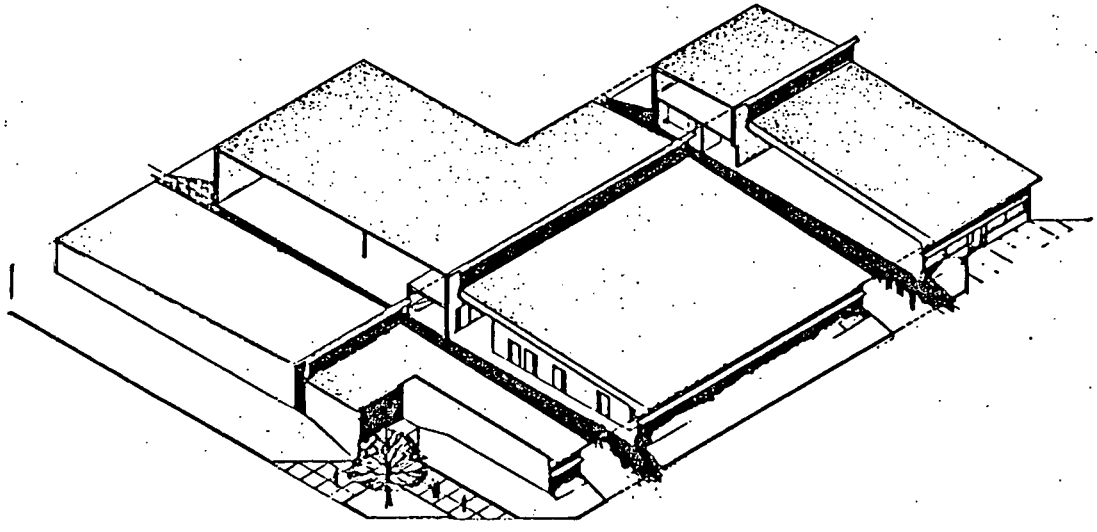
*ESTIMATED SAVINGS 33 %

TOTAL CONSTRUCTION COST $ 848,654

*PASSIVE INCREMENTAL COST $ 149,141

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



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D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME St. Mary's School Multi-use addition
PROJECT NO. 362
LOCATION (CITY/STATE) Alex. VA
NEW/RETROFIT/(ADDITION) (CIRCLE ONE)

BUILDING TYPE Gym/Auditorium
*CONDITIONED BLDG., S.F. 8,880
TOTAL S.F. (If Different)
TECHNICAL MONITOR W. J. Fisher

KEY PERSONNEL

OWNER
FIRM Most Reverend Thomas Welsh
STREET 210 N. Glebe Road
CITY Arlington
STATE/ZIP Virginia 22203
TELEPHONE NO. (703) 841-2500
CONTACT Dave R. Gallagher

MECHANICAL ENGINEER
FIRM Leland D. Eisenhower, Ltd.
STREET 4201 John Marr Drive
CITY Annandale
STATE/ZIP Virginia 22003
TELEPHONE NO. (703) 941-8480
CONTACT Same

SOLAR DESIGNER
FIRM Archetype **
STREET 1808 Corcoran Street, N.W.
CITY Washington
STATE/ZIP District of Columbia 20009
TELEPHONE NO. (202) 265-7565
CONTACT Belinda Reeder

BUILDING CONTRACTOR
FIRM Whitener & Jackson Inc.
STREET 101 Birch Street
CITY Box 289 - Falls Church
STATE/ZIP Virginia 22046
TELEPHONE NO. (703) 532-0566
CONTACT Wade P. Whitener

ARCHITECT
FIRM Architects Group Practice
STREET 300 N. Washington St. #330
CITY Alexandria
STATE/ZIP Virginia 22314
TELEPHONE NO. (703) 549-0809
CONTACT Dave R. Gallagher

INSTRUMENTATION TEAM
FIRM Virginia Polytechnic Institute & State University
STREET 201 Cowgill Hall
CITY Blacksburg
STATE/ZIP Virginia 24061
TELEPHONE NO. (703) 961-7736
CONTACT Robert P. Schubert, Asst. Prof. Architect & Environ. Design

*See Definition Sheet
** William Glennie, Design Analyst -- 225 S. Harrison, Princeton, NJ 08504

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	September 1981	(September 1982)
PHASE III (EVALUATION)		

(A) INSTRUMENTATION METHOD Automatic data logger system.

