

# MAINE STATE LEGISLATURE

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**REPORT  
ON THE  
BUREAU OF  
GENERAL SERVICES  
ENERGY SAVINGS PILOT PROGRAM  
JANUARY 31, 2001**

**Prepared for: Joint Standing Committee on Utilities and Energy**

**Prepared by: Department of Administrative & Financial Services  
Bureau of General Services**

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Table of Contents

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1. Introduction
2. State Owned Facilities List
3. Procedure to Compile Data
4. Executive Summary Life Cycle Analysis
5. Current Energy Management Processes
6. Plan to Achieve 25% Savings

APR 19 2001



## INTRODUCTION

The Bureau of General Services is responsible for the construction, maintenance and repair of many state owned facilities. Other governmental agencies have responsibility over buildings and real property within their programs. For many years, BGS has used its resources to make prudent decisions related to energy efficiency within state buildings as resources allowed.

In the spring of 2000, the 119<sup>th</sup> Legislature passed a law which required the BGS to quantify its efforts, identify buildings, capture energy use and explore the process and possibilities of 10 pilot projects which would demonstrate the feasibility of using performance based contracting to achieve sufficient energy savings to accomplish needed facility upgrades.

This task is not simple and the work is incomplete. This report identifies the current status of the tasks assigned to the Bureau. The work continues.



## State Owned Facilities List

The Bureau of General Services (BGS) has developed a list (included in this report as Appendix 1) of facilities to comply with the requirements of the new statute on the Energy Savings Pilot Program<sup>1</sup>. This list includes all Executive Branch agencies, the applicable institutions of higher learning, and the Legislative and Judicial branches. The list spans facilities whose use and size range from residences to the Burton Cross State Office Building.

This list will be used to create the baseline data necessary to accomplish the goals of this statute on the facilities managed by the BGS. Significant progress has been made to date. In addition to this activity, the Director will request similar information from the organizations who manage state facilities outside of the control of the BGS. These include the University of Maine System, the Maine Maritime Academy, the Technical College System and the Maine State Retirement System.

The University of Maine System is not required to follow the BGS statute by specific exemption<sup>2</sup>. The calculations and projections for the pilot program will not include facilities under their control. The Maine Maritime Academy and Technical College System are only required to use the BGS for technical review and process. It is their decision as to priority, scope and budget for a project within their campuses<sup>3</sup>.

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<sup>1</sup> 5 M.R.S.A. § 1770

<sup>2</sup> 5 M.R.S.A. § 1742 C (1)





## State Owned Buildings

1	BCR	2475	\$61,600.00	AMITY	55001	2 STALL STOR BLDG LOT 97
1	BDD	4000	\$528,000.00	ASHLAND	55604	5 STALL STO BLDG LOT146
1	FGF	4072	\$378,000.00	CARIBOU	55367	6 STALL STOR BLD2 LOT
1	FGD	4072	\$378,000.00	CARIBOU	55366	6 STALL STOR BLD1 LOT
1	FHH		\$50,400.00	CARIBOU	55424	SALT SHD MAINT LOT 123B
1	FXT	6400	\$215,040.00	CRYSTAL	55462	8 STALL STOR BLDG LOT
1	FXV		\$50,400.00	CRYSTAL	55463	SALT SHD MAINT LOT 200
1	GXZ		\$93,030.00	FORT KENT	55425	SALT SHD & COLD ST LOT12
1	GZL		\$68,145.00	FRENCHVILLE	55300	SALT & STOR SHD LOT 167
1	GZN		\$108,220.00	FRENCHVILLE	55681	SAND BUILDING (DOME) 162
1	HBB	4000	\$128,000.00	FT FAIRFIELD	55381	5 STALL EQ ST BLD2
1	HKL	4000	\$128,000.00	FT FAIRFIELD	55380	5 STALL EQ ST BLD1
1	HZL		\$72,000.00	HOULTON	55455	CR AR&MAT BLD LT1082A
1	JBB		\$182,910.00	HOULTON	55600	REST AREA BUILDING S A 4
1	JBD		\$50,400.00	HOULTON	55426	SALT SHED BLDG
1	KBB	1260	\$50,400.00	MACWAHOC	55027	SALT SHED
1	JZX	4072	\$153,600.00	MACWAHOC	55523	6 STALL STOR BLDG
1	KBP		\$163,420.00	MADAWASKA	55682	SAND BUILDING (DOME)
1	KBN		\$117,000.00	MADAWASKA	55603	SALT STOR BLD LOT
1	KBD	3200	\$258,000.00	MADAWASKA	55602	4 STALL ST BLD LOT
1	KCH	12480	\$304,642.00	MARS HILL	55287	SALT & TOOL DOME
1	KCD	4072	\$171,600.00	MARS HILL	55485	6 STALL STOR BLDG
1	KXL		\$211,360.00	OAKFIELD	55680	SAND BUILDING (DOME)
1	KXJ		\$63,000.00	OAKFIELD	55384	SALT SHED
1	NCZ		\$615,360.00	PRESQUE ISLE	55991	DIV OFF BLDG LOT 58
1	MYJ	4072	\$430,100.00	PRESQUE ISLE	55592	6 STALL STR BLD
1	NYV	6400	\$231,840.00	SHERMAN	55486	8 STALL STOR BLDG
1	PNF	3200	\$102,400.00	STOCKHOLM	55524	4 STALL STOR BLDG LOT 24
1	QWF	4072	\$174,400.00	VAN BUREN	55423	6 STALL STOR BLDG
1	QWM	9600	\$148,763.00	VAN BUREN	55612	SAND/SALT
2	CWH	3200	\$128,000.00	AURORA	55343	4 STALLS LIVING QRTRS L9
2	CXC		\$550,000.00	BAILEYVILLE	55749	7 BAY GARAGE/OFFICE RT 1
2	DNR	4000	\$112,000.00	BAR HARBOR	55429	5 STALL STORAGE BLDG 102
2	PQH	2560	\$128,000.00	BEDDINGTON	55347	4 STALLS LIVING QRTRS 9
2	FBF	2800	\$140,000.00	CALAIS		INFO BUILDIN RT1 (UNION ST)
2	FVD	4000	\$112,000.00	CHERRYFIELD	55525	5 STALL STORAGE BLDG
2	GJF	7020	\$216,780.00	ELLSWORTH	55051	15 STALL SHED BLDG
2	GJX		\$351,360.00	ELLSWORTH	55992	OFFICE BLDG 1 & 3
2	HKN		\$63,000.00	GOULDSBORO	55587	SALT SHED
2	HXR	1890	\$66,000.00	HANCOCK		EROSION CONTROL BLDG
2	JFH	6400	\$179,200.00	JONESBORO	55464	8 STALL STORAGE BLDG 1
2	KZD	6400	\$179,200.00	ORLAND	55487	8 STALL STOR BLDG
2	MFH		\$184,800.00	PEMBROKE	55683	SAND/STORAGE BLDG
2	KZG	9600	\$146,723.00	SEDGWICK	55540	SAND STORAGE BUILDING
2	QRJ		\$110,000.00	TOPSFIELD	55468	SAND/STORAGE BLDG 1&6
2	QQX	4000	\$112,000.00	TOPSFIELD	55427	5 STALL STORAGE BLDG 1&6
2	RKL		\$85,000.00	WESLEY	55685	SAND/STORAGE BLDG
2	RKD	3200	\$89,600.00	WESLEY	55344	4 STALL, SHED 9
229B	DPH	528	\$175,000.00	BASS HARBOR		TERMINAL BLDG & PROP
229B	DPF		2,500,000.00	BASS HARBOR		PIER
229B	DPN		\$150,000.00	BATH		DRAW CONTROL HSE
229B	FHX		\$185,100.00	CARMEL	55459	MAINTENANCE STOREHSE FULLER ROAD

229B	FJQ	1880	\$56,400.00	CARMEL	55074 STORAGE FULLER ROAD
229B	FTZ		\$300,000.00	CHEBEAGUE IS	WHARF
229B	GNZ		\$100,000.00	FAIRFIELD	MAINTENANCE STOREHSE
229B	HSB		\$400,000.00	GT DIAMND IS	WHARF
229B	HXN		\$60,000.00	HANCOCK	55138 BRIDGE MAINT STORAGE
229B	HXZ		\$100,000.00	HANCOCK	55353 STORAGE SHED
229B	HXT		\$100,000.00	HANCOCK	55351 MAINTENANCE STOREHSE
229B	JBZ		\$160,000.00	ISLESBORO	CREW QTRS
229B	JCF		2,300,000.00	ISLESBORO	PIER
229B	JCH		\$200,000.00	ISLESBORO	TERMINAL BLDG
229B	JPZ		\$100,000.00	LINCOLNVILLE	TERMINAL BLDG & PROP
229B	JPP		2,400,000.00	LINCOLNVILLE	PIER - LINCOLNVILLE
229B	JQT		\$320,000.00	LITTLE DIAMD	WHARF
229B	JRH		\$300,000.00	LONG ISLAND	WHARF
229B	KFH		\$350,000.00	MATINICUS	WHARF
229B	KNX		\$127,000.00	NAPLES	MAINT STORE HSE
229B	KTB	8400	\$270,000.00	NEW LIMERICK	55034 BRIDGE MAINT STORAGE BLDG
229B	KVV		\$160,000.00	NORTH HAVEN	CREW QRTRS
229B	KVZ		\$150,000.00	NORTH HAVEN	TERMINAL BLDG & PROP
229B	KVX		2,350,000.00	NORTH HAVEN	PIER
229B	MDP		4,000,000.00	PEAKS ISLAND	WHARF & VEH FACILITY
229B	PHC		\$208,000.00	PORTLAND	BRIDGE MAINT BLDNG
229B	NBZ		\$88,424.00	PRESQUE ISLE	MAINTENANCE STORE HSE
229B	NGV		\$125,000.00	RICHMOND	DRAW CONTROL HSE ME-KENN BR
229B	NKH		\$800,000.00	ROCKLAND	TERMINAL BLDG & PROP
229B	NJZ	17000	3,000,000.00	ROCKLAND	PIER
229B	NJJ	2400	\$150,000.00	ROCKLAND	COLD STORAGE BLDG
229B	PHB		\$125,000.00	S PORTLAND	DRAW CONTROL HSE SO PORT BR
229B	NXD		\$100,000.00	SCARBORO	MAINTENANCE STOREHSE
229B	PCX	3250	\$146,250.00	SKOWHEGAN	55730 4 STALL STORAGE RT 201
229B	PFV		\$125,000.00	SO BRISTOL	DRAW CONTROL HSE GUT BR
229B	PPR		\$150,000.00	SWANS ISLAND	CREW QUARTERS
229B	PPV		\$100,000.00	SWANS ISLAND	TERMINAL BLDG & PROP
229B	PPT		2,400,000.00	SWANS ISLAND	PIER-SWANS ISLAND
229B	QXR		\$160,000.00	VINALHAVEN	CREW QUARTERS
229B	QXV		\$100,000.00	VINALHAVEN	TERMINAL BLDG & PROP
229B	QXT		1,900,000.00	VINALHAVEN	PIER
229B	QYR		\$100,000.00	W FARMINGTON	55327 MAINT STOREHOUSE 2-4
229B	RCT		\$160,000.00	WASHINGTON	8 BAY MAINT STOREHSE
229B	RRH		\$100,000.00	WOODSTOCK	MAINT STOREHOUSE
229B	RSJ		\$80,000.00	YORK	MAINTENANCE STOREHSE
3	BCP		\$56,700.00	ALTON	55320 SALT SHED AND GARAGE
3	DMR	5620	\$351,250.00	BANGOR	55323 NO 7 STALL STORAGE SHED
3	DLV		\$88,200.00	BANGOR	55469 SALT SHED
3	DFD		\$322,524.00	BANGOR	55368 MTS GARAGE
3	DKL	5620	\$351,250.00	BANGOR	55324 SO 7 STALL STORAGE SHED
3	DKP		\$949,782.00	BANGOR	55993 OFFICE BLDG
3	DFP		\$137,800.00	BANGOR	55113 CONFERENCE BLDG
3	FJD		\$52,000.00	CARMEL	55066 SALT STORAGE SHED S A 6
3	FHT	4000	\$250,000.00	CARMEL	55529 5 STALL STOR BLDG SA 6
3	FJB		\$60,480.00	CARMEL	55313 SALT SHED 69
3	FJJ		\$112,000.00	CARMEL	55065 VEHICLE STOR S A 6
3	FQF	2400	\$150,000.00	CHARLESTON	55432 3 STALL STORAGE BLDG 15
3	FTT		\$124,760.00	CHARLESTON	55687 SAND STORAGE SHED 15
3	FZZ	3200	\$200,000.00	DEXTER	55528 4 STALL STORAGE BLDG 7
3	GBD		\$60,480.00	DEXTER	55312 SALT SHED 7
3	GFL		\$60,480.00	EDDINGTON	55082 SALT SHED 9

3	GFJ	5620	\$351,250.00	EDDINGTON	55345	7 STALL STORAGE SHED 9
3	KFL	10500	\$165,000.00	ENFIELD	55673	SAND STORAGE SHED
3	HSL	2475	\$154,687.50	GUILFORD	55235	2 BAY STORAGE
3	HSN	4072	\$254,500.00	GUILFORD	55491	6 STALL STORAGE BLDG 15
3	HXH	3394	\$255,620.00	HAMPDEN	55250	-TOURIST INFO CTR
3	HXF	5147	\$383,425.00	HAMPDEN	55249	-TOURIST INFO CTR
3	JJH	2400	\$150,000.00	LAGRANGE	55431	3 STALL STORAGE BLDG 155
3	JRF		\$70,000.00	LONG A TWP	55076	SALT STORAGE SHED 11
3	KFV		\$302,000.00	MEDWAY	55618	REST AREA I95 SB
3	KGD		\$373,601.00	MEDWAY	55451	VEHICLE STORAGE
3	KFT		\$302,000.00	MEDWAY	55617	REST AREA I95 NB
3	KHT	6400	\$400,000.00	MILO	55430	8 STALL STORAGE BLDG 16
3	KHW		\$100,000.00	MILO	55238	STORAGE
3	KHY		\$240,000.00	MILO		SAND SHED
3	KJF		\$60,480.00	MONSON	55308	SALT & TRACTOR STOR SHD
3	MLF		\$305,000.00	PLYMOUTH	55329	VEHICLE STORAGE SHED
3	MLD		\$130,000.00	PLYMOUTH	55672	SAND STORAGE SHED 7
3	NLF		\$168,000.00	ROCKWOOD	55614	SAND STORAGE
3	NKX	2400	\$150,000.00	ROCKWOOD	55337	3 STALL STORAGE BLDG 15
3	NZB	3200	\$200,000.00	SHIRLEY	55492	4 STALL STOR BLD 15
3	PJX	4000	\$250,000.00	SPRINGFIELD	55433	5 STALL STORAGE BLDG 6
3	QHS	2800	\$98,000.00	T02 R08	55374	SAND SHED
3	RKV	4072	\$254,500.00	WEST ENFIELD	55341	6 BAY VEH STOR BLDG 2
3	RKX	6400	\$400,000.00	WEST ENFIELD	55553	8 STALL STOR BLDG 2
3	RKZ		\$65,100.00	WEST ENFIELD	55554	SALT SHED 2
3	RKS		\$70,000.00	WEST ENFIELD		STORAGE 2000 SQFT
3	RPT		\$124,760.00	WINN	55686	SAND STORAGE SHED 168
3	RPN	5620	\$351,250.00	WINN	55468	7 STALL STORAGE BLDG 16
4	BDZ	3200	\$90,000.00	ATHENS	55411	4 STALL STORAGE BLDG 150
4	BNJ		\$65,125.00	AUGUSTA	55385	BLDG REST AREA I95
4	BJX		\$710,900.00	AUGUSTA	55700	NEW SIGN SHOP BLDG
4	CMR		\$50,400.00	AUGUSTA	55231	SALT SHED SA2
4	KVD		\$157,000.00	AUGUSTA		SAND/SALT STORAGE
4	KVG		\$536,000.00	AUGUSTA	55243	GARAGE
4	GPN	1500	\$60,000.00	BELGRADE	55231	HAY BARN
4	DRF	6400	\$256,000.00	BELGRADE	55471	8 STALL STORAGE BLDG 135
4	FDB	6400	\$400,000.00	CANAAN	55310	8 STALL STORAGE BLDG 2
4	GPR		\$51,000.00	FAIRFIELD	55609	STORAGE BARN 201
4	GNP	6400	\$256,000.00	FAIRFIELD	55493	8 STALL STOR BLDG 201
4	GNL	3200	\$112,000.00	FAIRFIELD	55338	4 STALL VEH STOR BLDG
4	GPH		\$467,075.00	FAIRFIELD	55994	OFFICE BLDG 201
4	GPP		\$54,880.00	FAIRFIELD	55610	STORAGE 201
4	GNN	2719	\$250,000.00	FAIRFIELD	55245	5 STALL STOR BLDG 201
4	GNJ	3200	\$91,000.00	FAIRFIELD	55303	4 STALL STORAGE BLDG 201
4	JCP	6400	\$400,000.00	JACKMAN	55304	8 STALL STORAGE BLDG 15
4	KGF	5620	\$198,000.00	MERCER	55389	7 STALL STORAGE BLDG 137
4	KKJ	3200	\$200,000.00	MOSCOW	55418	4 STALL STORAGE BLDG 201
4	MJX		\$216,000.00	PITTSFIELD	55302	VEHICLE STORAGE SHED
4	MJP		\$500,000.00	PITTSFIELD	55228	MAINE FACILITY 2
4	NFP	4000	\$112,000.00	RANDOLPH	55415	5 STALL STORAGE BLDG 226
4	NFT		\$59,500.00	RANDOLPH	55233	SALT SHED S A 5 BIRM
4	NZJ	4000	\$101,000.00	SIDNEY	55244	5 STALL STORAGE BLDG I95
4	NZN		\$142,352.00	SIDNEY	55058	REST AREA I95
4	PGF		\$150,000.00	SO CHINA		SALT/SAND STORAGE DOME 3
4	PFZ	6400	\$180,000.00	SO CHINA	55414	8 STALL STORAGE BLDG 3
4	PHV	4072	\$135,000.00	SOLON	55390	6 STALL STORAGE BLDG
4	RLF	4000	\$112,000.00	THE FORKS	55391	5 STALL STORAGE BLDG 201

4	QZF		\$150,000.00	W GARDINER	55671	SALT/SAND STOR DOME 126
4	QYZ	4000	\$112,000.00	W GARDINER	55416	5 STALL STORAGE BLDG 126
4	RQH	6480	\$227,000.00	WINTHROP	55336	8 STALL STOR BLDG
4	DRL	12640	\$500,000.00	WINTHROP	55718	SAND / SALT BLDG
5	DVL	3005	\$77,000.00	BROOKS	55112	SALT SHED& 1 BAY GARAGE
5	GFR	5160	\$201,250.00	EDGECOMB	55473	8 STALL STORAGE BLDG 1
5	JHX	5160	\$182,000.00	KNOX	55386	8 BAY STORAGE BLDG 137
5	JJB	21642	\$184,730.00	KNOX	55679	SAND/SALT DOME 137
5	KJT	5410	\$184,800.00	MONTVILLE	55008	SAND/SALT STORAGE DOME
5	KJH	3880	\$134,400.00	MONTVILLE	55495	6 BAY STORAGE BLDG 3
5	KWF	5160	\$242,900.00	NORTHPORT	55558	8 BAY STORAGE BLDG 1
5	NHJ	9852	\$100,000.00	RICHMOND	55689	SAND/SALT STOR BLDG 138
5	NGN	5160	\$179,200.00	RICHMOND	55530	8 BAY STORAGE BLDG 138
5	NJX	4032	\$315,000.00	ROCKLAND	55995	OFFICE BLDG
5	NKF	7200	\$252,000.00	ROCKLAND	55012	STORAGE BLDG
5	NKJ	5160	\$179,200.00	ROCKPORT	55531	8 BAY STORAGE BLDG 90
5	NXX	4072	\$176,400.00	SEARSPORT	55264	6 BAY STORAGE BLDG 1
5	QRV	6280	\$392,500.00	TOPSHAM	55645	8 BAY STORAGE BLDG 196
5	QWD	3851	\$80,000.00	UNITY	55691	SAND/SALT STOR BLDG
5	QZX	6514	\$179,200.00	WALDOBORO	55434	8 STALL STORAGE BLDG 1
5	RCV	5160	\$179,200.00	WASHINGTON	55458	8 STALL STORAGE BLDG 17
5	RDB	5120	\$179,200.00	WASHINGTON	55535	VEHICLE STORAGE
6	BBL	5620	\$351,250.00	ALFRED	55395	STALL STORAGE SHED 4
6	BBP		\$50,400.00	ALFRED	55396	SALT STORAGE SHED 4
6	DVD		\$50,400.00	BRIDGTON	55413	SALT SHED
6	QZV	4000	\$160,000.00	BRIDGTON	55438	5 STALL STORAGE BLDG
6	DVF		\$111,352.00	BRIDGTON	55677	SAND/SALT STORAGE DOME
6	DTV	4000	\$160,000.00	BRIDGTON	55437	5 STALL STORAGE BLDG
6	GYR	4072	\$262,200.00	FREEPORT	55622	6-BAY GARAGE/BOILER ROOM
6	GZF		\$142,700.00	FREEPORT	55621	SAND SHED
6	GYT	4072	\$193,000.00	FREEPORT	55623	6-BAY STORAGE BLDG
6	HKH		\$264,000.00	GORHAM	55339	STORAGE BLDG 202
6	HKF		\$189,960.00	GORHAM	55674	SAND/SALT STOR DOME 202
6	HMB		\$81,900.00	GRAY	55155	OPEN SHED 100
6	HPN		\$50,400.00	GRAY	55474	SALT SHED 100
6	HMJ	6400	\$400,000.00	GRAY	55534	8 STALL BLDG 100
6	JGJ		\$50,400.00	KENNEBUNK	55448	SALT SHED 1
6	JHR		\$98,175.00	KITTERY	55630	STATE POLICE WEIGH STA
6	JHJ		\$840,432.00	KITTERY	55541	INFO & REST AREA
6	JMP		\$67,200.00	LIMERICK	55536	SALT SHED TYPE B OFF 11
6	JRX		\$67,200.00	LYMAN	55537	SALT SHED 202
6	KVN		\$172,800.00	NO BERWICK	55321	STORAGE SHED SA 6
6	KVL		\$50,400.00	NO BERWICK	55317	SALT SHED SA 6
6	MMD		\$127,160.00	POLAND	55676	SAND/SALT STOR DOME 26
6	MLH	4072	\$192,000.00	POLAND	55436	6 STALL STORAGE BLDG 26
6	NXL		\$800,000.00	SCARBORO	55996	OFFICE BUILDING SA 11
6	NWL	6400	\$400,000.00	SCARBORO	55496	8 STALL BLDG SA 11
6	NXP		\$98,400.00	SCARBORO	55497	SALT SHED SA 11
6	NWM	6400	\$400,000.00	SCARBORO	55556	8 STALL BLDG SA 11
6	PFN	4072	\$192,000.00	SO BERWICK	55535	STALL BLDG 236
6	PFT		\$105,560.00	SO BERWICK	55675	SAND/SALT STOR DOME 236
6	PFR		\$50,400.00	SO BERWICK	55475	SALT SHED 236
6	PLH		\$163,340.00	STANDISH	55692	SAND/SALT STOR DOME SA12
6	PLJ		\$204,000.00	STANDISH	55340	STORAGE BLDG 25
6	QZN		\$52,217.00	W SCARBORO	55181	OPEN SHED 1
6	QZL		\$80,000.00	W SCARBORO	55180	GARAGE 1
6	RRT		\$50,400.00	YARMOUTH	55449	SALT SHED 1

6	RRR		\$770,750.00	YARMOUTH	55668	INFO CENTER
6	RSP		\$98,715.00	YORK	55629	ST POLICE WEIGH STA I95N
6	RSL		\$50,400.00	YORK	55476	SALT SHED 1
6	RSH		\$256,000.00	YORK	55456	GARAGE 1
6	RSB	6400	\$400,000.00	YORK	55555	8 STALL BUILDING 1
7	BHD	2400	\$126,665.00	AUBURN	55273	VEH STORAGE 3 STALL 122
7	CWZ	4000	\$203,830.00	AVON	55392	VEHICLE SHED 4 STALL
7	DRV		\$50,400.00	BETHEL	55442	SALT SHED
7	DSH	4072	\$258,720.00	BETHEL	55309	VEH STOR SHD 6 STALL
7	FDV	2400	\$127,215.00	CANTON	55298	STORAGE SHED 3 STALL 108
7	FPT	2400	\$110,495.00	CHAIN OF PDS	55461	3 STALL STORAGE BLDG 27
7	FYT		\$50,400.00	DALLAS	55501	SALT SHED 16
7	FZF	5620	\$246,400.00	DALLAS	55379	VEH STOR SHED 7 STALL 16
7	GBT		\$50,400.00	DIXFIELD	55443	SALT SHED 2
7	GBL	5620	\$285,340.00	DIXFIELD	55457	7 STALL STORAGE BLDG 2
7	GBP		\$374,500.00	DIXFIELD	55997	OFFICE BLDG 2
7	GMT		\$50,400.00	FAIRBANKS	55568	SALT SHED 4
7	GMP	5620	\$351,250.00	FAIRBANKS	55500	7 STALL STOR BLDG 4
7	GZT		\$50,400.00	FRYEURG	55480	SALT SHED 302
7	GZR	4072	\$251,515.00	FRYEURG	55322	6 STALL STORAGE SHED 302
7	HQJ		\$50,400.00	GREENE	55477	SALT SHED
7	HQL		\$57,600.00	GREENE	55284	SHED STORAGE
7	HQF	2400	\$154,000.00	GREENE	55439	3 STALL STORAGE BLDG
7	JCZ	3200	\$169,950.00	JAY	55307	4 STALL VEHICLE SHED
7	JDB		\$50,960.00	JAY	55387	SALT SHED
7	JGP		\$70,320.00	KINGFIELD	55502	SALT SHED STORAGE
7	JGX	3200	\$177,650.00	KINGFIELD	55299	STORAGE SHED 4 STALL 27
7	JRL	2400	\$96,470.00	LOVELL	55267	3 STALL VEHICLE STOR 5
7	JRN		\$55,920.00	LOVELL	55479	SALT SHED 5
7	PJJ		\$50,400.00	S PARIS	55441	SALT SHED 26
7	PJF	6400	\$400,000.00	S PARIS	55440	8 STALL STORAGE BLDG 26
7	NTV		\$69,300.00	SABATTUS	55510	SALT SHED 9
7	PGJ		\$50,400.00	SO HIRAM	55445	SALT SHED
7	PJD	2475	\$52,800.00	SO HIRAM	55295	2 STALL VEH SHED
7	PPB		\$112,860.00	STRATTON	55505	BUILDING 16
7	QVH		\$89,726.00	TURNER	55678	SAND/SALT STORAGE DOME
7	QVF		\$50,400.00	TURNER	55503	SALT SHED
7	QVT	3200	\$126,700.00	TURNER	55275	VEHICLE SHED 4 STALL
7	QXN		\$50,400.00	VIENNA	55444	SALT SHED 41
7	QYS	2392	\$83,720.00	W FARMINGTON	55194	STORAGE SHED OPEN
7	RMH		\$105,000.00	WILSON MILLS	55447	SALT SHED 16
AERO	CHV		\$612,000.00	AUGUSTA		NEW ADMIN BLDG
AERO	BMF	12320	\$850,000.00	AUGUSTA		HANGAR 1999
AERO	CHX		\$84,000.00	AUGUSTA		NEW AIRPORT STORGE BLDG
AERO	BMH		\$183,750.00	AUGUSTA		AIRPORT MAINT BLDG & HGR
AERO	CDP	10500	\$420,000.00	AUGUSTA		SNOW REMOVAL EQUIP BLDG
AGR	BLZ		\$52,350.00	AUGUSTA		AGRI CALIBRATION STATION
AGR	BMB	18500	1,375,675.00	AUGUSTA		AGRI SHOP & STORAGE BLDG
AGR	NCP		\$83,000.00	PRESQUE ISLE		PVYN LAB
AGR	PKD		1,653,750.00	SPRINGFLD MA		EASTERN STATES EXPO
AMHI	BTZ	2948	\$120,100.00	AUGUSTA		FARMHOUSE - HALFWAY HSE
AMHI	BWV		1,255,475.00	AUGUSTA		GYM
AMHI	CGX	8800	\$879,875.00	AUGUSTA		MECHANICAL BLDG
AMHI	BWL	4808	\$106,400.00	AUGUSTA		GREENHOUSE - GROW WORKSHOP
AMHI	CSH	57557	13853928.00	AUGUSTA		STONE NORTH
AMHI	CSJ	21964	12495625.00	AUGUSTA		STONE SOUTH
AMHI	CSV	3938	\$243,026.00	AUGUSTA		SUPERINTENDENT'S RESIDENCE #3

AMHI	BLT	18647	2,528,900.00	AUGUSTA	ADMIN BLDG-HOSPITAL ST
AMHI	CVP	18860	\$855,675.00	AUGUSTA	WAREHOUSE
AMHI	CWB	17640	4,159,309.00	AUGUSTA	WILLIAMS PAVIL CHAPEL & CLINIC
AMHI	CDJ	11600	\$625,670.00	AUGUSTA	LAUNDRY
AMHI	CJH	1574	\$120,000.00	AUGUSTA	NORTON - HALFWAY HSE
AMHI	CLN		\$66,750.00	AUGUSTA	PUMP HOUSE-HOSPITAL ST
AMHI	BTF	47695	3,425,675.00	AUGUSTA	ELKINS BLDG
AMHI	BRZ	2912	\$162,006.00	AUGUSTA	DOCTORS HOUSE #2
AMHI	BSB	2707	\$99,666.00	AUGUSTA	DOCTORS HOUSE #4 (CAPE COD)
AMHI	BPX	9600	\$440,160.00	AUGUSTA	CARPENTER SHOP
AMHI	CDB	65058	8,195,675.00	AUGUSTA	CENTER BUILDING & PASSAGEWAYS
AMHI	BSD	2292	\$99,066.00	AUGUSTA	DOCTORS HOUSE #5 (GARRISON)
AMHI	CFP	2000	\$133,852.00	AUGUSTA	LOCKE HOUSE-RIVERSIDE
AMHI	BRX	2912	\$162,856.00	AUGUSTA	DOCTORS HOUSE #1
ARC	MZN	8274	\$742,291.00	PRESQUE ISLE	AROOS RES CTR-LOMBARD ST
BAXSCH	GQF	14000	\$966,183.75	FALMOUTH	C BLDG-TAYLOR HALL
BAXSCH	GQV	28000	2,089,243.80	FALMOUTH	K BLDG-SANDERS HALL
BAXSCH	GQJ	2820	\$157,502.10	FALMOUTH	FARMHOUSE (UNOCCUPIED)
BAXSCH	GQH	14000	1,222,475.10	FALMOUTH	D BLDG-GREENLAW HALL
BAXSCH	GQN	4880	\$199,053.75	FALMOUTH	GARAGE
BAXSCH	GQZ	6012	\$257,959.80	FALMOUTH	PASSAGEWAYS-W BLDG
BAXSCH	GQR	9000	\$622,401.15	FALMOUTH	I BLDG-PATRICK HALL
BAXSCH	GQT	13080	1,006,701.15	FALMOUTH	J BLDG-GYM
BAXSCH	GQD	7724	\$750,423.45	FALMOUTH	A BKDG-BAXTER HALL
BAXSCH	GQP	10300	\$630,184.80	FALMOUTH	H BLDG-BARTON HALL
BAXSCH	GQB	12136	\$622,905.15	FALMOUTH	B BLDG-YOUNG HALL
BAXSCH	GQL	15766	1,211,004.90	FALMOUTH	G BLDG-CARTER HALL
BFD	PMB		\$53,000.00	ASHLAND	MAINTENANCE BUILDING
BFD	JFV		\$115,815.00	JONESPORT	WOOD PIER
BFD	NGT		\$80,115.00	RICHMOND	C39 MAINTNEANCE BLDG
BFD	NHL		\$58,905.00	RICHMOND	STORAGE BLDG #1
BMHI	DCZ	7427	\$613,545.00	BANGOR	A-1 LAUNDRY
BMHI	DFV	57144	5,826,483.00	BANGOR	D BLDG
BMHI	DDL	22508	2,685,524.00	BANGOR	B BLDG
BMHI	DCX	73900	8,101,695.00	BANGOR	A BUILDING
BMHI	DJF	48770	5,592,405.00	BANGOR	K BUILDING
BMHI	DJV	12852	\$740,255.00	BANGOR	MAINT BLDG AT BMHI
BMHI	DKV	74748	19815718.00	BANGOR	PAVILLION
BMHI	DHP	8000	\$278,342.00	BANGOR	HAYBARN
BMHI	DMX	3090	\$175,000.00	BANGOR	STAFF (HALFWAY) HOUSE II
BMHI	DGB	45281	5,911,949.00	BANGOR	E BLDG
BMHI	DGR	47400	6,449,190.00	BANGOR	F BUILDING-STATE ST
BMHI	DMV	2743	\$175,000.00	BANGOR	STAFF (HALFWAY) HOUSE I
BMHI	DHX	14776	1,446,913.00	BANGOR	HEDIN HALL
BMHI	DKT	1300	\$179,432.00	BANGOR	PASSAGEWAYS
BMHI	DFH	2200	\$160,422.00	BANGOR	CHIEF ENGINEERS RESIDENCE
BMHI	DLJ	21200	2,500,000.00	BANGOR	PRE-RELEASE
BMHI	DFE	44225	5,911,949.00	BANGOR	C BLDG
BMHI	DDR	14490	\$922,622.00	BANGOR	B-1 OFFICE BLDG
BPI	CGJ	3683	\$193,537.00	AUGUSTA	MCLEAN BUILDING
BPI	BXT	76080	7,471,769.00	AUGUSTA	HUMAN SERVICES BUILDING
BPI	CKJ	25132	2,448,570.00	AUGUSTA	242 STATE STREET
BPI	CKV	0	4,500,000.00	AUGUSTA	PARKING GARAGE
BPI	CLV	48191	7,752,423.00	AUGUSTA	RAY BLDG
BPI	BPH		1,155,787.00	AUGUSTA	BURLEIGH PAVILLION
BPI	CTN	35100	4,519,850.00	AUGUSTA	TYSON PAVILLION
BPI	CGZ	2639	\$251,153.00	AUGUSTA	MERRILL HOUSE

BPI	CHR	4944	1,009,790.00	AUGUSTA	NASH SCHOOL
BPI	BQR	132579	20299087.00	AUGUSTA	CULTURAL BLDG
BPI	BQZ	1640	\$523,455.00	AUGUSTA	DACHSLAGER HOUSE
BPI	HVP		\$85,000.00	AUGUSTA	LOCK HOUSE
BPI	CRX	9645	\$469,225.00	AUGUSTA	STATE POLICE GARAGE
BPI	CMX	3325	\$308,680.00	AUGUSTA	SMITH HOUSE
BPI	BRH	36009	6,235,434.00	AUGUSTA	DEERING BLDG
BPI	BWZ	29485	3,480,526.00	AUGUSTA	HARLOW BUILDING
BPI	CHZ		6,760,990.00	AUGUSTA	NEW MOTOR VEHICLE BLDG
BPI	CJJ	15536	1,677,487.00	AUGUSTA	NURSES HOME - CETA
BPI	CRL	7540	\$664,054.00	AUGUSTA	STATE PLANNING OFFICE
BPI	CVR	12194	\$714,537.00	AUGUSTA	WAREHOUSE (CENTRAL)
BPI	CKH	16339	2,305,115.00	AUGUSTA	OLD MAXIMUM SECURITY BLDG
BPI	CGF	10948	1,196,870.00	AUGUSTA	MAINTENANCE BLDG
BPI	CNP	82024	83780000.00	AUGUSTA	STATE CAPITOL BLDG
BPI	CPD	11100	3,000,000.00	AUGUSTA	STATE CRIME LAB
BPI	CPL	208590	34500000.00	AUGUSTA	BURTON M. CROSS BUILDING
BPI	CRP		\$63,405.00	AUGUSTA	STATE PLANNING OFFICE GARAGE
BPI	BRR		\$326,570.00	AUGUSTA	DEMAND RESP BLDG & OFFICE FAC
BPI	CTB	116393	9,806,110.00	AUGUSTA	TRANSPORTATION BLDG
BPI	CRR	20160	1,996,005.00	AUGUSTA	STATE POLICE HQ
BPI	CSL	5000	\$118,341.00	AUGUSTA	STORAGE #49
BPI	CFV	3432	\$104,858.00	AUGUSTA	MAGAZINE BLDG. #41
BPI	BPT	18720	\$429,650.00	AUGUSTA	CAMPBELL STORAGE BARN #45
BPI	CGH	58710	8,299,151.00	AUGUSTA	MARQUARDT BLDG
BPI	CKW	0	\$750,000.00	AUGUSTA	SWITCH GEAR BUILDING
BPI	CLJ	11367	7,575,985.00	AUGUSTA	POWER HOUSE-ENGINE & BOILER RM
BPI	BVT	1487	\$105,978.00	AUGUSTA	GATE HOUSE
BPI	BWN		6,165,785.00	AUGUSTA	GREENLAW BLDG
BPI	CJD	6510	\$403,676.00	AUGUSTA	NORTH BURLEIGH HSE
BPI	BVP	13144	\$634,568.00	AUGUSTA	GARAGE & OIL STORAGE BLDG
BPI	BTJ	800	\$295,675.00	AUGUSTA	EMERGENCY GENERATOR BLDG
BPI	CKT	1395	\$88,795.00	AUGUSTA	PAINT SHOP
BPI	BMT	13042	\$978,965.00	AUGUSTA	AUGUSTA DISTRICT CT
BPI	BPD	20960	\$481,700.00	AUGUSTA	BURLEIGH ANNEX
BPI	CTH	5922	\$394,491.00	AUGUSTA	TREASURER'S HOUSE-SCHOOL
BPI	BJW		1,300,000.00	AUGUSTA	EDISON DRIVE KEY BANK BLDG
BPI	CFR	3100	\$326,575.00	AUGUSTA	MACHINERY STORAGE
BPI	CNB	3240	\$359,566.00	AUGUSTA	SOUTH BURLEIGH
BPI	DHF	44000	5,985,670.00	BANGOR	H BLDG OFFICE CENTER
BPI	HTB	3640	\$92,000.00	HALLOWELL	WATER ST SALT BARN
BPI	HVH	20915	1,962,300.00	HALLOWELL	CENTRAL BUILDING
BPI	HTJ	9693	\$840,255.00	HALLOWELL	BAKER BLDG
BPI	HTR	8307	\$225,700.00	HALLOWELL	BOILER HSE
BPI	HWZ	16116	1,936,407.00	HALLOWELL	STEVENS BLDG
BPI	HTD	4980	\$344,050.00	HALLOWELL	ADM BLDG-STAFF APT BLDG
BPI	HWP	2137	\$181,836.00	HALLOWELL	PRERELEASE DIRECTOR'S HSE
BPI	HVV	7665	\$789,676.00	HALLOWELL	FLAGG/DUMMER BLDG
BPI	HVZ	1320	\$53,565.00	HALLOWELL	GARAGE & REPAIR SHOP
BPI	HWB	6216	\$927,655.00	HALLOWELL	HAYDEN BUILDING
BPI	HWJ	2137	\$144,521.00	HALLOWELL	59 WINTHROP ST
BPI	HWX	12948	1,255,319.00	HALLOWELL	REED AUDITORIUM
BPI	HVL	5994	\$488,090.00	HALLOWELL	CLEVELAND BLDG-WINTHROP ST
BPI	HTT	60765	5,590,100.00	HALLOWELL	BUR OF ALCOHOLIC BEVERAGES
BPI	HWT	350	\$60,301.00	HALLOWELL	PUMP HSE
BPI	HVT	3640	\$99,878.00	HALLOWELL	48H FARWELL HSE
BPI	QXB	53040	2,060,000.00	VASSALBORO	MCJA BUILDING B



BPI	QWZ	29112	1,534,700.00	VASSALBORO	MCJA BUILDING A
BPI	QXF	29897	1,534,700.00	VASSALBORO	MCJA BUILDING C
CCC	FQJ	1295	\$55,675.00	CHARLESTON	BLDG# 104 MOTOR POOL
CCC	FST	2425	\$94,962.00	CHARLESTON	BLDG# 111 CENTRAL SUPPLY BLDG
CCC	FTJ		\$752,538.00	CHARLESTON	DORM I
CCC	FSV	5710	\$225,303.00	CHARLESTON	BLDG# 114 MAINTENANCE BLDG
CCC	FQP	5710	\$336,378.00	CHARLESTON	BLDG# 107 RECEIVING
CCC	FQL	5710	\$336,378.00	CHARLESTON	BLDG# 105 DORM II
CCC	FQT	5710	\$336,378.00	CHARLESTON	BLDG# 112 DORM III
CCC	FSZ	1440	\$415,976.00	CHARLESTON	BLDG# 126 SEWAGE TREAT PLANT
CCC	FSH	2470	\$68,125.00	CHARLESTON	BLDG# 210 STORAGE WHSE
CCC	FSR	4179	\$185,012.00	CHARLESTON	BLDG# 108 VISITOR RM & CO2 OFF
CCC	FQZ	3840	\$222,891.00	CHARLESTON	BLDG# 120 LEARNING CTR
CCC	FQX	8824	\$530,953.00	CHARLESTON	BLDG# 119 GYMNASIUM
CCC	FSX	2667	\$82,190.00	CHARLESTON	BLDG# 115 METAL STORAGE BLDG
CCC	FQR	4088	\$248,273.00	CHARLESTON	BLDG# 110 KITCHEN
CCC	FSP	3000	\$594,069.00	CHARLESTON	BLDG# 103 ADM BLDG SEGR BLDG
CCC	FQN	2714	1,020,000.00	CHARLESTON	BLDG# 106 HEATING PLANT
CONADM	BXR		\$92,302.00	AUGUSTA	HOUSE, TRIAL
CONINS	BTP		\$200,109.00	AUGUSTA	ENTOMOLOGICAL LAB
DCF	DZH	6926	1,215,844.72	MACHIASPORT	REC/SEG BLDG #12-DCF
DCF	JZB	3510	\$325,675.00	MACHIASPORT	DORM III BLDG #15
DCF	JZF	2904	\$411,234.00	MACHIASPORT	MESS HALL BLDG #17
DCF	JZH	3273	\$141,235.00	MACHIASPORT	MOTOR POOL/WELDING BLDG #11
DCF	JZV	1995	\$303,125.00	MACHIASPORT	WATER STORAGE BLDG #845
DCF	JZN	1226	\$134,593.00	MACHIASPORT	SEWAGE FACILITY #250
DCF	JZP	1875	\$77,890.00	MACHIASPORT	STORAGE BLDG #300
DCF	JZR	4314	\$319,670.00	MACHIASPORT	TRAINING CTR #8
DCF	JZD	11333	1,007,890.00	MACHIASPORT	DORMS I & II BLDG #18
DCF	JYZ	2400	\$209,870.00	MACHIASPORT	BUILDING #16-CONTROL
DCF	DZF		\$84,131.77	MACHIASPORT	ADMINISTRATION BLDG
DCF	JYT	164	\$58,270.00	MACHIASPORT	424-SEWER LIFT STATION
DCF	JYR	7464	\$572,746.00	MACHIASPORT	12-RECREATION/SEGREGATION
DOTBPL	GYP		\$103,000.00	FREEMPORT	12 DESERT RD
DTH	NJL	9600	\$144,000.00	ROCKLAND	ENGINE HSE-ROCKLAND RAILWAY
DVS	CSD		\$51,525.57	AUGUSTA	STEEL STORAGE BLDG
DVS	BMP	36391	4,128,376.00	AUGUSTA	AUGUSTA ARMORY
DVS	CSF	10390	\$234,575.00	AUGUSTA	STEEL STORAGE BLDG-CP KEYES-30
DVS	DDF		5,665,000.00	BANGOR	ARMED FORCES RES CTR
DVS	DDN	15652	\$972,518.00	BANGOR	B I A ARMORY
DVS	DPZ		\$50,185.00	BATH	STEEL STORAGE BLDG
DVS	FBX		\$69,300.00	CALAIS	STEEL STORAGE BLDG ARMORY
DVS	FGN	30821	2,135,675.00	CARIBOU	GENERAL CARTER ARMORY
DVS	GXR	16230	1,149,766.28	FORT KENT	FORT KENT ARMORY
DVS	HCN	16324	1,107,980.00	GARDINER	ARMORY
DVS	JBH		\$95,033.00	HOULTON	STEEL STORAGE BLDG
DVS	PDL	14358	1,100,169.00	SKOWHEGAN	SKOWHEGAN ARMORY
DVS	RFR	36526	2,438,900.55	WATERVILLE	WATERVILLE ARMORY
EDVIS	HXJ		\$50,200.00	HAMPDEN	VENDING MACHINE BLDG
EUT	DRN		1,500,000.00	BENADICTA	BENEDICTA SCHOOL
EUT	FWV	10138	1,486,000.00	CONNOR TWP	CONNOR CONSOLIDATED SCH
EUT	GGF	6716	2,067,677.90	EDMUNDS TWP	EDMUNDS CONSOLIDATED SCH
EUT	JGZ	4312	1,406,919.15	KINGMAN TWP	KINGMAN ELEM SCHOOL
EUT	JHB	1008	\$73,217.55	KINGMAN TWP	KINGMAN ELEM SCHOOL ANNEX
EUT	NKV		1,030,000.00	ROCKWD STRIP	ROCKWOOD ELEMENTARY SCH
EUT	QHL	12800	\$983,981.25	T17 R04 WELS	PATRICK THERRIAULT SCHOOL
FFC	BCB		\$175,000.00	ALLAGASH	STOREHOUSE