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Responsiveness of passive system to a variety of comfort conditions required for a multi-use space.
- High outside air requirements for ventilation needed.
- Architectural compatibility with existing school & historic neighborhood.

DESIGN PROCESS KEY ISSUES:

- Recognizing energy opportunities/constraints of intended multi-use functions for space.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER).

- Heating - unvented Trombe wall; varying thickness of wall staggers thermal transfer into space.
- Roof monitors provide direct gain heat as well as daylight.
- Cooling - induced ventilation through Trombe a space via low interior vents.

LESSONS LEARNED:

- Simple systems are more effective.
- Design passive elements to address more than one energy requirement.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME St. Mary's
PROJECT NO. 362 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 5009

CITY Washington

STATE DC

SERI Insolation Data Manual

COOLING DEGREE DAYS 940

ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1208

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

- SUNTEMPERED* [ ]
- DIRECT GAIN* [x]
- INDIRECT GAIN* [x]
- ISOLATED GAIN* [ ]

SPECIFIC

- SUNSPACE/ATRIUM [ ]
- MASS FLOOR [x]
- MASS WALL [x]
- WATER STORAGE [ ]
- CONVECTIVE LOOP [ ]
- EARTH CONTACT [ ]
- OTHER (SPECIFY) _____ [ ]

[ ] SOLAR DHW (SPECIFY)

[ ] OTHER (SPECIFY) _____

* See Definition Sheet

[x] SPACE COOLING

- EARTH CONTACT [ ]
- NATURAL VENTILATION [ ]
- FORCED VENT./NIGHT FLUSHING [x]
- BUILDING LOAD MANAGEMENT* [ ]
- EVAPORATION* [ ]
- RADIATION* [ ]
- DEHUMIDIFICATION* [ ]
- OTHER (SPECIFY) _____ [ ]

[x] DAYLIGHTING

- WINDOWS [ ]
- LIGHTSHELVES* [ ]
- CLERESTORIES* [ ]
- ROOF MONITORS* [x]
- SUNSPACE [ ]
- SKYLIGHTS* [ ]
- OTHER (SPECIFY) Hanging baffles within roof monitors. [ ]

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME St. Mary's
PROJECT NO. 362 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 51,000 BTU/SF-YR (REFERENCE) Gyms, (DC)

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	44,683**	0.20	x				Final Report p. 14 & p. 33
COOLING	4,440	0.07			x		"
LIGHTING	17,700	0.27			x		"
DHW	8,960	0.04	x				"
(OTHER) Fans	2,180	0.03			x		"
TOTAL	77,963	0.61					"

CONDITIONED BUILDING 8,880 (S.F.) TOTAL BUILDING ENERGY COSTS 5,417 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES (Reference Source, Page No.) Final Report p. 33

Gas @ $.40/Therm @ 75% efficiency = $5.33/Million BTU

Electric - Based on 1981 VEPCO rates = ($.052/KWH @ 100% efficiency) = $15.17/Million BTU

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating - Electric heat pumps w/gas boost Final Report p. 15
DHW gas fired furnace

Cooling - Electric heat pump - COP = 2

Lighting - Mercury vapor lamps Final Report p. 14

* See Definition Sheet

** See Footnote on page 6

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME St. Mary's
PROJECT NO. 362 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	8,177	.035	x				Final Report p.15 Final Report p.34
COOLING	5,450	.082			x		"
LIGHTING	2,470	.037			x		"
DHW	8,960	.036	x				"
(OTHER) Fans	2,040	.03			x		"
TOTAL	27,097	.22					"

CONDITIONED BUILDING 8,880 (S.F.)

TOTAL BUILDING ENERGY COSTS 1,954 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES Final Report p. 34
(Reference Source, Page No.)

Gas @ $.40/Therm @ 75% efficiency = $5.33/Million BTU

Elec. @ $.052/KWH @ 100% efficiency = $15.17/Million BTU
(1981 VEPCO rates)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating - Electric heat pumps w/gas boost; gas used 90% of the time & electric 10% of the time (COP = 3 for electric heating)
Cooling - Electric heat pump - COP = 2
Lighting - Fluorescent (?)

Final Report p. 34&15

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME St. Mary's
PROJECT NO. 362 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS =	ENERGY CONTRIBUTIONS		
	** BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR) =	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	36,500	15,500 *	21,000*	Final Report P. 34
COOLING	(-1,010)	(-1,010)		
LIGHTING	15,200	5,300	9,900	"
DHW	-			
(OTHER) (Fans)	(- 140)	(- 140)		
TOTAL	50,550	19,650	30,900	"

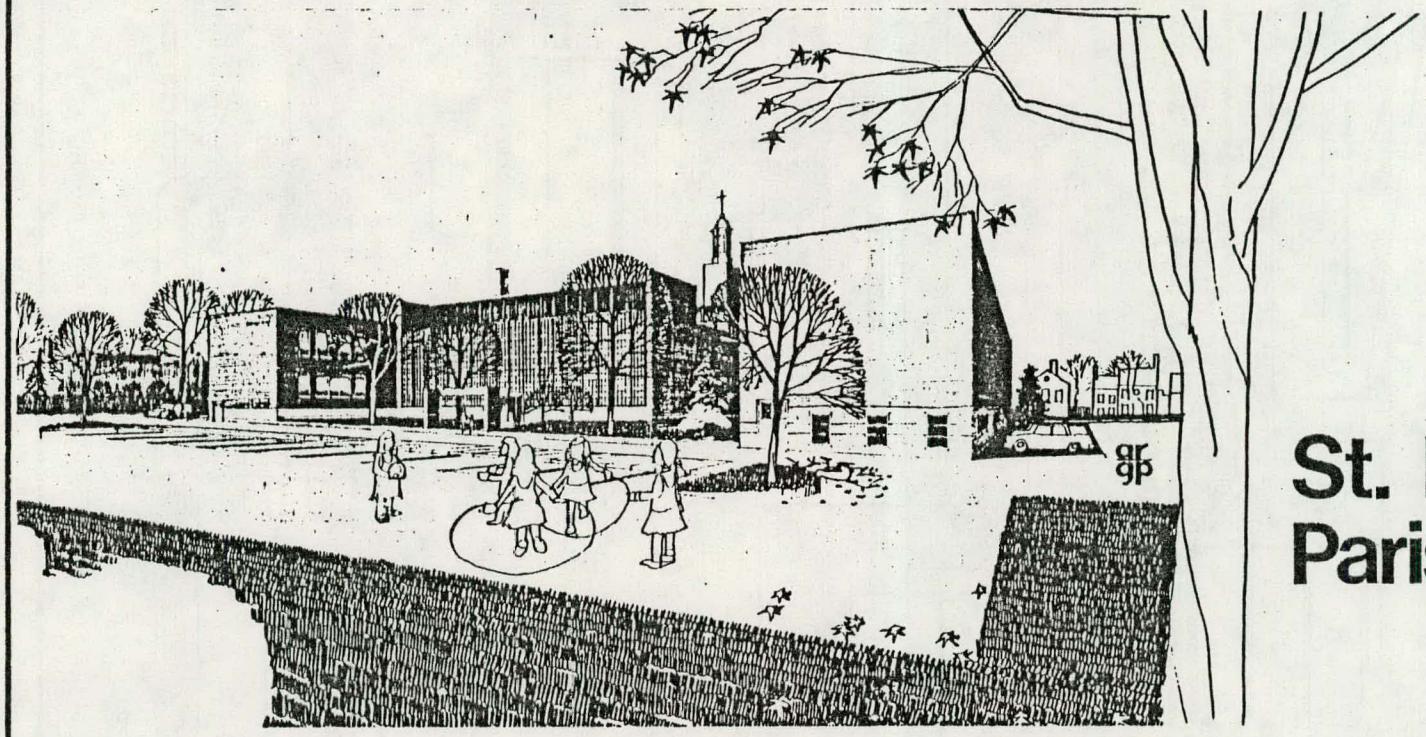
*ESTIMATED SAVINGS 65 %
TOTAL CONSTRUCTION COST $ 540,000
*PASSIVE INCREMENTAL COST $ 80,000

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

Lighting conservation - using high efficiency lamps & ballasts - Final Report p. 130
Insulation - increased "R" - value in walls & ceiling