FFC	BBZ	\$97,230.00	ALLAGASH	RANGER HOUSE
FFC	BDV	\$350,000.00	ASHLAND	STOREHOUSE
FFC	BDW	\$800,000.00	ASHLAND	OFFICE
FFC	CMH	\$421,717.00	AUGUSTA	REG HQS & WAREHOUSE
FFC	BPJ	4356 \$122,140.00	AUGUSTA	BUTLER BLDG
FFC	DRR	\$60,795.00	BENTON	RANGER HOUSE
FFC	DWV	\$75,000.00	BROWNVILLE	STOREHOUSE
FFC	DWT	\$75,000.00	BROWNVILLE	RANGER HOUSE
FFC	FFZ	\$61,005.00	CARATUNK	STORE HOUSE
FFC	FFX	\$62,895.00	CARATUNK	RANGER HOUSE
FFC	FWL	\$75,000.00	CHSNCOOK DAM	STOREHSE
FFC	FWJ	\$100,000.00	CHSNCOOK DAM	RANGER HOUSE QRTS
FFC	FXL	\$61,005.00	CORNISH	RANGER HSE
FFC	FYF	\$51,135.00	CUPSUPTIC	STOREHOUSE, FIRE EQUIP BLDG
FFC	FXZ	\$200,000.00	CUPSUPTIC	DISTRICT HQ (220)
FFC	KHG	\$275,000.00	E MILLINOCKT	RANGER STATION
FFC	GLT	\$100,000.00	ENFIELD	RANGER HSE
FFC	GMJ	\$60,895.00	EUSTIS	RANGER HOUSE W/LIVING QTRS
FFC	GML	\$60,795.00	EUSTIS	STOREHOUSE
FFC	HPH	\$119,520.00	GRAY	RANGER HOUSE
FFC	HQB	\$200,000.00	GRAY	STOREHSE, DISTRICT HQ (210)
FFC	HRT	\$250,000.00	GREENVILLE	OFFICE BLDG
FFC	HQR	\$150,000.00	GREENVILLE	BUTLER BLDG
FFC	HXX	\$75,000.00	HANCOCK	RANGER HSE
FFC	JBR	\$80,000.00	ISLAND FALLS	POLE GARAGE BLDG
FFC	JBL	\$150,000.00	ISLAND FALLS	BUTLER BLDG
FFC	JBK	\$100,000.00	ISLAND FALLS	DISTRICT OFFICE
FFC	JDP	\$200,000.00	JEFFERSON	DISTRICT HQ (240)
FFC	JDL	\$87,780.00	JEFFERSON	BUTLER BLDG
FFC	JDX	\$78,960.00	JEFFERSON	RANGER HSE (240)
FFC	JFL	\$100,000.00	JONESBORO	RANGER HSE
FFC	JFR	\$200,000.00	JONESBORO	STOREHSE
FFC	JBN	\$80,000.00	LEE	STORAGE BLDG
FFC	JKH	\$100,000.00	LEE	DISTRICT RANGER OFFICE
FFC	JKL	\$158,000.00	LEE	STOREHSE
FFC	JKJ	\$125,000.00	LEE	POLE BARN
FFC	JRV	\$72,240.00	LYMAN	RANGER HSE
FFC	JSB	\$163,000.00	LYMAN	STOREHOUSE
FFC	KDR	\$90,000.00	MASARDIS	REG RANGER HSE
FFC	FWT	\$175,000.00	MASARDIS	STOREHSE
FFC	KDL	\$80,000.00	MASARDIS	POLE BARN
FFC	KDV	\$200,000.00	MASARDIS	STORE HSE/OFFICE
FFC	KKF	\$75,000.00	MOOSE RIVER	STORE HSE
FFC	KML	\$65,000.00	MUSQUACOOK	RANGER CAMP
FFC	KTT	\$90,825.00	NORRIDGEWOCK	RANGER HSE
FFC	KVP	\$140,000.00	NORRIDGEWOCK	DISTRICT HQ (230)
FFC	KYX	1200 \$75,000.00	OLD TOWN	RANGER HOUSE-DEWITT FLD (100)
FFC	KXT	\$240,120.00	OLD TOWN	AIRCRAFT HANGAR (STORAGE)
FFC	KXV	\$250,000.00	OLD TOWN	BUTLER BLDG (SHOP)
FFC	KYB	\$200,000.00	OLD TOWN	BUTLER OFFICE BLDG HQ
FFC	KXR	\$308,000.00	OLD TOWN	AIRCRAFT HANGAR (MAIN)
FFC	KYN	\$75,000.00	OLD TOWN	POLE BARN (100)
FFC	MKP	\$75,000.00	PITTSTONFARM	RANGER HOUSE
FFC	MKR	\$150,000.00	PITTSTONFARM	STOREHOUSE
FFC	MMJ	\$60,000.00	PORTAGE	POLE BARN
FFC	MMN	\$200,000.00	PORTAGE	STOREHOUSE
FFC	NML	\$85,000.00	S AGATHA	RANGER HOUSE

FFC	NMT		\$100,000.00	S PAMPHILE	RANGER HOUSE
FFC	PFL		\$90,000.00	SNARE BRK	RANGER CAMP
FFC	PKP		\$85,260.00	SQUAW BROOK	HOUSE
FFC	FYL		\$80,000.00	T11 R17 WELS	DIST RANGER HSE
FFC	FYN		\$200,000.00	T11 R17 WELS	STOREHSE/OFFICE
FFC	QRP		\$150,000.00	TOPSFIELD	STOREHOUSE
FFC	QRN		\$100,000.00	TOPSFIELD	STORE HOUSE METAL
FFC	QRB		\$75,000.00	TOPSFIELD	DISTRICT RANGER HOUSE
FFC	RGV		\$62,895.00	WELD	RANGER OFFICE
FFC	RKP		\$100,000.00	WESLEY	STOREHOUSE METAL
FFC	RKN		\$175,000.00	WESLEY	STOREHOUSE
FFC	RLP		\$66,780.00	WEST PARIS	RANGER HSE
FFC	RLR		\$61,215.00	WEST PARIS	STOREHOUSE
FSQ	GZJ	11284	1,810,200.00	FREEPORT	HOUSE I & WORKSHOP
FSQ	GZK	11284	\$175,000.00	FREEPORT	HOUSE II
GOV	CNJ	1972	\$255,293.85	AUGUSTA	STAFF HOUSE
GOV	BNH	8663	\$934,273.20	AUGUSTA	BLAINE HOUSE
IFWADM	BDJ	2116	\$105,384.67	ASHLAND	REGIONAL HQ
IFWADM	BDT	2496	\$51,577.15	ASHLAND	STORAGE BLDG-ADMIN
IFWADM	BTL	2075	\$70,000.00	AUGUSTA	ENGINEERING STORHSE
IFWADM	CST	2620	\$261,662.00	AUGUSTA	STORE HOUSE/GARAGE
IFWADM	BDK		\$105,000.00	CLAYTON LAKE	CLAYTON LAKE HOUSE
IFWADM	GLJ	1792	\$80,588.34	ENFIELD	HEADQUARTERS-ADMIN
IFWADM	HNN	8588	\$371,380.00	GRAY	GRAY HQ-ADMIN
IFWADM	HRJ	5760	\$348,655.70	GREENVILLE	GREENVILLE HQ-HANGAR
IFWADM	HRD	2600	\$83,677.54	GREENVILLE	GREENVILLE HQ GARAGE - ADMIN
IFWADM	HRF	4524	\$198,370.62	GREENVILLE	GREENVILLE HQ-ADMIN
IFWADM	JFC	2496	\$200,000.00	JONESBORO	REGIONAL HQ - ROUTE 1A
IFWADM	JTJ	2112	\$83,028.17	MACHIAS	MACHIAS HQ - ADMIN
IFWADM	JTL	1092	\$70,000.00	MACHIAS	MACHIAS HQ - STORAGE
IFWADM	NZL		\$466,575.00	SIDNEY	LYONS ROAD REGION B HQ
IFWADM	PPG	1440	\$200,000.00	STRONG	STRONG HEADQUARTERS
IFWRES	BWD	2496	\$55,455.00	AUGUSTA	GOVERNOR HILL GARAGE/GRIND RM
IFWRES	BWB	1512	\$76,750.80	AUGUSTA	GOVERNOR HILL CONANT HSE
IFWRES	CDD	2620	\$81,421.00	AUGUSTA	LABORATORY
IFWRES	BWH	6400	\$300,000.00	AUGUSTA	GOVERNOR HILL HATCHERY BLDG
IFWRES	FLJ	1024	\$100,000.00	CASCO	ULTRA VIOLET BLDG & UNITS
IFWRES	FLB	864	\$59,039.40	CASCO	CASCO HATCH GRIND RM&CLD STOR
IFWRES	FLF	4364	\$120,000.00	CASCO	DWELLING DUPLEX
IFWRES	FLD		\$66,000.00	CASCO	CASCO POOL ROOFS
IFWRES	FLH	4680	\$300,000.00	CASCO	HATCHERY DWELLING
IFWRES	GKN	1144	\$70,000.00	EMBDEN	GARAGE/GRINDING RM
IFWRES	GKL	2688	\$106,898.40	EMBDEN	DWELLING/DUPLEX
IFWRES	GKZ	896	\$76,750.80	ENFIELD	HATCHERY DWELLING #1
IFWRES	GLD	3500	\$118,077.75	ENFIELD	HATCHERY FILTER BLDG
IFWRES	GLB	896	\$76,750.80	ENFIELD	HATCHERY DWELLING #3
IFWRES	GKX	7936	\$236,155.50	ENFIELD	HATCHERY BLDG
IFWRES	GLR		\$66,000.00	ENFIELD	POOL ROOFS
IFWRES	HLB	600	\$85,000.00	GR LK STR PT	HOUSE #3
IFWRES	HKT	864	\$65,000.00	GR LK STR PT	#1 SINGLE DWELLING
IFWRES	HLF	2392	\$82,654.95	GR LK STR PT	GARAGE/GRINDING RM
IFWRES	HLD	988	\$57,881.25	GR LK STR PT	FILTER BLDG
IFWRES	HKV		\$70,846.65	GR LK STR PT	#2 SINGLE DWELLING
IFWRES	HLJ	4320	\$177,117.15	GR LK STR PT	HATCHERY BLDG
IFWRES	HPZ	1245	\$55,647.90	GRAY	STOREHSE EQUIPMENT
IFWRES	HNV	1433	\$62,968.50	GRAY	LAB/FEED RM
IFWRES	HMN	3720	\$165,472.65	GRAY	BROODER HSE #1

IFWRES	HPD		\$69,503.70	GRAY	POOL ROOFS
IFWRES	HMP	4680	\$207,937.80	GRAY	BROODER HSE #2
IFWRES	HNZ	1804	\$76,750.80	GRAY	OLD HATCHERY/WORKSHOP #7
IFWRES	HND	1897	\$83,468.70	GRAY	DWELLING/GARAGE
IFWRES	HNX	6216	\$350,000.00	GRAY	MAIN HATCHERY DWELLING
IFWRES	HNB	1664	\$70,290.15	GRAY	DWELLING SINGLE #20
IFWRES	HMZ	1768	\$67,585.35	GRAY	DWELLING SINGLE #17
IFWRES	HMR	4620	\$205,010.40	GRAY	BROODER HSE #3
IFWRES	HPL		\$90,000.00	GRAY	REHAB BLDG
IFWRES	KJN	1536	\$67,360.65	MONTVILLE	FRYE MOUNTAIN STORE HSE
IFWRES	KSJ	1728	\$64,431.15	NEW GLOUCSTR	SINGLE DWELLING #36
IFWRES	KQN	1344	\$76,750.80	NEW GLOUCSTR	HATCHERY BLDG
IFWRES	KSH	1152	\$64,431.15	NEW GLOUCSTR	SINGLE DWELLING #30 MARLENE
IFWRES	KRL		\$425,000.00	NEW GLOUCSTR	NEW GLOUCESTER FISH HATCH
IFWRES	LCJ	1425	\$59,039.40	ORONO	DEER PENS HOUSE
IFWRES	MDD	2464	\$64,431.15	PALERMO	GARAGE/GRINDING ROOM HATCHERY
IFWRES	MCZ	1768	\$76,750.80	PALERMO	DWELLING, SINGLE, BY POOLS
IFWRES	MDB	1794	\$76,750.80	PALERMO	DWELLING, SINGLE, ON HILL
IFWRES	MHL	1054	\$67,540.20	PERKINS TWP	SLTBX HEBBARDHSE SPOWELL WMA
IFWRES	MGZ	1548	\$85,960.35	PERKINS TWP	POWELL HOUSE-STEVE POWELL WMA
IFWRES	MGX	1946	\$78,750.00	PERKINS TWP	PARKRBLNHSE-CUSTD SPOWELL WMA
IFWRES	MHJ	2016	\$61,400.85	PERKINS TWP	REED HOUSE STEVE POWELL WMA
IFWRES	MHT	900	\$65,000.00	PHILLIPS	SINGLE DWELLING
IFWRES	MHR	2496	\$94,462.20	PHILLIPS	GARAGE/HATCHERY
IFWRES	NGL		\$74,970.00	RAYMOND	FISH TRAP FACILITY
IFWRES	NXJ	813	\$70,061.00	SCARBORO	NATURE CTR WILDLIFE MGMT AREA
JUD	CJP	6200	\$480,000.00	AUGUSTA	OFF OF CHF JUST & COMP SVCS
LABCO	BNZ	40530	4,250,000.00	AUGUSTA	20 UNION ST
levins	DGL		\$237,510.00	BANGOR	ENCLOSED POOL STRUCTURE
levins	DGH	21386	2,555,930.00	BANGOR	ELIZABETH LEVINSON CTR
MCC	RNL	7776	1,113,525.00	WINDHAM	MIN SEC DORM #5
MCC	RND	9360	1,252,438.90	WINDHAM	KITCHEN/DINING HALL
MCC	RPD	8200	\$300,000.00	WINDHAM	MAINTENANCE HEADQUARTERS
MCC	RNH	2400	\$80,000.00	WINDHAM	MAINTENANCE PIPE SHOP
MCC	RNT		\$220,000.00	WINDHAM	PIGGERY
MCC	RNR	2584	\$95,000.00	WINDHAM	PASTORAL CARE CENTER
MCC	RNP	1600	\$132,488.53	WINDHAM	OAK HAVEN
MCC	RML	96894	13125000.00	WINDHAM	ADMIN BUILDING
MCC	RNB		\$929,862.83	WINDHAM	INDUSTRIES BLDG
MCC	RMR	2475	\$241,500.00	WINDHAM	BARRACK BLDG #3
MCC	RNN		6,890,625.00	WINDHAM	MULTI-PURPOSE HSING BLDG
MCC	RNZ	256	\$160,000.00	WINDHAM	SEWAGE PUMPING STATION
MCC	RMP	2475	\$241,500.00	WINDHAM	BARRACK BLDG #2
MCC	RPJ	13170	\$600,000.00	WINDHAM	WAREHOUSE & OFFICE
MCC	RMT	2475	\$305,847.83	WINDHAM	BARRACK BLDG #4
MCC	RMN	2475	\$252,000.00	WINDHAM	BARRACK BLDG #1
MCC	RPH	113	\$822,509.10	WINDHAM	TREATMENT PLANT
MCC	RMV		1,113,525.00	WINDHAM	DORM #6
MCJA	RDN	4984	\$484,336.41	WATERVILLE	ADMINISTRATION BLDG-MCJA
MCJA	RDR	2112	\$193,734.33	WATERVILLE	CONFERENCE BLDG
MCJA	RDX	7600	\$500,480.64	WATERVILLE	HENNESSEY HALL
MCJA	RFH	7570	\$371,325.58	WATERVILLE	NICHOLS HALL
MCJA	RFL	14160	\$887,949.31	WATERVILLE	PARKS HALL
MEMA	GCD	180	\$150,828.15	DIXMONT	COMMUNICATIONS BLDG & TWR
MEMA	HVN	135	\$150,828.15	HALLOWELL	COMMUNICATIONS BLDG & TOWER
MEMA	QWV	180	\$150,828.15	VASSALBORO	COMMU BLDG&EQUIP&TWR COOK HILL
MFS	NJK	12960	1,620,000.00	ROCKLAND	ROCKLAND TRAIN STATION

MIL	BGN	6160	\$247,569.00	AUBURN	ORGANIZATIONAL MAINT SHOP 2
MIL	BFP	0	\$178,958.67	AUBURN	BAFFLE RANGE AUBURN TNG SITE
MIL	CPJ	50439	3,526,086.90	AUGUSTA	STATE HEADQUARTERS & WHSE
MIL	BMX	1024	\$78,393.28	AUGUSTA	BARRACKS
MIL	BLP	4782	\$321,928.95	AUGUSTA	ADMIN AND MESS HALL BLDG
MIL	CLT	3600	\$175,888.65	AUGUSTA	RATION BREAKDOWN BLDG
MIL	BVL	23056	\$935,319.00	AUGUSTA	GAR,AMRY,HISMUS-CP KEYES 6A-6B
MIL	CTV	7358	1,162,008.75	AUGUSTA	US PROPERTY & FISCAL OFF BLDG
MIL	CTR	3848	\$283,651.20	AUGUSTA	US PROP & FISCAL OFF PRINT PLT
MIL	CTT	25440	1,145,319.00	AUGUSTA	US PROP & FISCAL OFF WHSE
MIL	BQJ	21215	1,549,453.50	AUGUSTA	COMBINED SUPPORT MAINT SHOP
MIL	BQN	10390	\$208,650.55	AUGUSTA	CONTINGENCY SITE STORAGE BLDG
MIL	BTT	11000	\$894,143.25	AUGUSTA	FACILITIES MGMT OFFICE
MIL	BVH	2460	\$130,793.25	AUGUSTA	FMO WAREHOUSE
MIL	CJT	1350	\$199,185.00	AUGUSTA	OFFICE BUILDING
MIL	BWX	3154	\$270,784.50	AUGUSTA	HANGAR 1957
MIL	CHF	10000	\$287,676.90	AUGUSTA	MOTOR VEHICLE STOR BLDG&WHSE
MIL	CHJ	9540	\$293,884.50	AUGUSTA	MOTOR VEHICLE STORAGE BLDG
MIL	CKR	8900	\$628,719.00	AUGUSTA	ORGANIZATIONAL MAINT SHOP 4
MIL	CKB	1715	\$320,506.20	AUGUSTA	OFFICER QUARTERS 1
MIL	BVV	560	\$248,172.75	AUGUSTA	GENERATOR BLDG
MIL	CJX	2700	\$160,392.75	AUGUSTA	OFFICE BUILDING-CP KEYES-10
MIL	CVX	2316	\$77,989.80	AUGUSTA	WAREHOUSE/SHOP
MIL	CKD	1500	\$99,153.60	AUGUSTA	OFFICES
MIL	CGN	821	\$50,221.50	AUGUSTA	MCPHERSON HALL
MIL	CLL	512	\$138,519.15	AUGUSTA	PUMP HOUSE-CP KEYES
MIL	DKH		\$144,768.75	BANGOR	MOTOR VEHICLE STORAGE BLDG
MIL	DNB		\$113,395.80	BANGOR	STEEL STORAGE BLDG
MIL	DDH	22575	1,379,917.35	BANGOR	ARMORY
MIL	DKR		\$424,803.75	BANGOR	ORGANIZATIONAL MAINT SHOP 3
MIL	DFN		\$988,100.40	BANGOR	COLD STORAGE BLDG
MIL	DLB		1,297,248.75	BANGOR	PINE TREE INN-BILLET
MIL	DDJ		2,347,569.00	BANGOR	ARMY AVIATION SUPPORT FAC
MIL	CZX	64000	6,069,945.00	BANGOR	300-ARMED FORCES RES CTR
MIL	DPJ	17835	1,120,156.80	BATH	BATH ARMORY
MIL	DQP	21287	1,349,312.93	BELFAST	BELFAST ARMORY
MIL	DTB	23056	1,742,633.55	BREWER	BREWER ARMORY
MIL	DTL		\$55,387.50	BREWER	STEEL STORAGE BLDG ARMORY
MIL	DXN	216	\$64,061.19	BRUNSWICK	#9 AMMU BUNKER
MIL	DXV	21680	1,362,784.50	BRUNSWICK	BRUNSWICK ARMORY
MIL	DXL	210	\$62,282.88	BRUNSWICK	#8 AMMU BUNKER
MIL	DZJ		\$179,751.31	BUXTON	BAFFLE RANGE
MIL	DZX	15186	1,144,783.50	CALAIS	CALAIS ARMORY
MIL	FBP	3439	\$165,768.75	CALAIS	MOTOR VEHICLE STORAGE BLDG
MIL	FHD	4236	\$239,064.00	CARIBOU	ORGANIZATIONAL MAINT SHOP 5
MIL	FHB	3500	\$192,806.25	CARIBOU	MOTOR VEHICLE STORAGE BLDG
MIL	FHL		\$88,654.65	CARIBOU	STEEL STORAGE BLDG-ARMORY
MIL	FGV	3500	\$130,809.00	CARIBOU	MAINTENANCE BLDG
MIL	GYD		\$89,761.53	FORT KENT	STEEL STORAGE BLDG
MIL	HBD	22624	1,576,412.25	FT FAIRFIELD	ARMORY
MIL	HBF		\$107,064.30	FT FAIRFIELD	ARMORY STEEL STORAGE BLDG
MIL	HCZ	3439	\$236,722.50	GARDINER	MOTOR VEHICLE STORAGE BLDG
MIL	HDB		\$82,005.00	GARDINER	STEEL STORAGE BLDG-ARMORY
MIL	HCR		\$341,358.17	GARDINER	BAFFLE RANGE TNG SITE
MIL	HGP	0	\$79,685.57	GILEAD	KITCHEN
MIL	HGN		\$231,461.98	GILEAD	EDUCATION BLDG
MIL	HGF	0	\$53,655.91	GILEAD	#5 DORMITORY

MIL	HGD	0	\$53,655.91	GILEAD	#4 DORMITORY
MIL	HGL		\$53,655.91	GILEAD	#8 DORMITORY
MIL	HGH	0	\$53,655.91	GILEAD	#6 DORMITORY
MIL	HGJ		\$53,655.91	GILEAD	#7 DORMITORY
MIL	HGX	0	\$51,100.87	GILEAD	TOILET/SHWR
MIL	HFZ	0	\$53,655.91	GILEAD	#1 DORMITORY
MIL	HFZ	0	\$53,655.91	GILEAD	#2 DORMITORY
MIL	HGB	0	\$53,655.91	GILEAD	#3 DORMITORY
MIL	HZP	17090	1,217,652.45	HOULTON	HOULTON ARMORY
MIL	JLX		\$104,769.00	LEWISTON	STEEL STORAGE BLDG-ARMORY
MIL	JLF	25897	1,784,470.80	LEWISTON	LEWISTON ARMORY
MIL	KWZ		\$70,202.38	NORWAY	STEEL STORAGE BLDG ARMORY
MIL	KWX	15337	1,350,104.43	NORWAY	NORWAY ARMORY
MIL	MSX	61550	3,770,145.75	PORTLAND	STEVENS AVE ARMORY & OMS 1
MIL	MQT	8080	\$261,312.84	PORTLAND	MOTOR VEHICLE STORAGE BLDG
MIL	NCL	18396	1,250,413.50	PRESQUE ISLE	PRESQUE ISLE ARMORY
MIL	NDF		\$78,362.55	PRESQUE ISLE	STEEL STORAGE BLDG-ARMORY
MIL	NTB	28620	2,263,453.50	S PORTLAND	SOUTH PORTLAND ARMORY
MIL	NVP	30073	1,916,277.13	SACO	SACO ARMORY
MIL	NWH	15148	1,088,794.99	SANFORD	SANFORD ARMORY
MIL	PDX		\$57,219.75	SKOWHEGAN	STEEL STOR BLDG-ARMORY
MIL	RLX	14862	1,132,348.83	WESTBROOK	WESTBROOK ARMORY
MIL	RLV	3439	\$217,760.13	WESTBROOK	MOTOR VEHICLE STORAGE BLDG
MR	DZB	2244	\$700,000.00	BOOTHBAY HBR	WELCH HOUSE
MR	DYJ	1596	\$400,000.00	BOOTHBAY HBR	BOILER PUMP BLDG
MR	DYL	1152	\$411,683.00	BOOTHBAY HBR	DOCK HOUSE
MR	DYF	4560	\$646,754.00	BOOTHBAY HBR	BIOCHEMISTRY BLDG
MR	DYV		\$109,200.00	BOOTHBAY HBR	MILLER PORTABLE LAB
MR	DYX	1540	\$115,500.00	BOOTHBAY HBR	STORAGE BARN
MR	DYH	9145	\$900,000.00	BOOTHBAY HBR	BOAT STORAGE SHOP
MR	DYN	7042	\$693,472.50	BOOTHBAY HBR	LIBRARY BUILDING
MR	DYT	7489	\$950,000.00	BOOTHBAY HBR	MAIN OFFICE/LAB
MR	JJZ		\$224,700.07	LAMOINE	WATER QUALITY LAB
MR	NJF	1500	\$86,467.50	ROCKLAND	BOAT REPAIR/DIV OFFICE
MR	QYQ		\$75,000.00	SOUTHPORT	BOATHOUSE
MR	QYC		\$500,000.00	SOUTHPORT	LIGHT TOWER & DWELLING
MR	QYK		\$75,000.00	SOUTHPORT	OIL HOUSE
MR	QYH		2,000,000.00	W BOOTHBAY	WATERFRONT OFFICE BLDG
MR	QYD	25156	5,000,000.00	W BOOTHBAY	LAB/AQUARIUM
MR	QYF	2030	\$331,489.20	W BOOTHBAY	WD EAST PIER AT OFFICE/LAB
MR	QYB	116	\$60,926.25	W BOOTHBAY	GENERATOR SHED
MR	QYJ	2030	\$200,000.00	W BOOTHBAY	WD WEST PIER AT OFFICE/LAB
MSP	QPP	13200	1,357,459.87	THOMASTON	ALL PURPOSE BLDG & GARAGE
MSP	QPT	5120	\$178,304.74	THOMASTON	BUS OFF
MSP	QQJ	600	\$54,723.90	THOMASTON	SAWDUST BLDG & DUST COLLECTOR
MSP	QPN	41800	12339723.00	THOMASTON	ADMIN & CELL BLDG
MSP	QNT	3440	1,854,000.00	THOMASTON	433-RECREATION BLDG
MSP	QNZ	2700	7,273,965.00	THOMASTON	467-COMBINATION BLDG
MSP	QNN	6600	\$150,828.15	THOMASTON	201 MAIN ST
MSP	QPZ	8160	\$180,994.43	THOMASTON	INDUS STOREHSE 1 & APARTMENT
MSP	QQF	20160	2,500,000.00	THOMASTON	PEARSON BLDG-SHOWROOM
MSP	QNR	30000	1,900,421.51	THOMASTON	430-WHSE, SEGREGATION & DORMS
MSP	QPJ	130	\$150,000.00	THOMASTON	473-FREEZER HOUSE
MSP	QNV	280	\$162,894.00	THOMASTON	434-TRANSFORMER HSE
MSP	QQD		\$536,559.19	THOMASTON	MAINTENANCE BLDG
MSP	QPR	3750	1,809,944.33	THOMASTON	BOILER HSE & EMER PWR PLANT
MSP	QNX	2160	\$101,661.00	THOMASTON	466-FIRE HOUSE

MSP	RBN	15500	1,855,533.88	WARREN	BOLDUC HOUSING #1
MSP	RBT	3840	\$296,885.81	WARREN	BOLDUC RECREATION BLDG
MSP	RCN		13965000.00	WARREN	MCI WARREN FAC MAX SEC BLDG
MSP	RBP		1,855,533.88	WARREN	BOLDUC HOUSING #2
MSP	RBL	15500	1,963,683.88	WARREN	BOLDUC ADMIN BLDG
MSP	RBR	3840	\$196,075.95	WARREN	BOLDUC NOVELTY/CLASS/AUTO BODY
MSP	RCP	23104	\$150,000.00	WARREN	PIGGERY
MTS	BKB		\$157,430.00	AUGUSTA	(G) STORAGE SHED 26 TO 47
MTS	BKJ		\$178,675.00	AUGUSTA	55699 (G) WAREHOUSE (NEW)
MTS	BJZ		\$154,945.00	AUGUSTA	(G) STORAGE SHED 1 TO 21
MTS	BJT		\$225,560.00	AUGUSTA	(G) AUG SANITARY BLDG
MTS	BKH		\$120,960.00	AUGUSTA	(G) STORAGE SHED 71 TO 78
MTS	BJX		\$710,900.00	AUGUSTA	55700 NEW SIGN SHOP BLDG
MTS	BKD		\$151,900.00	AUGUSTA	(G) STORAGE SHED 48 TO 60
MTS	BKF		\$152,250.00	AUGUSTA	(G) STORAGE SHED 61 TO 70
MTS	BJR		2,549,802.00	AUGUSTA	55698 CAPITOL ST OFFICE BUILDING
MTS	CXF	4000	\$112,000.00	BAILEYVILLE	55428 5 STALL STORAGE BLDG 1
MTS	CXB	2400	\$112,000.00	BAILEYVILLE	55240 3 STALL SHED
MTS	FGB		1,400,000.00	CARIBOU	55695 (G) NEW GAR BLDG 556
MTS	GBH		\$177,250.00	DIXFIELD	55214 (G) BRIDGE RT 2 BLDG
MTS	GBJ		\$336,000.00	DIXFIELD	55213 (G) MAINT DIV7 GAR BLDG
MTS	GHZ		\$216,780.00	ELLSWORTH	55052 (G) 15 STALL STOR BLDG
MTS	GJB		\$168,000.00	ELLSWORTH	(G) GARAGE
MTS	GJD		\$108,900.00	ELLSWORTH	55053 (G) STORAGE STOCK BLDG
MTS	GXD		\$288,000.00	FORT KENT	55406 6 STALL ST BLD LOT 12
MTS	HMD		\$52,920.00	GRAY	55154 HTR GAR/MT GAR/GR GAR
MTS	HSZ		\$140,000.00	GUILFORD	55263 VEHICLE STORAGE
MTS	HZD		\$288,000.00	HOULTON	55407 6 STALL ST BLD LOT 108
MTS	JGF		\$336,000.00	KENNEBUNK	55048 (G) MAINT STORAGE
MTS	KXH		\$336,000.00	OAKFIELD	55349 6 STALL ST BLDG
MTS	MFD		\$83,913.00	PEMBROKE	55545 (G)
MTS	MXH		\$268,800.00	PRESQUE ISLE	55034 (G) S A 1
MTS	NXQ		\$541,600.00	SCARBORO	55664 SALT SHED SA 11
MTS	PDF		\$80,000.00	SKOWHEGAN	55696 POLE BARN
MTS	NZT		\$150,640.00	SKOWHEGAN	55335 (G) NEW RT 2 BLDG
MTS	QVD		\$105,000.00	TURNER	55225 (G) MTS GARAGE
MTS	RRP		\$800,000.00	YARMOUTH	55409 (G) MAINT STORAGE
MVD	RCL	4160	1,122,449.92	WARREN	LICENSE PLATE SHOP
MYC	NQP	1557	\$445,393.00	S PORTLAND	GROUNDS BLDG
MYC	NSN	16100	5,000,000.00	S PORTLAND	NEW SECURITY BLDG
MYC	NQT	5865	\$678,875.00	S PORTLAND	HAYDEN
MYC	NNX	17594	1,631,410.00	S PORTLAND	CORNISH BLDG - GYMNASIUM
MYC	NQV	2300	\$375,675.00	S PORTLAND	HEATING PLANT
MYC	NNH	8160	\$695,640.00	S PORTLAND	A R GOULD SCHOOL
MYC	NRH	2296	\$63,800.00	S PORTLAND	IMPLEMENT SHED
MYC	NTR	15560	1,765,780.00	S PORTLAND	VOCATIONAL-PURINGTON
MYC	NNJ	37440	2,875,675.00	S PORTLAND	ADMIN BLDG-675 WESTBROOK ST
MYC	NQN	4198	\$150,000.00	S PORTLAND	HOUSE A-HERITAGE HOUSE
MYC	NQS	3614	\$125,000.00	S PORTLAND	HOUSE B
MYC	NPJ	8160	\$696,806.00	S PORTLAND	COTTAGE #6
MYC	NPB	8160	\$818,650.00	S PORTLAND	COTTAGE #2 & GARAGE
MYC	NPF	8160	\$835,525.00	S PORTLAND	COTTAGE #4
MYC	NNZ	8160	\$825,765.00	S PORTLAND	COTTAGE #1
MYC	NPH	8160	\$261,262.00	S PORTLAND	COTTAGE #5
MYC	NPD	8160	\$835,525.00	S PORTLAND	COTTAGE #3
NMJD	FTN		2,700,000.00	CHARLESTON	NO MAINE JUVENILE DETENTN FAC
OCMED	BQD	8157	1,030,747.00	AUGUSTA	CHIEF MEDICAL EXAMINER'S FACIL

PARK	DVY	\$75,000.00	BROOKSVILLE	BARN
PARK	DVN	\$165,375.00	BROOKSVILLE	BARN, ISLAND
PARK	DVR	\$147,000.00	BROOKSVILLE	DWELLING
PARK	DWN	\$100,000.00	BROWNVILLE	KILN, CHARCOAL D
PARK	DWL	\$100,000.00	BROWNVILLE	FURNACE D
PARK	FCR	\$200,000.00	CAMDEN	LATRINE, UPPER CA
PARK	FCN	\$200,000.00	CAMDEN	LATRINE
PARK	FCT	\$100,000.00	CAMDEN	SERVICE BLDG & GARAGE
PARK	FCD	\$75,000.00	CAMDEN	SHELTER
PARK	FCP	\$225,000.00	CAMDEN	LATRINE, LOWER CA
PARK	FCL	\$135,000.00	CAMDEN	HDQRTRS & GARAGE
PARK	FFB	\$200,000.00	CAPE ELIZ	B10 CONCESSION
PARK	FFD	\$200,000.00	CAPE ELIZ	B11 MAINTENANCE BLDG
PARK	FDX	\$125,000.00	CAPE ELIZ	015 TOLL STATION-OFFICE
PARK	FFP	\$270,000.00	CAPE ELIZ	B9 BATHHOUSE
PARK	FFH	\$450,000.00	CAPE ELIZ	B5 LATRINES (2)
PARK	FFF	\$200,000.00	CAPE ELIZ	B4 DWELLING & GARAGE
PARK	FFN	\$175,000.00	CAPE ELIZ	B8 PICNIC SHELTER
PARK	FFJ	\$125,000.00	CAPE ELIZ	B6 SERVICE BLDG
PARK	FJX	\$200,000.00	CASCO	A 23 SERV BLDG & GARAGE
PARK	FKL	\$200,000.00	CASCO	A28 LATRINES, FLUSH (2)
PARK	FKF	\$200,000.00	CASCO	A 31 CONCESSION
PARK	FJV	\$275,000.00	CASCO	A 22 SOUTHERN REGION HQS
PARK	FKR	\$65,000.00	CASCO	A33 LATRINE, CHEMICAL
PARK	FKV	\$65,000.00	CASCO	A35 PICNIC SHELTER
PARK	FKN	\$225,000.00	CASCO	A29 BATHHOUSES (3)
PARK	FJZ	\$100,000.00	CASCO	A 24 GARAGE & STORAGE
PARK	FKD	\$125,000.00	CASCO	A 26 RANGER STA DWELLING
PARK	FKH	\$130,000.00	CASCO	A 32 SHELTERS
PARK	QDH	\$135,500.00	CHURCHILL	RANGER CABIN
PARK	GCP	\$350,000.00	DOVR FOXCRFT	LATRINES (3)
PARK	GDB	\$100,000.00	DOVR FOXCRFT	SERVICE BLDG
PARK	GCJ	\$120,000.00	DOVR FOXCRFT	BATHHOUSE
PARK	GCZ	\$75,000.00	DOVR FOXCRFT	RANGERS RESIDENCE
PARK	GHF	\$125,000.00	EDMUNDS TWP	MGR RESIDENCE
PARK	GGR	\$100,000.00	EDMUNDS TWP	OFFICE/SHOP
PARK	GHD	\$94,500.00	EDMUNDS TWP	RANGERS RESIDENCE
PARK	GGJ	\$115,500.00	EDMUNDS TWP	EQUIPMENT BLDG
PARK	GHH	\$94,500.00	EDMUNDS TWP	SHOWER BLDG
PARK	GXJ	\$250,000.00	FORT KENT	BLOCKHOUSE
PARK	GZB	\$200,000.00	FREEPORT	A 49 LATRINE
PARK	GYV	\$125,000.00	FREEPORT	A 46 CAMP
PARK	FDN	\$65,000.00	FREEPORT	SHELTER
PARK	PCH	200 \$100,000.00	GARFTON NOTCH	CAMP/STORAGE
PARK	HFT	\$195,000.00	GEORGETOWN	C8 LATRINE
PARK	HFL	\$100,000.00	GEORGETOWN	C4 SCHOOL HOUSE D
PARK	HFN	\$200,000.00	GEORGETOWN	C5 BATHHOUSE (GH)
PARK	HDP	\$100,000.00	GEORGETOWN	C11 STORAGE BLDG
PARK	HDL	\$100,000.00	GEORGETOWN	C1 SHELTER (KIDD BEACH)
PARK	HDX	\$175,000.00	GEORGETOWN	C16 HQ & RESIDENCE
PARK	HFJ	\$125,000.00	GEORGETOWN	C3 CHECKING STATION
PARK	HDN	\$200,000.00	GEORGETOWN	C10 SERV BLDG & GARAGE
PARK	HFV	\$300,000.00	GEORGETOWN	C9 BATHHSE/CONCESS (TP)
PARK	HFF	\$100,000.00	GEORGETOWN	C2 CONCESSION (GH)
PARK	HLR	\$125,000.00	GRAFTN NOTCH	HEADQUARTERS
PARK	HLV	\$75,000.00	GRAFTN NOTCH	STORAGE BLDG
PARK	FLL	\$600,000.00	HARPSWELL	ADMIRAL PEARY'S HOUSE



PARK	FLN	\$150,000.00	HARPSWELL	B2 CARETAKERS HOUSE
PARK	FLM	\$100,000.00	HARPSWELL	B1 PIER
PARK	HYJ	\$115,500.00	HERMON	HOUSE
PARK	JCB	\$150,000.00	ISLESBORO	FLOAT & PIER
PARK	JFD	\$55,000.00	JEFFERSON	TOILET BLDG
PARK	JHF	\$150,000.00	KITTERY	B17 LATRINE/STORAGE
PARK	JHD	\$300,000.00	KITTERY	B16 BLOCK HSE
PARK	JHH	\$65,000.00	KITTERY	B19 SHELTER
PARK	PCD	504 \$225,000.00	LAMOINE	TOILET/SHOWER BLDG
PARK	JJN	\$225,000.00	LAMOINE	BARN
PARK	JJT	\$126,000.00	LAMOINE	DWELLING - HDQS
PARK	JMD	\$175,000.00	LIBERTY	C51 HQ, DWELL, SHED & BARN
PARK	JMJ	\$150,000.00	LIBERTY	E55 TOILET BLDG
PARK	JNR	\$450,000.00	LINCOLNVILLE	DINING HALL & KITCHEN VILLAGE
PARK	JMZ	\$63,300.00	LINCOLNVILLE	CABIN STYLE A QTY:6 HABITAT
PARK	JNB	\$63,300.00	LINCOLNVILLE	CABIN STYLE A QTY:6 LEDGES
PARK	JNV	\$75,000.00	LINCOLNVILLE	HILLTOP, VILLAGE
PARK	JNN	\$105,505.00	LINCOLNVILLE	CABIN STYLE C LEDGES
PARK	JPH	\$62,000.00	LINCOLNVILLE	LODGE, HABITAT
PARK	JNP	\$62,000.00	LINCOLNVILLE	CRAFT SHOP OR ART CTR VILLAGE
PARK	JPJ	\$58,000.00	LINCOLNVILLE	LODGE, LEDGES
PARK	JPF	\$62,000.00	LINCOLNVILLE	LODGE, BIG PINE
PARK	JQH	\$75,000.00	LINNEUS	DWELLING R
PARK	JRR	\$175,000.00	LUBEC	DUPLEX RESIDENCE / OFFICE
PARK	KJB	\$120,000.00	MONMOUTH	COTTAGE
PARK	KMR	\$60,000.00	N EDGECOMB	C23 CHECKING STA & STOR BLDG
PARK	KMP	\$275,000.00	N EDGECOMB	C21 BLOCKHOUSE
PARK	KNN	\$175,000.00	NAPLES	A19 LATRINE (CONTROL STA)
PARK	KNR	\$125,000.00	NAPLES	A8 RANGER ST DWELLING
PARK	KMX	\$65,000.00	NAPLES	A15 AMPHITHEATRE
PARK	KMT	\$67,515.00	NAPLES	A10 LATRINE, LOG #2
PARK	KNT	\$170,000.00	NAPLES	A9 ICE & WOOD BLDG & GARAGE
PARK	KMV	\$125,000.00	NAPLES	A14 CHECKING STATION
PARK	KNP	\$175,000.00	NAPLES	A7 HQ & DWELLING
PARK	KNF	\$900,000.00	NAPLES	A11 LATRINES, (4)
PARK	MDZ	\$350,000.00	PEMAQUID	RESTAURANT
PARK	MFB	\$60,000.00	PEMAQUID	SERVICE BUILDING
PARK	MDT	\$500,000.00	PEMAQUID	FORT HOUSE
PARK	MDV	\$350,000.00	PEMAQUID	MUSEUM
PARK	MDX	\$200,000.00	PEMAQUID	PIER
PARK	MDR	\$400,000.00	PEMAQUID	FORT
PARK	MJB	\$100,000.00	PHIPPSBURG	C27 SHOP
PARK	MJD	\$350,000.00	PHIPPSBURG	C28 FORT
PARK	MJL	\$250,000.00	PHIPPSBURG	S31 LATRINES & CHANGE AREA
PARK	MJJ	\$200,000.00	PHIPPSBURG	S24 MATHERSON BLDG / HDQ
PARK	MJZ	\$250,000.00	PITTSTON	C45 COLBURN HOUSE
PARK	MKD	\$75,000.00	PITTSTON	C47 CARRAIGE SHED D
PARK	MKB	\$100,000.00	PITTSTON	C46 BARN D
PARK	MLN	\$200,000.00	POLAND	A38 MENS BATHHOUSE/TOILET
PARK	MLL	\$125,000.00	POLAND	A37 MGRS RESIDENCE
PARK	MLP	\$200,000.00	POLAND	A39 WOMENS BATHHOUSE/TOILET
PARK	MLR	\$100,000.00	POLAND	A40 MAINTENANCE BLDG
PARK	MLJ	\$75,000.00	POLAND	A 43 FIRST AID BLDG
PARK	HYJ	\$150,000.00	PORTLAND	CARE TAKERS HOUSE
PARK	HYJ	\$600,000.00	PORTLAND	ADMIRAL PEARY'S HOUSE
PARK	MVR	\$65,000.00	POWNAL	A5 SHELTER
PARK	MVP	\$350,000.00	POWNAL	A1 HQ, DWELL, SHOP & GARAGE

PARK	MVV		\$125,000.00	POWNAI	CHECKING STATION
PARK	NBT		\$152,107.00	PRESQUE ISLE	HQ & DWELLING
PARK	PBT	580	\$120,000.00	PRESQUE ISLE	TOILET BLDG
PARK	NDM		\$75,000.00	PRESQUE ISLE	SERVICE BLDNG
PARK	PCJ	230	\$125,000.00	PROSPECT	SHOP / OFFICE
PARK	NDV		\$75,000.00	PROSPECT	BARN
PARK	NDZ		\$120,000.00	PROSPECT	DWELLING
PARK	NFH		\$210,000.00	PROSPECT	TORPEDO SHED / VISITORS CTR
PARK	NFL		\$75,000.00	PROSPECT	TOILET BLDG
PARK	NFX		\$550,000.00	RANGELEY	LATRINES (3)
PARK	NFV		\$125,000.00	RANGELEY	CONTROL STATION
PARK	NGF		\$65,000.00	RANGELEY	STORAGE SHED
PARK	NGH		\$100,000.00	RANGELEY	SVC BUILDING
PARK	NGJ		\$75,000.00	RANGELEY	WOOD SHED
PARK	NGB		\$125,000.00	RANGELEY	RANGER STATION
PARK	NGP		\$75,000.00	RICHMOND	C35 MAINTENANCE BUILDING
PARK	NLN		\$115,500.00	ROQUE BLUFFS	HOUSE/OFFICE
PARK	NMR		\$100,000.00	S BERWICK	SHOP/OFFICE
PARK	NTZ		\$100,000.00	SACO	B33 SHOP
PARK	NVB		\$80,000.00	SACO	B34 LATRINES (2)
PARK	NWT		\$150,000.00	SCARBORO	B25 BEACH HOUSE / CHANGE AREA
PARK	NYH		\$150,000.00	SEARSPORT	REG SRVC BLDG
PARK	NZZ		\$80,854.00	SKOWHEGAN	ADLER HOUSE
PARK	PNV		\$150,000.00	STOCKTON SPR	PIER, 2 FLOATS
PARK	PNR		\$176,400.00	STOCKTON SPR	LIGHTKEEPERS RESIDENCE
PARK	QHP		\$82,500.00	T02 R10 WELS	MANAGERS CAMP
PARK	QHZ		\$75,600.00	T03 R14 WELS	RANGER CAMP LOBSTER
PARK	QKP		\$80,955.00	T06 R11 WELS	CABIN UMBAZOOKSUS RD
PARK	QKX		\$90,000.00	T06 R11 WELS	MAINTENANCE BLDG
PARK	QKZ		\$90,000.00	T06 R11 WELS	RANGER STATION - CTB
PARK	QLH		\$75,000.00	T07 R12 WELS	LEASEES RESIDENCE NUGENTS
PARK	QMD		\$100,000.00	T07 R12 WELS	MAIN LODGE NUGENTS
PARK	PCL	300	\$90,000.00	T07 R14 WELS	RANGER STATION
PARK	QNB		\$60,000.00	T08 R13 WELS	CAMP EAGLE 1
PARK	QPV	1,250,000.00	T10 R12 WELS	T10 R12 WELS	CHURCHILL DAM
PARK	QDL		\$150,000.00	T10 R12 WELS	SUPERVISOR RES / HDQS
PARK	QDJ		\$175,500.00	T10 R12 WELS	STOREHOUSE/BARN
PARK	QDX		\$70,000.00	T10 R12 WELS	WORKSHOP / CHURCHILL
PARK	QDF		\$150,000.00	T10 R12 WELS	BOARDING HOUSE
PARK	QDV		\$90,000.00	T11 R13 WELS	CONTROL STATION A UMSASKIS
PARK	QGN		\$90,000.00	T15 R11 WELS	RANGER CAMP - MICHAUD
PARK	QKC	1,300,000.00	T6 R11	T6 R11	DAM
PARK	QKG		\$80,000.00	T6 R11	MAIN LODGE
PARK	HRL		\$90,000.00	TA2 R13&14	JOHNSON CAMP (CROSS)
PARK	HRN		\$150,000.00	TA2 R13&14	REGIONAL SHOP
PARK	HQZ		\$53,130.00	TA2 R13&14	CONTROL STATION
PARK	HQX		\$125,000.00	TA2 R13&14	CAMP ROWELLS COVE & WOOD SHED
PARK	HSD		\$75,000.00	TA2 R13&14	SVC BLDG 2-BAY
PARK	BCC	1,000,000.00	TO7 R13 WELS	TO7 R13 WELS	LOCK DAM
PARK	RHB		\$150,000.00	WELD	RECREATION BUILDING
PARK	RGJ		\$200,000.00	WELD	HQ DWELLING
PARK	RGF		\$125,000.00	WELD	CONTROL STATION WEBB BEACH
PARK	RFZ		\$100,000.00	WELD	4-BAY STORAGE
PARK	RGD		\$200,000.00	WELD	BATHHOUSE, WEBB BEACH
PARK	RHR		\$75,000.00	WELD	WOODSHED
PARK	RGT		\$100,000.00	WELD	RANGER CAMP MT BLUE D
PARK	RGZ		\$100,000.00	WELD	RANGER STATION WEBB BCH

PARK	RGX		\$100,000.00	WELD	RANGER STATION CENTER HILL
PARK	RHD		\$200,000.00	WELD	SERVICE BUILDING
PARK	RGL		\$75,000.00	WELD	LATRINES, CHEM, WEBB BEACH
PARK	RGM		\$275,000.00	WELD	LATRINE / SHOWER COMPLEX
PARK	RHJ		\$100,000.00	WELD	SHELTERS (2) BEACH
PARK	RPX		\$145,000.00	WINSLOW	FORT HALIFAX
POLICE	BBT		\$542,926.12	ALFRED	STATE POLICE BARRACKS
POLICE	GDN		1,273,387.50	DRY MILLS	STATE POLICE BARRACKS
POLICE	GDP		\$132,917.00	E MACHIAS	STATE POLICE BARRACKS
POLICE	JBH	3703	\$329,205.00	HOULTON	STATE POLICE BARRACKS
POLICE	JBM		1,500,000.00	HOULTON	US ROUTE 1 STATE POLICE BARRACKS
POLICE	LYX	3450	\$475,670.00	ORONO	STATE POLICE BARRACKS
POLICE	NTF		\$552,187.12	S PORTLAND	STATE POLICE GARAGE
POLICE	PDT	3450	\$253,455.00	SKOWHEGAN	STATE POLICE BARRACKS
POLICE	QQL	4200	\$362,161.82	THOMASTON	STATE POLICE BARRACKS
PUBLIC	BDH		1,000,000.00	ASHLAND	ASHLAND FACILITY
PUBLIC	DSX		\$484,800.00	BIGELOW	FLAGSTAFF LODGE
PUR	CMN	12852	\$229,198.00	AUGUSTA	ROOT CELLAR (SURPLUS)
RETIRE	BKL		3,313,485.00	AUGUSTA	2 CENTRAL PLAZA
SALMON	BVK	33	\$132,000.00	CHERRYFIELD	RT 193, DEBLOIS RD
SALMON	FVG		\$250,000.00	COLUMBIA FALLS	COLUMBIA FALLS FISH WEIR
SALMON	FVF		\$250,000.00	DENNYVILLE	DENNYVILLE FISH WEIR
SEED	BDN		\$132,759.74	ASHLAND	PACKING SHED
SEED	HYV	2000	\$116,303.83	HOMESTEAD FL	DWELLING
SEED	HYX	6000	\$90,000.00	HOMESTEAD FL	PACKING SHED
SEED	KCZ		\$65,000.00	MASARDIS	GREENHOUSE #2
SEED	KDN	2400	\$65,000.00	MASARDIS	POTATO STORAGE HSE PORTER
SEED	KDD	10500	\$200,000.00	MASARDIS	METAL POTATO WHSE
SEED	KDH	2400	\$305,000.00	MASARDIS	OFFICE & CONTROL STA
SEED	KCT	1000	\$69,457.50	MASARDIS	DWELLING AT SAL-MOR FARM
SEED	KDP	2400	\$65,000.00	MASARDIS	POTATO STORAGE HSE SAL MOR
SEED	KCV	8000	\$100,000.00	MASARDIS	EQUIPMENT/MACHINE SHOP
SEED	KDB		\$64,878.52	MASARDIS	GREENHOUSE #3
VC	CGC	3000	\$400,000.00	AUGUSTA	ADMIN BLDG MT VERNON RD
VC	CVJ	1766	\$100,000.00	AUGUSTA	VET CEMETERY OFFICE & GARAGE#1
VC	CGD	1612	\$262,500.00	AUGUSTA	MAINE VETERANS MEM CEM CHAPEL
WAR	DST	864	\$77,175.00	BIG TWTY TWP	ESTCOURT WARDEN HSE
WAR	GDZ	1800	\$80,000.00	EAGLE LAKE	PILOT DWELLING
WAR	GDT	1900	\$118,077.75	EAGLE LAKE	AIRCRAFT HANGER
WAR	HRR	896	\$80,000.00	GREENVILLE	MECHANIC'S HSE
WAR	KPB	1430	\$70,000.00	NAPLES	NAPLES WARDEN CAMP
WAR	MKJ	720	\$59,039.40	PITTSTONACAD	PITTSTON FARM HOUSE
WAR	PYX		\$80,000.00	T03 R11 WELS	RIPOGENUS PRE FAB RESIDENCE
WAR	QBH	608	\$65,000.00	T05 R20 WELS	BOUNDARY COTTAGE-ST ZACHARIE
WAR	QKR		\$75,000.00	T06 R11 WELS	COFFELOS CAMP - T6 R11
WAR	QFH	720	\$59,039.40	T11 R13 WELS	UMSASKIS LK WARDEN CAMP
WAR	QFL	590	\$65,000.00	T11 R17 WELS	DAAQUAM WARDEN HOUSE #2
WAR	QJB	768	\$65,000.00	T31 MD BPP	WESLEY WARDEN CAMP

## Procedure to Compile Data

The Property Management Division of the Bureau of General Services currently tracks and collects utility data with the use of the “**Utility Analysis Report**”. This report was the result of a program done in 1998, and eliminated a spreadsheet tracking system which was in place.

The Utility Analysis Report keeps track of oil, gas/propane, electric, sewer, water, fire protection, and catch basin use and fees. It has the ability to sort data by window of time, utility compilation, or by building. The data is compiled from utility bills received from the utility companies. This information is then entered in the report and available for recovery. We have compiled information for this report by building for the years 1998 and 1999 and put them in an easy to read format.



FUEL OIL/PROPANE	1998
BUILDING	COST <i>054/gal.</i>
HALLOWELL COMPLEX	\$10,439.22
DISTRICT COURT	\$4,571.34
BLAINE HOUSE	\$2,837.11
SURPLUS PROPERTY	\$939.84
MEDICAL EXAMINERS BUILDING	\$1,793.57
CULTURAL BUILDING	\$1,276.84
DACHSLAGER HOUSE	\$1,550.98
DEP RESPONSE BUILDING	\$1,165.24
AMHI HOUSE #1	\$749.16
AMHI HOUSE #2	\$707.67
AMHI FARM HOUSE	\$1,408.90
TRIAL HOUSE	\$423.94
HUMAN SERVICES	\$32,434.40
AMHI MACHINE SHOP	\$6,361.34
BGS SERVICE BUILDING	\$3,510.22
MCCLEAN HOUSE	\$1,768.28
MERRILL HOUSE	\$1,005.62
NASH SCHOOL	\$2,091.52
MOTOR VEHICLE BUILDING	\$13,306.45
NORTON HOUSE	\$603.27
PUC BUILDING	\$4,068.53
AMHI HEATING PLANT	\$193,212.95
SMITH HOUSE	\$977.99
STAFF HOUSE/GARAGE	\$1,088.52
CRIME LAB	\$5,441.56
STATE OFFICE BUILDING	\$106,468.82
MTA/GANNETT HOUSE	\$1,753.00
STATE POLICE HEADQUARTERS	\$5,439.75
STATE POLICE GARAGE	\$7,191.76
AMHI HOUSE #3	\$738.03
DOT BUILDING	\$21,878.58
ADMIN. BUILDING HALLOWELL	\$2,073.30
BAKER BUILDING	\$2,220.30
CENTRAL HEAT PLANT HALLOWELL	\$21,950.36
LIQUOR/LOTTERY BUILDING	\$6,097.23
CLEVELAND BUILDING	\$3,646.59
PRE-RELEASE GARAGE	\$670.81
59 WINTHROP ST.	\$244.14
89 WINTHROP ST.	\$918.61
REED BUILDING	\$6,307.33
PRE-RELEASE CENTER	\$1,637.89
OAK GROVE COBURN	\$14,785.00
<b>TOTAL COST FOR 1998</b>	<b>\$497,756.47</b>

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ELECTRICAL	1998
BUILDING	COST
HALLOWELL COMPLEX	\$84,185.01
STREET LIGHTS	\$1,962.82
STREET LIGHTS	\$712.34
DISTRICT COURT	\$8,183.48
MEDICAL EXAMINERS BLDG.	\$10,303.75
TRIAL HOUSE	\$972.08
MCLEAN HOUSE	\$1,085.61
MOTOR VEHICLE BUILDING	\$98,139.69
SWITCH GEAR BUILDING	\$661,179.26
CRIME LAB	\$16,836.69
STATE OFFICE BUILDING	\$378,195.80
STATE POLICE HEADQUARTERS	\$14,350.24
LIQUOR/LOTTERY BUILDING	\$42,577.60
OAK GROVE COBURN	\$5,713.87
<b>TOTAL COST FOR 1998</b>	<b>\$1,324,398.24</b>

BUILDING/COMPLEX	1998			1999			1998			1999			1998			1999		
	ELECTRIC	AVG COST PER KWH	TOTAL KWH	ELECTRIC	AVG COST PER KWH	TOTAL KWH	FUEL OIL	COST PER GALLON	TOTAL GALLONS	FUEL OIL	COST PER GALLON	TOTAL GALLONS	PROPANE	COST PER GALLON	TOTAL GALLONS	PROPANE	COST PER GALLON	TOTAL GALLONS
65M Capitol Park																		
66M: Capitol Complex Capitol Complex Parking Lots																		
67M: Hallowell Complex	\$84,310.15	\$0.72	925109	\$105,533.41	\$0.72	1016571												
68M: AMHI Street Lights	\$1,472.90	\$0.07		\$1,896.37	\$0.72													
69M: Capitol Complex Birchwood/Columbia St.																		
70M: Capitol Complex Capitol, Child, Valley & Gage Sts.																		
71M: East Side Hospital St. Parking																		
BMT: Capitol Complex District Court	\$10,911.32	\$0.72	100372	\$13,071.59	\$0.72	103920	\$4,571.34	0.645	7043.5	\$5,346.36	\$0.59	9061						
BNH: Capitol Complex Blaine House							\$2,837.11	0.645	4352.5	\$2,529.26	\$0.59	4296.4						
BPT: AMHI Complex Surplus Property							\$939.84	0.645	1452.5	\$1,189.55	\$0.59	1991.8						
BQ: Capitol Complex Medical Examiner's Bldg.	\$12,364.51	\$0.72	104570	\$14,723.29	\$0.72	113701	\$1,590.37	0.645	2462.6	\$535.20	\$0.59	910.8	\$135.40	\$0.66	\$203.20	\$207.12	\$0.68	\$304.60
BQR: Capitol Complex Cultural Building													\$360.33	\$0.95	\$377.70	\$195.71	\$0.68	\$286.80
BQZ: Capitol Complex Dachslager House							\$1,550.98	0.645	2394.7	\$1,625.95	\$0.59	2777.7						
BRH: AMHI Complex Deering Building																		
BRP: AMHI Complex DEP Response Building							\$973.07	0.645	1546.1	\$1,346.93	\$0.59	2276.4				\$916.27	\$0.68	1339.8
BRT: AMHI Complex Ray Building																		
BRX: AMHI Complex House #1							\$749.16	0.645	1156.8	\$805.08	\$0.59	1367.6						
BRZ: AMHI Complex House #2							\$707.67	0.645	1106.6	\$363.21	\$0.59	607.7						









BUILDING/COMPLEX	1998			1999			1998			1999			1998			1999		
	ELECTRIC	COST PER KWH	TOTAL KWH	ELECTRIC	COST PER KWH	TOTAL KWH	FUEL OIL	COST PER GALLON	TOTAL GALLONS	FUEL OIL	COST PER GALLON	TOTAL GALLONS	PROPANE	COST PER GALLON	TOTAL GALLONS	PROPANE	COST PER GALLON	TOTAL GALLONS
Capitol Complex East me Lab	\$20,277.49	\$0.72	2041209	\$72,528.91	\$0.72	566221				\$5,397.30	\$0.59	9104.3	\$403.39	\$0.68	\$593.20	\$1,626.03	\$0.68	\$2,387.20
CPL: Capitol Complex West State Office Bldg. Heats, SOB, State House, Education and Cultural Bldg. / Electrical was changed over to CKW in 1998	\$378,195.80		3068800				\$89,342.70 \$17,030.47	0.645	1399242.4 41074.61	\$73,627.49	\$0.59	124020	\$95.65		\$50.70	\$3,051.99	\$0.69	\$4,423.40
CRL: Capitol Complex West MTA/Gannett House							\$1,743.40	0.645	2702.96	\$1,956.95	\$0.59	3326.3						
CRR: Capitol Complex East State Police Headquarters	\$14,350.24	\$0.72	162480	\$32,033.97	\$0.72	326280	\$5,439.75	0.645	8389	\$5,826.57	\$0.59	9748.1						
CRX: Capitol Complex East State Polic Garage							\$3,595.88	0.645	5534.3	\$2,375.08	\$0.59	4037						
CSV: AMHI Complex House #3							\$738.03	0.645	1148.3	\$674.02	\$0.59	1120.6						
CTB: Capitol Complex West DOT Building													\$21,878.58	\$0.68	\$32,173.90	\$24,149.17	\$0.68	\$35,367.90
HTD: Hallowell Complex Admin. Building							\$2,073.30	0.645	3224.7	\$1,931.64	\$0.59	3176.82						
HTJ: Hallowell Complex er Building							\$2,220.30	0.645	3511.9	\$110,142.33	\$0.59	6099				\$14.01	\$0.68	\$20.60
HTR: Hallowell Complex Heat Plant feeds: Central Bldg. Erksine , Central Maine Pre-Release & Flagg/Dummer							\$5,219.61 \$16,631.79	0.645 0.414	8501 40113.04	\$21,491.23	\$0.59	35002	\$98.96		\$75.60	\$171.19	\$0.69	\$248.10
HTT: Hallowell Complex Liquor/Lottery Building	\$51,091.60	\$0.72	539550	\$48,979.36	\$0.72	480545	\$6,026.92	0.645	9156.2	\$8,802.41	\$0.59	14972.64	\$70.31	\$0.68	103.4	\$94.01	\$0.69	\$137.10
HVL: Hallowell Complex Cleveland Building							\$3,646.59	0.645	5635.3	\$3,148.58	\$0.59	5343.8						
HVZ: Hallowell Complex Pre-Release Garage							\$670.81	0.645	1030.1	\$664.76	\$0.59	1117.9						
HWJ: Hallowell Complex 59 Winthrop St.							\$244.14	0.645	372.6	\$305.09	\$0.59	514.5						
HWP: Hallowell Complex 89 Winthrop St.							\$918.61	0.645	1421.2	\$815.99	\$0.59	1372.5						
HWX: Hallowell Complex Reed Building							\$6,208.37	0.645	9540.6	\$5,851.46	\$0.59	9902.4	\$98.96		\$75.60			
HWZ: Hallowell Complex Central Maine Pre-Release							\$1,637.89	0.645	2573.4							\$134.00	\$0.69	\$194.20
: Vassalboro Grove Coburn	\$5,713.87		49333	\$1,691.59		6586	\$14,785.51	0.645	22895.3	\$13,230.84	\$0.59	21375.8						



FUEL OIL/PROPANE	1999
BUILDING	COST 0.69/gal.
DISTRICT COURT	\$5,346.36
BLAINE HOUSE	\$2,529.26
SURPLUS PROPERTY	\$1,189.55
MEDICAL EXAMINERS BUILDING	\$742.32
CULTURAL BUILDING	\$195.71
DACHSLAGER HOUSE	\$1,625.95
DEP RESPONSE BUILDING	\$2,263.20
AMHI HOUSE #1	\$805.08
AMHI HOUSE #2	\$363.21
AMHI FARM HOUSE	\$1,206.91
TRIAL HOUSE	\$366.61
HUMAN SERVICES	\$31,496.44
AMHI MACHINE SHOP	\$6,647.32
BGS SERVICE BUILDING	\$3,348.48
MCCLEAN HOUSE	\$1,710.72
MERRILL HOUSE	\$1,077.31
NASH SCHOOL	\$1,824.43
MOTOR VEHICLE BUILDING	\$13,647.06
NORTON HOUSE	\$684.49
PUC BUILDING	\$3,442.80
AMHI HEATING PLANT	\$158,889.29
SMITH HOUSE	\$893.18
STAFF HOUSE/GARAGE	\$798.15
STATE HOUSE	\$1,039.97
CRIME LAB	\$7,023.33
STATE OFFICE BUILDING	\$76,679.48
MTA/GANNETT HOUSE	\$1,956.95
STATE POLICE HEADQUARTERS	\$5,826.57
STATE POLICE GARAGE	\$4,750.16
AMHI HOUSE #3	\$674.02
DOT BUILDING	\$24,149.17
ADMIN. BUILDING HALLOWELL	\$1,931.64
BAKER BUILDING	\$110,156.34
CENTRAL HEAT PLANT HALLOWELL	\$21,662.42
LIQUOR/LOTTERY BUILDING	\$8,896.42
CLEVELAND BUILDING	\$3,148.58
PRE-RELEASE GARAGE	\$664.76
59 WINTHROP ST.	\$305.09
89 WINTHROP ST.	\$815.99
REED BUILDING	\$5,851.46
PRE-RELEASE CENTER	\$1,990.14
OAK GROVE COBURN	\$13,230.84
<b>TOTAL COST FOR 1999</b>	<b>\$531,847.16</b>

ELECTRICAL	1999
BUILDING	COST
HALLOWELL COMPLEX	\$64,361.96
STREET LIGHTS	\$1,896.37
STREET LIGHTS	\$535.66
DISTRICT COURT	\$8,714.39
MEDICAL EXAMINERS BUILDING	\$9,815.53
TRIAL HOUSE	\$684.94
MOTOR VEHICLE BUILDING	\$88,716.24
SWITCH GEAR BUILDING	\$1,202,159.94
CRIME LAB	\$48,352.63
STATE POLICE HEADQUARTERS	\$23,737.97
LIQUOR/LOTTERY BUILDING	\$28,571.36
OAK GROVE COBURN	\$1,691.59
<b>TOTAL COST FOR 1999</b>	<b>\$1,479,238.58</b>

## **Executive Summary Life Cycle Analysis**

Title 5: Administrative Procedures And Services

Part 4: Finance

Chapter 153: Public Improvements

Subchapter 1-A: Energy Conservation in Buildings Act

Sections: 1762,1763,1764

The Energy Conservation In Buildings Act was passed in 1977 by the 108th legislature and gave The Bureau of General Services authorization to implement the Act. Sections 1762, 1763, and 1764 of the Act requires a life cycle analysis be provided for facilities constructed in excess of 5000 square feet and for facilities leased in excess of 10,000 square feet.

The Bureau of General Services with the cooperation of the Department of Education and Department of Energy Resources published rules and procedures to implement the Act. The rules and procedures were promulgated in 1977 and were revised in 1983-1984.

The rules and procedures handbook contains instructions and forms used by architects and engineers in generating the life cycle analysis. Two forms are used and submitted in the analysis: Form "LCA-1" is the Required Energy Items form used to identify the energy usage items and calculate the yearly energy usage of the facility in MBTU per year. Form "LCA-2" is the life cycle cost- benefit analysis form used to calculate the annual cost per square foot of the total system over its projected life, generally 30 years.

The Bureau of General Services requires that the life cycle analysis report be submitted as part of the design development submission. During this phase of the project the design engineer determines which energy efficient systems are applicable to the facility and what systems the budget will support. The architect provides an energy efficient envelope that complies with the Energy Conservation in Buildings Act, which is met by compliance with the ASHRAE energy standard 90.1. The life cycle report defines all of the energy used by the facility as well as the energy losses of the structure. The ASHRAE standard provides minimum energy-efficient requirements for the design and construction of new buildings and their systems, new additions to buildings or renovations to buildings and their systems, as well as new systems and equipment in existing buildings. The standard applies to the envelope of the building and all systems and equipment used in the building. Because buildings and their systems are being designed to meet the ASHRAE standards the owner is getting the most energy efficient building that the budget will allow while at the same time minimizing energy use

Although the Bureau of General Services does require that a life cycle analysis be completed per Title 5, at this time the Bureau does not keep formal records substantiating that the life cycles analysis are always done. The Bureau of General Services will set up a database for gathering and compiling data, and verifying that the life cycle analysis are being completed per Title 5.





## **Appendices**

**Appendix I Life Cycle Analysis**

**Appendix II ASHRAE Standard**

**Appendix III Life Cycle Analysis**  
**Maine Criminal Justice Academy**  
**Madison Elementary School**



# LIFE CYCLE ANALYSIS



STATE OF MAINE

**BUREAU OF GENERAL SERVICES**

Elaine L. Clark, Director      Angus S. King, Jr., Governor

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BUREAU OF GENERAL SERVICES  
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STATE OF MAINE

LIFE CYCLE ANALYSIS

PUBLIC IMPROVEMENTS INCLUDING PUBLIC SCHOOL PROJECTS

Constructed Under the Supervision of

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In Cooperation with the Department of Education

and the Department of Energy Resources

Augusta, Maine

July 1977

Revised - 1983-84



## TABLE OF CONTENTS

### Section I - History - Laws and Rule Making

I.A. Responsibilities and Duties

I.B. History

### Section II - General

II.A. General Instructions

II.B. Life-Cycle Costs

II.C. Energy Performance Index (and Section III)

### Section III - Application

III.A. Introduction

A.1.0 Purpose

A.1.1 Goals

A.1.2 Summary

III.B. Energy Performance Index

B.1.0 Energy Performance Index (EPI)

B.1.1 Introduction

B.1.2 Limits

B.2.0 Required Energy Items (Reporting Format)

III.C Analysis of Energy

C.1.0 Approved Systems

C.2.0 Modified Degree Day Procedure/ASHRAE

C.2.1 Table/Degree Days/Maine

C.3.0 Hand Calculations Method for Life Cycle Analysis

C.3.1 Base Electrical Load

C.3.2 Comfort Conditioning System

C.4.0 Bin Method

C.4.1 Explanation of Forms

C-1 Heating Form

C-2 Cooling Form

C.4.2 Passive Solar Temperature Factor

C.4.3 Heating Energy Form

C.4.4 Cooling Energy Form

C.5.0 Computer Method for Energy Analysis

C.6.0 Passive Solar Energy Gains and Losses

C.7.0 Active Solar Systems





III.D.        Life Cycle Costing/Financial Analysis

- D.1.0        Introduction
- D.2.0        Hand Calculation
- D.3.0        Form/Life Cycle Cost-Benefit Analysis (Reporting Format)
- D.4.0        Interest Table

Appendix A:    Sample Problems

Appendix B:    References

Appendix C:    Heating Form C-1  
                    Cooling Form C-2

User's Guide

	<u>Page #</u>
Who Shall File for Life-Cycle Analysis	1
Codes and Alternate Conformance	2
Maximum Energy Goals	4
Building Energy ( <u>Reporting Format</u> ) Form "ICA-1"	6
Energy Calculations - Modified Degree Day	7
Energy Calculations - Bin Method	12
Energy Calculations - Computer Method	15
Passive Solar Analyzing	16
Active Solar Analyzing	18
Life Cycle Cost ( <u>Reporting Format</u> ) Form "ICA-2"	20



## P R E F A C E

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These rules and procedures have been promulgated by the Bureau of Public Improvements in consultation and coordination with the Department of Education and Cultural Services and the Office of Energy Resources to achieve these purposes.

Leighton Cooney, Director  
Bureau of Public Improvements



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## TABLE OF CONTENTS

### Section I - History - Laws and Rule Making

- I.A. Responsibilities and Duties
- I.B. History

### Section II - General

- II.A. General Instructions
- II.B. Life-Cycle Costs
- II.C. Energy Performance Index (and Section III)

### Section III - Application

#### III.A. Introduction

- A.1.0 Purpose
- A.1.1 Goals
- A.1.2 Summary

#### III.B. Energy Performance Index

- B.1.0 Energy Performance Index (EPI)
- B.1.1 Introduction
- B.1.2 Limits
- B.2.0 Required Energy Items (Reporting Format)

#### III.C Analysis of Energy

- C.1.0 Approved Systems
- C.2.0 Modified Degree Day Procedure/ASHRAE
- C.2.1 Table/Degree Days/Maine
- C.3.0 Hand Calculations Method for Life Cycle Analysis
- C.3.1 Base Electrical Load
- C.3.2 Comfort Conditioning System
- C.4.0 Bin Method
- C.4.1 Explanation of Forms
  - C-1 Heating Form
  - C-2 Cooling Form
- C.4.2 Passive Solar Temperature Factor
- C.4.3 Heating Energy Form
- C.4.4 Cooling Energy Form
- C.5.0 Computer Method for Energy Analysis
- C.6.0 Passive Solar Energy Gains and Losses
- C.7.0 Active Solar Systems





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- D.1.0      Introduction
- D.2.0      Hand Calculation
- D.3.0      Form/Life Cycle Cost-Benefit Analysis (Reporting Format)
- D.4.0      Interest Table

Appendix A:    Sample Problems

Appendix B:    References

Appendix C:    Heating Form C-1  
                    Cooling Form C-2

User's Guide

	<u>Page #</u>
Who Shall File for Life-Cycle Analysis	1
Codes and Alternate Conformance	2
Maximum Energy Goals	4
Building Energy ( <u>Reporting Format</u> ) Form "LCA-1"	6
Energy Calculations - Modified Degree Day	7
Energy Calculations - Bin Method	12
Energy Calculations - Computer Method	15
Passive Solar Analyzing	16
Active Solar Analyzing	18
Life Cycle Cost ( <u>Reporting Format</u> ) Form "LCA-2"	20



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## TABLE OF CONTENTS

### Section I - History - Laws and Rule Making

- I.A. Responsibilities and Duties
- I.B. History

### Section II - General

- II.A. General Instructions
- II.B. Life-Cycle Costs
- II.C. Energy Performance Index (and Section III)

### Section III - Application

#### III.A. Introduction

- A.1.0 Purpose
- A.1.1 Goals
- A.1.2 Summary

#### III.B. Energy Performance Index

- B.1.0 Energy Performance Index (EPI)
- B.1.1 Introduction
- B.1.2 Limits
- B.2.0 Required Energy Items (Reporting Format)

#### III.C Analysis of Energy

- C.1.0 Approved Systems
- C.2.0 Modified Degree Day Procedure/ASHRAE
- C.2.1 Table/Degree Days/Maine
- C.3.0 Hand Calculations Method for Life Cycle Analysis
- C.3.1 Base Electrical Load
- C.3.2 Comfort Conditioning System
- C.4.0 Bin Method
- C.4.1 Explanation of Forms
  - C-1 Heating Form
  - C-2 Cooling Form
- C.4.2 Passive Solar Temperature Factor
- C.4.3 Heating Energy Form
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- D.4.0      Interest Table

Appendix A:    Sample Problems

Appendix B:    References

Appendix C:    Heating Form C-1  
                    Cooling Form C-2

User's Guide

	<u>Page #</u>
Who Shall File for Life-Cycle Analysis	1
Codes and Alternate Conformance	2
Maximum Energy Goals	4
Building Energy ( <u>Reporting Format</u> ) Form "LCA-1"	6
Energy Calculations - Modified Degree Day	7
Energy Calculations - Bin Method	12
Energy Calculations - Computer Method	15
Passive Solar Analyzing	16
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Life Cycle Cost ( <u>Reporting Format</u> ) Form "LCA-2"	20



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Leighton Cooney, Director  
Bureau of Public Improvements



## Section I

### History - Laws and Rule Making

#### I.A. Responsibilities and Duties

The law requires that there shall be no public improvement constructed in excess of 5,000 square feet, leased in excess of 10,000 square feet without verification of life cycle costs that will meet or exceed the energy efficiency standards promulgated by the Office of Energy Resources under Title 10, Chapter 214, and the Bureau of Public Improvements under Title 5, Section 1764.

The Bureau of Public Improvements shall review and approve life cycle costs for the following:

1. All state government construction work regardless of source of funding.
2. All state government leased space where more than 5,000 square feet of combined leased area occurs in one building, life cycle costs shall comply.

#### I.B. History

The 108th Legislature required that life cycle costing become a part of public improvement projects to assure that energy considerations, first cost, operating costs and long term costs are consistently analyzed and approved by the Bureau of Public Improvements. The law was later amended to include compliance with energy efficiency building performance standards (building envelope energy loss) promulgated by the Office of Energy Resources.

Life cycle energy evaluation required by the Bureau of Public Improvements addresses the total energy used by a facility (envelope, equipment, process, etc.). Because of Maine's climatic economic and social conditions, the efficient use of energy in all forms must be promoted in all new, renovated and leased buildings. Energy efficient buildings should be less expensive to own and operate over its expected life.

## Section II

### General

#### II.A. General Instructions

1. All public improvement projects must have life cycle analysis developed by the Architect and/or Engineer to select the best alternative total energy system that will serve the project needs at the minimum energy cost over the project life.
2. Designer has the option of selecting designated hand calculation method or computer system to provide the desired comparative information. In the event the designer desires to use other alternative system(s), he must secure prior approval from the Bureau of Public Improvements.
3. Copies of sample calculations and base data tables showing typical comparative information can be obtained by request from the B.P.I.

#### II.B. Life Cycle Costs

1. Other factors to be considered influencing life cycle costs shall include, but not be limited to:
  - A. Design Code for the State of Maine: As a minimum, energy conservation standards as called for in "The BOCA Basic Energy Conservation Code" or its approved successor. This code is a part of the BOCA Code or its approved successor which is the design code for the State of Maine and implements the recommendations contained in the ASHRAE, Energy Conservation Standards.
  - B. Maine Office of Energy Resources: As a minimum, the design shall meet the building performance standard set for in O.E.R. - "Maine Energy Conservation Building Standards".
  - C. For these studies, the useful life of the building structure will be assumed at 30 years unless otherwise approved by the Bureau of Public Improvements and/or the Department of Education. The study will reflect the parts of the building such as roof, mechanical and electrical system, exterior finishes and other components as applicable with the appropriate life in accordance with industry standards.
2. Alternate Conformance: All public improvements under 5,000 square feet and leased space under 5,000 square feet, if certified to B.P.I. that construction is in conformance with the "Manual of Accepted Practices" issued by the Maine Office of Energy Resources, will be acceptable in lieu of life cycle analysis.

#### II.C. Energy Performance Index

See Section III.B. for energy performance indexes to be used in the evaluation of design proposals submitted for public improvement and for public school construction.

## Section III

### Application

#### III.A. Introduction

##### The Maine Life Cycle Energy Evaluation Technique

A.1.0 Purpose: The procedures have been developed in response to actions taken by the Maine Legislature requiring the life cycle costing become a part of the evaluation process for public improvements to assure that energy considerations, first cost, operating costs and long term costs are consistently analyzed as public improvement projects are being considered for approval.

A.1.1 Goals: It is readily recognized that the life long energy usage of a building is largely determined by the original design and selection of detail equipment. Once a building has been erected, it becomes very expensive and difficult to modify construction to accommodate more energy conservation equipment.

1. Energy Performance Index (EPI): Target goals have been established to limit total building energy usage.

2. Analysis of Energy: The Maine Life Cycle Energy Evaluation Technique Program is intended to help the designer quickly evaluate his alternative designs to determine those which may save the most energy.

3. Life Cycle Economic Analysis: An evaluation format to be used in the final design selection. This procedure identifies the initial capital cost and the owning cost (energy cost and equipment maintenance cost) to determine the life cycle costs throughout the project life.

A.1.2 Summary: The purpose of the design standards is not to limit architectural freedom, but is intended to create an awareness that all designs must effectively minimize the use of energy.

1. Hand Calculations: It is anticipated that the hand calculation method of analyzing the technical portion and the hand calculation method of financial analysis for life cycle costing will be adequate for most of the anticipated construction in the area of public education and state facilities.

2. Computer Models: Computer programming for the analysis of both or either the technical or financial portions of the study will be acceptable to the Bureau if the Base Model meets the following requirements:

- A. The Bureau has on file the operation manual of the program.

- B. Base Model to be evaluated by B.P.I. or certified by a third party professional acceptable to B.P.I. and the applicant.



C. Submits unmodified base data runs of the analysis.

3. Submissions: The following is the minimum requirements for submission of life cycle analysis to B.P.I.:

A. Building Energy Form "LCA-1"

B. Life Cycle Cost Form "LCA-2"

C. Solar Analysis (if applicable)

D. All backup calculations and data for all the above submitted energy and cost analysis.

E. Preparers information to include name, affiliation, telephone number, registration (stamp or number), and date.

III.B. Energy Performance Index (EPI)

B.1.0 Energy Performance Index (EPI)

B.1.1 Introduction: The goal of this program is to encourage the development of the most energy conservation building that is consistent with current standards, codes and practices for the buildings intended use.

B.1.2 Limits: In no instance will total building designed energy consumption exceed the following standards:

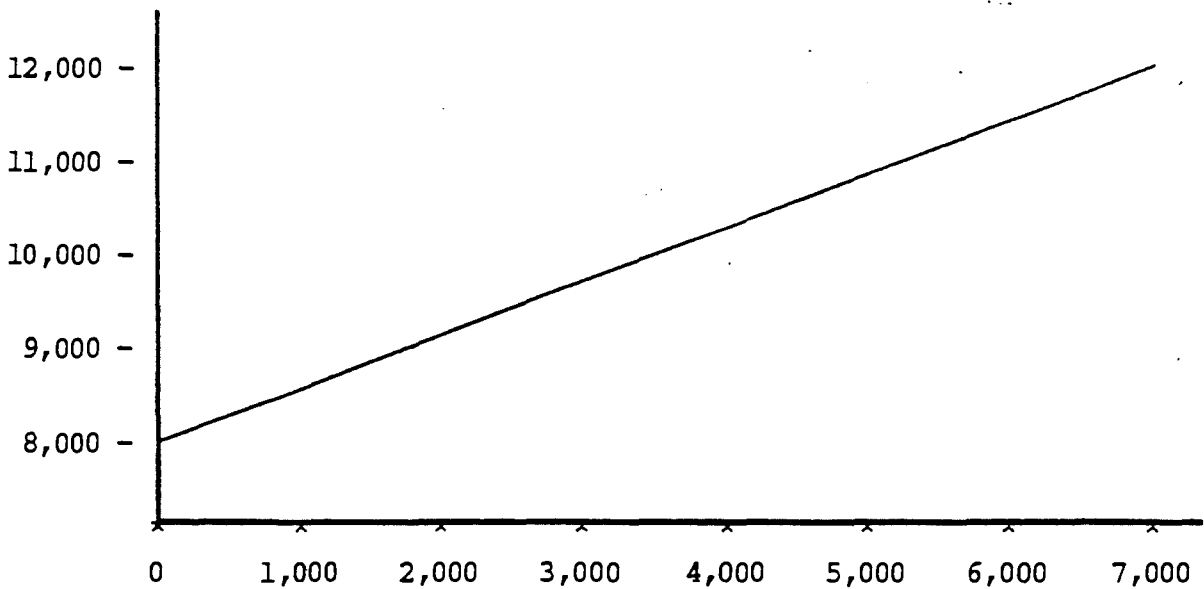
1. Maximum Energy Goals: Goals are established from recent construction experience utilizing passive and active solar, energy recovery, alternate energy use and other innovated techniques.

A. Elementary and Junior High Schools	40,000 BTU/s.f.
B. High Schools	45,000 BTU/s.f.
C. Vocational Technical Schools	50,000 BTU/s.f.
D. Office Buildings (12 month use)	
1) New Construction	65,000 BTU/s.f.
2) New Leased/Renovated	70,000 BTU/s.f.
E. Dormitories (9 month use)	
1) Regular	45,000 BTU/s.f.
2) Apartment Style	46,000 BTU/s.f.

B. The above listed BTU/s.f. limits are based on 100% system and equipment efficiency and shall be increased by an appropriate factor representing seasonal efficiency of the selected system and equipment to reflect estimated annual fuel use.

C. Values based on 8,000 degree days. Additional allowances will be allowed in locations where total degree days exceed 8,000 degree days according to the following table or graph below:

8,000 Degree Days	0
9,000 Degree Days	1,750 BTU/s.f.
10,000 Degree Days	3,500 BTU/s.f.
11,000 Degree Days	5,250 BTU/s.f.
12,000 Degree Days	7,000 BTU/s.f.



D. The Director, upon staff recommendations, may increase the above energy goals by 10% for historic buildings, hardship occurrences, facility reuse and other non-reoccurring and unique circumstances.

FORM "LCA-1"

B.2.0 Required Energy Items (Reporting Format)

State of Maine

Energy Conservation in Buildings

Building Name/Use \_\_\_\_\_

Building I.D. \_\_\_\_\_ Location \_\_\_\_\_

Date \_\_\_\_\_

1. Average Number of Occupants \_\_\_\_\_

2. Degree Days \_\_\_\_\_/year

3. Design Temperature \_\_\_\_\_

4. Building Area \_\_\_\_\_

Energy/Point of Use Per Year

5. Lighting \_\_\_\_\_ Base Units #1 \_\_\_\_\_ MBTU

6. Heating \_\_\_\_\_ " \_\_\_\_\_ MBTU

7. Cooling \_\_\_\_\_ " \_\_\_\_\_ MBTU

8. Water Heating \_\_\_\_\_ " \_\_\_\_\_ MBTU

9. Equipment \_\_\_\_\_ " \_\_\_\_\_ MBTU

10. Other \_\_\_\_\_ " \_\_\_\_\_ MBTU

11. Total Energy \_\_\_\_\_ " \_\_\_\_\_ MBTU

12. Yearly Energy Usage  
Per Building Square  
Foot Area \_\_\_\_\_

#1 Base Units of Energy - KWH of electricity, gallons of oil (#2, #4, #5 or #6), tons of coal, etc. shall be evaluated a N = 100% to determine annual energy consumption (BTU/square foot).

Note: Apply factors on Page 8 "C<sub>d</sub>" and "N" to develop projected fuel usage (gallons of oil, tons of coal, etc.) to report on Form "LCA-2".

### III.C. Analysis of Energy

C.1.0 Approved Systems: The ASHRAE's Modified Degree Day Procedure will be used in analyzing the simple heating and ventilation systems. For those systems which involve computing cooling and night setback loads, internal and solar gains, the bin method or computer modeling is required.

Both methods are included in this document (see C.2.0 and C.4.0).

A sample is included in the Appendix A of the Modified Degree Day calculation.

C.2.0 Modified Degree Day Procedure: (Chapter 43, ASHRAE 1980 System Handbook) The general equation for calculating the probable energy consumption by the modified degree day method is as follows:

$$E = \frac{(H_1 \times D \times 24)}{(\Delta t \times N \times V)} \quad (C_d)$$

where

- E = Fuel or energy consumption for the estimate period.
- H<sub>1</sub> = Design heat loss, including infiltration, BTU per hour.
- D = Number of 65° F degree days for the estimate period.
- t = Design temperature difference, Fahrenheit.
- N = Correction factor for equipment efficiency.
- V = Heating value of fuel, consistent with H<sub>1</sub> and E.
- C<sub>d</sub> = Interim correction factor for heating effect vs. degree days.

Values of heating load. H<sub>1</sub> must be determined for the particular building for which the estimate is being made. It must account for size, building materials, architectural features, use, and climatic conditions. Table 1 gives values for C<sub>d</sub> and N.

Table 1

Correction Factor Vs. Degree Days Interim  
Factor  $C_d$

Design Degree Days	6,000	7,000	8,000	9,000	10,000
Factor $C_d$	.60	.64	.68	.71	.71

The correction factor N is empirical and should not be confused with any ratings for "seasonal efficiency". The following values shall be used:

- N = 1 - Electric Resistance Heating
- N = .75 - Pressurized Gas Fired Boiler or System
- N = .70 - Oil Fired Boiler with Air Atomizing or Flame Retention Burner
- N = .65 - Atmospheric Gas Fired System
- N = .50 - Coal Fired Boiler Conventional Stoker
- N = .65 - Coal Fired Boiler Pressurized Forced Draft Firing System
- N = .55 - Old Oil Fired Systems

Note: If other values are to be used, submit verification and backup data.