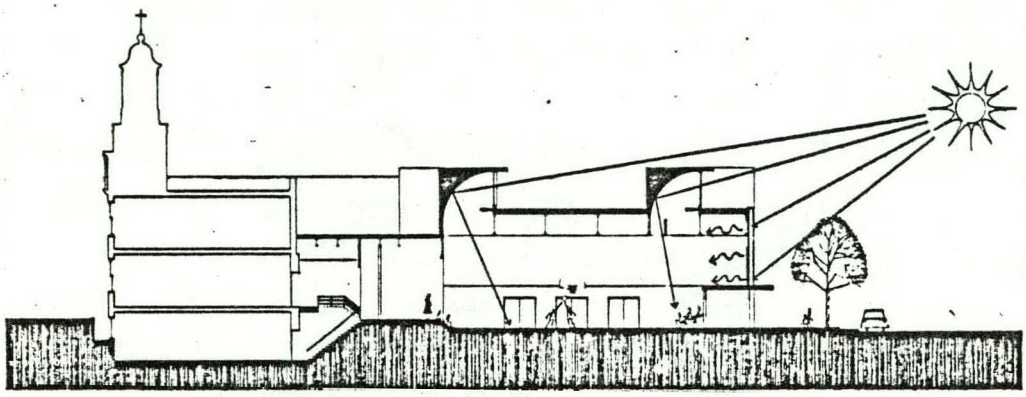
*Assume 90% gas at 75% efficiency; 10% gas at C.O.P. of 3
(.90 ÷ .75) + (.10 ÷ 3) = 1.23 1.23 = energy consumption replacement factor, applied to project conservation and solar contribution.