C.2.1 Table/Degree Days/Maine

Maine

Monthly and Annual Heating Degree Day Normals

Station	July	Aug.	Sept	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Annual
Bar Harbor	47	49	193	459	741	1153	1280	1137	998	669	381	133	7240
Caribou	84	122	327	657	1008	1516	1683	1459	1283	849	474	170	9632
Eastport	117	109	246	499	762	1175	1314	1162	1048	744	499	258	7833
Farmington	40	75	239	555	891	1361	1500	1296	1107	705	364	104	8237
Gardiner	29	51	204	502	816	1274	1414	1232	1060	681	364	99	7726
Greenville	86	119	321	639	978	1460	1628	1417	1249	837	481	172	9387
Houlton	61	91	271	592	936	1426	1584	1369	1181	780	409	127	8827
Lewiston	12	33	163	456	798	1234	1383	1196	1035	657	331	76	7374
Madison	29	59	214	530	864	1339	1482	1285	1101	702	370	96	8071
Millinocket	38	65	245	580	912	1398	1553	1352	1147	741	398	104	8533
Old Town FAA Airport	53	83	273	595	900	1380	1531	1347	1159	756	431	140	8648
Portland	27	55	200	493	792	1218	1349	1179	1029	669	381	106	7498
Presque Isle	66	98	283	614	969	1473	1624	1408	1231	804	431	134	9135
Ripogenus Dam	76	106	277	605	957	1466	1637	1450	1265	831	471	147	9288
Rockland	41	57	195	481	765	1175	1293	1142	1008	672	397	127	7353
Rumford Power Plant	36	64	216	521	858	1305	1438	1246	1076	693	361	98	7912
Waterville Pump Station	20	32	181	477	810	1277	1417	1224	1039	642	319	75	7513
Woodland	37	82	218	539	846	1305	1454	1294	1107	723	397	119	8121

### C.3.0 Hand Calculations Method for Life Cycle Analysis

DATE \_\_\_\_\_ ARCHITECT \_\_\_\_\_  
PROJECT \_\_\_\_\_ ENGINEER \_\_\_\_\_  
LOCATION \_\_\_\_\_ DATA OBTAINED BY: \_\_\_\_\_

Energy needs for buildings can be divided into three basic categories: (1) Base Electrical Loads; (2) Comfort Conditioning System; (3) Domestic Hot Water. The calculation sequence has been segmented accordingly. The analysis must start with an understanding of the proposed building usage and will require detailed data on the sub-components of the electrical and HVAC system. This detailed data should be available as a result of (1) preliminary design and (2) analysis of methods that will optimize energy conservation within the building.

C.3.1 Base Electrical Load: This section analyzes the annual electrical energy consumption due to the lighting system, HVAC system, (fans, pumps, etc.), exhaust fans, kitchens, shops, elevators, and other specialized operations. A "guideline" comment follows each topic area to clarify the type of data sought. The diversity factor represents the fact that lighting, for instance, is rarely all on or all off.

#### 1. Lights, Miscellaneous Power Usages:

- A. KW connected \_\_\_\_\_ KW
- B. Usage \_\_\_\_\_ hrs./day x \_\_\_\_\_ days/week  
\_\_\_\_\_ hours/month 12 month/year = \_\_\_\_\_ hours/year
- C. Diversity \_\_\_\_\_ %
- D. \_\_\_\_\_ KW x \_\_\_\_\_ Diversity = \_\_\_\_\_ KW
- E. \_\_\_\_\_ KW x \_\_\_\_\_ hours/year = \_\_\_\_\_ KWH/year

#### Guidelines:

- 1) Example: 8 hours/day + 4 hours for lunch and cleanup = 12 hours/day.
- 2) Weeks/Month = 4.3
- 3) 80 - 100% Diversity

2. Air Distribution System Electrical Usages (Heating, Cooling and Ventilation):

- A. HP connected \_\_\_\_\_ HP
- B.  $746 \text{ KW/HP} \times \text{_____ HP} = \text{_____ KW}$   
Efficiency \_\_\_\_\_ %
- C. Diversity \_\_\_\_\_ %
- D. Occupied \_\_\_\_\_ hours/month
- E. Unoccupied \_\_\_\_\_ hours/month
- F. \_\_\_\_\_ KW x \_\_\_\_\_ Diversity = \_\_\_\_\_ KW
- G. \_\_\_\_\_ KW x \_\_\_\_\_ hours/month = \_\_\_\_\_ KWH/month
- H. \_\_\_\_\_ KWH/month x \_\_\_\_\_ month/year = \_\_\_\_\_ KWH/year

Guidelines:

- 1) Hours Operation: 400 hours/month or 4000 to 4800 hours/annum.
- 2) 80% Diversity
- 3) Will system operate during unoccupied hours?

3. Exhaust Fan System Usages:

- A. HP connected \_\_\_\_\_ HP
- B.  $.746 \text{ KW/HP} \times \text{_____ HP} = \text{_____ KW}$   
Efficiency \_\_\_\_\_ %
- C. Occupied \_\_\_\_\_ hours/month
- D. Diversity \_\_\_\_\_ %
- E. Usage: 25% x Occupied Hours = \_\_\_\_\_ hours/month
- F. \_\_\_\_\_ KW x \_\_\_\_\_ Diversity = \_\_\_\_\_ KW
- G. \_\_\_\_\_ KW x \_\_\_\_\_ hours/month = \_\_\_\_\_ KWH/month
- H. \_\_\_\_\_ KWH/month x \_\_\_\_\_ month/year = \_\_\_\_\_ KWH/year

Guidelines:

- 1) Hours Operation: 300 hours/month - 3600 to 4000 hours/annum.
- 2) 100% Diversity

3) Will system operate during unoccupied hours?

4. Elevator Usages (if required):

- A. HP connected \_\_\_\_\_
- B. .746 KW/HP x \_\_\_\_\_ HP = \_\_\_\_\_ KW  
Efficiency \_\_\_\_\_ %
- C. Occupied \_\_\_\_\_ hours/month
- D. Diversity \_\_\_\_\_ %
- E. Usage: 25% x occupied hours = \_\_\_\_\_ hours/month
- F. \_\_\_\_\_ KW x \_\_\_\_\_ Diversity = \_\_\_\_\_ KW
- G. \_\_\_\_\_ KW x \_\_\_\_\_ hours/month = \_\_\_\_\_ KWH/month
- H. \_\_\_\_\_ KWH/month x \_\_\_\_\_ month/year = \_\_\_\_\_ KWH/year

Guidelines:

- 1) 50% Diversity for Office Buildings
- 2) 25% Usage for Office Buildings

C.3.2 Comfort Conditioning System: Similar to the previous section, this section emphasizes the derivation of the annual energy consumption for the HVAC system for space heating and cooling. But since heating and cooling is functionally related to ambient environment, a different technique must be utilized to derive annual energy temperature differential between inside and ambient, a separate calculation using "bin" method is necessary. The method statistically arranges weather data in "bins" by day period according to 5° F increments and numbers of hours per year.

1. Building Load Information:

- A. Winter Heating - Outside Design \_\_\_\_\_ F<sup>o</sup>D.B.  
  Inside Design \_\_\_\_\_ F<sup>o</sup>D.B.
- Heat Loss \_\_\_\_\_ BTUH
- Ventilation
- \_\_\_\_\_ CFM x 1.08 x \_\_\_\_\_ F<sup>o</sup>TD = \_\_\_\_\_ BTUH
- Total Heat Loss \_\_\_\_\_ BTUH



B. Summer Cooling - Outside Design  $\underline{\hspace{2cm}}$  °F.D.B.  $\underline{\hspace{2cm}}$  °F.W.B.  
 Inside Design  $\underline{\hspace{2cm}}$  °F.D.B.

Solar Heat Gain	$\underline{\hspace{2cm}}$	BTUH
Transmission	$\underline{\hspace{2cm}}$	BTUH
Motors	$\underline{\hspace{2cm}}$	BTUH
Lights	$\underline{\hspace{2cm}}$	BTUH
People	$\underline{\hspace{2cm}}$	BTUH
Other Heat Sources	$\underline{\hspace{2cm}}$	BTUH
Ventilation		
$\underline{\hspace{2cm}}$ CFM x 4.5 x $\underline{\hspace{2cm}}$ Ah**	$\underline{\hspace{2cm}}$	BTUH
Total Heat Gain	$\underline{\hspace{2cm}}$	BTUH

\*Notes: This load information should include both sensible and latent heat requirements.

\*\*AH = Enthalpy at Saturation BTU Per Pound of Dry Air

C.4.0 Bin Method: See Chapter 43, ASHRAE, 1981 Systems Handbook for General Reference

C.4.1 Explanation of Forms

- C-1 Heating Form (see Appendix C)
- C-2 Cooling Form (see Appendix C)

Column 1 Three eight hour periods during the day.

Column 2 Average monthly temperature from weather data.

Column 3 Temperature difference equals temperature inside minus (AVG) temperature outside.

Column 4 "U" value times area equals heat gain or heat loss per degree of temperature, including infiltration & ventilation or greater of the two.

Column 5 Column 3 times Column 4

Column 6 Hours listed in the weather data of each "bin" of temperature.

Column 7 Column 5 times Column 6

Column 8/8a Peak internal load in MBTU: Peak solar load in MBTU.

Column 9/9a Annual Factor in a percentage of the time that the internal or solar loads occur, and are useable. (Note: A percentage of the available internal & solar gain must be rejected during day occupied cycle.)

Column 10 Estimated hours of internal load.

Column 10a Same as Column 6. (For C-2 Cooling Form Only)

Column 11 Column 8 x 9 x 10..

Column 11a Column 8a x 9a (For C-1 Heating Form Only)

Column 12 Column 7 + 11 + 11a.

#### C.4.2 Passive Solar

Values for  $\Delta t$  in solar analysis shall be determined using the three eight hour periods above.

#### C.4.3 Heating Energy

##### 1. Electric Consumption

A. \_\_\_\_\_ MBTU/YR. = \_\_\_\_\_ MBTU/KWH = \_\_\_\_\_ KWH/YR.

##### Guidelines:

1) Resistance Heating 3.413 MBTU/KWH

##### 2. Oil Consumption

A. \_\_\_\_\_ MBTU/YR. X MBTU/GAL. = \_\_\_\_\_ GAL/YR.  
Boiler Efficiency

##### Guidelines:

1) #2 oil = 140 MBTU/GAL.

##### 3. Energy Performance Index (Annual)

##### A. Electrical Heating Consumption

1. \_\_\_\_\_ KW/HR : \_\_\_\_\_ Gross Sq. Ft. = \_\_\_\_\_ KWH/SQ.FT.

2. \_\_\_\_\_ KWH/SQ. FT. X 3.413 MBTU/KWH = \_\_\_\_\_ MBTU/SQ. FT.

##### B. Heating Consumption (Oil Fired)

1. \_\_\_\_\_ GAL. : X \_\_\_\_\_ Gross Sq. Ft. = \_\_\_\_\_ GAL/SQ. FT.

2. \_\_\_\_\_ KWH/SQ. FT. X \_\_\_\_\_ MBTU/GAL. = \_\_\_\_\_ MBTU/SQ. FT.

C.4.4 COOLING ENERGY

1. Electrical Consumption

A. \_\_\_\_\_ MBTU/YR : 12 MBTU/TON = \_\_\_\_\_ TON HR/YR.

B. \_\_\_\_\_ TON/HR/YR X \_\_\_\_\_ KW/TON = \_\_\_\_\_ KWH/YR.

Guidelines:

- 1) Reciprocating Equipment 1.2 to 1.7 KW/TON
- 2) Centrifugal Equipment .75 to 1.1 KW/TON

2. Absorption System Consumption (Oil Fired)

A. \_\_\_\_\_ MBTU/YR. : 12 MBTU/TON = \_\_\_\_\_ TON/HR/YR.

B. \_\_\_\_\_ TON/HR/YR. x \_\_\_\_\_ GAL/TON = \_\_\_\_\_ GAL/YR.

Guidlelines:

- 1) High Pressure Absorption .1 GAL/TON
- 2) Low Pressure Absorption .13 GAL/TON

3. Energy Performance Index (Annual)

A. Electric Cooling Consumption

1. \_\_\_\_\_ KWH : \_\_\_\_\_ Gross Sq. Ft. = \_\_\_\_\_ KWH/SQ./FT.

2. \_\_\_\_\_ KWH/SQ. FT. x 3,413 MBTU/KWH = \_\_\_\_\_ MBTU/Sq. Ft.

B. Absorption System Consumption (Oil Fired)\*

1. \_\_\_\_\_ GAL x 140MBTU = \_\_\_\_\_ MBTU/HR.

2. \_\_\_\_\_ MBTU : \_\_\_\_\_ Gross Sq. Ft. = \_\_\_\_\_ MBTU/SQ. FT.

\*Absorption system run by "waste" heat or by solar heat should not be included.

Guidelines:

1) Electrical Cost:

$$\text{_____ KWH/YR} \times \text{_____ cents/KWH} = \$ \text{_____ /YR}$$

2) Fossil Fuel Cost:

a. Fuel Oil Cost: \_\_\_\_\_ GAL/YR x \_\_\_\_\_ CENTS/GAL  
= \$ \_\_\_\_\_ /YR

b. Coal: \_\_\_\_\_ TON COAL/YR x \$ \_\_\_\_\_ /TON =  
\$ \_\_\_\_\_ /YR

c. Steam: \_\_\_\_\_ POUNDS OF STEAM/YR x \_\_\_\_\_  
CENTS/POUND = \$ \_\_\_\_\_ /YR

C.5.0 Computer Method for Energy Analysis

1. Computer programs that provide a simulated analysis of a facility for a complete year of usage will be considered by B.P.I. The computer base model will be evaluated by B.P.I. or certified by a third party professional acceptable to B.P.I. and the applicant. The following data must be submitted and kept on file at the B.P.I.:

A. Program Operation Manual

B. A dump of the basic computer program or submission of base data used in the program.

C. A computer run (modified ) of a base data building. Base data building to be selected by B.P.I.

2. Computer Programs Now Acceptable:

A. "ECM 5" currently running on the University of Maine at Orono main computer.

B. "BPI Model" currently being run on the Bureau of Public Improvements in-house computer "TRS 80".

C.6.0 Passive Solar: This section analyzes the energy gains and losses due to southern exposed glass. The windows analyzed under this section should not be included in the previous sections, but shall be added on to obtain the total energy usage in the building.

1. EQ (1)  $Q_{total} = Q_{gain} - Q_{cond}$

where:

$Q_{total}$  = net energy. if positive then it represents a gain in energy and shall be subtracted from the building energy load; if negative then it represents a loss of energy and shall be added to the energy load.

2. EQ (2)  $Q_{\text{gain}} = (B) (C) (ST) (A) (D)$

where:

$Q_{\text{gain}}$  = solar gain through southern exposed glass.

B = BTU/sq. ft. day, see solar intensity table.

C = Percentage of possible sunshine, see table.

ST = Percentage of solar transmittance, obtained from window manufacturer.

A = Area of glass.

D = Days in month analyzed.

3. EQ (3)  $Q_{\text{cond}} = (U_1 \Delta t_1 + U_2 \Delta t_2 + U_2 \Delta t_3) (8) (D) (A)$

where:

$Q_{\text{cond}}$  = Energy conducted through the glass.

$U_1$  = U factor during the day.

$U_2$  = U factor during the night (if different from  $U_1$ ).

$\Delta t_1$  = Inside temperature minus average outdoor temperature during the day.

$\Delta t_2$  = Inside temperature minus average outdoor temperature during early morning period.

$\Delta t_3$  = Inside temperature minus average outdoor temperature during the night.

D = Days in month analyzed.

A = Area of glass.

Values of  $\Delta t$  are determined using the bin method (see Section C.4.2).

SOLAR INTENSITY TABLE

Portland

<u>Month</u>	<u>*BTU/Square Foot Day</u>	<u>**% of Sunshine</u>
January	860	55
February	1,044	59
March	1,113	56
April	1,051	56
May	947	56
June	904	60
July	924	64
August	1,092	65
September	1,153	61
October	1,138	58
November	825	47
December	735	53

\* Obtained from Passive Solar Design Handbook, Volume 2.

\*\* Obtained from Local Climatological Data for Portland, Maine

Example Problem: For a southern exposed double glazed window, for the month of January.

January

$$\Delta t_1 = (68-27) = 41$$

$$\Delta t_2 = (68-18.7) = 49.3$$

$$\Delta t_3 = (68-21.4) = 46.6$$

$$B = 860, C = .55, ST = .73$$

$$A = 20$$

$$U_1 = .53$$

$$U_2 = \text{With panel of R-7 placed over the windows at night} - U_2 = .14.$$

$$EQ (2) \quad Q_{gain} = (B) (C) (ST) (A) (D)$$

$$= (860) (.55) (.73) (20) (31) = 214,080 \text{ BTU}$$

month

With Insulated Panel:

$$\begin{aligned}\text{EQ (3)} \quad Q_{\text{cond}} &= (U_1 \Delta t_1 + U_2 \Delta t_2 + U_2 \Delta t_3) \quad (8) \quad (D) \quad (A) \\ &= (.53 \times 41 + .14 \times 49.3 + .14 \times 46.6) \quad (8) \quad (31) \quad (20) \\ &= 174,374 \quad \frac{\text{BTU}}{\text{month}}\end{aligned}$$

$$\begin{aligned}\text{EQ (1)} \quad Q_{\text{total}} &= Q_{\text{gain}} - Q_{\text{cond}} \\ &= 214,080 - 174,374 = 39,706 \text{ BTU/month gain.}\end{aligned}$$

This value is to be subtracted from the buildings total energy usage.

Without Insulated Panel:

$$\text{EQ (2)} \quad Q_{\text{gain}} = 214,080$$

$$\begin{aligned}\text{EQ (3)} \quad Q_{\text{cond}} &= (41 + 49.3 + 46.6) (.53) \quad (8) \quad (31) \quad (20) \\ &= 359,883 \text{ BTU/month}\end{aligned}$$

$$\begin{aligned}\text{EQ (1)} \quad Q_{\text{total}} &= Q_{\text{gain}} - Q_{\text{cond}} \\ &= 214,080 - 359,883 = -145,803 \text{ BTU/month loss.}\end{aligned}$$

This value is to be added to the buildings total energy usage.

C.7.0 Active Solar Analyzing

All active solar systems shall be analyzed separate from this document and submitted to the B.P.I. for review. The designer must compare alternate combinations of heating systems and document. An acceptable life cycle analysis would include, but not be limited to the following scope: 10% cost of money, total system cost, system efficiency, total estimate available energy/sq. ft. of panel, total estimated usable energy, present worth of replacement energy, component life, and operational and maintenance cost.

Exclusions to this are as follows:

1. Financing of the total system is from other than state funds.
2. The system is for education purposes and accepted by DECS (Department of Educational and Cultural Services).

Building energy credits would be applicable at such time the actual cost of the system is known.

### III.D. Life Cycle Costing/Financial Analysis

#### D.1.0 Introduction

Life Cycle Costing is a conceptual extension of the conventional method for awarding contracts to the lowest bidder. Instead of focusing just on the initial cost, Life Cycle Costing takes into account the additional costs for energy, operation and maintenance, and system replacements. In this manner, all costs associated with building ownership are fully taken into account when selecting the best alternative design. The overall objective of Life Cycle Costing is more extensive than conventional first cost analysis since it seeks to evaluate the quality of the building over its lifetime. This concept is especially important when energy costs are rapidly increasing.

#### D.2.0 Hand Calculation

The Life Cycle cost evaluation has been established utilizing the uniform annual cost model.

The annual cost model has been developed by forecasting all cost, whether positive or negative, involved with the total system over its projected life. These costs are divided into annual payments taking into account the time value of money for an appropriate interest rate associated with the project.

For the purpose of our project, a 10% rate has been assigned. We have also assigned a 30 year life to the building structure.

Mathematically we are using a uniform recover rate as follows:

$$A = P \frac{(i (1+i)^Y)}{(1+i)^Y - 1} *$$

A = uniform end of year sum.

P = present value of today's cost.

i = interest rate for period.

y = number of years

Table has been included with values for given interest and applicable years.

\*Material from text by K and G Associates, Box 7596, Irwood Station, Dallas, Texas 75209.



FORM "LCA-2"

D.3.0 Life Cycle Cost-Benefit Analysis  
(Reporting Format)

DATE \_\_\_\_\_  
PREPARED BY \_\_\_\_\_

STATE OF MAINE

PROJECT \_\_\_\_\_ DISCOUNT RATE \_\_\_\_\_

Column Identification      A      B      C      D      E      F      G

Item	Estimated First Cost P	Est. Life (P-A)	UCR Factor	Salvage	(1st Cost Salvage X UCR = A)	Salvage X Interest	Remarks
------	------------------------------	--------------------	---------------	---------	------------------------------------	--------------------------	---------

Site Development

Building Structure  
(All items exclusive  
of those listed below.)

Roofing

Conveying Systems

Mechanical

Electrical

Equipment Built-In

TOTAL ESTIMATED  
CONSTRUCTION COST

SUBTOTALS COL. E

ENERGY USAGE AMOUNT	ANNUAL COST TYPE	COL. F
------------------------	---------------------	--------

HEATING FUEL (Oil, Gas, Coal, Elec.)  
ELECTRICITY (Except for Heating)

SEWER  
INSURANCE  
TAXES (Or Loss of Taxes)  
MAINTENANCE AND REPAIR  
MAINTENANCE CONTRACTS  
OTHER  
TOTAL UNIFORM ANNUAL SUM  
UNIFORM ANNUAL SUM/SQ FT (New Only)

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
AIA GROSS  
SQ. FT. \_\_\_\_\_

D.4.0 Interest Table:

10% Interest Factors

YEAR	SCA	SPW	UCA	USF	UCR	UPW
Y	P-F	F-P	A-F	F-A	P-A	A-P
1	1.100	.9091	1.000	1.000	1.000	0.909
2	1.210	.8264	2.100	.4762	.5762	1.736
3	1.331	.7513	3.310	.3021	.4021	2.487
4	1.464	.6830	4.461	.2155	.3155	3.170
5	1.611	.6209	6.105	.1638	.2638	3.791
6	1.772	.5645	7.716	.1296	.2296	4.355
7	1.949	.5132	9.487	.1054	.2054	4.868
8	2.144	.4665	11.44	.0874	.1874	5.335
9	2.358	.4241	13.58	.0736	.1736	5.759
10	2.594	.3855	15.94	.0628	.1628	6.144
11	2.853	.3505	18.53	.0540	.1540	6.500
12	5.054	.1978	40.54	.0247	.1247	8.022
18	5.560	.1799	45.60	.0219	.1219	8.201
19	6.116	.1635	51.16	.0196	.1196	8.365
20	6.727	.1486	57.28	.0175	.1175	8.514
21	7.400	.1351	64.00	.0156	.1156	8.649
22	8.140	.1228	71.40	.0140	.1140	8.772
23	8.954	.1117	79.54	.0126	.1126	8.883
24	9.850	.1015	88.50	.0113	.1113	8.985
25	10.84	.0923	98.35	.0102	.1102	9.077
30	17.50	.0573	164.5	.0061	.1061	9.427
35	28.10	.0356	271.0	.0037	.1037	9.644
40	45.26	.0221	442.6	.0023	.1023	9.779
45	72.89	.0137	718.9	.0014	.1014	9.863
50	117.4	.0085	1164.	.0009	.1009	9.915
60	304.5	.0033	3035.	.0003	.1003	9.967
70	789.7	.0013	7877.	.0001	.1001	9.987
80	2048.	.0005	20474.	.0001	.1001	9.995
90	5313.	.0002	53120.	.0000	.1000	9.999

APPENDIX A

SAMPLE PROBLEMS

A copy of sample problems is available upon request.

<u>Contents</u>	<u>Page</u>
Hand Calculation - Modified Degree Day Procedure	22.1 - 22.11
Hand Calculation - Bin Method	22.12 - 22.28
Computer Method	22.29 - 22.40
Weather Data	22.41 - 22.50

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

FORM "LCA-1"

B.2.0 Required Energy Items (Reporting Format)

State of Maine

Energy Conservation in Buildings

Building Name/Use Sample School - Hand Calculation Method

Building I.D. Sample Location Sample

Date Sample

- 1. Average Number of Occupants 66
- 2. Degree Days 8,500 /year
- 3. Design Temperature -20° F
- 4. Building Area 5,634

Energy/Point of Use Per Year

5. Lighting	7,955 KWH	Base Units #1	27,150	MBTU
6. Heating	934 gallons	"	130,760	MBTU
7. Cooling	_____	"	_____	MBTU
8. Water Heating	101 gallons	"	14,140	MBTU
9. Equipment	10,999 KWH	"	37,471	MBTU
10. Other (Kitchen, Exterior Lighting)	12,036 KWH	"	41,079	MBTU
11. Total Energy	_____	"	250,600	MBTU
12. Yearly Energy Usage Per Building Square Foot Area	44.5			MBTU
13. Yearly Energy Gain from Passive Solar in MBTU per Building Square Foot Area	5.5			MBTU

TOTAL 39 MBTU/square foot with Solar

#1 Base Units of Energy - KWH of electricity, gallons of oil (#2, #4, #5 or #6), tons of coal, etc. shall be evaluated a N = 100% to determine annual energy consumption (BTU/square foot).

Note: Apply factors on Page 8 "C<sub>d</sub>" and "N" to develop projected fuel usage (gallons of oil, tons of coal, etc.) to report on Form "LCA-2".

HAND CALCULATION METHOD FOR LIFE CYCLE ANALYSIS SAMPLE PROBLEM

1. LIGHTS, MISCELLANEOUS POWER USAGES:

- A. KW Connected 4.5 KW
- B. Usage: 10 hours/day x 5 days/week x 37 weeks/year = 1,850 hours/year.
- C. Diversity: 95%
- D.  $4.5 \text{ KW} \times .95 = \underline{4.3 \text{ KW}}$
- E.  $4.3 \text{ KW} \times 1,850 \text{ hours/year} = \underline{7,955 \text{ KWH/year}}$

2. HEATING SYSTEM:

A. Air Distribution:

- 1) HP Connected 3.5 HP
- 2)  $.746 \text{ KW/HP} \times 3.5 \text{ HP} = \underline{2.61 \text{ KW}}$
- 3) Diversity: 90% occupied - 10% unoccupied
- 4) Occupied 200 hours/month
- 5) Unoccupied 472 hours/month
- 6) Occupied KW:
  - a.  $2.61 \times .9 = \underline{2.35 \text{ KW}}$
  - b.  $2.35 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{4,348 \text{ KWH/year}}$
- 7) Unoccupied KW:
  - a.  $2.61 \times .1 = \underline{.26 \text{ KW}}$
  - b.  $.26 \text{ KW} \times 472 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{1,140 \text{ KWH/year}}$
- 8) Total KW =  $4,348 + 1,140 = \underline{5,488 \text{ KWH/year}}$

B. Hot Water Distribution:

- 1) HP Connected 2/3 HP
- 2)  $.746 \text{ KW/HP} \times 2/3 \text{ HP} = \underline{.5 \text{ KW}}$
- 3) Diversity: 95% occupied - 85% unoccupied
- 4) Occupied 200 hours/month
- 5) Unoccupied 472 hours/month

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

6) Occupied KW:

a.  $.5 \text{ KW} \times .95 = \underline{.475}$

b.  $.475 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{879 \text{ KW/year}}$

7) Unoccupied KW:

a.  $.5 \text{ KW} \times .85 = \underline{.425 \text{ KW}}$

b.  $.425 \text{ KW} \times 472 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{1.856 \text{ KW/year}}$

8) Total KW =  $1,856 + 879 = \underline{2,735 \text{ KW/year}}$

3. KITCHEN:

A. Total Connected 20 KW

B. Usage:  $4 \text{ hours/day} \times 5 \text{ days/week} \times 37 \text{ weeks/year} = \underline{740 \text{ hours/year}}$

C. Diversity: 75%

D.  $20 \text{ KW} \times .75 = \underline{15 \text{ KW}}$

E.  $15 \text{ KW} \times 740 \text{ hours/year} = \underline{11,100 \text{ KWH/year}}$

4. EXHAUST FAN SYSTEM:

A. Connected 2 HP

B.  $.746 \text{ KW/HP} \times 2 \text{ HP} = \underline{1.49 \text{ KW}}$

C. Occupied 200 hours/month

D. Diversity: 100%

E.  $1.49 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{2,756 \text{ KWH/year}}$

5. EXTERIOR LIGHTING:

A. Connected .3 KW

B. Usage:  $60 \text{ hours/week} \times 52 \text{ weeks/year} = \underline{3,120 \text{ hours/year}}$

C.  $.3 \text{ KW} \times 3,120 \text{ hours/year} = \underline{936 \text{ KW/year}}$

TOTALS

1.	Lights, Miscellaneous Power Usages	7,955
2.	Heating System	5,488
		2,735
3.	Kitchen	11,100
4.	Exhaust Fan System	2,756
5.	Exterior Lighting	936
	TOTAL =	30,970 KWH/YEAR

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

WINTER HEATING LOAD

1. Building Load Information:

<u>Winter Heating:</u>	Outside Design	-20° F DB
	Inside Design	70° F DB
	Heat Loss	47,938 BTUH
<u>Ventilation:</u>	380 CFM x 1.08 x 90° FTD	= 36.936 BTUH
TOTAL HEAT LOSS		<u>84,874 BTUH</u>

Modified Degree Day Procedure:

$$E = \frac{(Hl \times D \times 24)}{(\Delta t \times N \times V)} (Cd)$$

Hl = 84,874 BTUH

D = 8,121

$\Delta t = 90^\circ \text{ F}$

N = .65

V = 140,000 BTU/gallon

Cd = .68

$$E = \frac{(84,874 \times 8,500 \times 24)}{(90 \times .65 \times 140,000)} (.68) = 1.438 \text{ gallons/year}$$

2. Hot Water Load:

- A. Usage Per Week: 5 gallons/person
- B. Occupancy: 66 people
- C. 5 gallons/person/week x 66 people x 37 weeks/year = 12,210 gallons
- D. 12,210 gallons x 1  $\frac{\text{BTU}}{\text{lb}^\circ \text{ F}}$  x 8.33 lb./gallon x 140° = 14,239,302 BTU
- E.  $\frac{14,239,302 \text{ BTU}}{140,000 \text{ BTU/gallon} \times .65} = 156 \text{ gallons}$

TOTAL OIL USAGE 156 + 1.438 = 1.594 gallons

Usage at 100% efficiency

1.438 gallons x .65 = 934 gallons

156 gallons x .65 = 101 gallons

SOLAR TROMBE WALL

EQ(1)  $Q_{total} = Q_{gain} - Q_{cond}$

EQ(2)  $Q_{gain} = (B) (C) (ST) (A) (D)$

EQ(3)  $Q_{cond} = (U_1 \Delta t + U_2 \Delta t_2 + U_3 \Delta t_3) (8) (D) (A)$

Peak Heat Loss for the Gym = 55,360

Heat Gain:

Lights - 24 lights x 100 watts/light x 3.413 BTU/light = 8,191

People - 15 people x approximately 255 BTU/person = 3,825

Total = 12,016 BTU

Gym Usage Factor = 60%

Total Heat Gain = .6 x 12,016 = 7,210 BTU

$Q = \Delta t \times u \times A$

let  $u \times A = C$  (constant)

$Q = \Delta t \times C$      $C = 55,360/90 = 615.1$

let  $Q =$  Internal Heat Gain = 7,210 BTU, find  $\Delta t$

$7,210 = \Delta t (615.1)$

$\Delta t = 11.7^\circ \text{ F}$

Building will heat itself at  $65^\circ - 11.7^\circ = 53.3^\circ \text{ F}$

or by using solar heat gain graph:

% Heat Gain =  $7,210 / 55,360 = .13$  or 13%

%  $\Delta t$  from graph which building will heat itself = 13%

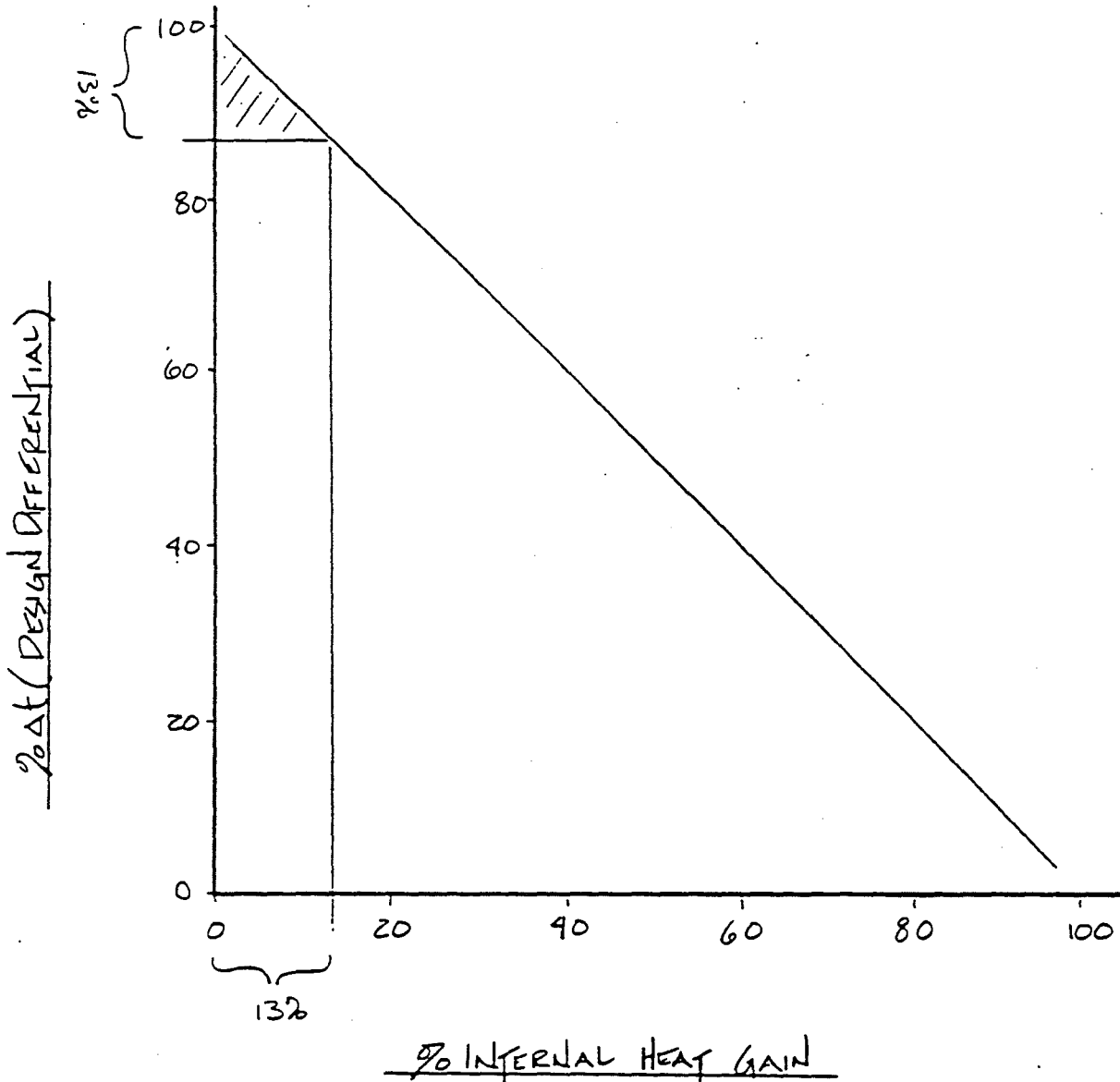
$\Delta t = .13 \times 90 = 11.7^\circ \text{ F}$

Building will heat itself at  $65^\circ \text{ F} - 11.7^\circ = 53.3^\circ \text{ F}$

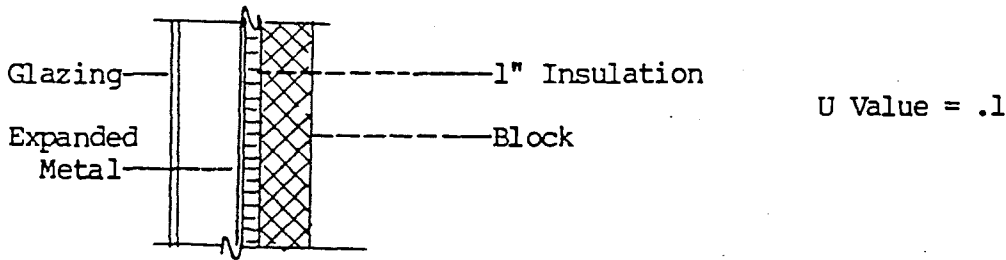
Therefore, heating season based on average monthly bin temperatures is between October - May.



SOLAR HEAT GAIN GRAPH  
(SAMPLE PROBLEM)



HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE



Oct: EQ(2)  $Q_{\text{gain}} = (1042) (.58) (.74) (378) (31) = 5,240,599$

EQ(3)  $Q_{\text{cond}} = [(65-40.2) + (65-50.4) + (65-42.2)] (.1) (8) (31) (378) = 583,088$

(1)  $Q_{\text{total}} = 5,240,599 - 583,088 = 4,657,511$  BTU/month gain

Nov: (2)  $Q_{\text{gain}} = (722) (.47) (.74) (378) (30) = 2,847,606$

(3)  $Q_{\text{cond}} = [(65-30) + (65-36) + (65-31.2)] (.1) (8) (30) (378) = 887,242$

(1)  $Q_{\text{total}} = 2,847,606 - 887,242 = 1,960,364$  BTU/month gain

Dec: (2)  $Q_{\text{gain}} = (691) (.53) (.74) (378) (31) = 3,175,698$

(3)  $Q_{\text{cond}} = [(65-14.1) + (65-20.7) + (65-16)] (.1) (8) (31) (378) = 1,351,788$

(1)  $Q_{\text{total}} = 3,175,698 - 1,351,788 = 1,823,910$  BTU/month gain

Jan: (2)  $Q_{\text{gain}} = (881) (.55) (.74) (378) (31) = 4,201,688$

(3)  $Q_{\text{cond}} = [(65-9.8) + (65-17.7) + (65-12)] (.1) (8) (31) (378) = 1,457,719$

(1)  $Q_{\text{total}} = 4,201,688 - 1,457,719 = 2,743,969$  BTU/month gain

Feb: (2)  $Q_{\text{gain}} = (1214) (.59) (.74) (378) (28) = 5,609,863$

(3)  $Q_{\text{cond}} = [(65-10) + (65-21) + (65-14.8)] (.1) (8) (28) (378) = 1,263,306$

(1)  $Q_{\text{total}} = 5,609,863 - 1,263,306 = 4,346,557$  BTU/month gain

March: (2)  $Q_{\text{gain}} = (1424) (.56) (.74) (378) (31) = 6,914,857$

(3)  $Q_{\text{cond}} = [(65-19.6) + (65-31.1) + (65-24.1)] (.1) (8) (31) (378) = 1,126,803$

(1)  $Q_{\text{total}} = 6,914,857 - 1,126,803 = 5,788,054$  BTU/month gain

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

April: (2)  $Q_{\text{gain}} = (1257) (.56) (.74) (378) (30) = 5,907,015$

(3)  $Q_{\text{cond}} = [(65-33.4) + (65-44.4) + (65-36.5)] (.1) (8) (30) (378) = 732,110$

(1)  $Q_{\text{total}} = 5,907,015 - 732,110 = 5,174,905$  BTU/month gain

May: (2)  $Q_{\text{gain}} = (1055) (.56) (.74) (378) (31) = 5,123,016$

(3)  $Q_{\text{cond}} = [(65-44.8) + (65-54.7) + (65-47.8)] (.1) (8) (31) (378) = 447,158$

(1)  $Q_{\text{total}} = 5,123,016 - 447,158 = 4,675,857$  BTU/month gain

Summation of  $Q_{\text{total}} = 31,171,127$  BTU/year gain

$31,171,127 / 5,634 = 5,533$  BTU/square foot

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

SOLAR INTENSITY TABLE

<u>Month</u>	<u>* BTU/Sq. ft. Day</u>	<u>** % of Sunshine</u>
January	881	55
February	1,214	59
March	1,424	56
April	1,257	56
May	1,055	56
June	1,023	60
July	1,084	64
August	1,170	65
September	1,206	61
October	1,042	58
November	722	47
December	691	53

\* Obtained from passive solar design handbook. Volume 2 (for Caribou, Maine).

\*\* Used values on page 17 of Life Cycle Analysis.

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

DATA FOR "LCA-2" FORM

Oil Usage = 1,594 gallons - solar gain

Solar Gain = 31,171,127 BTU/year

With a boiler at 65% efficiency the solar gain will reduce oil usage by:

$$\frac{31,171,127 \text{ BTU/gallon}}{.65 \times 140,000 \text{ BTU/year}} = 342 \text{ gallons}$$

Total Oil Usage = 1,594 - 342 = 1,252 gallons at 65% efficiency

1,252 gallons at \$1.00/gallon = \$ 1,252

30,970 KWH at \$.075/KWH = 2,323

\$ 3,575

HAND CALCULATION - MODIFIED DEGREE DAY PROCEDURE

FORM "LCA-2"

D.3.0 Life Cycle Cost-Benefit Analysis  
(Reporting Format)

DATE Sample  
PREPARED BY Sample

STATE OF MAINE

PROJECT Sample School - Hand Calculation Method DISCOUNT RATE 10%

Column Identification	A	B	C	D	E	F	G
Item	Estimated First Cost P	Est. Life (yr)	UCR (P-A) Factor	Salvage	(1st Cost Salvage X UCR = A)	Salvage X Interest	Remarks
Site Development	23,210	30 yr	.106	0	2,460		
Building Structure (All items exclusive of those listed below.)	209,020	30 yr	.106	0	22,156		
Roofing	15,400	30 yr	.106	0	1,632		
Conveying Systems	_____	_____	_____	_____	_____		
Mechanical	60,000 6,000	30 yr 15 yr	.106 .1315	0 0	6,360 787		
Electrical	24,400	30 yr	.106	0	2,586		
Equipment Built-In	8,560	30 yr	.106	0	908		

TOTAL ESTIMATED CONSTRUCTION COST 346,590 SUBTOTALS COL. E 36,891 0

ENERGY USAGE AMOUNT	ANNUAL COST TYPE	COL. F
1,252 Gal.	HEAT FUEL (Oil, Gas, Coal, Elec.)	1,252
30,970 KWH	ELECTRICITY (Except for Heating)	2,323

SEWER	_____	
INSURANCE	500	
TAXES (Or Loss of Taxes)	_____	
MAINTENANCE AND REPAIR .5 x 5964	2,982	
MAINTENANCE CONTRACTS	_____	
OTHER	_____	
TOTAL UNIFORM ANNUAL SUM	43,948	
UNIFORM ANNUAL SUM/SQ FT (New Only)	7.37	AIA GROSS SQ. FT. 5,964

HAND CALCULATION - BIN METHOD

FORM "LCA-1"

B.2.0 Required Energy Items (Reporting Format)

State of Maine

Energy Conservation in Buildings

Building Name/Use Sample School - Hand Calculation Method

Building I.D. Sample Location Sample

Date Sample

1. Average Number of Occupants 66
2. Degree Days 9,000/year
3. Design Temperature -20° F
4. Building Area 5,634

Energy/Point of Use Per Year

5. Lighting	<u>7,955 KWH</u>	Base Units #1	<u>27,150</u> MBTU
6. Heating	<u>751 gallons</u>	"	<u>105,140</u> MBTU
7. Cooling	<u>      </u>	"	<u>      </u> MBTU
8. Water Heating	<u>101 gallons</u>	"	<u>14,140</u> MBTU
9. Equipment	<u>10,999 KWH</u>	"	<u>37,471</u> MBTU
10. Other (Kitchen, Exterior Lighting)	<u>12,036 KWH</u>	"	<u>41,079</u> MBTU
11. Total Energy	<u>      </u>	"	<u>224,980</u> MBTU
12. Yearly Energy Usage Per Building Square Foot Area	<u>39.9 MBTU</u>		
13. Yearly Energy Gain from Passive Solar in MBTU per Building Square Foot Area	<u>5.5 MBTU</u>		

TOTAL 34.4 MBTU/square foot with Solar

#1 Base Units of Energy - KWH of electricity, gallons of oil (#2, #4, #5 or #6), tons of coal, etc. shall be evaluated a N = 100% to determine annual energy consumption (BTU/square foot).

Note: Apply factors on Page 8 "C<sub>d</sub>" and "N" to develop projected fuel usage (gallons of oil, tons of coal, etc.) to report on Form "LCA-2".

HAND CALCULATION METHOD FOR LIFE CYCLE ANALYSIS SAMPLE PROBLEM1. LIGHTS, MISCELLANEOUS POWER USAGES:A. KW Connected 4.5 KWB. Usage: 10 hours/day x 5 days/week x 37 weeks/year = 1,850 hours/year.C. Diversity: 95%D.  $4.5 \text{ KW} \times .95 = \underline{4.3 \text{ KW}}$ E.  $4.3 \text{ KW} \times 1,850 \text{ hours/year} = \underline{7,955 \text{ KWH/year}}$ 2. HEATING SYSTEM:A. Air Distribution:1) HP Connected 3.5 HP2)  $.746 \text{ KW/HP} \times 3.5 \text{ HP} = \underline{2.61 \text{ KW}}$ 

3) Diversity: 90% occupied - 10% unoccupied

4) Occupied 200 hours/month5) Unoccupied 472 hours/month

6) Occupied KW:

a.  $2.61 \times .9 = \underline{2.35 \text{ KW}}$ b.  $2.35 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{4,348 \text{ KWH/year}}$ 

7) Unoccupied KW:

a.  $2.61 \times .1 = \underline{.26 \text{ KW}}$ b.  $.26 \text{ KW} \times 472 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{1,140 \text{ KWH/year}}$ 8) Total KW =  $4,348 + 1,140 = \underline{5,488 \text{ KWH/year}}$ B. Hot Water Distribution:1) HP Connected 2/3 HP2)  $.746 \text{ KW/HP} \times 2/3 \text{ HP} = \underline{.5 \text{ KW}}$ 

3) Diversity: 95% occupied - 85% unoccupied

4) Occupied 200 hours/month5) Unoccupied 472 hours/month



HAND CALCULATION - BIN METHOD

6) Occupied KW:

a.  $.5 \text{ KW} \times .95 = \underline{.475}$

b.  $.475 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{879 \text{ KW/year}}$

7) Unoccupied KW:

a.  $.5 \text{ KW} \times .85 = \underline{.425 \text{ KW}}$

b.  $.425 \text{ KW} \times 472 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{1,856 \text{ KW/year}}$

8) Total KW =  $1,856 + 879 = \underline{2,735 \text{ KW/year}}$

3. KITCHEN:

A. Total Connected 20 KW

B. Usage:  $4 \text{ hours/day} \times 5 \text{ days/week} \times 37 \text{ weeks/year} = \underline{740 \text{ hours/year}}$

C. Diversity: 75%

D.  $20 \text{ KW} \times .75 = \underline{15 \text{ KW}}$

E.  $15 \text{ KW} \times 740 \text{ hours/year} = \underline{11,100 \text{ KWH/year}}$

4. EXHAUST FAN SYSTEM:

A. Connected 2 HP

B.  $.746 \text{ KW/HP} \times 2 \text{ HP} = \underline{1.49 \text{ KW}}$

C. Occupied 200 hours/month

D. Diversity: 100%

E.  $1.49 \text{ KW} \times 200 \text{ hours/month} \times 9.25 \text{ months/year} = \underline{2,756 \text{ KWH/year}}$

5. EXTERIOR LIGHTING:

A. Connected .3 KW

B. Usage:  $60 \text{ hours/week} \times 52 \text{ weeks/year} = \underline{3,120 \text{ hours/year}}$

C.  $.3 \text{ KW} \times 3,120 \text{ hours/year} = \underline{936 \text{ KW/year}}$

TOTALS

1.	Lights, Miscellaneous Power Usages	7,955
2.	Heating System	5,488
		2,735
3.	Kitchen	11,100
4.	Exhaust Fan System	2,756
5.	Exterior Lighting	<u>936</u>
	TOTAL =	30,970 KWH/YEAR

WINTER HEATING LOAD

September

Average Temperature	2-9	10-5	6-1
67	17 = 1,139	44 = 2,948	16 = 1,072
62	26 = 1,612	50 = 3,100	30 = 1,860
57	35 = 1,995	46 = 2,622	43 = 2,451
52	47 = 2,444	29 = 1,508	51 = 2,652
47	42 = 1,974	12 = 564	40 = 1,880
42	32 = 1,344	2 = 84	28 = 1,176
37	22 = 814	1 = 37	17 = 629
32	11 = 352	0 = 0	6 = 192
27	4 = 108	0 = 0	1 = 27
	236 = 11,782	184 = 10,863	232 = 11,939
	$11,782/236 = 49.9^\circ$	$10,863/184 = 59^\circ$	$11,939/232 = 51.5^\circ$

October

Average Temperature	2-9	10-5	6-1
67	2 = 134	16 = 1,072	2 = 134
62	5 = 310	24 = 1,488	9 = 558
57	10 = 570	34 = 1,938	16 = 912
52	24 = 1,248	53 = 2,756	28 = 1,456
47	43 = 2,021	48 = 2,256	40 = 1,880
42	43 = 1,806	34 = 1,428	42 = 1,764
37	42 = 1,554	20 = 740	46 = 1,702
32	47 = 1,504	6 = 192	38 = 1,216
27	24 = 648	1 = 27	16 = 432
22	7 = 154	0 = 0	2 = 44
17	1 = 17	0 = 0	0 = 0
	248 = 9,966	236 = 11,897	239 = 10,098
	$9,966/248 = 40.2^\circ$	$11,897/236 = 50.4^\circ$	$10,098/239 = 42.2^\circ$

HAND CALCULATION - BIN METHOD

November

Average Temperature	2-9	10-5	6-1
67		1 = 67	
62	1 = 62	2 = 124	1 = 62
57	2 = 114	5 = 285	2 = 114
52	3 = 156	8 = 416	6 = 312
47	9 = 423	17 = 799	9 = 423
42	19 = 798	40 = 1,680	25 = 1,050
37	34 = 1,258	53 = 1,961	31 = 1,147
32	63 = 2,016	58 = 1,856	69 = 2,208
27	47 = 1,269	34 = 918	49 = 1,323
22	31 = 682	13 = 286	26 = 572
17	18 = 306	0 = 0	11 = 187
12	7 = 84	3 = 36	5 = 60
7	3 = 21	0 = 0	4 = 28
2	2 = 4	0 = 0	2 = 4
-3	1 = -3	0 = 0	0 = 0
	240 = 7,190	234 = 8,428	240 = 7,490
	$7,190/240 = 30^\circ$	$8,428/234 = 36^\circ$	$7,490/240 = 31.2^\circ$

December

Average Temperature	2-9	10-5	6-1
67			
62			
57			
52	1 = 52	1 = 52	0 = 0
47	2 = 94	4 = 188	2 = 94
42	5 = 210	5 = 210	6 = 252
37	11 = 407	19 = 703	11 = 407
32	20 = 640	30 = 960	24 = 768
27	26 = 702	35 = 945	32 = 864
22	37 = 814	42 = 924	30 = 660
17	28 = 476	37 = 629	29 = 493
12	27 = 324	33 = 396	34 = 408
7	25 = 175	21 = 147	30 = 210
2	22 = 44	11 = 22	19 = 38
-3	12 = -36	7 = -21	14 = -42
-8	14 = -112	3 = -24	9 = -72
-13	10 = -130	0 = 0	5 = -65
-18	5 = -90	0 = 0	2 = -36
-23	2 = -46	0 = 0	1 = -23
-28	1 = -28	0 = 0	0 = 0
	248 = 3,496	248 = 5,131	248 = 3,956
	$3,496/248 = 14.1^\circ$	$5,131/248 = 20.7^\circ$	$3,956/248 = 16^\circ$

HAND CALCULATION - BIN METHOD

January

Average Temperature	2-9	10-5	6-1
42	3 = 126	8 = 336	3 = 126
37	7 = 259	18 = 666	6 = 222
32	18 = 576	25 = 800	22 = 704
27	27 = 729	31 = 837	30 = 810
22	27 = 594	38 = 836	25 = 550
17	29 = 493	35 = 595	28 = 476
12	21 = 252	31 = 372	25 = 300
7	21 = 147	28 = 196	25 = 175
2	22 = 44	22 = 44	26 = 52
-3	19 = -57	16 = -48	26 = -78
-8	23 = -184	4 = -32	19 = -152
-13	15 = -195	1 = -13	8 = -104
-18	8 = -144	1 = -18	3 = -54
-23	5 = -115	0 = 0	2 = -46
-28	2 = -56	0 = 0	0 = 0
-33	1 = -33	0 = 0	0 = 0

248 = 2,436                      258 = 4,571                      248 = 2,981

2,436/248 = 9.8°      4,571/258 = 17.7°      2,981/248 = 12°

February

Average Temperature	2-9	10-5	6-1
47	0 = 0	1 = 47	0 = 0
42	2 = 84	5 = 210	1 = 42
37	5 = 185	12 = 444	8 = 296
32	16 = 512	30 = 960	22 = 704
27	20 = 540	40 = 1,080	30 = 810
22	20 = 440	42 = 924	28 = 616
17	30 = 510	37 = 629	33 = 561
12	26 = 312	29 = 348	28 = 336
7	21 = 147	11 = 77	25 = 175
2	22 = 44	9 = 18	18 = 36
-3	20 = -60	5 = -15	13 = -39
-8	13 = -104	3 = -24	8 = -64
-13	8 = -104	0 = 0	6 = -78
-18	8 = -144	0 = 0	3 = -54
-23	4 = -92	0 = 0	1 = -23
-28	2 = -56	0 = 0	0 = 0
-33	1 = -33	0 = 0	0 = 0

218 = 2,181                      224 = 4,698                      224 = 3,318

2,181/218 = 10°                      4,698/224 = 21°                      3,318/224 = 14.8°

HAND CALCULATION - BIN METHOD

March

Average Temperature	2-9	10-5	6-1
52	0 = 0	1 = 52	0 = 0
47	0 = 0	9 = 423	0 = 0
42	2 = 84	26 = 1,092	6 = 252
37	19 = 703	59 = 2,183	29 = 1,073
32	46 = 1,472	58 = 1,856	53 = 1,696
27	30 = 810	41 = 1,107	48 = 1,296
22	37 = 814	27 = 594	41 = 902
17	31 = 527	18 = 306	28 = 476
12	28 = 336	6 = 72	20 = 240
7	16 = 112	2 = 14	11 = 77
2	10 = 20	1 = 2	5 = 10
-3	8 = -24	0 = 0	4 = -12
-8	4 = -32	0 = 0	1 = -8
-13	3 = -39	0 = 0	1 = -13
-18	3 = -54	0 = 0	1 = -18
-23	1 = -23	0 = 0	0 = 0
-28	1 = -28	0 = 0	0 = 0
	<hr/>	<hr/>	<hr/>
	239 = 4,678	248 = 7,703	248 = 5,971
	$4,678/239 = 19.6^\circ$	$7,703/248 = 31.1^\circ$	$5,971/248 = 24.1^\circ$

April

Average Temperature	2-9	10-5	6-1
67	0 = 0	5 = 335	0 = 0
62	0 = 0	9 = 558	1 = 62
57	1 = 57	17 = 969	8 = 456
52	4 = 208	27 = 1,404	8 = 416
47	10 = 470	55 = 2,585	18 = 846
42	31 = 1,302	59 = 2,478	44 = 1,848
37	68 = 2,516	41 = 1,517	65 = 2,405
32	61 = 1,952	18 = 576	57 = 1,824
27	34 = 918	5 = 135	30 = 810
22	19 = 418	2 = 44	9 = 198
17	8 = 136	1 = 17	3 = 51
12	3 = 36	0 = 0	2 = 24
7	1 = 7	0 = 0	0 = 0
2	0 = 0	0 = 0	0 = 0
	<hr/>	<hr/>	<hr/>
	240 = 8,020	239 = 10,618	245 = 8,940
	$8,020/240 = 33.4^\circ$	$10,618/239 = 44.4^\circ$	$8,940/245 = 36.5^\circ$

HAND CALCULATION - BIN METHOD

May

Average Temperature	2-9	10-5	6-1
67	5 = 335	26 = 1,742	8 = 536
62	7 = 434	44 = 2,728	15 = 930
57	20 = 1,140	47 = 2,679	31 = 1,767
52	38 = 1,976	40 = 2,080	45 = 2,340
47	56 = 2,632	35 = 1,645	58 = 2,726
42	51 = 2,142	19 = 7,980	47 = 1,974
37	40 = 1,480	6 = 222	24 = 888
32	21 = 672	1 = 32	13 = 416
27	7 = 189	0 = 0	3 = 81
22	1 = 22	0 = 0	0 = 0
	<u>246 = 11,022</u>	<u>218 = 11,926</u>	<u>244 = 11,658</u>
	$11,022/246 = 44.8^\circ$	$11,926/218 = 54.7^\circ$	$11,658/244 = 47.8^\circ$

2 - 9 I. = 57.5

10 - 5 I. = 70

6 - 1 I. = 50

JOB \_\_\_\_\_

BLDG. TYPE \_\_\_\_\_

DATE \_\_\_\_\_ BY \_\_\_\_\_

C-1 HEATING FORM

HEATING DESIGN TEMP. \_\_\_\_\_ ΔT: \_\_\_\_\_

SPACE TEMP. \_\_\_\_\_ WEATHER STA. \_\_\_\_\_

M O N T H	Heating Load							Internal Load				Solar Load			Net Load
	Period of Day (1)	Avg. Temp. (2)	ΔT = T <sub>1</sub> - T <sub>0</sub> (3)	Heat Loss MBTU (4)	MBTU (5)	Hours in "Bin" (6)	Annual MBTU (7)	Peak Internal Load MBTU (8)	Ann. Factor (9)	Hours in "Bin" (10)	Annual MBTU (11)	Peak Solar Load MBTU (8a)	Ann. Factor (9a)	Annual MBTU (11a)	
S E P	2-9	49.9	7.6		9.12	236	2147.6			60	3182.4				-
	10-5	59	11	1.2	13.2	184	2428.8	66.3	.8	240	12729.6				-
	6-1	51.5	-												-
O C T	2-9	40.2	17.3	1.2	20.76	248	5158.4	66.3	.8	62	3288.5				1,870
	10-5	50.4	19.6	1.2	23.52	236	5546	66.3	.8	248	13153.9				-
	6-1	42.2	7.8	1.2	9.36	239	2246.6	66.3	.8						2,247
N O V	2-9	30	27.5	1.2	33	240	7920	66.3	.8	60	3182.4				4,738
	10-5	36	34	1.2	40.8	234	9547.2	66.3	.8	240	12729.6				-
	6-1	31.2	18.8	1.2	22.6	240	5424	66.3	.8						5,424
D E C	2-9	14.1	43.4	1.2	52.1	248	12921	66.3	.8	62	3288.5				9,633
	10-5	20.7	49.3	1.2	59.2	248	14681.6	66.3	.8	248	13153.9				1,528
	6-1	16	34	1.2	40.8	248	10118.4	66.3	.8						10,118
J A N	2-9	9.8	47.7	1.2	57.2	248	14185.6	66.3	.8	62	3288.5				10,897
	10-5	17.7	52.3	1.2	62.8	248	15574.4	66.3	.8	248	13153.9				2,421
	6-1	12	38	1.2	45.6	248	11308.8	66.3	.8						11,309
F E B	2-9	10	47.5	1.2	57	224	12768	66.3	.8	56	2970.2				9,798
	10-5	21	49	1.2	58.8	224	13171.2	66.3	.8	224	11880.1				1,291
	6-1	14.8	35.2	1.2	42.2	224	9452.8	66.3	.8						9,453
M A R	2-9	19.6	37.9	1.2	45.5	248	11284	66.3	.8	62	13288.5				7,996
	10-5	31.1	38.9	1.2	46.7	248	11581.6	66.3	.8	248	3153.9				-
	6-1	24.1	25.9	1.2	31.1	248	7712.8	66.3	.8						7,713
A P R	2-9	33.4	24.1	1.2	28.9	240	6936	66.3	.8	60	3182.4				3,754
	10-5	44.4	25.6	1.2	30.7	239	7337.3	66.3	.8	240	12,729.6				-
	6-1	36.5	13.5	1.2	16.2	240	3888	66.3	.8						3,888
M A Y	2-9	44.8	12.7	1.2	15.2	246	3739.2	66.3	.8	62	3288.5				451
	10-5	54.7	15.3	1.2	18.4	218	4011.2	66.3	.8	248	13,153.9				-
	6-1	47.8	2.2	1.2	2.6	244	634.4	66.3	.8						634
	2-9														
	10-5														
	6-1														

GROSS TOTAL 105,163

B.P.I. 6  
REV: 3-84

HAND CALCULATION - BIN METHOD

22.20

WINTER HEATING LOAD

1. Total Heating Load = 105,163,000 BTU/year

$$\text{Oil Usage} = \frac{105,163,000}{.65 \times 140,000} = 1,156 \text{ gallons/year}$$

2. Hot Water Load:

A. Usage Per Week: 5 gallons/person

B. Occupancy: 66 people

C. 5 gallons/person/week x 66 people x 37 weeks/year = 12,210 gallons

D. 12,210 gallons x 1  $\frac{\text{BTU}}{\text{lb}^\circ \text{F}}$  x 8.33 lb./gallon x 140° = 14,239,302 BTU

E.  $\frac{14,239,302 \text{ BTU}}{140,000 \text{ BTU/gallon} \times .65} = 156 \text{ gallons}$

TOTAL OIL USAGE 1,156 + 156 = 1,312 gallons

Usage at 100% efficiency

1,156 gallons x .65 = 751 gallons

156 gallons x .65 = 101 gallons



SOLAR TROMBE WALL

EQ(1)  $Q_{total} = Q_{gain} - Q_{cond}$

EQ(2)  $Q_{gain} = (B)(C) (ST) (A) (D)$

EQ(3)  $Q_{cond} = (U_1\Delta t + U_2\Delta t_2 + U_2\Delta t_3) (8) (D) (A)$

Peak Heat Loss for the Gym = 55,360

Heat Gain:

Lights - 24 lights x 100 watts/light x 3.413 BTU/light = 8,191

People - 15 people x approximately 255 BTU/person = 3,825

Total = 12,016 BTU

Gym Usage Factor = 60%

Total Heat Gain = .6 x 12,016 = 7,210 BTU

$Q = \Delta t \times u \times A$

let  $u \times A = C$  (constant)

$Q = \Delta t \times C$   $C = 55,360/90 = 615.1$

let  $Q =$  Internal Heat Gain = 7,210 BTU, find  $\Delta t$ 

$7,210 = \Delta t (615.1)$

$\Delta t = 11.7^\circ F$

Building will heat itself at  $65^\circ - 11.7^\circ = 53.3^\circ F$

or by using solar heat gain graph:

% Heat Gain =  $7,210 / 55,360 = .13$  or 13%

%  $\Delta t$  from graph which building will heat itself = 13%

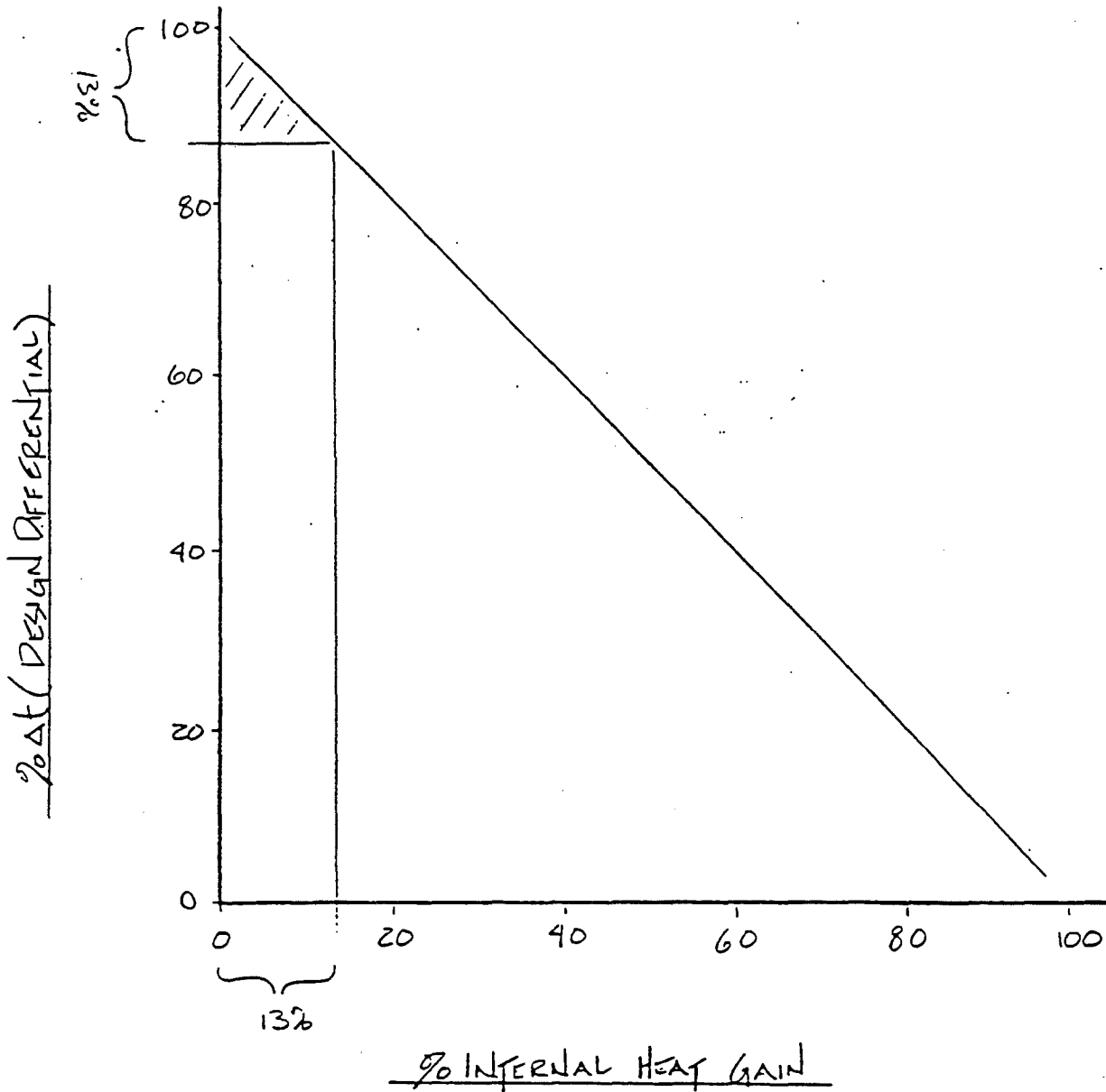
$\Delta t = .13 \times 90 = 11.7^\circ F$

Building will heat itself at  $65^\circ F - 11.7^\circ = 53.3^\circ F$

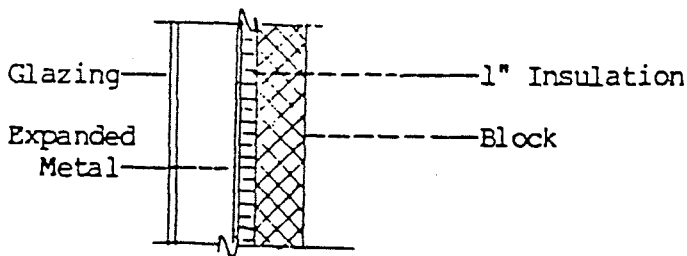
Therefore, heating season based on average monthly bin temperatures is between October - May.

SOLAR HEAT GAIN GRAPH

(SAMPLE PROBLEM)



HAND CALCULATION - BIN METHOD



U Value = .1

Oct: EQ(2)  $Q_{gain} = (1042) (.58) (.74) (378) (31) = 5,240,599$

EQ(3)  $Q_{cond} = [(65-40.2) + (65-50.4) + (65-42.2)] (.1) (8) (31) (378) = 583,088$

(1)  $Q_{total} = 5,240,599 - 583,088 = 4,657,511$  BTU/month gain

Nov: (2)  $Q_{gain} = (722) (.47) (.74) (378) (30) = 2,847,606$

(3)  $Q_{cond} = [(65-30) + (65-36) + (65-31.2)] (.1) (8) (30) (378) = 887,242$

(1)  $Q_{total} = 2,847,606 - 887,242 = 1,960,364$  BTU/month gain

Dec: (2)  $Q_{gain} = (691) (.53) (.74) (378) (31) = 3,175,698$

(3)  $Q_{cond} = [(65-14.1) + (65-20.7) + (65-16)] (.1) (8) (31) (378) = 1,351,788$

(1)  $Q_{total} = 3,175,698 - 1,351,788 = 1,823,910$  BTU/month gain

Jan: (2)  $Q_{gain} = (881) (.55) (.74) (378) (31) = 4,201,688$

(3)  $Q_{cond} = [(65-9.8) + (65-17.7) + (65-12)] (.1) (8) (31) (378) = 1,457,719$

(1)  $Q_{total} = 4,201,688 - 1,457,719 = 2,743,969$  BTU/month gain

Feb: (2)  $Q_{gain} = (1214) (.59) (.74) (378) (28) = 5,609,863$

(3)  $Q_{cond} = [(65-10) + (65-21) + (65-14.8)] (.1) (8) (28) (378) = 1,263,306$

(1)  $Q_{total} = 5,609,863 - 1,263,306 = 4,346,557$  BTU/month gain

March: (2)  $Q_{gain} = (1424) (.56) (.74) (378) (31) = 6,914,857$

(3)  $Q_{cond} = [(65-19.6) + (65-31.1) + (65-24.1)] (.1) (8) (31) (378) = 1,126,803$

(1)  $Q_{total} = 6,914,857 - 1,126,803 = 5,788,054$  BTU/month gain

HAND CALCULATION - BIN METHOD

April: (2)  $Q_{\text{gain}} = (1257) (.56) (.74) (378) (30) = 5,907,015$

(3)  $Q_{\text{cond}} = [(65-33.4) + (65-44.4) + (65-36.5)] (.1) (8) (30) (378) = 732,110$

(1)  $Q_{\text{total}} = 5,907,015 - 732,110 = 5,174,905$  BTU/month gain

May: (2)  $Q_{\text{gain}} = (1055) (.56) (.74) (378) (31) = 5,123,016$

(3)  $Q_{\text{cond}} = [(65-44.8) + (65-54.7) + (65-47.8)] (.1) (8) (31) (378) = 447,158$

(1)  $Q_{\text{total}} = 5,123,016 - 447,158 = 4,675,857$  BTU/month gain

Summation of  $Q_{\text{total}} = 31,171,127$  BTU/year gain

$31,171,127/5,634 = 5,533$  BTU/square foot

HAND CALCULATION - BIN METHOD

SOLAR INTENSITY TABLE

<u>Month</u>	<u>* BTU/Sq. ft. Day</u>	<u>** % of Sunshine</u>
January	881	55
February	1,214	59
March	1,424	56
April	1,257	56
May	1,055	56
June	1,023	60
July	1,084	64
August	1,170	65
September	1,206	61
October	1,042	58
November	722	47
December	691	53

\* Obtained from passive solar design handbook. Volume 2 (for Caribou, Maine).

\*\* Used values on page 17 of Life Cycle Analysis.

DATA FOR "LCA-2" FORM

Oil Usage = 1,312 gallons - solar gain

Solar Gain = 31,171,127 BTU/year

With a boiler at 65% efficiency the solar gain will reduce oil usage by:

$$\frac{31,171,127 \text{ BTU/gallon}}{.65 \times 140,000 \text{ BTU/year}} = 342 \text{ gallons}$$

Total Oil Usage = 1,312 - 342 = 970 gallons at 65% efficiency

970 gallons at \$1.00/gallon = \$ 970

30,970 KWH at \$.075/KWH = 2,323

\$ 3,293

HAND CALCULATION - BIN METHOD

FORM "LCA-2"

D.3.0 Life Cycle Cost-Benefit Analysis  
(Reporting Format)

DATE Sample  
PREPARED BY Sample

STATE OF MAINE

PROJECT Sample School - Hand Calculation Method DISCOUNT RATE 10%

Column Identification A B C D E F G

Item	Estimated First Cost P	Est. Life (P-A)	UCR (P-A) Factor	Salvage	(1st Cost Salvage X UCR = A)	Salvage X Interest	Remarks
Site Development	23,210	30 yr	.106	0	2,460		
Building Structure (All items exclusive of those listed below.)	209,020	30 yr	.106	0	22,156		
Roofing	15,400	30 yr	.106	0	1,632		
Conveying Systems	—	—	—	—	—		
Mechanical	60,000 6,000	30 yr 15 yr	.106 .1315	0 0	6,360 787		
Electrical	24,400	30 yr	.106	0	2,586		
Equipment Built-In	8,560	30 yr	.106	0	908		

TOTAL ESTIMATED CONSTRUCTION COST 346,590 SUBTOTALS COL. E 36,891 0

ENERGY USAGE AMOUNT	ANNUAL COST TYPE	COL. F
970 Gal.	HEAT FUEL (Oil, Gas, Coal, Elec.)	970
30,970 KWH	ELECTRICITY (Except for Heating)	2,323

SEWER	—
INSURANCE	500
TAXES (Or Loss of Taxes)	—
MAINTENANCE AND REPAIR .5 x 5964	2,982
MAINTENANCE CONTRACTS	—
OTHER	—
TOTAL UNIFORM ANNUAL SUM	43,666
UNIFORM ANNUAL SUM/SQ FT (New Only)	7.32
	AIA GROSS
	SQ. FT. 5,964

COMPUTER METHOD

FORM "LCA-1"

B.2.0 Required Energy Items (Reporting Format)

State of Maine

Energy Conservation in Buildings

Building Name/Use Sample School - Computer Method

Building I.D. Sample Location Sample

Date Sample

1. Average Number of Occupants 66
2. Degree Days 8,750 /year
3. Design Temperature -20° F
4. Building Area 5,634 square feet

Energy/Point of Use Per Year

- |   |                    |               |                     |
|---|--------------------|---------------|---------------------|
| 5. Lighting and Equipment   | <u>19,595 KWH</u>  | Base Units #1 | <u>66,878</u> MBTU  |
| 6. Heating  | <u>732 gallons</u> | At 100% Eff.  | <u>102,512</u> MBTU |
| 7. Cooling  | <u>      </u>      | "             | <u>      </u> MBTU  |
| 8. Water Heating  | <u>113 gallons</u> | "             | <u>15,764</u> MBTU  |
| 9. Equipment  | <u>10,668 KWH</u>  | "             | <u>36,410</u> MBTU  |
| 10. Other (Exterior Lights)   | <u>936 KWH</u>     | "             | <u>3,195</u> MBTU   |
| 11. Total Energy  | <u>      </u>      | "             | <u>224,759</u> MBTU |
| 12. Yearly Energy Usage Per Building Square Foot Area                           | <u>39.9</u> MBTU   |               |                     |
| 13. Yearly Energy Gain from Passive Solar in MBTU per Building Square Foot Area | <u>5.5</u> MBTU    |               |                     |

TOTAL 34.4 MBTU/square foot with Solar

#1 Base Units of Energy - KWH of electricity, gallons of oil (#2, #4, #5 or #6), tons of coal, etc. shall be evaluated a N = 100% to determine annual energy consumption (BTU/square foot).

Note: Apply factors on Page 8 "C<sub>d</sub>" and "N" to develop projected fuel usage (gallons of oil, tons of coal, etc.) to report on Form "LCA-2".



COMPUTER METHOD

BUILDING TOPS REVISION 08 03/27/84

:BUILDING ID: SAMPLE COMPUTER METHOD

: WEATHER STATE AND ZONE:

ME4

FREE DAYS                      LANGELYS                      WINTER WIND SPEED  
50                                      315                                      12

: TOTAL ENCLOSED SQ FT:	5634.00
: NUMBER OF OCCUPANTS:	66.00
: AVERAGE LIGHTING (WATTS/SQ FT):	1.80
: AVERAGE EQUIPMENT (WATTS/SQ FT):	0.10
: AVERAGE OCCUPIED HOURS PER WEEK DURING WINTER:	40.00
: HOURS PER WEEK THAT INTERIOR LIGHTS ARE ON:	50.00
: LENGTH OF SUMMER OCCUPANCY SCHED IN WEEKS:	15.00
: SUMMER OCCUPANTS:	0.00
: SUMMER LIGHTS PER SQ FT:	0.00
: SUMMER EQUIP PER SQ FT:	0.00
: AVERAGE OCCUPIED HOURS PER WEEK (SUMMER):	0.00
: WINTER INDOOR TEMP DURING DAY:	68.00
: CONTROLLED WINTER INDOOR RELATIVE HUMIDITY DURING DAY:	0.00
: WINTER O.A. VENT RATE DURING THE DAY:	380.00
: WINTER EXHAUST RATE TO O.A. DURING THE DAY:	380.00
: HRS/WEEK THAT DAYTIME ENVIRONMENTAL CONDITIONS ARE MAINTAINED DUR	50.00
: WINTER INDOOR TEMP DURING NIGHT:	55.00
: WINTER O.A. VENT RATE DURING THE NIGHT:	0.00
: WINTER EXHAUST RATE TO O.A. DURING THE NIGHT:	0.00
: HEATING FUEL:	1.00
: PLANT SEASONAL EFFICIENCY:	0.65
: PLANT COOLED IN SUMMER:	NO
: CONTROLLED SUMMER INDOOR DAYTIME TEMP:	0.00
: CONTROLLED SUMMER INDOOR DAYTIME RELATIVE HUMIDITY:	0.00
: SUMMER OUTSIDE AIR VENTILATION:	0.00
: SUMMER EXHAUST AIR RATE TO O.A.:	0.00
: HOURS PER WEEK SUMMER DAYTIME ENVIRONMENTAL CONDITIONS ARE MAINTAINED	0.00
: COOLING FUEL:	2.00
: TYPE OF CHILLER:	1.00
: COOLING PLANT SEASONAL EFFICIENCY:	0.00
: WINTER FAN HORSEPOWER DURING DAY:	4.20
: WINTER FAN HORSEPOWER DURING THE NIGHT:	0.00
: WINTER PUMP HORSEPOWER DURING DAY:	1.17
: WINTER PUMP HORSEPOWER DURING THE NIGHT:	1.00
: NUMBER OF WEEKS PER YEAR OF WINTER PLANT OPERATION:	37.00
: SUMMER FAN HORSEPOWER DURING DAY:	0.00
: SUMMER FAN HORSEPOWER DURING THE NIGHT:	0.00
: SUMMER PUMP HORSEPOWER DURING THE NIGHT:	0.00
: SUMMER PUMP HORSEPOWER DURING THE NIGHT:	0.00
: HOURS PER WEEK SUMMER DAYTIME ENVIRONMENTAL CONDITIONS ARE MAINTAINED	15.00
: NUMBER OF WEEKS PER YEAR OF SUMMER PLANT OPERATION:	15.00
: HOT WATER USE PER PERSON PER WEEK:	5.00
: DOMESTIC HOT WATER TEMP:	120.00
: TYPE OF HOT WATER HEATER:	4.00
: EXTERIOR LIGHTING (WATTS):	300.00
: HOURS PER WEEK EXT. LIGHTING IS USED:	60.00
: PRICE OF DIST OIL (DOLLARS/GAL):	1.00
: PRICE OF RESID OIL (DOLLARS/GAL):	0.00
: PRICE OF ELECTRICITY (DOLLARS/KWH):	0.07
: PRICE OF NAT GAS (DOLLARS/FT3):	0.00
: PRICE OF STEAM (DOLLAR/KLBS):	0.00

COMPUTER METHOD

LLS

	AREA	ORIENT	SHADE	U	ABSOR
10	170.00	1	0	0.05000	1
10	40.00	2	1	0.05000	1
10T2	24.00	1	0	0.05000	1
NS	60.00	4	1	0.05000	1
NS	208.00	1	0	0.05000	1
NS	45.00	2	0	0.05000	1
LTP	1260.00	1	0	0.05000	1
LTP	1020.00	2	0	0.05000	1
LTP	882.00	3	0	0.05000	1
F	39.00	2	0	0.05000	1
F	343.00	3	0	0.05000	1
STOR	182.00	3	0	0.05000	1

NDOWS

	MULT	AREA	DIR	SHADE	U	FRAME	CRACK	SC
10	1	18.0	1	0	0.58000	1	0	0.92
10A	1	10.0	1	0	0.58000	14	12	0.92
EST	2	11.0	4	1	0.58000	1	0	0.92
EST	1	10.0	4	1	0.58000	1	0	0.92
EST	1	12.0	4	0	0.58000	1	0	0.92
F	1	8.0	3	0	0.58000	14	12	0.92

DFS

	AREA	U	ABSOR
10	483.00	0.0400	1
11	42.00	0.0400	1
12	334.00	0.0400	1
3	136.00	0.0400	1
14	176.00	0.0400	1
15	3570.00	0.0400	1
16	420.00	0.0400	1
17	207.00	0.0400	1
18	322.00	0.0400	1

DRS

	MULT	TYPE	AREA	USE
11	1	6	21.00	1
15	1	5	21.00	3
15	1	5	21.00	3
16	1	5	21.00	0

COMPUTER METHOD

BUILDING NAME: TOPS REVISION LEVEL: 08

03/27/84

ANALYSIS FOR: SAMPLE COMPUTER METHOD

TOTAL INTERNAL HEAT GAIN: -55156192 -81.28 %  
 81.28 PERCENT OF THE HEAT GAIN MUST BE REJECTED

CELL ID	HEAT LOSS		HEAT LOSS PER SQFT	
10	1242676	1.21%	7310	0.01%
10	292394	0.29%	7310	0.01%
10T2	175437	0.17%	7310	0.01%
NS	438591	0.43%	7310	0.01%
NS	1520450	1.48%	7310	0.01%
NS	289351	0.28%	6430	0.01%
LTP	9210420	8.98%	7310	0.01%
LTP	6558615	6.40%	6430	0.01%
LTP	4962928	4.84%	5627	0.01%
T	250771	0.24%	6430	0.01%
T	1930027	1.88%	5627	0.01%
STOR	1024096	1.00%	5627	0.01%

TOTAL WALL CONDUCTION: 27895755.166 27.21%

DOOR ID	HEAT LOSS		HEAT LOSS PER SQFT	
10	2579822	2.52%	5341	0.01%
11	224332	0.22%	5341	0.01%
12	1783977	1.74%	5341	0.01%
3	726410	0.71%	5341	0.01%
14	940060	0.92%	5341	0.01%
15	19068253	18.60%	5341	0.01%
16	2243324	2.19%	5341	0.01%
17	1105638	1.08%	5341	0.01%
18	1719882	1.68%	5341	0.01%

TOTAL ROOF CONDUCTION: 30391697.445 29.65%

WINDOW ID	HEAT LOSS		INFILTRATION LOAD		HEAT LOSS PER SQFT	
10	1494624	1.46%	0	0.00%	83035	0.08%
10A	830347	0.81%	1289985	1.26%	83035	0.08%
EST	1826763	1.78%	0	0.00%	83035	0.08%
EST	830347	0.81%	0	0.00%	83035	0.08%

COMPUTER METHOD

EST	806867	0.79%	0	0.00%	67239	0.07%
T	356900	0.35%	1289985	1.26%	44612	0.04%

TAL WINDOW CONDUCTION/SHG:	6145847.096	6.00%
TAL WINDOW INFILTRATION:	2579970.351	2.52%

OR ID	HEAT LOSS		INFILTRATION LOAD		HEAT LOSS PER SQFT	
11	810557	0.79%	13462466	13.13%	38598	0.04%
15	1486022	1.45%	3127348	3.05%	70763	0.07%
15	1486022	1.45%	3127348	3.05%	70763	0.07%
16	1486022	1.45%	3611958	3.52%	70763	0.07%

TAL DOOR INFILTRATION:	23329121.214	22.76%
TAL DOOR CONDUCTION LOSS:	5268623.472	5.14%

VENTILATION AIR LOAD:	27403549	26.73 %
CUPANT LOAD:	-6378643	-6.22 %
SHTING LOAD:	-13380427	-13.05 %
TERNAL EQUIP LOAD:	-743357	-0.73 %
TAL INTERNAL HEAT GAIN:	-20502427	-20.00 %

\* \* TOTAL WINTER LOAD \* \* \* :

102512136.81 BTU/YR
157710979.70 BTU/YR WITH EFFIC
1126.51 GALLONS OF DIST OIL
1126.51 DOLLARS

ELECTRICITY FOR LIGHTS AND EQUIP:	19595 KWH
COST:	\$1274 DOLLARS

ELECTRICITY FOR EXTERIOR LIGHTING:	936KWH
COST:	\$61DOLLARS

HEATING HOT WATER LOAD:	15764467 BTU/YR
	113 GALLONS OF DIST OIL
	\$113 DOLLARS

FAN & PUMP ELECTRICAL USAGE:	10668 KWH
COST:	\$693 DOLLARS

TOTAL ENERGY CONSUMPTION:

1239 GALLONS OF DIST OIL
0 GALLONS OF RESID OIL
31199 KWH OF ELECTRICITY
0 CUBIC FEET OF GAS
0 KLBS OF STEAM

\* \* TOTAL COST \* \* \*

\$3267 DOLLARS
----------------

TOTAL ENERGY USE *	39893 BTU PER SQFT ACTUAL
	49691 BTU PER SQFT WITH SYSTEM EFFIC

COMPUTER METHOD

SOLAR TROMBE WALL

EQ(1)  $Q_{total} = Q_{gain} - Q_{cond}$

EQ(2)  $Q_{gain} = (B) (C) (ST) (A) (D)$

EQ(3)  $Q_{cond} = (U_1 \Delta t + U_2 \Delta t_2 + U_2 \Delta t_3) (8) (D) (A)$

Peak Heat Loss for the Gym = 55,360

Heat Gain:

Lights - 24 lights x 100 watts/light x 3.413 BTU/light = 8,191

People - 15 people x approximately 255 BTU/person = 3,825

Total = 12,016 BTU

Gym Usage Factor = 60%

Total Heat Gain = .6 x 12,016 = 7,210 BTU

$Q = \Delta t \times u \times A$

let  $u \times A = C$  (constant)

$Q = \Delta t \times C$      $C = 55,360/90 = 615.1$

let  $Q =$  Internal Heat Gain = 7,210 BTU, find  $\Delta t$

$7,210 = \Delta t (615.1)$

$\Delta t = 11.7^\circ \text{ F}$

Building will heat itself at  $65^\circ - 11.7^\circ = 53.3^\circ \text{ F}$

or by using solar heat gain graph:

% Heat Gain =  $7,210 / 55,360 = .13$  or 13%

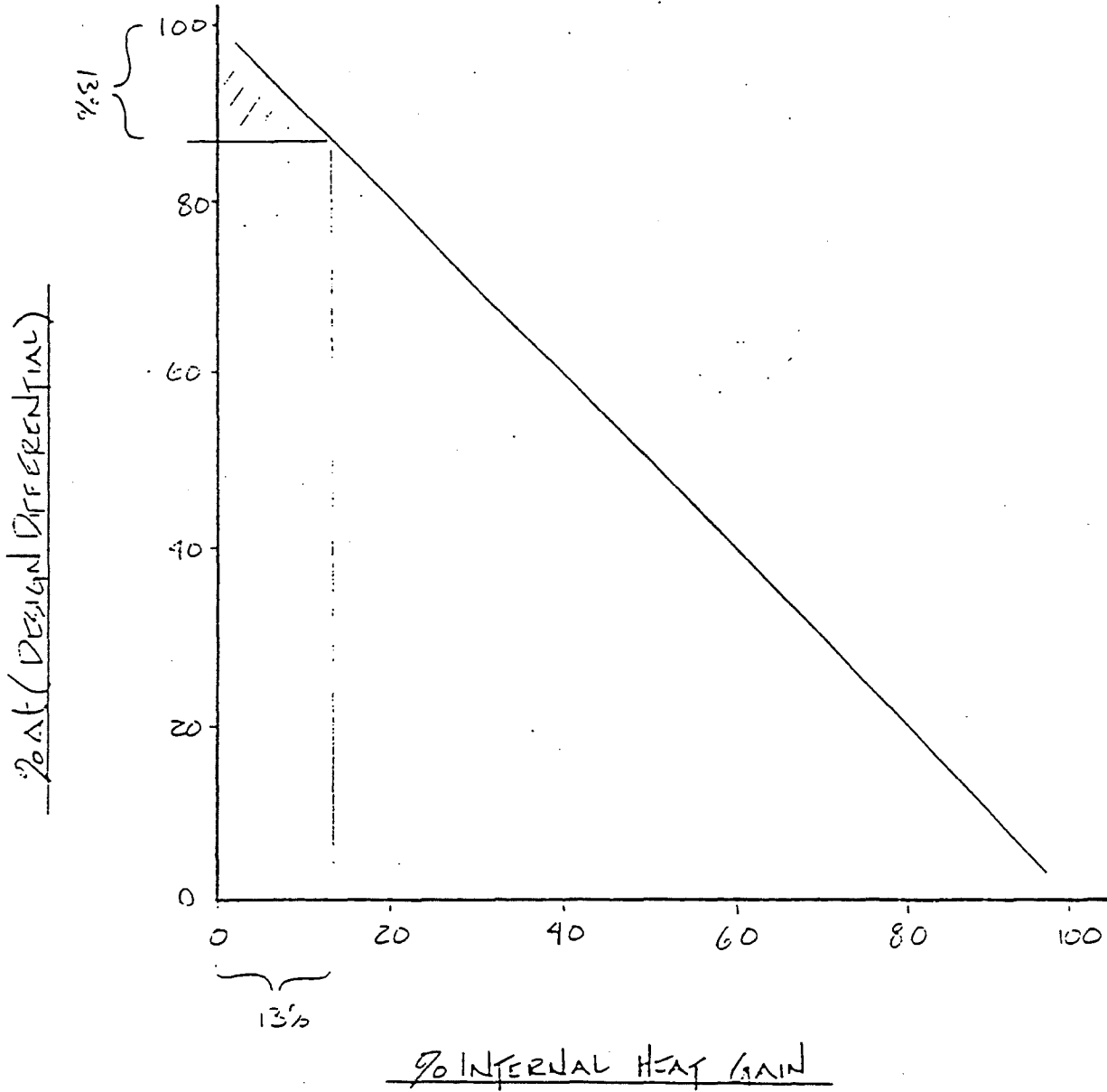
%  $\Delta t$  from graph which building will heat itself = 13%

$\Delta t = .13 \times 90 = 11.7^\circ \text{ F}$

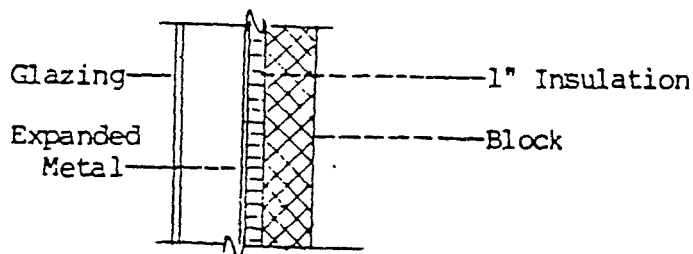
Building will heat itself at  $65^\circ \text{ F} - 11.7^\circ = 53.3^\circ \text{ F}$

Therefore, heating season based on average monthly bin temperatures is between October - May.