** See Definition Sheet

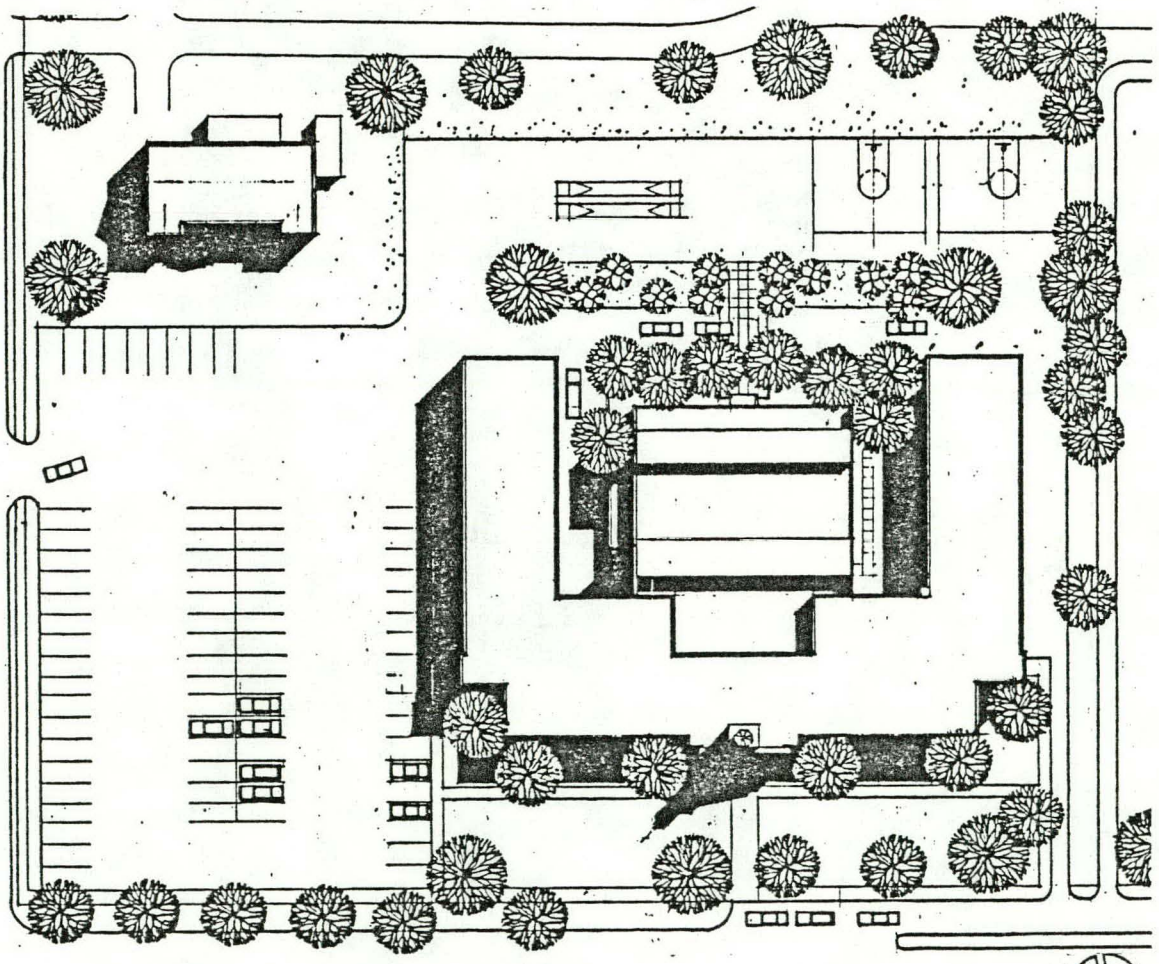


St. Mary's Parish Hall

PERSPECTIVE



LONGITUDINAL SECTION A-A SCALE



SITE PLAN

D.O.E. PASSIVE SOLAR COMMERCIAL BUILDINGS PROGRAM

PROJECT SUMMARY DATA

PROJECT NAME: Kieffer Store
PROJECT NO.: 343
LOCATION (CITY/STATE): Wassau, WI
NEW/(RETROFIT)/ADDITION (CIRCLE ONE)

BUILDING TYPE: Commercial (Retail)
*CONDITIONED BLDG., S.F.: 3212
TOTAL S.F. (If Different):
TECHNICAL MONITOR: R. Mizell

KEY PERSONNEL

OWNER
FIRM: G.D. Kieffer
STREET: 821 Turner Street
CITY: Wassau
STATE/ZIP: Wisconsin
TELEPHONE NO.: (715) 845-6787
CONTACT: G.D. Kieffer

MECHANICAL ENGINEER
FIRM: Not applicable
STREET:
CITY:
STATE/ZIP:
TELEPHONE NO.:
CONTACT:

SOLAR DESIGNER
FIRM: North Design
STREET: 2206 Chadbourne Avenue
CITY: Madison
STATE/ZIP: Wisconsin 53705
TELEPHONE NO.: (608) 238-8990
CONTACT: B. Kieffer

BUILDING CONTRACTOR
FIRM: Gordon D. Kieffer
STREET: 821 Turner Street
CITY: Wassau
STATE/ZIP: Wisconsin
TELEPHONE NO.:
CONTACT: Gordon Kieffer

ARCHITECT
FIRM: North Design
STREET: 2206 Chadbourne Avenue
CITY: Madison
STATE/ZIP: Wisconsin 53705
TELEPHONE NO.: (608) 238-8990
CONTACT: B. Kieffer

INSTRUMENTATION TEAM
FIRM: North Design
STREET: 2206 Chadbourne
CITY: Madison
STATE/ZIP: Wisconsin
TELEPHONE NO.: (608) 238-8990
CONTACT: B. Kieffer

*See Definition Sheet

SOLAR PROJECT SCHEDULE

	STARTING DATE (MO/YR)	COMPLETION DATE (MO/YR)
PHASE II (CONSTRUCTION)	January, 1981	October, 1981
PHASE III (EVALUATION)	September, 1981	September, 1982

(A) INSTRUMENTATION METHOD Data Logger

(B) INFORMATION DISSEMINATION (ARTICLES, PAPERS, LECTURES, ETC.) Information packet, press release, brochure (1000 copies), open houses (Bldg. owners, Design & Construction Professionals, and General Public)

DESIGN PROCESS

ARCHITECTURAL/ENERGY PROBLEM DESCRIPTION:

- Develop marketable energy efficient retail/office space from existing building.

DESIGN PROCESS KEY ISSUES:

- How to estimate daylight savings.
- How to simplify solar features.

SYSTEM OPERATION: (HEATING/COOLING/DAYLIGHTING-DAY/NIGHT-WINTER/SUMMER):

- Operate air circulators to distribute solar heat.
- Operate sunspace vents on 2nd floor as needed for comfort.
- Place shading in sunspace & roof monitors to reduce unwanted heat gain.

LESSONS LEARNED:

- The primary energy savings is daylighting, rather than thermal energy.

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Kieffer Store
PROJECT NO. 343 PAGE NO. 3

CLIMATE

HEATING DEGREE DAYS 8,586
CITY Eau Claire
STATE Wisconsin

COOLING DEGREE DAYS 351
ANNUAL AVERAGE DAILY HORIZONTAL SOLAR RADIATION (BTU/SF-DAY) 1132

SUMMARY OF PASSIVE DESIGN

[x] SPACE HEATING

STRATEGIES

GENERAL

SUNTEMPERED*	☐
DIRECT GAIN*	☒
INDIRECT GAIN*	☐
ISOLATED GAIN*	☐

SPECIFIC

SUNSPACE/ATRIUM	☒
MASS FLOOR	☒
MASS WALL	☐
WATER STORAGE	☐
CONVECTIVE LOOP	☒
EARTH CONTACT	☐
OTHER (SPECIFY) _____	
_____	☐

[x] SPACE COOLING

EARTH CONTACT	☐
NATURAL VENTILATION	☒
FORCED VENT./NIGHT FLUSHING	☐
BUILDING LOAD MANAGEMENT*	☒
EVAPORATION*	☐
RADIATION*	☐
DEHUMIDIFICATION*	☐
OTHER (SPECIFY) Natural vent with wind turbines	☒

[x] DAYLIGHTING

WINDOWS	☒
LIGHTSHELVES*	☒
CLERESTORIES*	☐
ROOF MONITORS*	☒
SUNSPACE	☒
SKYLIGHTS*	☐
OTHER (SPECIFY) Exterior reflectors, interior light baffles	
_____	☐

[ ] SOLAR DHW (SPECIFY)

_____

_____

[ ] OTHER (SPECIFY) _____

_____

_____

_____

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Kieffer Store
PROJECT NO. 343 PAGE NO. 4

BASE CASE BUILDING PROFILE*

BEPS 48,000 BTU/SF-YR (REFERENCE) Small office; Madison, WI

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	22,813	.171	x				DOE Pass. Update Proceedings Aug., 1981, p.4-29
COOLING	5,234	.094			x		"
LIGHTING	9,944	.179			x		"
DHW & Equipment	3,125	.056			x		"
(OTHER)	-	-					
TOTAL	41,116	.500					" Using area based on schematic review

CONDITIONED BUILDING 3,200 (S.F.) TOTAL BUILDING ENERGY COSTS $1600 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity - $17.90/MBTU; $.054/kwh (Final Report, p. 154)
Gas - $7.50/MBTU (Final Report p. 154, gas @ $0.56/CCF, 60% efficiency included)

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating efficiency - 60% (Pg. 154 of Final Report)
Cooling - C.O.P. 2.0 (p. 36 Final Report)

*See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Kieffer Store
PROJECT NO. 343 PAGE NO. 5

SOLAR BUILDING PROFILE

	AUXILIARY FUEL REQUIREMENTS						REFERENCE SOURCE, PAGE NO.
	*GROSS ENERGY CONSUMPTION (BTU/SF-YR)	BUILDING ENERGY COST ($/SF-YR)	GAS	OIL	ELEC.	OTHER	
HEATING	12,188	.091	x				DOE Pass. Update Proceedings Aug., 1981 p. 4-29
COOLING	3,094	.055			x		"
LIGHTING	4,844	.087			x		"
DHW & Equipment	3,125	.056			x		"
(OTHER)	-	-					
TOTAL	23,251	0.289					"

CONDITIONED BUILDING 3,200 (S.F.)

TOTAL BUILDING ENERGY COSTS $925 ($/YR)

ITEMIZE FUEL COSTS ($/MBTU) & DEMAND CHARGES
(Reference Source, Page No.)

Electricity - $17.90/MBTU; $.054/kwh (Final Report, p. 154)
Gas - $7.50/MBTU (.58/CCF @ 60¢ efficiency (Final Report, p. 9))

DESCRIBE HVAC/LIGHTING EQUIPMENT & COEFFICIENTS OF PERFORMANCE (C.O.P.) (Reference Source, Page No.)