SOLAR HEAT GAIN GRAPH  
(SAMPLE PROBLEM)



COMPUTER METHOD



U Value = .1

Oct: EQ(2) Qgain = (1042) (.58) (.74) (378) (31) = 5,240,599

EQ(3) Qcond = [(65-40.2) + (65-50.4) + (65-42.2)] (.1) (8) (31) (378) = 583,088

(1) Qtotal = 5,240,599 - 583,088 = 4,657,511 BTU/month gain

Nov: (2) Qgain = (722) (.47) (.74) (378) (30) = 2,847,606

(3) Qcond = [(65-30) + (65-36) + (65-31.2)] (.1) (8) (30) (378) = 887,242

(1) Qtotal = 2,847,606 - 887,242 = 1,960,364 BTU/month gain

Dec: (2) Qgain = (691) (.53) (.74) (378) (31) = 3,175,698

(3) Qcond = [(65-14.1) + (65-20.7) + (65-16)] (.1) (8) (31) (378) = 1,351,788

(1) Qtotal = 3,175,698 - 1,351,788 = 1,823,910 BTU/month gain

Jan: (2) Qgain = (881) (.55) (.74) (378) (31) = 4,201,688

(3) Qcond = [(65-9.8) + (65-17.7) + (65-12)] (.1) (8) (31) (378) = 1,457,719

(1) Qtotal = 4,201,688 - 1,457,719 = 2,743,969 BTU/month gain

Feb: (2) Qgain = (1214) (.59) (.74) (378) (28) = 5,609,863

(3) Qcond = [(65-10) + (65-21) + (65-14.8)] (.1) (8) (28) (378) = 1,263,306

(1) Qtotal = 5,609,863 - 1,263,306 = 4,346,557 BTU/month gain

March: (2) Qgain = (1424) (.56) (.74) (378) (31) = 6,914,857

(3) Qcond = [(65-19.6) + (65-31.1) + (65-24.1)] (.1) (8) (31) (378) = 1,126,803

(1) Qtotal = 6,914,857 - 1,126,803 = 5,788,054 BTU/month gain

COMPUTER METHOD

April: (2)  $Q_{\text{gain}} = (1257) (.56) (.74) (378) (30) = 5,907,015$

(3)  $Q_{\text{cond}} = [(65-33.4) + (65-44.4) + (65-36.5)] (.1) (8) (30) (378) = 732,110$

(1)  $Q_{\text{total}} = 5,907,015 - 732,110 = 5,174,905$  BTU/month gain

May: (2)  $Q_{\text{gain}} = (1055) (.56) (.74) (378) (31) = 5,123,016$

(3)  $Q_{\text{cond}} = [(65-44.8) + (65-54.7) + (65-47.8)] (.1) (8) (31) (378) = 447,158$

(1)  $Q_{\text{total}} = 5,123,016 - 447,158 = 4,675,857$  BTU/month gain

Summation of  $Q_{\text{total}} = 31,171,127$  BTU/year gain

$31,171,127/5,634 = 5,533$  BTU/square foot



COMPUTER METHOD

SOLAR INTENSITY TABLE

<u>Month</u>	<u>* BTU/Sq. ft. Day</u>	<u>** % of Sunshine</u>
January	881	55
February	1,214	59
March	1,424	56
April	1,257	56
May	1,055	56
June	1,023	60
July	1,084	64
August	1,170	65
September	1,206	61
October	1,042	58
November	722	47
December	691	53

\* Obtained from passive solar design handbook. Volume 2 (for Caribou, Maine).

\*\* Used values on page 17 of Life Cycle Analysis.

COMPUTER METHOD

DATA FOR "LCA-2" FORM

Oil Usage = 1,126 gallons - solar gain

Solar Gain = 31,171,127 BTU/year

With a boiler at 65% efficiency the solar gain will reduce oil usage by:

$$\frac{31,171,127 \text{ BTU/gallon}}{.65 \times 140,000 \text{ BTU/year}} = 343 \text{ gallons}$$

Total Oil Usage = 1,126 - 343 = 783 gallons at 65% efficiency

783 gallons at \$1.00/gallon = \$ 783

30,970 KWH at \$.075/KWH = 2,323

\$ 3,106

COMPUTER METHOD

FORM "LCA-2"

D.3.0 Life Cycle Cost-Benefit Analysis  
(Reporting Format)

DATE Sample  
PREPARED BY Sample

STATE OF MAINE

PROJECT Sample School - Computer Method DISCOUNT RATE \_\_\_\_\_

Column Identification      A      B      C      D      E      F      G

Item	Estimated First Cost P	Est. Life (P-A) Factor	UCR (P-A) Factor	Salvage	(1st Cost Salvage X UCR = A)	Salvage X Interest	Remarks
Site Development	23,210	30 yr	.106	0	2,460		
Building Structure (All items exclusive of those listed below.)	209,020	30 yr	.106	0	22,156		
Roofing	15,400	30 yr	.106	0	1,632		
Conveying Systems	_____	_____	_____	_____	_____		
Mechanical	60,000 6,000	30 yr 15 yr	.106 .1315	0 0	6,360 789		
Electrical	24,400	30 yr	.106	0	2,586		
Equipment Built-In	8,560	30 yr	.106	0	908		

TOTAL ESTIMATED  
CONSTRUCTION COST      346,590      SUBTOTALS      COL. E      36,891      0

ENERGY USAGE AMOUNT    TYPE	ANNUAL COST	COL. F
783 Gal.	HEAT FUEL (Oil, Gas, Coal, Elec.)	783
31,199 KWH	ELECTRICITY (Except for Heating)	2,340

SEWER	_____	
INSURANCE	500	
TAXES (Or Loss of Taxes)	_____	
MAINTENANCE AND REPAIR .5 x 5964	2,982	
MAINTENANCE CONTRACTS	_____	
OTHER	_____	
TOTAL UNIFORM ANNUAL SUM	<u>43,496</u>	
UNIFORM ANNUAL SUM/SQ FT (New Only)	<u>7.29</u>	AIA GROSS SQ. FT. <u>5,964</u>

- DEPARTMENT OF THE AIR FORCE MANUAL
- DEPARTMENT OF THE ARMY TECHNICAL MANUAL
- DEPARTMENT OF THE NAVY MANUAL

AFM 88-29

TM 5-785

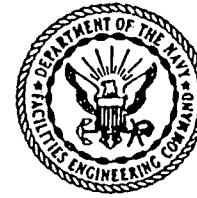
NAVFAC P-89

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Facility Design and Planning

# ENGINEERING WEATHER DATA

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DEPARTMENTS OF THE AIR FORCE, THE ARMY, AND THE NAVY

1 JULY 1978

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STATE  Station	LOCATION			WINTER DESIGN DATA HEATING				DEGREE DAYS  Heating	SUMMER DESIGN DATA AIR CONDITIONING							SUMMER CRITERIA DATA AIR CONDITIONING							
				Dry Bulb					Dry Bulb				Wet Bulb			Dry Bulb		Wet Bulb					
	Lat	Long	Elev	99%	97.5%	Prvg Wind	Mean Speed		annual	1% MCWB		Mean Dry Bulb Prvg Wind			5% MCWB		1%	2.5%	5%	≥ 93°F	≥ 80°F	≥ 73°F	≥ 67°F
										°	°	ft	°	°	dir	knots	°	°	°	dir	°	°	°
<b>KENTUCKY</b>																							
	N	W																					
Ashland	38 33	82 44	546	5	10	W	6	4555	94	76	91	74	27	SW	89	73	78	77	75	47	797	470	1671
Blue Grass Army Depot	37 41	84 14	1035	3	8	WNW	9	4729	93	73	91	73	24	SW	88	72	77	76	75	37	822	401	1641
Covington	39 03	84 40	869	1	6	W	9	5070	92	73	90	72	23	SW	88	72	77	75	74	24	748	316	1423
Fort Campbell/Campbell AAF	36 40	87 29	571	4	10	N	6	4290	94	77	92	75	22	W	89	74	79	77	76	56	998	664	1975
Fort Knox/Godman AAF	37 54	85 58	753	1	7	W	7	4616	92	76	90	75	22	WSW	88	74	79	77	76	20	847	543	1740
Lexington/Blue Grass Field	38 02	84 36	966	3	8	WNW	9	4729	93	73	91	73	24	SW	88	72	77	76	75	37	822	401	1641
Louisville/Standiford Field	38 11	85 44	477	5	10	NW	8	4640	95	74	93	74	24	SW	90	74	79	77	76	80	1022	668	1886
Owensboro	37 45	87 10	407	5	10	NW	9	4220	97	76	94	75	25	SW	91	75	79	78	77	113	1106	777	1942
Richmond	37 40	84 15	1043	3	8	WNW	9	4729	93	73	91	73	24	SW	88	72	77	76	75	37	822	401	1641
<b>LOUISIANA</b>																							
	N	W																					
Alexandria/Esler Field	31 24	92 18	92	23	27	N	7	2200	95	77	94	77	20	S	92	77	80	79	78	133	1599	1797	3264
Barksdale AFB/Shreveport	32 30	93 40	167	19	24	N	6	2337	96	77	94	77	22	S	93	77	80	79	78	156	1518	1558	2996
Baton Rouge/Ryan Aprt	30 32	91 09	64	25	29	ENE	8	1670	95	77	93	77	20	W	92	77	80	80	79	116	1607	2150	3482
Claibourne	31 07	92 35	200	23	27	N	7	1964	95	77	94	77	20	S	92	77	80	79	79	133	1599	1797	3264
England AFB/Alexandria	31 20	92 33	89	23	27	N	7	1964	95	77	94	77	20	S	92	77	80	79	79	133	1599	1797	3264
Fort Polk/Polk AAF	31 03	93 11	330	23	27	N	7	1889	95	77	94	77	20	S	92	77	80	79	79	133	1599	1797	3264
Hammond ANG Comm Sta	30 31	90 24	40	26	30	ENE	8	1591	95	77	93	77	20	W	92	77	80	80	79	116	1667	2150	3482
Lafayette	30 12	92 00	42	26	30	N	8	1551	95	78	94	78	22	SW	92	78	81	80	79	142	1678	2476	3577
Lake Charles AFS	30 10	93 10	15	27	31	N	9	1498	95	77	93	77	18	SSW	92	77	80	79	79	92	1766	2475	3589
Lake Charles MAP	30 07	93 13	9	27	31	N	9	1498	95	77	93	77	18	SSW	92	77	80	79	79	92	1766	2475	3589
Louisiana Ordnance Plant	32 34	93 34	195	19	24	N	6	2337	96	77	94	77	22	S	93	77	80	79	78	156	1518	1558	2996
Monroe MAP	32 31	92 02	79	20	25	N	9	2311	99	77	96	76	22	S	94	76	79	79	78	244	1774	1853	3194
New Orleans Army Terminal	29 58	90 02	5	29	33	NNE	9	1465	93	78	92	78	18	SSW	90	77	81	80	79	44	1727	2572	3670
New Orleans/Moisant IAP	29 59	90 15	4	29	33	NNE	9	1465	93	78	92	78	18	SSW	90	77	81	80	79	44	1727	2572	3670
New Orleans NAS	29 50	90 01	3	28	31	NNE	8	1617	93	78	91	78	16	W	90	78	82	81	80	33	1639	2479	3618
Shreveport	32 28	93 49	254	20	25	N	9	2167	99	77	96	76	22	S	94	76	79	79	78	244	1774	1853	3194
<b>MAINE</b>																							
	N	W																					
Augusta	44 19	69 48	353	-7	-3	NNE	10	7826	88	73	85	70	25	WNW	82	68	74	72	70	5	246	63	442
Bangor IAP/Dow AFB	44 48	68 50	192	-11	-6	WNW	7	8034	86	70	83	68	24	S	80	67	73	71	69	2	181	34	321
Bar Harbor	44 27	68 22	84	-7	-3	NW	8	7240	86	70	83	68	22	W	80	67	73	71	69	1	170	34	321
Brunswick NAS	43 54	69 56	75	-6	-2	NW	8	7552	85	70	81	68	21	S	79	67	72	70	68	1	121	20	289
Bucks Harbor AFS	44 38	67 24	221	-11	-5	WNW	7	8056	86	70	83	69	22	WSW	80	67	73	71	69	1	171	34	321
Caribou MAP	46 52	68 01	624	-18	-13	WSW	10	9632	84	69	81	67	25	SW	78	66	71	69	67	0	103	13	195

STATE				WINTER DESIGN DATA HEATING					DEGREE DAYS	SUMMER DESIGN DATA AIR CONDITIONING								SUMMER CRITERIA DATA AIR CONDITIONING							
	LOCATION			Dry Bulb						Dry Bulb				Wet Bulb				Dry Bulb		Wet Bulb					
	Station	Lat	Long	Elev	99%	97.5%	Pvg Wind dir	Mean Speed knots		Heating	1% MCWB		Mean Daily Range		Pvg Wind dir	5% MCWB		1%	2.5%	5%	≥ 93°F	≥ 80°F	≥ 73°F	≥ 67°F	
											°F	°F	°F	°F		°F	°F								°F
<b>MAINE (CONT)</b>																									
	N	W																							
Caswell AFS	46 58	67 50	843	-16	-12	NW	8	9500	83	68	80	66	23	S	77	65	71	69	67	0	85	9	155		
Charleston AFS	45 05	69 05	930	-16	-10	WNW	7	9008	86	70	82	68	26	WSW	79	66	72	70	69	2	138	23	280		
Loring AFB	46 57	67 53	746	-16	-12	NW	8	9500	83	68	80	66	23	S	77	65	71	69	67	0	85	9	155		
Millinocket	45 39	68 42	413	-13	-9	WNW	11	8533	87	69	83	68	27	WNW	80	66	72	70	68	5	188	23	279		
Portland	43 39	70 19	43	-6	-1	W	7	7498	87	72	84	71	25	S	81	69	74	72	70	3	206	68	458		
Searsport	44 27	68 55	7	-11	-6	NW	8	7467	86	70	83	68	24	W	80	67	73	71	69	2	181	34	321		
Winter Harbor	44 20	68 04	11	-7	-3	NW	8	7240	86	70	83	68	22	W	80	67	73	71	69	1	170	34	321		
<b>MARYLAND</b>																									
	N	W																							
Aberdeen PG/Phillips AAF	39 28	76 10	57	11	15	NW	8	5184	94	77	90	75	21	SSW	88	75	80	78	76	42	713	601	1630		
Andrews AFB	38 49	76 52	279	10	14	NW	10	4551	92	75	90	74	20	SSW	87	73	78	76	75	16	729	445	1573		
Annapolis USNA	38 59	76 29	40	15	18	WNW	9	4548	91	77	89	77	16	S	86	75	80	79	77	13	742	879	1990		
Bainbridge NTC	39 37	76 04	50	11	15	NW	8	5184	94	77	90	75	21	SSW	88	75	80	78	76	42	713	601	1630		
Baltimore/Martin Apt	39 20	76 25	24	14	17	WNW	9	4866	92	77	89	76	18	S	87	75	80	78	76	27	727	740	1810		
Baltimore/Washington IAP	39 11	76 40	148	10	13	W	9	4729	94	75	91	75	22	WSW	89	74	78	77	76	43	790	533	1613		
Bethesda NAVNATMEDCEN	39 00	77 06	310	12	15	NW	10	4645	94	75	92	74	20	SSW	89	73	78	76	75	47	726	445	1573		
Bethesda NSRDC	38 59	77 12	130	11	15	WNW	11	4290	94	75	91	74	19	S	88	74	78	77	76	41	809	580	1744		
Cumberland MAP	39 37	78 46	790	6	10	WNW	10	5012	92	75	89	74	26	W	87	74	77	76	75	20	596	314	1254		
Edgewood Arsenal	39 24	76 18	22	13	16	WNW	9	4866	92	77	89	76	18	SSW	87	75	80	78	76	28	713	700	1761		
Fort Detrick	39 26	77 26	355	8	12	N	9	5059	93	76	91	75	26	WNW	88	74	79	77	76	35	647	472	1492		
Fort Holabird	39 16	76 32	32	15	19	WNW	9	4101	92	77	90	76	15	SW	87	75	80	78	77	23	813	800	1892		
Fort Meade/Tipton AAF	39 05	76 46	150	6	11	NW	6	4733	92	75	90	74	24	W	88	73	78	77	75	22	767	398	1393		
Fort Richie	39 40	77 28	1320	9	12	WNW	10	5897	91	74	88	73	26	W	86	73	76	75	74	16	416	221	1078		
Frederick	39 27	77 25	313	8	12	N	9	5059	94	76	91	75	26	WNW	88	74	78	77	76	41	693	469	1466		
Hagerstown	39 42	77 44	704	8	12	WNW	10	5152	94	75	91	74	26	W	89	74	77	76	75	44	702	384	1383		
Indian Head NOS	38 36	77 10	15	10	14	NW	6	4498	93	77	91	76	21	S	89	75	80	78	77	37	892	710	1884		
Patuxent River NAS	38 17	76 26	38	15	18	NW	11	4307	92	75	89	75	17	SW	87	74	79	77	76	20	772	682	1850		
White Oak NAVSURFWPCEN	39 02	76 59	200	12	15	NW	10	4483	93	75	90	74	20	SSW	87	73	78	76	75	27	670	445	1573		
<b>MASSACHUSETTS</b>																									
	N	W																							
Army Mat/Mech Res Cen	42 21	71 10	40	6	9	WNW	16	5621	91	73	88	71	21	SW	85	70	75	74	72	16	394	125	762		
Boston/Logan IAP	42 22	71 02	15	6	9	WNW	16	5621	91	73	88	71	21	SW	85	70	75	74	72	16	394	125	762		
Boston Navy Base	42 21	71 03	15	6	9	WNW	16	5621	91	73	88	71	21	SW	85	70	75	74	72	16	394	125	762		
Fall River	41 43	71 08	190	5	9	NW	10	5774	87	72	84	71	20	SW	81	69	74	73	72	5	230	90	780		
Fort Devens/Devens AAF	42 34	71 36	268	-3	1	NW	8	6475	92	73	89	72	24	WSW	86	70	76	74	73	26	466	154	770		

BANGOR IAP/DOW AFB MAINE

LAT 44 48N LONG 68 50W ELEV 192 FT

MEAN FREQUENCY OF OCCURRENCE OF DRY BULB TEMPERATURE (DEGREES F) WITH MEAN COINCIDENT WET BULB TEMPERATURE (DEGREES F) FOR EACH DRY BULB TEMPERATURE RANGE

Temperature Range	MAY				JUNE				JULY				AUGUST				SEPTEMBER				OCTOBER																	
	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B													
	01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24										
95/99																																						
90/94		0		0	70		2	0	2	69		0	0	0	74		1	1	1	74		1	1	74														
85/89		3	0	3	66		8	1	9	69		0	14	2	16	71		8	1	9	71		3	0	3	72		1	1	67								
80/84		5	1	6	64		0	22	4	26	66		0	41	8	49	68		0	31	4	35	68		0	10	1	11	69		1	1	65					
75/79		12	2	14	61		1	40	11	52	63		3	58	21	82	65		1	57	14	72	66		1	18	4	23	66		5	0	5	63				
70/74		1	19	6	26	58		5	52	25	82	61		14	63	42	119	64		8	71	40	119	63		2	37	12	51	62		9	1	10	61			
65/69		2	35	13	50	55		18	44	41	103	59		49	40	74	163	62		48	51	71	170	62		18	52	28	98	60		1	15	4	20	58		
60/64		9	48	26	83	52		45	39	59	143	57		92	21	65	178	59		82	22	69	173	59		40	56	54	150	57		6	33	14	53	56		
55/59		24	49	42	115	50		75	22	54	151	53		61	5	30	96	55		62	6	36	104	54		48	35	57	140	53		20	50	31	101	52		
50/54		47	39	57	143	47		60	10	35	105	49		24	0	5	29	50		33	1	11	45	49		49	23	45	117	49		41	57	53	151	48		
45/49		64	26	57	147	43		28	1	9	38	45		4	0	4	44			13	0	1	14	45		38	5	24	67	45		51	37	55	143	43		
40/44		55	9	31	95	39		7		1	8	40		1		1	40			2		1	3	40		26	1	10	37	40		43	24	42	109	39		
35/39		36	3	11	50	35		1			1	36								0			0	37		14		4	18	36		41	11	28	80	34		
30/34		10	0	1	11	31																				4		0	4	31		31	4	15	50	30		
25/29		0		0	0	25																																
20/24																																						
15/19																																						

- 22.44 -

BANGOR IAP/DOW AFB MAINE

WEATHER DATA

BANGOR IAP/DOW AFB MAINE

Temperature Range	NOVEMBER					DECEMBER					JANUARY					FEBRUARY					MARCH					APRIL					ANNUAL TOTAL																																																					
	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B	Obsn Hour Cp			Total Obsn	M C W B																																																						
	01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24			01 to 06	09 to 16	17 to 24	01 to 06	09 to 16	17 to 24	01 to 06	09 to 16	17 to 24																																													
95/99																															0	0	75																																																			
90/94																															8	0	8	72																																																		
85/89																															0	37	4	41	70																																																	
80/84																															0	110	18	128	67																																																	
75/79																															1	0	1	57	6	191	52	249	65																																													
70/74																															2	0	2	55	30	253	126	409	62																																													
65/69																															5	1	6	52	136	242	232	610	60																																													
60/64	1	3	0	4	56																															0	14	3	17	49	275	236	290	801	57																																							
55/59	5	11	9	25	54	0	1	1	55																															1	24	9	34	46	296	204	268	768	52																																			
50/54	12	27	14	53	49	1	2	1	4	48	0	1	1	47																															7	1	8	42	6	43	20	69	44	273	210	242	725	48																										
45/49	23	38	25	86	44	3	8	5	16	44	1	1	2	4	45	1	1	1	3	44	1	20	6	27	40	14	48	38	100	41	241	185	223	649	43																																																	
40/44	26	48	34	108	38	7	18	11	36	39	2	6	2	10	39	2	8	3	13	38	6	37	21	64	37	42	53	56	151	37	219	204	212	635	38																																																	
35/39	42	48	49	139	34	20	26	23	69	34	10	21	15	46	34	6	26	14	46	34	26	59	49	134	33	68	34	64	166	34	264	228	257	749	34																																																	
30/34	58	41	56	155	29	24	38	32	94	29	24	38	31	93	30	23	35	33	91	30	57	61	70	188	29	67	14	39	120	30	298	231	277	806	30																																																	
25/29	35	18	34	87	25	36	42	34	112	25	26	32	34	92	25	25	41	39	105	25	49	31	47	127	24	30	3	8	41	25	213	168	200	581	25																																																	
20/24	25	4	14	43	20	38	42	42	122	20	28	42	32	102	20	27	37	35	99	20	46	20	29	95	20	10	0	1	11	19	178	145	154	477	20																																																	
15/19	9	1	4	14	16	30	30	37	97	15	29	38	33	100	15	29	30	33	92	15	30	7	13	50	15	2	0	0	2	15	129	106	120	355	15																																																	
10/14	4	0	1	5	11	33	24	32	89	11	31	30	37	98	10	29	20	23	72	11	16	3	7	26	11	1	0	1	11	114	77	100	291	11																																																		
5/9	0	0	0	0	7	27	11	16	54	6	32	19	25	76	6	27	13	20	60	6	11	1	4	16	6																															97	44	65	206	6																								
0/4																															13	5	8	26	1	24	11	16	51	1	21	6	12	39	1	6	1	7	1																															64	22	37	123	1
-5/-1																															9	2	5	16	-3	17	6	12	35	-3	16	4	6	26	-4	2	2	-3																															44	12	23	79	-3	
-10/-6																															4	1	1	6	-8	11	4	5	20	-8	11	2	2	15	-8	0	0	-7																															26	7	8	41	-8	
-15/-11																															1	0	0	1	-13	8	1	2	11	-13	5	0	1	6	-13																															14	1	3	18	-13				
-20/-16																															0	0	0	0	-17	2	0	0	2	-18	2	0	0	2	-17																															4	0	0	4	-18				
-25/-21																															1	0	0	0	-23	1	0	0	0	-23	0	0	0	0	-23																															1	0	0	1	-23				
-30/-26																															0	0	0	0	-27	0	0	0	0	-28	0	0	0	0	-28																															0	0	0	0	-27				

- 22.45 -

WEATHER DATA



# BRUNSWICK NAS MAINE

LAT 43 54N LONG 69 56W ELEV 75 FT

MEAN FREQUENCY OF OCCURRENCE OF DRY BULB TEMPERATURE (DEGREES F) WITH MEAN COINCIDENT WET BULB TEMPERATURE (DEGREES F) FOR EACH DRY BULB TEMPERATURE RANGE

Tempera- ture Range	MAY					JUNE					JULY					AUGUST					SEPTEMBER					OCTOBER														
	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B															
	01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24																	
90/94						2	0	2	70						2	0	2	75	0	0	0	69																		
85/89		1	0	1	70	4	1	5	69						10	1	11	71	6	0	6	72						2	0	2	72									
80/84		3	0	3	66	0	16	2	67						1	29	3	68	24	3	27	69						6	1	7	68	0	0	61						
75/79	0	6	1	7	62	2	35	8	64						3	63	15	65	1	64	11	66						0	19	2	66	3	3	63						
70/74	1	17	4	22	58	7	52	21	62						17	73	46	63	11	72	41	64						3	38	11	63	9	0	9	60					
65/69	2	31	9	42	54	20	48	36	59						56	45	79	62	52	54	80	62						16	52	29	60	0	16	2	58					
60/64	8	49	22	79	53	52	45	66	57						102	22	79	59	90	21	75	59						48	59	59	57	6	38	17	56					
55/59	28	59	41	128	50	73	27	61	53						52	4	20	55	54	7	29	54						47	40	62	53	26	55	42	52					
50/54	59	48	74	181	47	60	11	37	50						16	3	19	49	31	1	9	49						52	18	44	49	46	67	59	48					
45/49	69	23	60	152	43	23	1	8	45						2	0	2	44	9	1	10	45						37	4	21	44	52	34	55	43					
40/44	50	8	29	87	40	4	0	4	41						0	0	0	42	1	0	1	40						24	1	9	40	46	18	39	39					
35/39	25	2	7	34	35														0			37						12	2	14	36	41	6	22	34					
30/34	7	0	0	7	31																							1	0	1	31	22	2	10	30					
25/29	0				26																							0			27	8	1	9	26					
20/24																												2	0	2	22									
15/19																												0			19									

BRUNSWICK NAS MAINE

### BRUNSWICK NAS MAINE

Temperature Range	NOVEMBER					DECEMBER					JANUARY					FEBRUARY					MARCH					APRIL					ANNUAL TOTAL					
	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B	Obsn Hour Cp			Total Obsn	R C W B						
	01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24			01 to 08	09 to 16	17 to 24	01 to 08	09 to 16	17 to 24
	90/94																										4	0	4	72						
85/89																										23	2	25	71							
80/84																			0	0	64				1	78	11	90	68							
75/79																									0	0	65	6	190	37	233	65				
70/74																									1	1	56	39	262	123	424	63				
65/69		0		0	55																			3	0	3	53	146	249	235	630	61				
60/64	0	2	1	3	54	0	0	0	48									0	0	50				0	13	2	15	50	306	249	321	876	57			
55/59	5	14	9	28	54	0	1		47					0	0	51							1	0	1	46	1	30	7	38	46	286	238	271	795	53
50/54	18	34	20	72	49	1	3	1	5	49	0	0	0	46			7	1	8	43			7	45	22	74	44	290	234	270	794	48				
45/49	28	49	31	108	44	4	8	6	18	44	1	3	2	6	44	1	2	1	4	41	1	21	6	28	40	24	61	47	132	41	251	206	238	695	43	
40/44	31	54	41	126	39	11	29	14	54	39	3	16	5	24	38	3	15	6	24	38	9	54	27	90	37	63	52	75	190	38	245	247	245	737	38	
35/39	47	47	55	149	34	20	33	30	83	34	17	31	25	73	34	11	35	22	68	33	41	72	66	179	33	73	27	61	161	34	287	253	290	830	34	
30/34	52	29	49	130	30	34	42	40	116	29	27	43	38	108	30	24	46	41	111	29	62	46	69	177	29	48	7	22	77	30	277	215	269	761	29	
25/29	34	9	25	68	25	47	48	44	139	25	35	45	42	122	24	32	40	43	115	24	56	26	43	125	24	17	1	3	21	25	229	169	201	599	25	
20/24	19	2	7	28	21	33	36	41	110	20	31	41	37	109	20	37	38	38	113	20	36	13	19	68	20	5	1	6	20	163	130	143	436	20		
15/19	6	1	1	8	16	32	24	32	88	16	33	29	36	98	15	31	21	26	78	15	21	6	10	37	15	1	0	1	15	124	81	105	310	15		
10/14	2		1	3	12	30	14	25	69	11	34	20	26	80	11	26	14	22	62	11	13	1	5	19	10	0		0	13	105	49	79	233	11		
5/9						18	7	10	35	7	25	11	20	56	6	21	8	12	41	6	6	0	1	7	6					70	26	43	139	6		
0/4						12	2	4	18	2	19	5	10	34	1	17	4	8	29	1	3		0	3	2					51	11	22	84	1		
-5/-1						5	0	3	8	-3	13	3	4	20	-4	15	2	3	20	-4	1		0	1	-3					34	5	10	49	-3		
-10/-6						2	0	0	2	-8	6	1	2	9	-8	5	0	1	6	-8										13	1	3	17	-8		
-15/-11						0			0	-13	3	0	0	3	-13	2	0	0	2	-13										5	0	0	5	-13		
-20/-16											1		1	-17		0			0	-17										1			1	-17		
-25/-21											0			0	-22					-22										0			0	-22		

LORING AFB MAINE

LAT 46 57N LONG 67 53W ELEV 746 FT

MEAN FREQUENCY OF OCCURRENCE OF DRY BULB TEMPERATURE (DEGREES F) WITH MEAN COINCIDENT WET BULB TEMPERATURE (DEGREES F) FOR EACH DRY BULB TEMPERATURE RANGE

Temperature Range	MAY					JUNE					JULY					AUGUST					SEPTEMBER					OCTOBER																																							
	Obsn Hour Cp			Total Obsn	N C	Obsn Hour Cp			Total Obsn	N C	Obsn Hour Cp			Total Obsn	N C	Obsn Hour Cp			Total Obsn	N C	Obsn Hour Cp			Total Obsn	N C																																								
	01 to 08	09 to 16	17 to 24		W B	01 to 08	09 to 16	17 to 24		W B	01 to 08	09 to 16	17 to 24		W B	01 to 08	09 to 16	17 to 24		W B	01 to 08	09 to 16	17 to 24		W B																																								
90/94						0			0	71	1	0	1	71	0			0	68																																														
85/89		1	0	1	66	6	1	7	66	9	1	10	70	2	0	2	70																																																
80/84		3	1	4	63	13	5	18	65	21	6	27	69	8	2	10	68																																																
75/79		9	3	12	60	1	21	9	31	63	1	40	17	58	65	0	33	9	42	65												9	2	11	65	1																													
70/74	1	14	7	22	57	3	38	22	63	60	8	65	39	112	63	3	51	24	78	63	1	22	7	30	62								4	0	4	61	4	0	4	61																									
65/69	2	23	13	38	54	15	51	41	107	58	37	58	58	153	61	22	64	52	138	61	9	37	19	65	60								9	2	11	58	9	2	11	58																									
60/64	6	34	25	65	52	38	49	53	140	56	67	36	67	170	58	57	58	65	180	58	20	46	38	104	57	2	17	10	29	56								2	17	10	29	56																							
55/59	17	44	33	94	49	56	36	47	139	52	74	16	42	132	54	65	24	53	142	54	34	54	50	138	52	10	28	17	55	52								10	28	17	55	52																							
50/54	29	46	45	120	45	58	17	36	111	48	43	2	16	61	50	53	5	32	90	49	50	40	47	137	48	26	42	32	100	48								26	42	32	100	48																							
45/49	54	40	49	143	42	41	7	21	69	44	15	2	17	45	36	2	10	48	45	52	23	42	117	44	37	54	48	139	43								37	54	48	139	43																								
40/44	62	23	42	127	38	22	1	5	28	40	2		0	2	40	10	0	1	11	41	37	4	23	64	40	46	45	48	139	39								46	45	48	139	39																							
35/39	46	10	22	78	34	5	0	1	6	35	0			0	37	1		0	1	37	23	0	10	33	35	48	28	43	119	34								48	28	43	119	34																							
30/34	27	2	8	37	30	0		0	0	32											13		2	15	31	49	18	35	102	30								49	18	35	102	30																							
25/29	5	0	0	5	25																					1		0	1	27	22	3	11	36	26								22	3	11	36	26																		
20/24	1	0	0	1	20																										8	0	2	10	22								8	0	2	10	22																		
15/19																															1							1							1							1							1						

LORING AFB MAINE

WEATHER DATA

LORING AFB MAINE

Temperature Range	NOVEMBER							DECEMBER							JANUARY							FEBRUARY							MARCH							APRIL							ANNUAL TOTAL																																																																																	
	Obsn Hour Cp			Total Obsn	R C	M B	Obsn Hour Cp			Total Obsn	R C	M B	Obsn Hour Cp			Total Obsn	R C	M B	Obsn Hour Cp			Total Obsn	R C	M B	Obsn Hour Cp			Total Obsn	R C	M B	Obsn Hour Cp			Total Obsn	R C	M B																																																																																								
	01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24				01 to 08	09 to 16	17 to 24	01 to 08	09 to 16	17 to 24	01 to 08	09 to 16	17 to 24	01 to 08	09 to 16	17 to 24																																																																												
	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11	09	10	11																																																																																											
90/94																													1	0	1	71																																																																																												
85/89																													18	2	20	68																																																																																												
80/84																													49	14	63	67																																																																																												
75/79																													0	0	55	2	113	40	155	64																																																																																								
70/74																													0	0	0	54	16	194	99	309	62																																																																																							
65/69																													0	0	0	52	85	244	185	514	59																																																																																							
60/64	0	1	0	1	57																													190	245	259	694	56																																																																																						
55/59	3	5	4	12	54																													259	219	250	728	52																																																																																						
50/54	5	11	8	24	49	1	1	1	3	51																													267	189	229	685	48																																																																																	
45/49	14	15	14	43	45	2	1	2	5	46	0	0	0	45	0	0	1	1	44	0	6	2	8	39	7	40	26	73	40	258	188	217	663	43																																																																																										
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30/34	51	60	67	178	30	21	28	23	72	30	11	18	15	44	30	8	20	12	40	29	39	58	49	146	29	78	36	58	172	30	297	240	269	806	30																																																																																									
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15/19	21	7	18	46	16	33	42	33	108	16	25	36	32	93	16	26	39	33	98	16	37	20	29	86	15	9	2	3	14	15	152	146	148	446	16																																																																																									
10/14	12	3	6	21	12	32	33	36	101	11	26	39	35	100	11	28	30	36	94	11	33	14	17	64	11	3	0	0	3	10	134	119	130	383	11																																																																																									
5/9	5	1	1	7	7	28	24	29	81	6	32	31	37	100	6	30	22	26	78	6	18	6	8	32	6	1	0	1	6	114	84	101	299	6																																																																																										
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-10/-6																													13	3	6	22	-8																													53	18	30	101	-8																																																										
-15/-11																													6	1	1	8	-13																													28	8	10	46	-13																																																										
-20/-16																													0	0	0	0	-17																													13	3	3	19	-18																																																										
-25/-21																													0	0	-25																													3	0	0	3	-22																													0	0	0	3	-22																											
-30/-26																													0	0	-27																													0	0	-27																													0	0	-27																													0	0	-27

State Station	Annual Cooling Degree Days
LOUISIANA (continued)	
New Orleans Army Terminal	2706
New Orleans/Moisant IAP	2706
New Orleans NAS	2703
Shreveport	2538
MAINE	
Augusta	271
Bangor IAP/Dow AFB	304
Bar Harbor	167
Brunswick NAS	308
Bucks Harbor AFS	121
Caribou MAP	128
Caswell AFS	152
Charleston AFS	93
Loring AFB	152
Millinocket	231
Portland	252
Searsport	200
Winter Harbor	167
MARYLAND	
Aberdeen PG/Phillips AAF	1076
Andrews AFB	1237
Annapolis USNA	1155
Bainbridge NTC	1076
Baltimore/Martin Aprt	1115
Baltimore/Washington IAP	1108
Bethesda NAVNATMEDCEN	1147
Cumberland MAP	828
Edgewood Arsenal	1115
Port Detrick	948

State Station	Annual Cooling Degree Days
Fort Holabird	1491
Fort Meade/Tipton AAF	1039
Fort Richie	688
Frederick	948
Hagerstown	891
Indian Head NOS	1348
Patuxent River NAS	1377
White Oak NAVSURFWPCEN	1161
MASSACHUSETTS	
Army Mat/Mech Res Cen	661
Boston/Logan IAP	661
Boston Navy Base	661
Fall River	599
Fort Devens/Devens AAF	560
Hanscom AFB/Bedford	591
Lawrence MAP	566
Lynn	661
Maynard	591
Nantucket	284
Natick Laboratories	636
New Bedford MAP	635
North Truro AFS	502
Otis AFB/Falmouth	490
Pittsfield MAP	317
Quincy	661
Salem	450
South Weymouth NAS	666
Springfield	740
Wellesly ANG Station	636
Westfield/Barnes MAP	584
Westover AFB	584

WEATHER DATA

Definitions and Example Format For Backup Calculations and Data

In order to facilitate the acceptance process of Life Cycle Energy Analysis, the Bureau feels that submittal of pertinent information is vital. These shall include:

1. Heat transfer coefficients and areas of all envelope components used in calculating the overall heat loss factor in Column 4 of Heating Form C-1.
2. Infiltration rate data, documentation and methodology.
3. Perimeter heat loss factors used in calculating UA overall.
4. Ventilation rate.
5. Number of persons during peak occupancy, sensible heat gain/person, diversity of occupancy during various bin periods.
6. Install kilowatts of lighting and equipment within the space which may contribute to internal gain, diversity of usage during various bin periods and duration of use.

Guideline: Only equipment (supply fan motors within the air stream of the distribution system) or lights which are uniformly distributed throughout the space may be considered for internal gain contribution. Heat gain given off by exhaust fans are generally exhausted with the air and in large equipment gains in highly localized area, such as boiler rooms, are generally vented out.

7. Calculations for internal heat gain adjustment factor  $F_c$ . See 1977 ASHRAE Fundamentals, Chapter 25.23, Equations 30, 31 and example 9, page 25.25.

EXAMPLE:

	<u>U-FACTOR</u>		<u>AREA</u>		<u>UA</u>
1. Roof (Type 1)	0.034	X	26000	=	884
Roof (Type 2)	0.026	X	6000	=	156
Wall (Type 1)	0.041	X	17000	=	697
Wall (Type 2)	0.05	X	2000	=	100
Window (Type 1)	0.5	X	2550	=	1275
Window (Type 2)	0.34	X	100	=	34
Doors	0.22	X	200	=	44
 Infiltration	 1.085	 X	 1067 CFM	 =	 1157
Perimeter Heat Loss	0.55	X	700 Ft.	=	385
					<u>4732</u>

$$(UA) = 4732 \text{ Btu/hr}^\circ\text{F (Col. 4)}$$

2. Air Change Method

$$\begin{aligned} \text{Volume} &= 320,000 \text{ Ft}^3 \\ \text{ACH} &= 0.2 \\ \text{Infiltration} &= \frac{(320000)(.2)}{60} = 1067 \text{ CFM} \end{aligned}$$

3. 1" Insulation on foundation frost wall, equation 4, Chapter 24.5 ASHRAE 1972 Fundamentals.

4. 5 CFM/Person X 200 Persons = 1000 CFM

5. 200 Persons peak occupancy  
SBG/Per = 210 Btu/hr. person  
Diversity of occupancy

1-8 = 20%  
9-4 = 85%  
5-12 = 20%

6. 20 KW Installed  
Diversity

1-8 = 40%  
9-4 = 90%  
5-12 = 40%

$$7. K_t = \frac{1}{L_f} (U_w A_w + U_{wi} A_{wi} + U_{RR} A_{RR} + U_D A_D)$$

$$= \frac{1}{700} (697 + 100 + 1275 + 34 + 884 + 156 + 44)$$

$$= 4.56$$

$$F_c = 1 - .02 (K_t) = 1 - .02 (4.56) = 0.91$$

8. Peak Internal Load (Col. 8, Form C-1)

$$(200) \left( \frac{210}{1000} \right) + (20)(3.413) = 110.26 \text{ Mbtu/hr}$$

9. Annual Factors (Col. 9, Form C-1)

$$\text{Bins (1-8), (5-12): } (200) \left( \frac{210}{1000} \right) (.2) + (20)(3.413)(.4) * 0.91 = 0.29$$

$$\text{Bin (9-4): } (200) \left( \frac{210}{1000} \right) (.85) + (20)(3.413)(.90) * .91 = 0.80$$

## BIN METHODOLOGY FOR ENERGY ESTIMATION

Simply stated, the bin method is an energy balance assuming steady state conditions over the time interval ("bin") of 8 hours. In equation form this is stated as:

$$\dot{Q}_{in} + \dot{Q}_{gen} = \dot{Q}_{out} + \dot{Q}_{stor}$$

where the generation term  $Q_{gen}$  represents internal and solar gains and since assuming steady state, the time rate of storage term ( $Q_{stor}$ ) equals zero.

Proper interpretation and use of this method is to calculate the terms  $Q_{out}$  and  $Q_{gen}$ , multiply by the appropriate time intervals and sum up for the required amount of energy to balance the equation, ( $Q_{in}$ ). Form C-1 of the Life Cycle Analysis document provides the format to do this. However, care must be exercised when using the form, not to forget the basic premise of the energy balance equation, when summing the numbers. An example, for a typical month, is in order:

Month: January	
Average monthly ambient temperatures	= 17.5°F (01-08) 25.2°F (09-16) 22.1°F (17-24)
Occupied temperature set point	= 70°F
Unoccupied temperature set point	= 55°F
South facing glass	= 100 Ft. Sq.
Solar transmittance of glass	= .7
Max. number of occupants	= 100
Ventilation rate during occupied cycle	= 500 CFM
Sensible heat gain/person	= 200 Btu/hr



Connected KW of lights and equipment which contribute heat to space: 15KW\*

\* Only those electrical loads which are uniformly distributed throughout the space or supply fan motors which are in the air stream of the distribution system. (Heat given off by exhaust fans is generally exhausted with the air and large equipment gains in highly localized areas, such as boiler rooms, are generally vented out).

Heat loss factor (UA) overall = 2.0 MBtu/hr°F (includes infiltration heating load and heat loss due to all windows)

No. of days occupied = 17 days

No. of days unoccupied (weekends, holidays) = 14 days

-----  
(01-08) Bin

$$Q_{out} = (UA)_o \Delta T \cdot \text{time} = (2.0 \text{ MBtu/}^\circ\text{F hr}) (55^\circ\text{F} - 17.5^\circ\text{F}) (31 \text{ days}) \left(\frac{8 \text{ hr}}{\text{day}}\right) \\ = 18600 \text{ MBtu (col. 7, C-1 Form)}$$

$$Q_{gen} = F_c * [(KW) \left(3.413 \frac{\text{MBTU}}{\text{KWH}}\right) (\text{diversity}) (\text{time}) + (\# \text{ people}) \left(\frac{\text{SHG}}{\text{person}}\right) (\text{diversity}) (\text{time})] \\ .9 [(15KW) \left(3.413 \frac{\text{MBTU}}{\text{KWH}}\right) (0.2) (17 \text{ days}) \left(\frac{1 \text{ hr}}{\text{day}}\right) + (100 \text{ persons}) \left(.2 \frac{\text{MBTU}}{\text{person}}\right) (.2) (17 \text{ days}) \left(\frac{1 \text{ hr}}{\text{day}}\right)] \\ = .9 [174 + 68] \\ = 217.8 \text{ MBtu (col. 11, C-1 Form)}$$

$$Q_{in} = Q_{out} - Q_{gen}$$

$$Q_{in} = 18600 - 217.8 = 18382 \text{ MBtu (col. 12, C-1 Form)}$$

-----  
(09-16) bin

Occupied Days = 17

$$\begin{aligned}
Q_{out} &= (UA)_O \Delta T \cdot \text{time} + 1.085 \cdot \text{CFM} \cdot \Delta T \cdot \text{time} \\
&= (2.0 \frac{\text{MBTU}}{\text{hr F}})(70-25.2^\circ\text{F})(17 \text{ days})(\frac{8 \text{ hrs}}{\text{day}}) + \frac{(1.085)(500 \text{ CFM})(70-25.2^\circ\text{F})(17 \text{ days})(\frac{6 \text{ hrs}}{\text{day}})}{1000} \\
&= 12185.6 + 2479 \\
&= 14665 \text{ MBtu}
\end{aligned}$$

$$\begin{aligned}
Q_{gen} &= F_c [(KW)(3.413 \frac{\text{MBTU}}{\text{KWH}})(\text{diversity})(\text{time}) + (\text{people})(\frac{\text{SHG}}{\text{person}})(\text{diversity})(\text{time})] + \\
&\quad (\frac{\text{insolation}}{\text{day ft sq}})(\text{clearness factor})(\text{area})(\text{transmittance})(\text{\#days}) \\
Q_{gen} &= .9 [(15KW)(3.413 \frac{\text{MBTU}}{\text{KWH}})(.85)(17 \text{ days})(\frac{8 \text{ hrs}}{\text{day}}) + (100 \text{ persons})(.2 \text{ MBtu/person})(.8) \\
&\quad (17 \text{ days})(8 \text{ hrs/day})] + \frac{(860 \text{ Btu/ft}^2 \text{ day})(.55)(100 \text{ ft}^2)(.7)(17 \text{ days})}{1000} \\
&= .9 [5918 + 2176] + 562.9
\end{aligned}$$

$$Q_{gen} = 7848 \text{ MBtu}$$

$$(Q_{in})_1 = Q_{out} - Q_{gen}$$

$$\begin{aligned}
(Q_{in})_1 &= 14665 - 7848 \\
&= 6818 \text{ MBtu}
\end{aligned}$$

If  $(Q_{in})_1$  had been less than zero,  $(Q_{in})_1 = 0$

#### Unoccupied Days

$$\begin{aligned}
Q_{out} &= (UA)_O \Delta T \cdot \text{Time} \\
&= (2.0 \frac{\text{MBTU}}{\text{hr F}})(55-25.2^\circ\text{F})(14 \text{ days})(\frac{8 \text{ hrs}}{\text{day}}) \\
&= 6675.2 \text{ MBtu}
\end{aligned}$$

$$\begin{aligned}
Q_{gen} &= (\frac{\text{insolation}}{\text{day ft sq}})(\text{Cl. factor})(\text{are})(\text{transmittance})(\text{time}) \\
&= \frac{(860 \text{ Btu/ft}^2 \cdot \text{day})(.55)(100 \text{ ft}^2)(.7)(14 \text{ days})}{1000} \\
&= 463.5 \text{ MBtu}
\end{aligned}$$

$$(Qin)_2 = 6675.2 - 463.5$$

$$= 6212 \text{ MBtu}$$

If  $(Qin)_2$  had been less than zero, then  $(Qin)_2 = 0$

$$(Qin) \text{ Total} = (Qin)_1 + (Qin)_2$$

$$(Qin) \text{ Total} = 6818 + 6212$$

$$= 13030 \text{ MBtu} \quad (\text{col. 12, C-1 Form})$$

(17-24) Bin

$$Q_{out} = (UA)_O \cdot T \cdot \text{time}$$

$$= (2.0 \frac{\text{MBTU}}{\text{F hr}})(55-22.1^\circ\text{F})(31 \text{ days})(\frac{8 \text{ hr}}{\text{day}})$$

$$= 16318 \text{ MBtu} \quad (\text{col. 7, C-1 Form})$$

$$Q_{gen} = [(KW)(3.413 \frac{\text{MBTU}}{\text{KWH}})(\text{diversity})(\text{time}) + (\# \text{ people})(\frac{\text{SHG}}{\text{person}})(\text{diversity})(\text{time})] * F_c$$

$$= [(15KW)(3.413 \frac{\text{MBTU}}{\text{KWH}})(.2)(17 \text{ days})(\frac{1 \text{ hr}}{\text{day}}) + (100)(.2 \frac{\text{MBTU}}{\text{person}})(.2)(17 \text{ days})(\frac{1 \text{ hr}}{\text{day}})] .9$$

$$= [174 + 68] (.9)$$

$$= 217.8 \text{ MBtu} \quad (\text{col. 11, C-1 Form})$$

$$Q_{in} = Q_{out} - Q_{gen}$$

$$= 16318 - 217.8$$

$$= 16100.2 \quad (\text{Col. 12, C-1 Form})$$

## Definitions, Solar Energy Systems

### 1. Solar Collector/Energy Systems Type

- A. Passive - A passive solar energy system is one where available solar radiation is admitted directly into the space, stored with a mass and re-radiated or direct radiation is incident upon a mass wall adjoining the space, stored and indirectly radiated to the space.
- B. Active - An active system is primarily characterized by virtue of the fact that no energy delivery to the space will occur unless the heat transport medium, be it air or water, is mechanically (i.e. fans, pumps) introduced.

### 2. Solar Energy Analysis

- A. Passive solar energy systems shall be analyzed in accordance with Section C.6.0 of the Life Cycle Analysis Document.
- B. Active solar systems shall be analyzed as stipulated in Section C.7.0. Among the variables required but not limited to submittal for review are:
  - 1. Substantiated documentation as to the heat removal factor or collector efficiency curve.
  - 2. Effective transmissivity of cover plate assembly (time averaged value due to dependence on incidence angle of sun and collector orientation).
  - 3. Effective collector aperture area.
  - 4. Tilt angle.
  - 5. Mass flow rate of collector fluid.
  - 6. Typical day hourly insulation data used.
  - 7. Control sequence of solar collector and interlocking of auxiliary heating system plus the system modelling technique used.
  - 8. Evaluation of the percentage of useful available solar energy supplied to the load for the typical day of each month.

## ECONOMIC BENCHMARKS FOR SOLAR DESIGN ("INDICES")

### I. INTRODUCTION

In recognition of the need to promote a better understanding of solar energy utilization and the requirements of an economically viable design the Bureau has prepared the following indices and discussion. It is not intended that such material or figures contained herein are to be used in lieu of good design practice or system analysis in justification of a solar project.

CONTENTS:	II. Indices
	III. System Characteristics
	IV. Use of Indices
	V. Bureau Recommendations
	VI. Tables and Figures

### II. INDICES

Figure 1. - tabulates the amount of insolation (direct & diffuse) which contributes to heat gain for various Maine latitudes, orientations and tilt angles. These values are summations of hour by hour calculations using standard mathematical modelling of solar geometry, atmospheric extinction ratios and terrestrial radiation flux values as outlined in ASHRAE 1980 SYSTEMS Volume, Chapter 59. Similarly the transmissivity (being a function of incidence angle) was calculated on an hour by hour basis for single glazing and double glazing (values in parentheses). Table values reflect the effective transmissivity as well as a time weighted annual average for percent possible sunshine equal to 0.56. Monthly hour by hour tabulations of insolation rates or the computer program (in BASIC) for calculating them are available from the Bureau, upon request, for design analyses.

Figure 2. - tabulates the values of solar radiation in Figure 1 for a thirty year period with the cost of money at 10 percent. The title "theoretical ceiling" denotes that these figures are the upper bound on costs simply due to the fact that no more energy can be collected than is typically available. It is not to be inferred that these costs represent acceptable design costs as they are theoretical maximums (i.e. 100% collector efficiency, utilization). They are presented in order to give the designer a "feel" for the limits of solar potential and design costs. Historically the Bureau has been presented designs for approval which exceed these maximums.

Three things should be readily apparent from examination of Figure 2:

1. Optimum solar energy collection will occur when angle of aperture is equal to latitude.

2. Even at 100% efficiency and utilization vertically hung collection systems will have a relatively low upper bound for square foot costs.
3. A design which is just economically viable in southern Maine would have to be improved in northern Maine, not only due to more severe climatic conditions, but reduced insolation as well.

### III. SYSTEM CHARACTERISTICS

#### 1. Passive

##### A. Direct Gain

- Used when sizeable thermal fluctuations can be tolerated
- Assymmetric solar excitation, such as occurs in south aperture systems, naturally drives a north-south separation. Mechanically assisted heat transfer would be appropriate.
- For low (0-25%) solar heating fractions generally no additional thermal mass storage is required
- To achieve large (more than 25%) solar heating fractions additional thermal mass is required to decrease temperature fluctuations. This additional thermal mass can be a significant expense.
- Glare, ultraviolet degradation can result from direct exposure
- Interior space temperature swings of 15 to 20 degree Fahrenheit are common even in well designed buildings.
- Moveable insulation systems over the glazing are generally required to reduce night losses, but such systems can be awkward and expensive for large areas.
- Use of operable shades by occupants to control temperature swings will result in reduced energy collection
- Spaces with internal gains sufficient to offset heating load of well insulated structures will result in heat rejection diminishing solar utilization percentage unless mechanical transport of energy to cooler zones is included in design.

## B. Indirect Gain

- Energy delivery to space more controllable than for direct gain systems. It can be immediate convective thermosyphon loop to satisfy daytime load or delayed through conduction and re-radiation from the walls inside surface to meet evening and nighttime loads.
- Indoor temperature swings are less than indirect gain systems on the order to 10 to 15 degrees Fahrenheit.
- Heat losses are increased due to proximity of thermal storage mass to the glazing, reducing efficiency.
- To minimize overheating during spring and summer months a mass wall must be shaded and vented to the outdoors.
- As with direct gain systems, spaces with internal gains and insulation to offset daytime heating loads will suffer a decrease in solar utilization and efficiency unless the mass of the wall is sized to store captured energy for delivery to nighttime loads.

The additional mass can lead to significant increases in cost. Isolated indirect gain systems (interior of wall insulated) will re-radiate absorbed energy back to the atmosphere especially if delivery to load is deferred.

## 2. Active

### A. Space heating collectors with air as the thermal transport medium

- Generally more appropriate for small buildings
- Simpler in design and components than liquid systems
- No freeze protection required
- Lower maintenance and easier leakage repair
- Low heat capacity and density of air requires large volumes and bulky ductwork and storage
- Higher energy requirements for fans than pumps noisier in operation

### B. Space heating collectors with liquid as thermal transport medium

- Generally preferred for commercial buildings because such buildings are nearly always heated by fan coil units, heating coils in air ducts and radiant hot water units all requiring hot water.

- Liquid collectors are generally more efficient
- Potential for combination with domestic hot water system
- More convenient to install in existing buildings.
- Greater supply of data and product availability due to greater attention given to liquid systems by solar industry.
- Higher installation costs for collectors and storage components
- Precautions must be taken against leakage, corrosion and boiling. Freeze protection may require antifreeze and heat exchangers which reduces efficiency.
- Greater maintenance requirements

#### IV. USE OF INDICES

As was previously stated, indice tables are based on 100% system efficiency and utilization. From the discussion of system characteristics it should be apparent that some adjustment for these factors must be figured in to arrive at the system cost for a viable design. A step wise procedure with guidelines for doing so, with examples, follows.

Before proceeding it is essential that the definitions of solar efficiency and utilization percentages, which must be initially assumed, are properly understood.

Solar efficiency as defined here refers to the ratio of energy collected (available minus losses) to energy available. Instantaneous collector efficiency is, of course, a function of a number of parameters, but reasonable average values for non-concentrating collectors range between 0.85 and 0.90 for a liquid heater and between 0.6 and 0.7 for an air heater.

Solar utilization defined as the portion of collected energy which actually offsets the building's or zone's heating load. Heating loads of buildings are often poorly matched to the time profile of the supply of available solar energy (see figure 3). Additionally, the seasonal variation of the sun's intensity and climate conditions works against total utilization of the annual figure presented in figure 1. The most obvious case of this mismatch is manifested in our inability to use summer warmth for winter heating needs. Designs without provision for properly sized storage means and/or peak internal heat gain profiles during solar availability will have poor utilization percentages.

- Step 1. The first step in a preliminary study of a building's potential for solar energy is to determine/estimate the building's or zone's thermal energy requirements. To proceed with a solar analysis independent of the space to which it will be an integral part (i.e. thermally interlocked) is to invite folly both economically and comfort-wise.



Step 2. Decide the fractional portion of heating load solar is to provide. While it is theoretically possible to design a solar space heating system to supply 100% of the annual energy requirements given sufficient collector area and thermal storage capacity, it is generally not cost effective to do so. A solar system is normally designed to meet 20 to 60 percent of the heating requirements. Modest expectations in Maine's severe climate are more likely to be realized in actual use.

Step 3. Calculate collector area:

$$\text{Area} = \frac{(\text{fuel unit})(\text{conventional system eff.})(\text{fuel BTU content/unit})}{(\text{solar eff.})(\text{solar utilization})(\text{radiation available})}$$

where radiation available is taken from figure 1 for latitude, tilt and orientation applicable.

Step 4. Calculate Total Allowable System Costs.

$$\text{TASC} = (\text{area})(\text{solar eff.})(\text{Solar utilization})(\text{ceiling s.f. cost})$$

where ceiling s.f. costs are taken from figure 2 for latitude, tilt and orientation of collector.

Step 5. Calculate actual maximum solar collector square foot costs.

$$\text{COST/S.F.} = \text{TASC/area}$$

Step 6. If it is still anticipated that the project can be implemented at the square foot cost determined in Step 5, then a thorough analysis should be performed by the designer/engineer to validate the assumptions made regarding utilization and efficiencies and a life cycle costing that reflects maintenance costs and system life.

#### EXAMPLE 1. Active Space Heating System

Collector system - single glazed, flat plate liquid heater

Latitude = 45

Tilt Angle = 45

Assumed annual collector efficiency = 0.9

Assumed annual solar utilization = 0.6

Step 1. Determined zone will require 900 gallons #2 oil per year at seasonal efficiency = 0.7

Step 2. Solar participation to be 1/3 of heating requirement or 300 gallons/year.

Step 3. Collector area =  $\frac{(300 \text{ gal.})(0.7)(140000 \text{ BTU/GAL})}{(0.9)(0.6)(277700 \text{ BTU/S.F.})} = 196 \text{ S.F.}$

Step 4. TASC =  $(\$26.71/\text{S.F.})(0.9)(0.6)(196 \text{ S.F.}) = \$2827$

Step 5. COST/S.F. =  $\$2827/196 \text{ S.F.} = \$14.42/\text{S.F.}$

Step 6. Monthly "typical day" calculation of zone load profile and solar insolation profile recommended.

EXAMPLE 2. Passive Direct Gain System

Double glazed windows, south facing, vertical  
U-factor = 0.5 BTU/s.f. - degree, no night insulation  
Latitude - 42

Step 1. 900 gallons/year

Step 2. 300 gallons/year

Step 3. From bin method calculations it is determined that a square foot of window will lose 84.3 MBtu/year through conduction.

$$\text{Efficiency} = (153.9 - 84.3) / 153.9 = 0.45$$

Utilization assumed = 0.5

$$\text{Glazing Area} = \frac{(300)(0.7)(140000)}{(0.45)(0.5)(153900)} = 849 \text{ square feet}$$

Step 4. TASC = (\$14.08)(.45)(0.5)(849) = \$2827.00

Step 5. COST/S.F. = \$2827.00/849  
= \$3.33/S.F.

V. BUREAU RECOMMENDATIONS

1.0. Five Rules of Thumb:

- 1.1. Retain Priorities - Solar heating should never be a first priority. Putting a solar system on a building that is inherently inefficient is a virtual waste of money and time. The essential first step in solarizing of any building is to get the basic structure airtight and insulated and to make sure the non-solar space and water heating systems operate at peak efficiency.
- 1.2. Keep it simple - In the abstract, solar heating is a simple idea. But, making it work in the real world is a little more complex. As the number of components goes up it tends to be expensive, takes up inordinate space and poses major reliability problems as Murphy's Law goes wild with each of the systems parts. Due to the amount of experimentation still going on in solar research it's become important to rely on objective tests to tell the ineffective from the effective designs.
- 1.3. Use simple reliable high quality components and accept no substitutes.
- 1.4. Make special provisions in specifications for quality control of installation and testing requirements for solar design.
- 1.5. Educate the owner or personnel in maintenance and operation of solar energy system.

- 2.0. The designer (Architect/Engineer) should make the owner aware of the drawbacks, such as increased maintenance, etc., to the solar energy systems as well as the benefits (basically reduced operating costs) to allow a more objective decision making process.
- 3.0. The designer employ a qualified individual experienced in solar design and evaluation to perform required calculations.
- 4.0. Solar designer should coordinate closely with controls designer.
- 5.0. Designers are encouraged to call on the Bureau of Public Improvements for guidance, information and such help as to what is required in evaluating solar energy system designs early on in the approval process.
- 6.0. Recommend that hourly typical day calculations for each month be done to evaluate solar energy system performance (efficiency, utilization). Clear day insolation values should be used for calculations and then monthly totals corrected for percent possible sunshine.
- 7.0. Preferred systems should:
  1. Rely on as few field connections (site built collectors) as possible.
  2. Avoid use of hard to find/replace/maintain components.
  3. Use gravity exhaust for summertime venting mode versus powered exhaust.
  4. Have considered being integrated into sloped roof structure to avoid damage due to wind loadings and increase collection of solar radiation.
  5. Have been evaluated/optimized to utilize some means of low temperature storage system in buildings or spaces with high internal heat gain profiles during insolation periods. System efficiency could potentially be improved by capture and storage of excess internal heat gains for delivery to night time loads.
  6. Maximize use of auxilliary heating and ventilation system, by supplying the solar output for distribution and any required "boosting" through those systems. A larger percentage of collected solar energy will thereby be used and the complicated control sequences of two independent systems eliminated. Additionally, any competition between solar and auxilliary systems will be avoided.
  7. Strive to achieve maximum utilization of solar energy collected by performing more than one function, i.e. domestic hot water (during spring, fall) as well as space heating (during winter)

8.0. Studies by the Solar Energy Research Institute would seem to indicate that a solar collector system in combination with a heat pump will function better than either system independently. Evaluate and investigate options.

SUMMARY:

The Bureau of Public Improvements purposes in publishing the observations contained herein is not to establish itself as an authority on solar design or limit the creativity of the designer in solarization of commercial sized structures. Rather, by identifying the critical factors leading to a successful solar design, it is hoped that the design challenge can be more successfully met than has historically been the case. Input from the professional community to items or ideas which are meritorious would be a welcome addition to our store of knowledge and goal of more energy efficient buildings.

Indice Table (Figure 2) assumes use of #2 oil heating plant, 70% efficient with cost of fuel \$1.00/gal. For different heating fuels, efficiencies or cost multiply the table figure by the following factor:

$$F = 98040 \times \frac{(\text{fuel cost/unit})}{(\text{efficiency})(\text{Btu/fuel unit})}$$

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FIGURE 1.  
ANNUAL\* AVERAGE SOLAR RADIATION AVAILABLE (BTU/S.F. - YR)

TILT ANGLE	ORIENTATION		
	SOUTH	S 15 E/W	S 30 E/W
<u>Latitude - 42</u>			
Horizontal	203500 (164400)	203500 (164400)	203500 (164400)
30	279000 (235400)	275600 (232500)	266100 (224300)
45	286400 (242700)	281800 (239000)	270000 (229700)
60	272500 (230000)	267800 (226600)	256600 (215700)
Vertical	188400 (153900)	188600 (152900)	186500 (146800)
<u>Latitude - 45</u>			
Horizontal	189400 (151900)	189400 (151900)	189400 (151900)
30	267700 (225600)	264300 (222600)	254700 (214400)
45	277700 (235400)	273100 (231600)	261100 (215500)
60	267100 (225700)	262200 (222200)	250700 (211000)
Vertical	190400 (156300)	190100 (155100)	186700 (147900)
<u>Latitude = 48</u>			
Horizontal	175100 (139500)	175100 (139500)	175100 (139500)
30	255300 (214800)	251800 (211800)	242300 (203600)
45	267500 (226700)	262900 (223000)	250900 (212400)
60	259900 (219900)	255400 (216300)	243400 (204900)
Vertical	190500 (157200)	189800 (155600)	185500 (147800)

\* Based on typical school year calendar

FIGURE 2.  
THEORETICAL\* "CEILING" SQUARE FOOT COSTS  
FOR SOLAR COLLECTOR SYSTEMS

TILT ANGLE	ORIENTATION		
	SOUTH	S 15 E/W	S 30 E/W
<u>Latitude = 42</u>			
Horizontal	\$19.57 (15.81)	\$19.57 (15.81)	\$19.57 (15.81)
30	26.83 (22.64)	26.51 (22.36)	25.59 (21.57)
45	27.54 (23.34)	27.10 (22.98)	25.96 (21.99)
60	26.21 (22.12)	25.75 (21.79)	24.68 (20.75)
Vertical	18.12 (14.80)	18.14 (14.71)	17.93 (14.12)
<u>Latitude - 45</u>			
Horizontal	\$18.21 (14.61)	\$18.21 (14.61)	\$18.21 (14.61)
30	25.75 (21.69)	25.42 (21.41)	24.49 (20.62)
45	26.71 (22.64)	26.26 (22.28)	25.11 (21.27)
60	25.69 (21.71)	25.22 (21.37)	24.11 (20.29)
Vertical	18.31 (15.03)	18.28 (14.91)	17.96 (14.23)
<u>Latitude - 48</u>			
Horizontal	\$16.84 (13.41)	\$16.84 (13.41)	\$16.84 (13.41)
30	24.55 (20.65)	24.22 (20.37)	23.30 (19.58)
45	25.73 (21.80)	25.28 (21.44)	24.13 (20.43)
60	24.99 (21.15)	24.56 (20.81)	23.41 (19.71)
Vertical	18.32 (15.12)	18.25 (14.97)	17.84 (14.22)

\* NOTE: Costs shown must be adjusted for collection efficiency and solar utilization. Refer to text. Designer must be prepared to demonstrate that values used for collection efficiency and percent utilization were responsibly derived through building thermal performance analysis.

Solar collector systems which have not adequate provision for storage of thermal energy will have resultant poor utilization of solar gain as bottom figure demonstrates. Shaded portions represent solar gain which actually offset the heating requirements of the space.

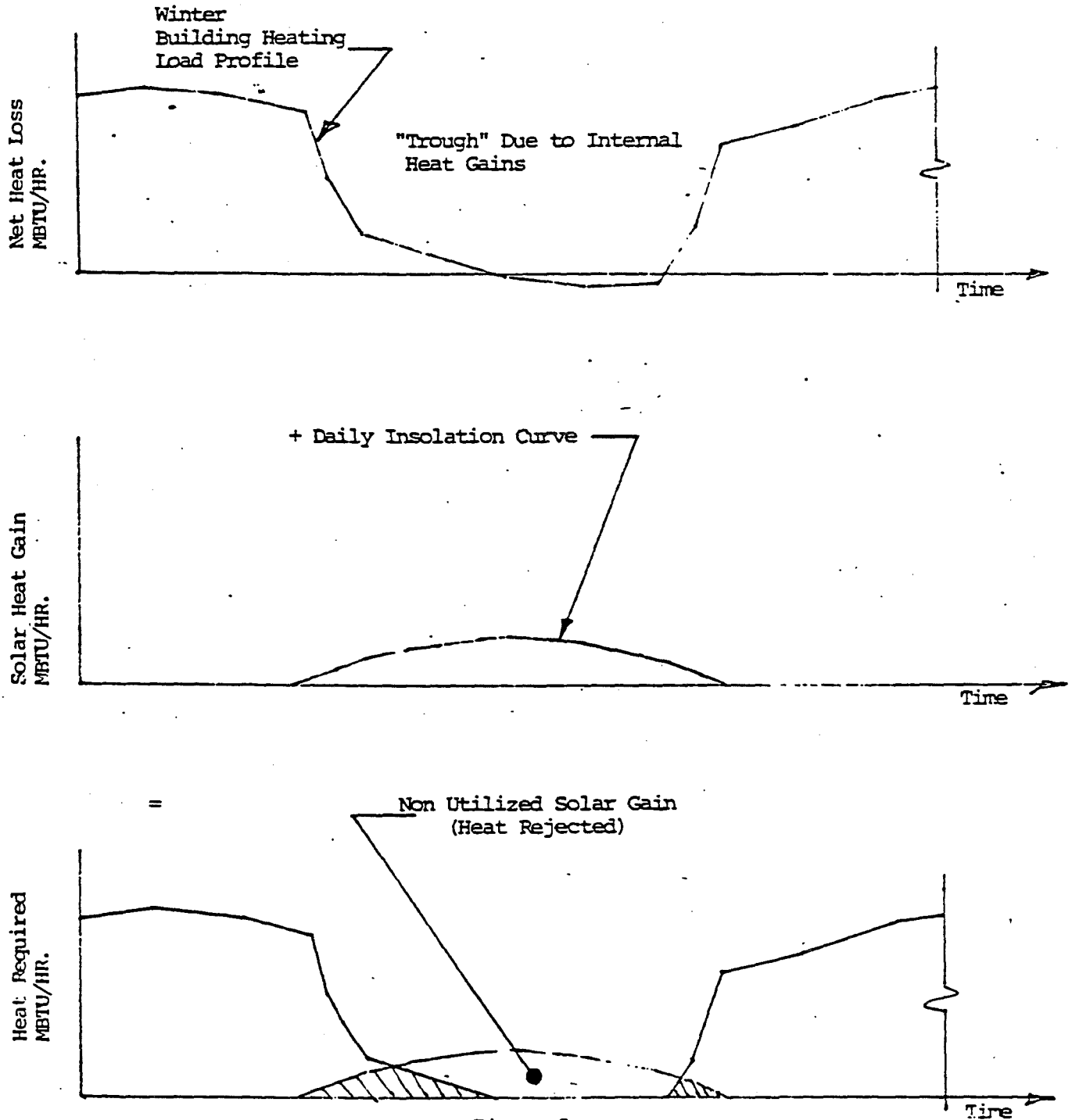


Figure 3  
Pg. 22-68

APPENDIX B

REFERENCES

- BOCA - The BOCA Basic Energy Conservation Code - Latest Edition  
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Data - National Oceanic and Atmospheric Administration





APPENDIX C

SAMPLE FORMS

C-1 Heating Form

C-2 Cooling Form







JOB \_\_\_\_\_  
 BLDG. TYPE \_\_\_\_\_  
 DATE \_\_\_\_\_ BY \_\_\_\_\_

C-1 COOLING FORM  
 HEATING DESIGN TEMP.: \_\_\_\_\_  $\Delta T$ : \_\_\_\_\_  
 SPACE TEMP. \_\_\_\_\_ WEATHER STA. \_\_\_\_\_

M O N T H	COOLING LOAD							INTERNAL LOAD				SOLAR LOAD				NET LOAD
	Period of Day (1)	Avg. Temp. (2)	$\Delta T = T_1 - T_0$ (3)	Heat Gain MBTU (4)	MBTU (5)	Hours in "Bin" (6)	Annual MBTU (7)	Peak Internal Load MBTU (8)	Ann. Factor (9)	Hours In "Bin" (10)	Annual MBTU (11)	Peak Solar Load MBTU (8a)	Ann. Factor (9a)	Hours In "Bin" (10a)	Annual MBTU (11a)	(12)
	2-9															
	10-5															
	6-1															
	2-9															
	10-5															
	6-1															
	2-9															
	10-5															
	6-1															
	2-9															
	10-5															
	6-1															
	2-9															
	10-5															
	6-1															
	GROSS TOTAL															

NOTE: Heating Form C 1, solar and internal annual MBTU for a building must be subtracted from the heating annual MBTU during the hours they occur and if more solar and internal consumption remains, those annual MBTU for solar and internal annual MBTU must be added to the total MBTU for cooling.



ASHRAE/IESNA Standard 90.1-1999



# ASHRAE® STANDARD

## Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

Approved by the ASHRAE Standards Committee June 19, 1999, and by the ASHRAE Board of Directors June 24, 1999.

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AMERICAN SOCIETY OF HEATING,  
REFRIGERATING AND  
AIR-CONDITIONING ENGINEERS, INC.  
1791 Tullie Circle, NE · Atlanta, GA 30329





LIFE CYCLE ANALYSIS

FOR

MAINE CRIMINAL JUSTICE  
ACADEMY

VASSALBORO, MAINE

DESIGN DEVELOPMENT SUBMISSION

February 18, 1999

BY

NEILL AND GUNTER INCORPORATED  
SCARBOROUGH, MAINE 04074  
207-883-3355

FOR

PDT ARCHITECTS  
PORTLAND, MAINE

RECEIVED

JAN 19 2001

STATE OF MAINE  
BUREAU OF GENERAL SERVICES

24081

NEILL AND GUNTER INCORPORATED

Life Cycle Analysis

Maine Criminal Justice Academy

PDT Architects, Portland, Maine

Design Development Submission

INDEX

<u>SUBJECT</u>	<u>PAGE</u>
Form "LCA-1"	1
Form "LCA-2"	2
Energy Consumption - By Component	3 - 9
Calculations and Back-up Data	Appendix A

Project: Maine Criminal Justice Academy

Prepared By:  
NEILL AND GUNTER INCORPORATED  
FILE: 24081/1  
DATE: February 18, 1999

**FORM "LCA-1"**

**B.2.0 Required Energy Items**

State of Maine

Energy Conservation in Buildings

Building Name/Use: Maine Criminal Justice Academy

Location: Vassalboro, Maine

Date: February 18, 1999

1. Average Number of Occupants: 250

2. Degree Days: 8000 per year

3. Inside Design Temperature: 72<sup>0</sup> F.  
Outside Design Temperature: -10<sup>0</sup> F.

4. Building Area: 130,000 SF

**Energy/Point of Use per Year**

5. Lighting: 608,400	kwh (100% efficiency)	2,077,686 MBTU
6. Heating: 23,908	gal No.2 oil @ 100% efficiency	3,299,372 MBTU
7. Cooling: 27,344	kwh (100% efficiency)	93,325 MBTU
8. Water Heating: 5,885	gal No.2 oil @100% efficiency	812,175 MBTU
9. Equipment: 260,171	kwh (100% efficiency)	888,484 MBTU
10. Other:* 0	not applicable	0 MBTU
11. Total energy:		7,171,042 MBTU

12. Yearly Energy Usage  
per Building Square  
Foot Area: 55.2 MBTU/Sq. Ft./Yr.

Project: Maine Criminal Justice Academy

PREPARED BY:  
 NEILL AND GUNTER INCORPORATED  
 FILE: 24081/1  
 DATE: February 18, 1999

FORM "LCA-2"

D.3.0 Life Cycle Cost-Benefit Analysis

State of Maine

Discount Rate: 10%

Column Identification	A	B	C	D	E
Item	Estimated First Cost (P)	Estimated Life (Yrs.)	UCR (P-A) Factor	Salvage Value	(First Cost x UCR) = A
Site Development	\$1,800,000	30	1061	0	\$ 190,980
Building Structure	\$3,440,000	30	1061	0	\$ 364,984
Elevators	\$200,000	30	1061	0	\$ 21,220
Roofing	\$310,000	30	1061	0	\$ 32,891
Mechanical	\$1,980,000	30	1061	0	\$ 210,078
Electrical	\$1,140,000	30	1061	0	\$ 120,954
Built-in Equip.	\$50,000	30	1061	0	\$ 5305

SUBTOTALS COLUMN "E" \$ 946,412

ESTIMATED TOTAL CONSTRUCTION COST = \$8,920,000

Energy Amount	Usage Type	Annual Cost - Col. F
42,563 gallons	No. 2 heating oil @1.00/gal (70% Efficiency)	\$42,563
895,915 KWH	Electricity @ \$.14/KWH (Except for Heating)	\$125,428
Sewer		\$ -
Insurance @ \$. 25/ sf		\$32,500
Taxes (or loss of taxes)		\$ -
Maintenance and Repair @ \$.50/ sf		\$65,000
Maintenance Contracts		\$ -
Other		\$ -
Total Uniform Annual Sum		\$1,211,903
Uniform Annual Sum/ SF	\$9.32	

Project: Maine Criminal Justice Academy

AIA Gross Square Feet = 130,000

PREPARED BY:  
NEILL AND GUNTER INCORPORATED  
FILE: 24081/1  
DATE: February 18, 1999

## HAND CALCULATION - BIN METHOD

### Hand Calculation Method for Life Cycle Analysis

#### 1. Lights, Miscellaneous Power Usages:

---

- A. KW Connected:  $130,000 \text{ sf} \times 2.0 \text{ w/sf} = 260.0 \text{ KW}$
- B. Usage:  $10 \text{ hrs/day} \times 5 \text{ days/wk} \times 52 \text{ wks/yr} = 2600 \text{ hrs/yr}$
- C. Diversity : 90%
- D.  $260.0 \text{ KW} \times .9 = 234.0 \text{ KW}$
- E.  $234.0 \text{ KW} \times 2600 \text{ hrs/yr} = 608,400 \text{ KWH/yr}$

#### 2. Heating System:

---

##### A. Air Distribution:

- 1. Hp Connected : 40.0 HP (Average)
- 2.  $.746 \text{ KW/HP} \times 40.0 \text{ HP} = 29.84 \text{ KW}$
- 3. Diversity : 90% Occupied - 10% Unoccupied
- 4. Occupied: 168 Hrs/Month
- 5. Unoccupied: 576 Hrs/Month
- 6. Occupied KW:
  - a.  $29.84 \text{ KW} \times .9 = 26.9 \text{ KW}$
  - b.  $26.9 \text{ KW} \times 168 \text{ hrs/month} \times 12 \text{ months/yr} = 54,230 \text{ KWH/yr}$
- 7. Unoccupied KW:
  - a.  $29.84 \text{ KW} \times .1 = 2.98 \text{ KW}$
  - b.  $2.98 \text{ KW} \times 576 \text{ hrs/month} \times 12 \text{ months/yr} = 20,598 \text{ KWH/yr}$
- 8. Total KWH =  $54,230 + 20,598 = 74,828 \text{ KWH/yr}$

##### B. Hot water distribution :

- 1. HP Connected: 15.0 HP
- 2.  $.746 \text{ KW/HP} \times 15.0 \text{ HP} = 11.2 \text{ KW}$

##### C. Diversity: 100%

PROJECT: MAINE CRIMINAL JUSTICE ACADEMY

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FILE: 24081/1  
DATE: February 18, 1999

Continuous during the heating season. Hours of operation =744 hr/month

KWH: 744 hr/month x 11.2 KW X 9.0 months/yr = 74,995 KWH/yr

4. Total KWH = 74,828 KWH + 74,995 KWH = 149,823 KWH/yr

3. Exhaust fan system:

---

- A. Connected: 20.0 HP
- B. .746 KW/HP x 20.0 HP = 14.9 KW
- C. Occupied: 210 hrs/month
- D. Diversity: 100%
- E. 14.9 KW x 210 hrs/month x 12 months/yr = 37,548 KWH/yr

4. Exterior Lighting:

---

- A. Connected: 20.0 KW
- B. Usage: 70 hrs/wk x 52 wks/yr = 3,640 hrs/yr
- C. 20.0 KW x 3,640 hrs/yr = 72,800 KWH/yr

5. Air Conditioning:

---

- A. Connected: 62.5 tons x 1.25 KW/ton x 350 equivalent full-load hours = 27,344 KWH

Totals

1.	Lights, Miscellaneous Power Usages	608,400 KWH/yr
2.	Heating System	149,823 KWH/yr
3.	Exhaust Fan System	37,548 KWH/yr
4.	Exterior Lighting	72,800 KWH/yr
5.	Air conditioning	27,344 KWH/yr
6.	Domestic water heating	----- KWH/yr
	<b>TOTAL</b>	<b>895,915 KWH/yr</b>

PROJECT: MAINE CRIMINAL JUSTICE ACADEMY

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DATE: February 18, 1999

"UA" Calculation ( See attached heating load calculation)

1. Total calculated heating transmission and infiltration load = 1,874,000 BTUH
2. South-facing glass = 2157 SF

Domestic Hot Water Use For Service Water Heating

1.  $250 \text{ occupants} \times 13.0 \text{ gal/day per occupant} \times 8.33 \text{ lb/gal} \times 1.0 \text{ BTU/LB-}^{\circ}\text{F} \times 300 \text{ days per year} \times 1.25 \text{ (standby losses)} \times 80^{\circ}\text{F} = 812,175,000 \text{ BTU/yr} / 138,000 \text{ btu/gal} = 5885 \text{ gal/yr}$

5885 gal/yr of heating oil at 100% efficiency.  
**8408 gal/yr** of heating oil at 70% efficiency

Outside Air Ventilation Requirements

1. The calculated minimum outside air for ventilation =  
 $250 \text{ students} \times 15 \text{ cfm per occupant} = 3750 \text{ CFM}$

Total heating (transmission, ventilation and infiltration) requirements

1.  $3,299,372 \text{ MBTU/yr} / 138.0 \text{ MBTU/gallon} = 23,908 \text{ gal/yr @ 100\% efficiency}$
2. OR **34,155 gal/yr @ 70% efficiency**



**APPENDIX "A"**  
**(BACK-UP CALCULATIONS)**

PREPARED BY:  
NEILL AND GUNTER INCORPORATED  
FILE: 24081/1  
DATE: February 18, 1999

MAINE CRIMINAL JUSTICE ACADEMY  
Vassalboro, Maine

Total calculated heating load = 3,909,097 BTUH (from load calculations)  
Ventilation preheat load = 279,495 BTUH (from load calculations)  
Ventilation reheat load = 109,924 BTUH (from load calculations)  
Total transmission and infiltration load = 1,874,000 BTUH  
BTUH/SF transmission + infiltration = 14.4 BTUH/SF

Overall "UA" = 1874.0 MBTUH / 87°F. = 21.6 MBTUH / °F  
Ventilation load = 250 occupants x 15 cfm / student = 3750 CFM

Lighting = 2 W / SF x 130,000 SF = 260.0 KW

South - facing glass = 2157 SF

Annual net heating load = 3,299,372 MBTU / yr. (BGS Calculation)



INPUT NAME OF BLDG Maine Criminal Justice Academy  
 INPUT AREA 130000

SELECT REGION (1-SOUTHERN 2-CENTRAL 3-NORTHERN) 2  
 SELECT SCHEDULE (1-ELEMENTARY 2-HIGH SCHOOL, VOCATIONAL 3-OFFICE 4-OTHER) 4  
 INPUT VENTILATION CFM 3750  
 INPUT OVERALL (UA) FACTOR 21.6  
 INPUT OCCUPIED TEMPERATURE 72  
 INPUT UNOCCUPIED TEMPERATURE 65  
 INPUT SOUTH FACING GLASS AREA 2157  
 INPUT SHADING COEFFICIENT .6  
 INPUT U-FACTOR FOR SOLAR GLASS .6  
 INPUT KILOWATTS OF LIGHTING, MISC 260  
 INPUT DIVERSITY OF LIGHTING DURING OCCUPIED CYCLE .8  
 INPUT DIVERSITY FOR LIGHTING DURING UNOCCUPIED CYCLE .1  
 INPUT PEAK NO. OF OCCUPANTS 250  
 INPUT DIVERSITY OF OCCUPANTS DURING OCCUPIED CYCLE .8  
 INPUT DIVERSITY OF OCCUPANT DURING UNOCCUPIED CYCLE .5  
 INPUT SENSIBLE HEAT GAIN DUE TO OCCUPANTS (BTU/PERSON-HR) 255  
 INPUT INTERNAL HEAT GAIN ADJUSTMENT FACTOR (Fc) .95

	HEATING LOAD			/	INTERNAL LOAD			/	SOLAR LOAD			/
	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	(8a)	(9a)	(11a)	(12)								
	14.2	-50.8	%21.600	%-1097.3	248	%-272125.5	951.1	0.015	248	3552		
E-1	0.0	0.00		0.0		268573.4						
JAN	20.9	-51.1	%25.669	%-1311.7	248	%-325295.0	951.1	0.760	248	846		
.3	29.5	%24924.77	121101.2									
	20.9	-44.1	%21.600	-952.6	0	0.0	951.1	0.000	0	0.0		
	846.3	0.00	0.0	0.0		0.0						
	18.2	-46.8	%21.600	%-1010.9	248	%-250698.2	951.1	0.015	248	3552		
.1	0.0	0.00		0.0		247146.2						
	14.5	-50.5	%21.600	%-1090.8	224	%-244339.2	951.1	0.015	224	3208		
.3	0.0	0.00		0.0		241130.9						
FEB	23.4	-48.6	%25.669	%-1247.5	224	%-279440.3	951.1	0.760	224	939		
.2	26.6	%24982.75	92537.2									
	23.4	-41.6	%21.600	-898.6	0	0.0	951.1	0.000	0	0.0		
	939.2	0.00	0.0	0.0		0.0						
	20.4	-44.6	%21.600	-963.4	224	%-215792.7	951.1	0.015	224	3208.3		
	0.0	0.00	0.0	0.0		212584.3						
	24.8	-40.2	%21.600	-868.3	248	%-215343.4	951.1	0.015	248	3552.1		
	0.0	0.00		0.0		211791.3						
MAR	34.4	-37.6	%25.669	-965.1	248	%-239356.0	951.1	0.760	248	742.1		
	29.5	%21856.20	38230.8									
	34.4	-30.6	%21.600	-661.0	0	0.0	951.1	0.000	0	0.0		
	742.1	0.00	0.0	0.0		0.0						
	30.3	-34.7	%21.600	-749.5	248	%-185881.0	951.1	0.015	248	3552.1		
	0.0	0.00	0.0	0.0		182328.9						
	35.4	-29.6	%21.600	-639.4	240	%-153446.4	951.1	0.015	240	3437.5		
	0.0	0.00		0.0		150008.9						
APR	46.5	-25.5	%25.669	-654.6	240	%-157092.8	951.1	0.760	240	479.8		
	28.5	%13673.90	0.0									

	46.5	-18.5	%21.600	-399.6	0	0.0	951.1	0.000	0	0.0
	479.8	0.00		0.0		0.0				
	41.0	-24.0	%21.600	-518.4	240	%-124416.0	951.1	0.015	240	3437.5
	0.0	0.00		0.0		120978.5				
	46.5	-18.5	%21.600	-399.6	248	-99100.8	951.1	0.015	248	3552.1
	0.0	0.00		0.0		95548.7				
MAY	56.7	-15.3	%25.669	-392.7	248	-97397.5	951.1	0.760	248	331.2
	29.5	9754.18		0.0						
	56.7	-8.3	%21.600	-179.3	0	0.0	951.1	0.000	0	0.0
	331.2	0.00		0.0		0.0				
	51.5	-13.5	%21.600	-291.6	248	-72316.8	951.1	0.015	248	3552.1
	0.0	0.00		0.0		68764.7				
	56.1	-8.9	%21.600	-192.2	240	-46137.6	951.1	0.015	240	3437.5
	0.0	0.00		0.0		42700.1				
JUN	69.5	-2.5	%25.669	-64.2	240	-15401.3	951.1	0.760	240	325.4
	28.5	9272.81		0.0						
	69.5	4.5	%21.600	97.2	0	0.0	951.1	0.000	0	0.0
	325.4	0.00		0.0		0.0				
	61.8	-3.2	%21.600	-69.1	240	-16588.8	951.1	0.015	240	3437.5
	0.0	0.00		0.0		13151.3				
	62.3	-2.7	%21.600	-58.3	248	-14463.4	951.1	0.015	248	3552.1
	0.0	0.00		0.0		10911.3				
JUL	73.2	1.2	%25.669	30.8	248	7639.0	951.1	0.760	248	375.2
	29.5	%11050.07		0.0						
	73.2	8.2	%21.600	177.1	0	0.0	951.1	0.000	0	0.0
	375.2	0.00		0.0		0.0				
	66.3	1.3	%21.600	28.1	248	6963.9	951.1	0.015	248	3552.1
	0.0	0.00		0.0		0.0				
	60.6	-4.4	%21.600	-95.0	248	-23569.9	951.1	0.015	248	3552.1
	0.0	0.00		0.0		20017.9				
AUG	72.2	0.2	%25.669	5.1	248	1273.2	951.1	0.760	248	540.9
	29.5	%15929.83		0.0						
	72.2	7.2	%21.600	155.5	0	0.0	951.1	0.000	0	0.0
	540.9	0.00		0.0		0.0				
	65.2	0.2	%21.600	4.3	248	1071.3	951.1	0.015	248	3552.1
	0.0	0.00		0.0		0.0				
	52.6	-12.4	%21.600	-267.8	240	-64281.6	951.1	0.015	240	3437.5
	0.0	0.00		0.0		60844.1				
SEP	60.6	-11.4	%25.669	-292.6	240	-70229.7	951.1	0.760	240	769.7
	28.5	%21937.18		0.0						
	60.6	-4.4	%21.600	-95.0	0	0.0	951.1	0.000	0	0.0
	769.7	0.00		0.0		0.0				
	56.3	-8.7	%21.600	-187.9	240	-45100.8	951.1	0.015	240	3437.5
	0.0	0.00		0.0		41663.3				
	43.4	-21.6	%21.600	-466.6	248	%-115706.9	951.1	0.015	248	3552.1
	0.0	0.00		0.0		112154.8				
OCT	52.5	-19.5	%25.669	-500.5	248	%-124134.1	951.1	0.760	248	879.0
	29.5	%25886.40		0.0						
	52.5	-12.5	%21.600	-270.0	0	0.0	951.1	0.000	0	0.0
	879.0	0.00		0.0		0.0				
	47.2	-17.8	%21.600	-384.5	248	-95351.0	951.1	0.015	248	3552.1
	0.0	0.00		0.0		91799.0				
	34.4	-30.6	%21.600	-661.0	240	%-158630.4	951.1	0.015	240	3437.5