Heating eff. - 60% (Final Report, p. 154)
Cooling - C.O.P. 2.0 (p. 36 Final Report)

* See Definition Sheet

D.O.E. PASSIVE SOLAR
COMMERCIAL BUILDINGS PROGRAM

PROJECT NAME Kieffer Store
PROJECT NO. 343 PAGE NO. 6

ENERGY SAVINGS SUMMARY

	GROSS ENERGY CONSUMPTION SAVINGS	=	ENERGY CONTRIBUTIONS		
	*BASE CASE MINUS SOLAR BLDG. AUX. FUEL REQTS. (BTU/SF-YR)	=	ENERGY CONSERVATION (BTU/SF-YR)	+ PASSIVE SOLAR (BTU/SF-YR)	REFERENCE SOURCE, PAGE NO.
HEATING	10,625			10,625	
COOLING	2,140			2,140	
LIGHTING	5,100			5,100	
DHW	0			0	
(OTHER)					
TOTAL	17,865			17,865	

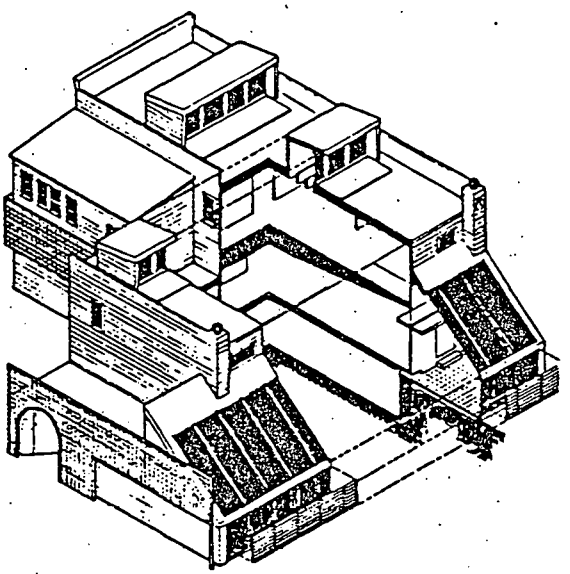
*ESTIMATED SAVINGS 43 %

TOTAL CONSTRUCTION COST $ 36,120

*PASSIVE INCREMENTAL COST $ 17,163

DESCRIBE ADDITIONAL ENERGY CONSERVATION FEATURES ITEMIZED ABOVE WHICH EXCEED BASE CASE DESIGN (If Applicable)

*See Definition Sheet



Kieffer Store - Exploded Axonometric

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* DEFINITIONS

SUMMARY OF PASSIVE DESIGN (Refers to Page 3)

Space Heating

- Suntempered: A condition where sun is let into a space but there is no thermal mass.
- Direct Gain: The space is used as a solar collector and contains thermal mass such as concrete, brick, stone, or water.
- Indirect Gain: Storage mass is placed between glazing and habitable space.
- Isolated Gain: Sunlight is converted to heat in an area independent of the habitable space, and then transported to the space.

Space Cooling

- Building Load Management: This refers to heat reduction strategies such as interior/exterior shading, reflective material, or window treatments.
- Evaporation: Water dissipates from a surface into the atmosphere causing a reduction in temperature. Systems incorporating this strategy include roof spraying, water trickle roofs, and mechanical evaporation systems.
- Radiation: Cooling thermal mass by exposure to a radiation heat sink (almost always the sky).
- Dehumidification: A process removing water from the air. An example strategy is the use of desiccants.

Daylighting

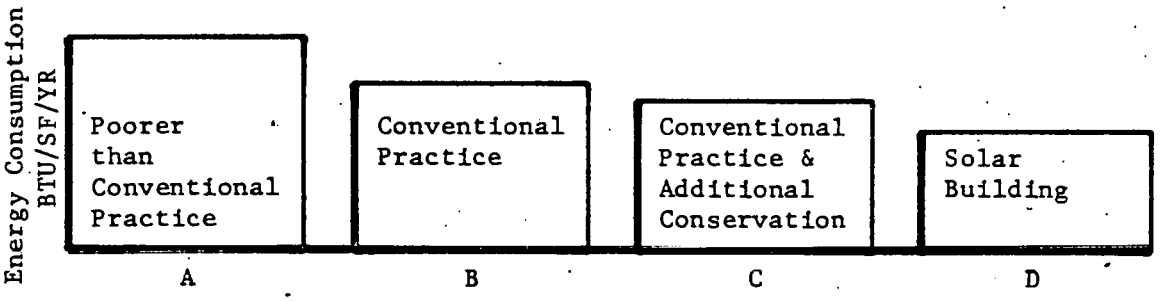
- Lightshelves: A reflective device (usually located near a window) which reflects and disperses sunlight onto ceilings and walls.
- Clerestory: An upper zone of a wall pierced with a window to admit light or air.
- Roof Monitor: A raised section of roof with openings, louvers, or windows (not parallel to roof plane) used to admit light or air.
- Skylight: A glazed roof aperture parallel to the roof.

* DEFINITIONS

BASE CASE/SOLAR BUILDING PROFILE (Refers to Page 4 & 5)

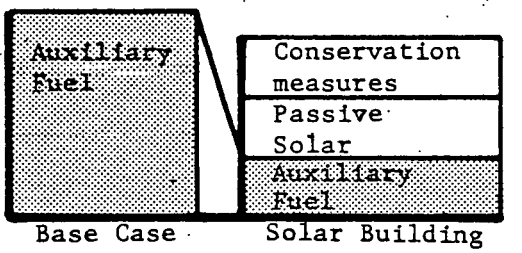
- BEPS: The building energy performance standard at the building line (does not include weighting factors for fuel).
- Base Case Building: A conventional building as defined by standard practice, which is compared to the solar building.

BUILDING COMPARISON SCENERIO



It is possible to use cases A, B, or C as a basis for comparison. DOE guidance has defined "B" as the base case, so that energy savings due to passive solar could be determined.

In some instances, project teams surpassed conventional practice and incorporated additional conservation measures in their solar designs, as illustrated below.



If this situation is applicable for your project, please use page 6 to separate energy savings due to conservation measures from the savings due to passive solar.

- Gross Energy Consumption: Also called Building Line Consumption. This number represents utility supplied energy to satisfy the building load, (Net heat loss/gain, lighting, etc.); the building load is that to which mechanical and lighting equipment respond.

* DEFINITIONS

$$\text{Gross Energy Consumption} = \frac{\text{Building Load Requirement}}{\text{Equipment C.O.P. or Efficiency *}}$$

*Equipment C.O.P. or efficiency for:

Heating - Average seasonal system efficiency for the Equipment used

Cooling - Average seasonal C.O.P. including fans, cooling towers, and ancillary equipment

Lighting- Efficiency should include ballast losses, if applicable, (EG. flourescent efficiency factor equals 1.25 x installed wattage; therefore efficiency equals 80%)

ENERGY SAVINGS SUMMARY (Refers to Page 6)

. Gross Energy Consumption Savings = [Base Case Total Gross Energy Consumption (Page 4)] - [Solar Building Total Gross Energy Consumption (Page 5)]

. Estimated Savings (%) = $\left[\frac{\text{Gross Energy Consumption Savings (Page 6)}}{\text{Base Case Total Gross Energy Consumption (Page 4)}}\right]$ x 100

. Passive Incremental Costs: The difference in cost between the estimated base building and solar building.

PROJECT COST SUMMARY (Refers to Page A-1)

. $/Million BTU's Saved = $\left(\frac{\text{Passive Incremental Cost (Page A-1)}}{\text{Passive Solar Total Energy Contributions (Page 6)} \times \text{Conditioned Bldg. SF (Page 1)}}\right)$

* DEFINITIONS

ECONOMIC DATA (Refers to Page A-2)

- Government-owned: A building owned by a governmental body not subject to income taxation. (E.G. Public School Board)
- Non-profit Organizations: A building owned by a private non-for-profit organization not subject to income taxation. (E.G. Private School or Community Group)
- Owner Occupied: A building owned and occupied by a private firm or company subject to income taxation. (E.G. Bank, Corporate HQ)
- Speculative (Rental): A building owned by a private firm or organization subject to income taxation which is rented out for profit.
- Incremental Increase In Rent: Please indicate difference if rents in solar building will vary from the base case
- Depreciation: The Accelerated Cost Recovery System (ACRS) as described in the Economic Recovery Act of 1981, has been assumed (This applies only to taxable owners).

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DEPARTMENT OF ENERGY
WASHINGTON, D.C. 20585

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