	0.0	0.00	0.0	155192.9						
NOV	40.6	-31.4	%25.669	-806.0	240	%-193439.7	951.1	0.760	240	702.6
	28.5	%20022.86	0.0							
	40.6	-24.4	%21.600	-527.0	0	0.0	951.1	0.000	0	0.0
	702.6	0.00	0.0	0.0						
	36.5	-28.5	%21.600	-615.6	240	%-147744.0	951.1	0.015	240	3437.5
	0.0	0.00	0.0	144306.5						
	19.9	-45.1	%21.600	-974.2	248	%-241591.7	951.1	0.015	248	3552.1
	0.0	0.00	0.0	238039.6						
DEC	25.6	-46.4	%25.669	%-1191.0	248	%-295375.5	951.1	0.760	248	740
..8	29.5	%21816.56	94289.9							
	25.6	-39.4	%21.600	-851.0	0	0.0	951.1	0.000	0	0.0
	740.8	0.00	0.0	0.0						
	22.6	-42.4	%21.600	-915.8	248	%-227128.3	951.1	0.015	248	3552.1
	0.0	0.00	0.0	223576.3						

SOLAR RADIATION AVAILABLE = 387907.9 MBTU/YR  
 SOLAR ENERGY UTILIZED = 113533.9 MBTU/YR  
 HEAT LOSS DUE TO SOLAR APERTURE = 272144.4 MBTU/YR  
 NET SOLAR GAIN = -158610.6 MBTU/YR

ENTER 3140762 ON LINE 6 OF FORM LCA-1  
 ENTER (+) 1.220081 ON LINE 13 OF FORM LCA-1  
 (-) -1.220081 ON LINE 13 OF FORM LCA-1

ANNUAL NET HEATING LOAD = 3299372 MBTU/YR

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\*\* TRACE 600 ANALYSIS \*\*  
\*\*  
\*\* by C.D.S. MARKETING \*\*  
\*\*  
\*\*\*\*\*  
\*\*\*\*\*

MAINE CRIMINAL JUSTICE ACADEMY  
VASSALBORO, ME  
PDT ARCHITECTS  
SP DOEL  
FILE 24081

Weather File Code: PORTLANM  
Location: PORTLAND, ME  
Latitude: 44.0 (deg)  
Longitude: 70.0 (deg)  
Time Zone: 5  
Elevation: 61 (ft)  
Barometric Pressure: 29.9 (in. Hg)

Summer Clearness Number: 1.02  
Winter Clearness Number: 1.02  
Summer Design Dry Bulb: 84 (F)  
Summer Design Wet Bulb: 72 (F)  
Winter Design Dry Bulb: -15 (F)  
Summer Ground Reflectance: 0.20  
Winter Ground Reflectance: 0.20

Air Density: 0.0759 (Lbm/cuft)  
Air Specific Heat: 0.2444 (Btu/lbm/F)  
Density-Specific Heat Prod: 1.1128 (Btu-min./hr/cuft/F)  
Latent Heat Factor: 4,898.6 (Btu-min./hr/cuft)  
Enthalpy Factor: 4.5526 (Lb-min./hr/cuft)

Design Simulation Period: June To November  
System Simulation Period: January To December  
Cooling Load Methodology: CLTD/CLF (Transfer Function Method)

Time/Date Program was Run: 15:19:40 2/ 9/99  
Dataset Name: 24081 .TM

AIRFLOW - ALTERNATIVE 1  
LOAD CALCULATION

-----  
SYSTEM SUMMARY  
(Design Airflow Quantities)  
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System Number	System Type	Main					Auxil.	Room
		Outside Airflow (Cfm)	Cooling Airflow (Cfm)	Heating Airflow (Cfm)	Return Airflow (Cfm)	Exhaust Airflow (Cfm)	Supply Airflow (Cfm)	Exhaust Airflow (Cfm)
1	RAD	4,500	0	0	0	5,474	0	0
2	VRH	2,000	23,519	7,056	25,025	3,507	0	0
3	SZ	2,000	4,307	4,307	4,593	2,287	0	0
4	RAD	8,000	0	0	0	9,134	0	0
5	RAD	3,000	0	0	0	3,775	0	0
6	RAD	1,000	0	0	0	1,210	0	0
7	RAD	1,168	0	0	0	1,168	0	0
Totals		21,668	27,825	11,362	29,619	26,556	0	0

CAPACITY - ALTERNATIVE 1  
LOAD CALCULATION

-----  
SYSTEM SUMMARY  
(Design Capacity Quantities)  
-----

System Number	System Type	Cooling					Heating							
		Main Sys. Capacity (Tons)	Aux. Sys. Capacity (Tons)	Opt. Capacity (Tons)	Vent Capacity (Tons)	Cooling Totals (Tons)	Main Sys. Capacity (Btuh)	Aux. Sys. Capacity (Btuh)	Preheat Capacity (Btuh)	Reheat Capacity (Btuh)	Humidif. Capacity (Btuh)	Opt. Capacity (Btuh)	Vent Capacity (Btuh)	Heating Totals (Btuh)
1	RAD	0.0	0.0	0.0	0.0	0.0	-861,131	0	0	0	0	0	0	-861,131
2	VRH	52.7	0.0	0.0	0.0	52.7	-506,875	0	-156,786	-109,924	0	0	0	-663,661
3	SZ	13.8	0.0	0.0	0.0	13.8	-322,919	0	-122,710	0	0	0	0	-322,919
4	RAD	0.0	0.0	0.0	0.0	0.0	-1,262,236	0	0	0	0	0	0	-1,262,236
5	RAD	0.0	0.0	0.0	0.0	0.0	-469,627	0	0	0	0	0	0	-469,627
6	RAD	0.0	0.0	0.0	0.0	0.0	-216,413	0	0	0	0	0	0	-216,413
7	RAD	0.0	0.0	0.0	0.0	0.0	-113,111	0	0	0	0	0	0	-113,111
Totals		66.5	0.0	0.0	0.0	66.5	-3,752,311	0	-279,495	-109,924	0	0	0	-3,909,097

The building peaked at hour 17 month 7 with a capacity of 66.4 tons

TOTAL VENTILATION LOAD (HEATING) =  
 $21,668 \text{ cfm} \times 87^\circ \text{F.} \times 1.08 =$   
 $2,036 \text{ MBH.}$

REQ'd Boiler Capacity.

TOTAL TRANSMISSION LOAD (HEATING) =  
 $3,910 \text{ MBH} - 2,036 \text{ MBH} = 1874 \text{ MBH}$   
 $UA = 1874 / 87 = 21.6$



ENGINEERING CHECKS - ALTERNATIVE 1  
LOAD CALCULATION

----- ENGINEERING CHECKS -----

System Number	Main/Auxiliary	System Type	Percent Outside Air	----- Cooling -----				--- Heating ---		Floor Area Sq Ft
				Cfm/ Sq Ft	Cfm/ Ton	Sq Ft /Ton	Btuh/ Sq Ft	Cfm/ Sq Ft	Btuh/ Sq Ft	
1	Main	RAD	0.00	0.00	0.0	0.0	0.00	0.00	-29.58	29,112
2	Main	VRH	8.50	0.64	445.9	693.1	17.31	0.19	-18.15	36,562
3	Main	SZ	46.44	1.29	312.5	242.7	49.45	1.29	-96.57	3,344
4	Main	RAD	0.00	0.00	0.0	0.0	0.00	0.00	-42.22	29,897
5	Main	RAD	0.00	0.00	0.0	0.0	0.00	0.00	-24.54	19,138
6	Main	RAD	0.00	0.00	0.0	0.0	0.00	0.00	-59.32	3,648
7	Main	RAD	0.00	0.00	0.0	0.0	0.00	0.00	-9.68	11,683

SYSTEM CHECKSUMS System 1 Block RAD - RADIATION HEATING SYSTEM

***** COOLING COIL PEAK *****											***** CLG SPACE PEAK *****			***** HEATING COIL PEAK *****		
Peaked at Time ==>		Mo/Hr: 0/ 0		*		Mo/Hr: 0/ 0		*		Mo/Hr: 13/ 1						
Outside Air ==>		OADB/WB/HR: 0/ 0/ 0.0		*		OADB: 0		*		OADB: -15						
Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Perct Of Tot (%)	*	Space Sensible (Btuh)	Perct Of Tot (%)	*	Space Peak (Btuh)	Coil Peak (Btuh)	Perct Of Tot (%)	Space Sens (Btuh)	Coil Peak (Btuh)	Perct Of Tot (%)		
Envelope Loads																
Skylite Solr	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Skylite Cond	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Roof Cond	0	0	0	0.00	*	0	0.00	*	-31,659	-31,659	3.68					
Glass Solar	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Glass Cond	0	0	0	0.00	*	0	0.00	*	-104,333	-104,333	12.12					
Wall Cond	0	0	0	0.00	*	0	0.00	*	-195,124	-195,124	22.66					
Partition	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Exposed Floor	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Infiltration	0	0	0	0.00	*	0	0.00	*	-94,338	-94,338	10.96					
Sub Total==>	0	0	0	0.00	*	0	0.00	*	-425,454	-425,454	49.41					
Internal Loads																
Lights	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
People	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Misc	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Sub Total==>	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Roofing Load	0	0	0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Outside Air	0	0	0	0.00	*	0	0.00	*	-435,676	-435,676	50.59					
Sup. Fan Heat			0	0.00	*		0.00	*					0	0.00		
Ret. Fan Heat		0	0	0.00	*		0.00	*					0	0.00		
Duct Heat Pkup		0	0	0.00	*		0.00	*					0	0.00		
OV/UNDR Sizing	0		0	0.00	*	0	0.00	*	0	0	0.00	0	0	0.00		
Exhaust Heat		0	0	0.00	*		0.00	*					0	0.00		
Terminal Bypass		0	0	0.00	*		0.00	*					0	0.00		
Grand Total==>	0	0	0	0.00	*	0	0.00	*	-861,131	-861,131	100.00					

-----COOLING COIL SELECTION-----

-----AREAS-----

	Total Capacity (Tons)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR (Deg F)	Leaving DB/WB/HR (Deg F)	Gross Total Floor	Glass (sf)	(%)
Main Clg	0.0	0.0	0	0.0	0.0	29,112		
Aux Clg	0.0	0.0	0	0.0	0.0	0		
Opt Vent	0.0	0.0	0	0.0	0.0	0		
Totals	0.0	0.0	0	0.0	0.0	7,278	0	0
						12,992	1,778	14

-----HEATING COIL SELECTION-----

-----AIRFLOWS (cfm)-----

-----ENGINEERING CHECKS-----

-----TEMPERATURES (F)-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent (Deg F)	Lvg (Deg F)	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg
Main Htg	-861.1	0	0.0	0.0	Vent	0	4,500	Clg Cfm/Sqft	0.00	SADB	0.0	72.1
Aux Htg	0.0	0	0.0	0.0	Infil	0	974	Clg Cfm/Ton	0.00	Plenum	0.0	72.0
Preheat	0.0	0	0.0	0.0	Supply	0	0	Clg Sqft/Ton	0.00	Return	0.0	72.0
Reheat	0.0	0	0.0	0.0	Mincfm	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	72.0
idif	0.0	0	0.0	0.0	Return	0	0	No. People	0	Runarnd	0.0	72.0
Opt Vent	0.0	0	0.0	0.0	Exhaust	0	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0
Total	-861.1				Rm Exh	0	0	Htg Cfm/SqFt	0.00	Fn BldTD	0.0	0.0
					Auxil	0	0	Htg Btuh/SqFt	-29.58	Fn Frict	0.0	0.0

SYSTEM CHECKSUMS System 2 Block VRH - VARIABLE VOLUME WITH REHEAT

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*

Peaked at Time ==> Mo/Hr: 7/17 \* Mo/Hr: 7/17 \* Mo/Hr: 13/ 1  
 Outside Air ==> OADB/WB/HR: 82/ 71/ 98.0 \* OADB: 82 \* OADB: -15

	Space	Ret. Air	Ret. Air	Net	Perct		Space	Perct	Space Peak	Coil Peak	Perct
	Sens.+Lat.	Sensible	Latent	Total	Of Tot		Sensible	Of Tot	Space Sens	Tot Sens	Of Tot
	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)		(Btuh)	(%)	(Btuh)	(Btuh)	(%)
Envelope Loads											
Skylite Solr	0	0		0	0.00	*	0	0.00	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	0	0	0.00
Roof Cond	37,678	0		37,678	5.95	*	37,678	8.00	-50,821	-50,821	8.91
Glass Solar	156,376	0		156,376	24.70	*	156,376	33.19	0	0	0.00
Glass Cond	11,515	0		11,515	1.82	*	11,515	2.44	-208,549	-208,549	36.55
Wall Cond	79,052	0		79,052	12.49	*	79,052	16.78	-287,761	-287,761	50.44
Partition	0			0	0.00	*	0	0.00	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	-145,894	-145,894	25.57
Sub Total==>	284,620	0		284,620	44.97	*	284,620	60.42	-693,025	-693,025	121.47
Internal Loads											
Lights	124,786	0		124,786	19.71	*	124,786	26.49	0	0	0.00
People	51,000			51,000	8.06	*	25,500	5.41	0	0	0.00
Misc	36,196	0	0	36,196	5.72	*	36,196	7.68	0	0	0.00
Sub Total==>	211,982	0	0	211,982	33.49	*	186,482	39.58	0	0	0.00
Chilling Load	0	0		0	0.00	*	0	0.00	0	0	0.00
Outside Air	0	0	0	69,476	10.98	*	0	0.00	0	-193,634	33.94
Sup. Fan Heat				66,897	10.57	*		0.00		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	316,142	316,142	-55.41
Exhaust Heat		0	0	0	0.00	*		0.00		0	0.00
Terminal Bypass		0	0	0	-0.00	*		0.00		0	0.00
Grand Total==>	496,603	0	0	632,976	100.00	*	471,103	100.00	-376,882	-570,516	100.00

-----COOLING COIL SELECTION-----

	Total Capacity	Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total	Glass (sf)	(%)
	(Tons)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor		
Main Clg	52.7	633.0	551.8	76.5	62.3	61.6	55.4	53.1	56.6	36,562		
Aux Clg	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		
Opt Vent	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0		
Totals	52.7	633.0								20,092	3,554	18

-----HEATING COIL SELECTION-----

	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	8.5	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent			Clg Cfm/Sqft	0.64	SADB	58.0	120.0
Main Htg	-506.9	7,056	55.4	120.0	Infil	0	1,507	Clg Cfm/Ton	445.87	Plenum	76.0	72.0
Aux Htg	0.0	0	0.0	0.0	Supply	23,519	7,056	Clg Sqft/Ton	693.14	Return	76.0	72.0
Preheat	-156.8	2,000	-15.0	55.4	Mincfm	7,056	7,056	Clg Btuh/Sqft	17.31	Ret/OA	76.5	47.3
Reheat	-109.9	7,056	58.0	72.0	Return	23,519	8,552	No. People	100	Runarnd	76.0	72.0
dif	0.0	0	0.0	0.0	Exhaust	2,000	3,507	Htg % OA	28.3	Fn MtrTD	0.6	0.6
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/Sqft	0.19	Fn BldTD	0.5	0.5
Total	-663.7				Auxil	0	0	Htg Btuh/Sqft	-18.15	Fn Frict	1.4	1.4

STEM CHECKSUMS System 3 Peak SZ - SINGLE ZONE SYSTEM

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*

Peaked at Time ==> Mo/Hr: 7/16 \* Mo/Hr: 7/18 \* Mo/Hr: 13/ 1  
 Outside Air ==> OADB/WB/HR: 84/ 72/ 98.0 \* OADB: 80 \* OADB: -15

	Space	Ret. Air	Ret. Air	Net	Perct		Space	Perct		Space Peak	Coil Peak	Perct
	Sens.+Lat.	Sensible	Latent	Total	Of Tot		Sensible	Of Tot		Space Sens	Tot Sens	Of Tot
	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)		(Btuh)	(%)		(Btuh)	(Btuh)	(%)
Envelope Loads												
Skylite Solr	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	10,768	0	0	10,768	6.51	*	9,848	11.42	*	-14,546	-14,546	4.50
Glass Solar	8,910	0	0	8,910	5.39	*	9,405	10.90	*	0	0	0.00
Glass Cond	1,782	0	0	1,782	1.08	*	1,129	1.31	*	-29,047	-29,047	9.00
Wall Cond	11,785	0	0	11,785	7.13	*	14,248	16.52	*	-57,925	-57,925	17.94
Partition	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0	0	0	0	0.00	*	0	0.00	*	-27,767	-27,767	8.60
Sub Total==>	33,244	0	0	33,244	20.10	*	34,630	40.14	*	-129,285	-129,285	40.04
Internal Loads												
Lights	22,826	0	0	22,826	13.80	*	22,826	26.46	*	0	0	0.00
People	51,000	0	0	51,000	30.84	*	25,500	29.56	*	0	0	0.00
Misc	3,311	0	0	3,311	2.00	*	3,311	3.84	*	0	0	0.00
Sub Total==>	77,137	0	0	77,137	46.65	*	51,637	59.86	*	0	0	0.00
Ceiling Load	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	51,151	30.93	*	0	0.00	*	0	-193,634	59.96
Sup. Fan Heat	0	0	0	3,828	2.32	*	0	0.00	*	0	0	0.00
Ret. Fan Heat	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Duct Heat Pkup	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
OV/UNDR Sizing	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Terminal Bypass	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Grand Total==>	110,381	0	0	165,360	100.00	*	86,267	100.00	*	-129,285	-322,919	100.00

-----COOLING COIL SELECTION-----

-----AREAS-----

	Total Capacity	Sens Cap.	Coil Airfl	Entering DB/WB/HR	Leaving DB/WB/HR	Gross Total	Glass (sf)	(%)
	(Tons)	(Mbh)	(cfm)	Deg F Deg F Grains	Deg F Deg F Grains	Floor ...		
Main Clg	13.8	165.4	4,307	79.5 68.0 84.8	57.2 56.1 65.7	Part	0	
Aux Clg	0.0	0.0	0	0.0 0.0 0.0	0.0 0.0 0.0	ExFlr	0	
Opt Vent	0.0	0.0	0	0.0 0.0 0.0	0.0 0.0 0.0	Roof	3,344	0 0
Totals	13.8	165.4				Wall	3,824	495 13

-----HEATING COIL SELECTION-----

-----AIRFLOWS (cfm)-----

-----ENGINEERING CHECKS-----

-----TEMPERATURES (F)-----

	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	46.4	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	2,000	2,000	Clg Cfm/Sqft	1.29	SADB	58.0	99.0
Main Htg	-322.9	4,307	31.6	99.0	Infil	0	287	Clg Cfm/Ton	312.53	Plenum	76.0	72.0
Aux Htg	0.0	0	0.0	0.0	Supply	4,307	4,307	Clg Sqft/Ton	242.67	Return	76.0	72.0
Preheat	-122.7	4,307	31.6	57.2	Mincfm	0	0	Clg Btuh/Sqft	49.45	Ret/OA	79.5	31.6
Reheat	0.0	0	0.0	0.0	Return	4,307	4,593	No. People	100	Runarnd	76.0	72.0
Midif	0.0	0	0.0	0.0	Exhaust	2,000	2,287	Htg % OA	46.4	Fn MtrTD	0.1	0.1
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	1.29	Fn BldTD	0.2	0.2
Total	-322.9				Auxil	0	0	Htg Btuh/SqFt	-96.57	Fn Frict	0.5	0.5

ITEM CHECKSUMS System 4 Block RAD - RADIATION HEATING SYSTEM

***** COOLING COIL PEAK *****						***** CLG SPACE PEAK *****			***** HEATING COIL PEAK *****			
Peaked at Time ==>	Mo/Hr: 0/ 0					*	Mo/Hr: 0/ 0			*	Mo/Hr: 13/ 1	
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0					*	OADB: 0			*	OADB: -15	
	Space	Ret. Air	Ret. Air	Net	Percent	*	Space	Percent	*	Space Peak	Coil Peak	Percent
	Sens.+Lat.	Sensible	Latent	Total	Of Tot	*	Sensible	Of Tot	*	Space Sens	Tot Sens	Of Tot
	(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	*	(Btuh)	(%)	*	(Btuh)	(Btuh)	(%)
Envelope Loads												
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	-33,269	-33,269	2.64
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	-115,717	-115,717	9.17
Wall Cond	0	0		0	0.00	*	0	0.00	*	-228,880	-228,880	18.13
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	-109,834	-109,834	8.70
Sub Total==>	0	0		0	0.00	*	0	0.00	*	-487,699	-487,699	38.64
Internal Loads												
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Planting Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	-774,536	-774,536	61.36
Sup. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-1,262,236	-1,262,236	100.00

-----COOLING COIL SELECTION-----

-----AREAS-----

	Total Capacity	Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total	Glass (sf)	(%)
	(Tons)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Part	0	
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	ExFlr	0	
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Roof	7,648	0 0
Totals	0.0	0.0								Wall	15,126	1,972 13

-----HEATING COIL SELECTION-----

-----AIRFLOWS (cfm)-----

-----ENGINEERING CHECKS-----

-----TEMPERATURES (F)-----

	Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg
	(Mbh)	(cfm)	Deg F	Deg F	Vent	0	8,000	Clg Cfm/Sqft	0.00	SADB	0.0	72.1
Main Htg	-1,262.2	0	0.0	0.0	Infil	0	1,134	Clg Cfm/Ton	0.00	Plenum	0.0	72.0
Aux Htg	0.0	0	0.0	0.0	Supply	0	0	Clg Sqft/Ton	0.00	Return	0.0	72.0
Preheat	0.0	0	0.0	0.0	Mincfm	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	72.0
Reheat	0.0	0	0.0	0.0	Return	0	3,134	No. People	0	Runarnd	0.0	72.0
Diff	0.0	0	0.0	0.0	Exhaust	0	9,134	Htg % OA	0.0	Fn MtrTD	0.0	0.0
Opt Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg Cfm/Sqft	0.00	Fn BldTD	0.0	0.0
Total	-1,262.2				Auxil	0	0	Htg Btuh/Sqft	-42.22	Fn Frict	0.0	0.0

EM CHECKSUMS System 5 Block RAD - RADIATION HEATING SYSTEM

***** COOLING COIL PEAK *****						***** CLG SPACE PEAK *****			***** HEATING COIL PEAK *****		
Peaked at Time ==>	Mo/Hr: 0/ 0	*	Mo/Hr: 0/ 0	*	Mo/Hr: 13/ 1						
Outside Air ==>	OADB/WB/HR: 0/ 0/ 0.0	*	OADB: 0	*	OADB: -15						
Envelope Loads	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Perct Of Tot (%)	Space Sensible (Btuh)	Perct Of Tot (%)	Space Peak (Btuh)	Coil Peak (Btuh)	Perct Of Tot (%)	
Skylite Solr	0	0	0	0	0.00	0	0.00	0	0	0.00	
Skylite Cond	0	0	0	0	0.00	0	0.00	0	0	0.00	
Roof Cond	0	0	0	0	0.00	0	0.00	-58,455	-58,455	12.45	
Glass Solar	0	0	0	0	0.00	0	0.00	0	0	0.00	
Glass Cond	0	0	0	0	0.00	0	0.00	-763	-763	0.16	
Wall Cond	0	0	0	0	0.00	0	0.00	-44,905	-44,905	9.56	
Partition	0	0	0	0	0.00	0	0.00	0	0	0.00	
Exposed Floor	0	0	0	0	0.00	0	0.00	0	0	0.00	
Infiltration	0	0	0	0	0.00	0	0.00	-75,053	-75,053	15.98	
Sub Total==>	0	0	0	0	0.00	0	0.00	-179,176	-179,176	38.15	
Internal Loads											
Lights	0	0	0	0	0.00	0	0.00	0	0	0.00	
People	0	0	0	0	0.00	0	0.00	0	0	0.00	
Misc	0	0	0	0	0.00	0	0.00	0	0	0.00	
Sub Total==>	0	0	0	0	0.00	0	0.00	0	0	0.00	
Cooling Load	0	0	0	0	0.00	0	0.00	0	0	0.00	
Outside Air	0	0	0	0	0.00	0	0.00	-290,451	-290,451	61.85	
Sup. Fan Heat				0	0.00		0.00		0	0.00	
Ret. Fan Heat		0	0	0	0.00		0.00		0	0.00	
Duct Heat Pkup		0	0	0	0.00		0.00		0	0.00	
OV/UNDR Sizing	0			0	0.00	0	0.00	0	0	0.00	
Exhaust Heat		0	0	0	0.00		0.00		0	0.00	
Terminal Bypass		0	0	0	0.00		0.00		0	0.00	
Grand Total==>	0	0	0	0	0.00	0	0.00	-469,627	-469,627	100.00	

-----COOLING COIL SELECTION-----

	Total Capacity		Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total		Glass (sf)	(%)
	(Tons)	(Mbh)	(Mbh)	(cfm)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor	19,138		
Main Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	13,438	0	0
Totals	0.0	0.0									Wall	10,336	13	0

-----HEATING COIL SELECTION-----

-----AIRFLOWS (cfm)-----

-----ENGINEERING CHECKS-----

-----TEMPERATURES (F)-----

Capacity (Mbh)	Coil Airfl (cfm)	Ent (Deg F)	Lvg (Deg F)	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg	
Main Htg	-469.6	0	0.0	0.0	Vent	0	3,000	Clg CfM/Sqft	0.00	SADB	0.0	72.1
Aux Htg	0.0	0	0.0	0.0	Infil	0	775	Clg CfM/Ton	0.00	Plenum	0.0	72.0
Preheat	0.0	0	0.0	0.0	Supply	0	0	Clg Sqft/Ton	0.00	Return	0.0	72.0
Reheat	0.0	0	0.0	0.0	Mincfm	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	72.0
Diff	0.0	0	0.0	0.0	Return	0	0	No. People	0	Runarnd	0.0	72.0
Opt Vent	0.0	0	0.0	0.0	Exhaust	0	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0
Total	-469.6				Rm Exh	0	0	Htg CfM/SqFt	0.00	Fn BldTD	0.0	0.0
					Auxil	0	0	Htg Btuh/SqFt	-24.54	Fn Frict	0.0	0.0

ITEM CHECKSUMS System 6 Block RAD - RADIATION HEATING SYSTEM

***** COOLING COIL PEAK *****					***** CLG SPACE PEAK *****			***** HEATING COIL PEAK *****		
Peaked at Time ==>	Mo/Hr:	0/ 0	*	Mo/Hr:	0/ 0	*	Mo/Hr:	13/ 1		
Outside Air ==>	OADB/WB/HR:	0/ 0/ 0.0	*	OADB:	0	*	OADB:	-15		
Space	Ret. Air	Ret. Air	Net	Perct	Space	Perct	Space Peak	Coil Peak	Perct	
Sens.+Lat.	Sensible	Latent	Total	Of Tot	Sensible	Of Tot	Space Sens	Tot Sens	Of Tot	
(Btuh)	(Btuh)	(Btuh)	(Btuh)	(%)	(Btuh)	(%)	(Btuh)	(Btuh)	(%)	
Envelope Loads										
Skylite Solr	0	0	0	0.00	0	0.00	0	0	0.00	
Skylite Cond	0	0	0	0.00	0	0.00	0	0	0.00	
Roof Cond	0	0	0	0.00	0	0.00	-15,869	-15,869	7.33	
Glass Solar	0	0	0	0.00	0	0.00	0	0	0.00	
Glass Cond	0	0	0	0.00	0	0.00	-49,291	-49,291	22.78	
Wall Cond	0	0	0	0.00	0	0.00	-34,104	-34,104	15.76	
Partition	0	0	0	0.00	0	0.00	0	0	0.00	
Exposed Floor	0	0	0	0.00	0	0.00	0	0	0.00	
Infiltration	0	0	0	0.00	0	0.00	-20,332	-20,332	9.39	
Sub Total==>	0	0	0	0.00	0	0.00	-119,596	-119,596	55.26	
Internal Loads										
Lights	0	0	0	0.00	0	0.00	0	0	0.00	
People	0	0	0	0.00	0	0.00	0	0	0.00	
Misc	0	0	0	0.00	0	0.00	0	0	0.00	
Sub Total==>	0	0	0	0.00	0	0.00	0	0	0.00	
Ceiling Load	0	0	0	0.00	0	0.00	0	0	0.00	
side Air	0	0	0	0.00	0	0.00	-96,817	-96,817	44.74	
Sup. Fan Heat			0	0.00		0.00		0	0.00	
Ret. Fan Heat		0	0	0.00		0.00		0	0.00	
Duct Heat Pkup		0	0	0.00		0.00		0	0.00	
OV/UNDR Sizing	0		0	0.00	0	0.00	0	0	0.00	
Exhaust Heat		0	0	0.00		0.00		0	0.00	
Terminal Bypass		0	0	0.00		0.00		0	0.00	
Grand Total==>	0	0	0	0.00	0	0.00	-216,413	-216,413	100.00	

-----COOLING COIL SELECTION-----										-----AREAS-----		
Total Capacity	Sens Cap.	Coil Airfl	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total	Glass (sf)	(%)	
(Tons)	(Mbh)	(Mbh)	Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor			
Main Clg	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Part	0		
Aux Clg	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	ExFlr	0		
Opt Vent	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	Roof	3,648	0 0	
Totals	0.0	0.0							Wall	2,800	840 30	

-----HEATING COIL SELECTION-----					-----AIRFLOWS (cfm)-----			-----ENGINEERING CHECKS-----		-----TEMPERATURES (F)-----		
Capacity	Coil Airfl	Ent	Lvg	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg	
(Mbh)	(cfm)	Deg F	Deg F	Vent	0	1,000	Clg Cfm/Sqft	0.00	SADB	0.0	72.1	
Main Htg	-216.4	0	0.0	Infil	0	210	Clg Cfm/Ton	0.00	Plenum	0.0	72.0	
Aux Htg	0.0	0	0.0	Supply	0	0	Clg Sqft/Ton	0.00	Return	0.0	72.0	
Preheat	0.0	0	0.0	Mincfm	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	72.0	
Reheat	0.0	0	0.0	Return	0	0	No. People	0	Runarnd	0.0	72.0	
dif	0.0	0	0.0	Exhaust	0	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0	
Opt Vent	0.0	0	0.0	Rm Exh	0	0	Htg Cfm/SqFt	0.00	Fn BldTD	0.0	0.0	
Total	-216.4			Auxil	0	0	Htg Btuh/SqFt	-59.32	Fn Frict	0.0	0.0	

SYSTEM CHECKSUMS System 7 Block RAD - RADIATION HEATING SYSTEM

\*\*\*\*\* COOLING COIL PEAK \*\*\*\*\* CLG SPACE PEAK \*\*\*\*\* HEATING COIL PEAK \*\*\*\*\*

Peaked at Time ==> Mo/Hr: 0/ 0 \* Mo/Hr: 0/ 0 \* Mo/Hr: 13/ 1  
 Outside Air ==> OADB/WB/HR: 0/ 0/ 0.0 \* OADB: 0 \* OADB: -15

	Space Sens.+Lat. (Btuh)	Ret. Air Sensible (Btuh)	Ret. Air Latent (Btuh)	Net Total (Btuh)	Percent Of Tot (%)	*	Space Sensible (Btuh)	Percent Of Tot (%)	*	Space Peak Space Sens (Btuh)	Coil Peak Tot Sens (Btuh)	Percent Of Tot (%)
Envelope Loads						*			*			
Skylite Solr	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Skylite Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Roof Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Solar	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Glass Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Wall Cond	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Partition	0			0	0.00	*	0	0.00	*	0	0	0.00
Exposed Floor	0			0	0.00	*	0	0.00	*	0	0	0.00
Infiltration	0			0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Internal Loads						*			*			
Lights	0	0		0	0.00	*	0	0.00	*	0	0	0.00
People	0			0	0.00	*	0	0.00	*	0	0	0.00
Misc	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Sub Total==>	0	0	0	0	0.00	*	0	0.00	*	0	0	0.00
Ceiling Load	0	0		0	0.00	*	0	0.00	*	0	0	0.00
Outside Air	0	0	0	0	0.00	*	0	0.00	*	-113,111	-113,111	100.00
Up. Fan Heat				0	0.00	*		0.00	*		0	0.00
Ret. Fan Heat		0		0	0.00	*		0.00	*		0	0.00
Duct Heat Pkup		0		0	0.00	*		0.00	*		0	0.00
OV/UNDR Sizing	0			0	0.00	*	0	0.00	*	0	0	0.00
Exhaust Heat		0	0	0	0.00	*		0.00	*		0	0.00
Terminal Bypass		0	0	0	0.00	*		0.00	*		0	0.00
Grand Total==>	0	0	0	0	0.00	*	0	0.00	*	-113,111	-113,111	100.00

-----COOLING COIL SELECTION-----

-----AREAS-----

	Total Capacity (Tons)	Sens Cap. (Mbh)	Coil Airfl (cfm)	Entering DB/WB/HR			Leaving DB/WB/HR			Gross Total	Glass (sf)	(%)
				Deg F	Deg F	Grains	Deg F	Deg F	Grains	Floor		
Main Clg	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Part	0	
Aux Clg	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	ExFlr	0	
Opt Vent	0.0	0.0	0	0.0	0.0	0.0	0.0	0.0	0.0	Roof	0	0 0
Totals	0.0	0.0								Wall	0	0 0

-----HEATING COIL SELECTION-----

-----AIRFLOWS (cfm)-----

-----ENGINEERING CHECKS-----

-----TEMPERATURES (F)-----

	Capacity (Mbh)	Coil Airfl (cfm)	Ent Deg F	Lvg Deg F	Type	Cooling	Heating	Clg % OA	0.0	Type	Clg	Htg
Main Htg	-113.1	0	0.0	0.0	Infil	0	1,168	Clg Cfm/Sqft	0.00	SADB	0.0	72.1
Aux Htg	0.0	0	0.0	0.0	Supply	0	0	Clg Cfm/Ton	0.00	Plenum	0.0	72.0
Preheat	0.0	0	0.0	0.0	Mincfm	0	0	Clg Sqft/Ton	0.00	Return	0.0	72.0
Reheat	0.0	0	0.0	0.0	Return	0	0	Clg Btuh/Sqft	0.00	Ret/OA	0.0	72.0
Humidif	0.0	0	0.0	0.0	Exhaust	0	0	No. People	0	Runarnd	0.0	72.0
Vent	0.0	0	0.0	0.0	Rm Exh	0	0	Htg % OA	0.0	Fn MtrTD	0.0	0.0
Total	-113.1				Auxil	0	0	Htg Cfm/SqFt	0.00	Fn BldTD	0.0	0.0
								Htg Btuh/SqFt	-9.68	Fn Frict	0.0	0.0



IN SYSTEM COOLING - ALTERNATIVE 1  
LOAD CALCULATION

----- P E A K C O O L I N G L O A D S -----

(Main System)

		----- Space -----							----- Coil -----						
Room		Peak	OA	Rm	Supp.	Space	Space	Space	Peak	OA	Rm	Supp.	Coil	Coil	Coil
Number	Description	Time	Cond.	Dry	Dry	Air	Sens.	Lat.	Time	Cond.	Dry	Dry	Air	Sens.	Lat.
		Mo/Hr	DB/WB	Blb	Bulb	Flow	Load	Load	Mo/Hr	DB/WB	Blb	Bulb	Flow	Load	Load
			(F)	(F)	(F)	(Cfm)	(Btuh)	(Btuh)		(F)	(F)	(F)	(Cfm)	(Btuh)	(Btuh)
2	OWEN HALL	7/17	82 71	76	58.0	23,519	471,103	25,500	7/17	82 71	76	58.0	23,519	551,799	81,177
Zone	2 Total/Ave.		82 71	76	58.0	23,519	471,103	25,500		82 71	76	58.0	23,519	551,799	81,177
Zone	2 Block	7/17	82 71	76	58.0	23,519	471,103	25,500	7/17	82 71	76	58.0	23,519	551,799	81,177
System	2 Total/Ave.		82 71	76	58.0	23,519	471,103	25,500		82 71	76	58.0	23,519	551,799	81,177
System	2 Block	7/17	82 71	76	58.0	23,519	471,103	25,500	7/17	82 71	76	58.0	23,519	551,799	81,177
3	AUDITORIUM	7/18	80 69	76	58.0	4,307	86,267	25,500	7/16	84 72	76	58.3	4,307	105,402	59,959
Zone	3 Total/Ave.		80 69	76	58.0	4,307	86,267	25,500		84 72	76	58.3	4,307	105,402	59,959
Zone	3 Block	7/18	80 69	76	58.0	4,307	86,267	25,500	7/16	84 72	76	58.3	4,307	105,402	59,959
System	3 Total/Ave.		80 69	76	58.0	4,307	86,267	25,500		84 72	76	58.3	4,307	105,402	59,959
System	3 Block	7/18	80 69	76	58.0	4,307	86,267	25,500	7/16	84 72	76	58.3	4,307	105,402	59,959

N SYSTEM HEATING - ALTERNATIVE 1  
LOAD CALCULATION

----- P E A K H E A T I N G L O A D S -----  
(Main System)

Room Number Description	Floor Area (Sq Ft)	Space					Coil						
		Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Space Air Flow (Cfm)	Space Sens. Load (Btuh)	Peak Time Mo/Hr	OA Cond. DB/WB (F)	Rm Dry Blb (F)	Supp. Dry Bulb (F)	Coil Air Flow (Cfm)	Coil Sens. Load (Btuh)
1 BRIGGS HALL	29,112	13/ 1	-15 -15	72	72.1	0	-861,131	13/ 1	-15 -15	72	72.1	0	-861,131
Zone 1 Total/Ave.	29,112		-15 -15	72	72.1	0	-861,131		-15 -15	72	72.1	0	-861,131
Zone 1 Block	29,112	13/ 1	-15 -15	72	72.1	0	-861,131	13/ 1	-15 -15	72	72.1	0	-861,131
System 1 Total/Ave.	29,112		-15 -15	72	72.1	0	-861,131		-15 -15	72	72.1	0	-861,131
System 1 Block	29,112	13/ 1	-15 -15	72	72.1	0	-861,131	13/ 1	-15 -15	72	72.1	0	-861,131
2 OWEN HALL	36,562	13/ 1	-15 -15	72	120.0	7,056	-376,882	13/ 1	-15 -15	72	120.0	7,056	-506,875
Zone 2 Total/Ave.	36,562		-15 -15	72	120.0	7,056	-376,882		-15 -15	72	120.0	7,056	-506,875
Zone 2 Block	36,562	13/ 1	-15 -15	72	120.0	7,056	-376,882	13/ 1	-15 -15	72	120.0	7,056	-506,875
System 2 Total/Ave.	36,562		-15 -15	72	120.0	7,056	-376,882		-15 -15	72	120.0	7,056	-506,875
System 2 Block	36,562	13/ 1	-15 -15	72	120.0	7,056	-376,882	13/ 1	-15 -15	72	120.0	7,056	-506,875
3 AUDITORIUM	3,344	13/ 1	-15 -15	72	99.0	4,307	-129,285	13/ 1	-15 -15	72	99.0	4,307	-322,919
Zone 3 Total/Ave.	3,344		-15 -15	72	99.0	4,307	-129,285		-15 -15	72	99.0	4,307	-322,919
Zone 3 Block	3,344	13/ 1	-15 -15	72	99.0	4,307	-129,285	13/ 1	-15 -15	72	99.0	4,307	-322,919
System 3 Total/Ave.	3,344		-15 -15	72	99.0	4,307	-129,285		-15 -15	72	99.0	4,307	-322,919
System 3 Block	3,344	13/ 1	-15 -15	72	99.0	4,307	-129,285	13/ 1	-15 -15	72	99.0	4,307	-322,919
4 SENIOR HALL	29,897	13/ 1	-15 -15	72	72.1	0	-1,262,236	13/ 1	-15 -15	72	72.1	0	-1,262,236
Zone 4 Total/Ave.	29,897		-15 -15	72	72.1	0	-1,262,236		-15 -15	72	72.1	0	-1,262,236
Zone 4 Block	29,897	13/ 1	-15 -15	72	72.1	0	-1,262,236	13/ 1	-15 -15	72	72.1	0	-1,262,236
System 4 Total/Ave.	29,897		-15 -15	72	72.1	0	-1,262,236		-15 -15	72	72.1	0	-1,262,236
System 4 Block	29,897	13/ 1	-15 -15	72	72.1	0	-1,262,236	13/ 1	-15 -15	72	72.1	0	-1,262,236
5 SPECIAL TRAINING	19,138	13/ 1	-15 -15	72	72.1	0	-469,627	13/ 1	-15 -15	72	72.1	0	-469,627
Zone 5 Total/Ave.	19,138		-15 -15	72	72.1	0	-469,627		-15 -15	72	72.1	0	-469,627
Zone 5 Block	19,138	13/ 1	-15 -15	72	72.1	0	-469,627	13/ 1	-15 -15	72	72.1	0	-469,627
System 5 Total/Ave.	19,138		-15 -15	72	72.1	0	-469,627		-15 -15	72	72.1	0	-469,627
System 5 Block	19,138	13/ 1	-15 -15	72	72.1	0	-469,627	13/ 1	-15 -15	72	72.1	0	-469,627
6 GYMNASIUM	3,648	13/ 1	-15 -15	72	72.1	0	-216,413	13/ 1	-15 -15	72	72.1	0	-216,413
Zone 6 Total/Ave.	3,648		-15 -15	72	72.1	0	-216,413		-15 -15	72	72.1	0	-216,413
Zone 6 Block	3,648	13/ 1	-15 -15	72	72.1	0	-216,413	13/ 1	-15 -15	72	72.1	0	-216,413
System 6 Total/Ave.	3,648		-15 -15	72	72.1	0	-216,413		-15 -15	72	72.1	0	-216,413
System 6 Block	3,648	13/ 1	-15 -15	72	72.1	0	-216,413	13/ 1	-15 -15	72	72.1	0	-216,413
7 OWENS BASEMENT	11,683	13/ 1	-15 -15	72	72.1	0	-113,111	13/ 1	-15 -15	72	72.1	0	-113,111
Zone 7 Total/Ave.	11,683		-15 -15	72	72.1	0	-113,111		-15 -15	72	72.1	0	-113,111
Zone 7 Block	11,683	13/ 1	-15 -15	72	72.1	0	-113,111	13/ 1	-15 -15	72	72.1	0	-113,111
System 7 Total/Ave.	11,683		-15 -15	72	72.1	0	-113,111		-15 -15	72	72.1	0	-113,111
System 7 Block	11,683	13/ 1	-15 -15	72	72.1	0	-113,111	13/ 1	-15 -15	72	72.1	0	-113,111

LOADING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- INTERNAL COOLING LOADS -----  
(At time of Coil Peak)

Room Number	Description	Lights		People	People	People	Misc. Space	Misc. Space	Misc. Ret. Air	Misc. CLF
		Sensible (Btuh)	Ret. Air (Btuh)							
2	OWEN HALL	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
Zone	2 Total/Ave.	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
Zone	2 Block	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
System	2 Total/Ave.	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
System	2 Block	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
3	AUDITORIUM	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
Zone	3 Total/Ave.	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
Zone	3 Block	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
System	3 Total/Ave.	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
System	3 Block	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990

COOLING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- INTERNAL COOLING LOADS -----  
(At time of Space Peak)

Room Number	Description	Lights		People	People	People	Misc. Space	Misc. Space	Misc. Ret. Air	Misc. CLF
		Sensible (Btuh)	Ret. Air (Btuh)							
2	OWEN HALL	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
Zone	2 Total/Ave.	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
Zone	2 Block	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
System	2 Total/Ave.	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
System	2 Block	124,786	0	1.000	25,500	25,500	1.000	36,196	0	0 0.990
3	AUDITORIUM	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
Zone	3 Total/Ave.	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
Zone	3 Block	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
System	3 Total/Ave.	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990
System	3 Block	22,826	0	1.000	25,500	25,500	1.000	3,311	0	0 0.990

LOADING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- INTERNAL HEATING LOADS -----

(At time of Coil Peak)

Room Number	Description	Lights			People		Misc.		
		Sensible (Btuh)	Ret. Air (Btuh)	Lites CLF	Sensible (Btuh)	Peopl CLF	Space (Btuh)	Ret. Air (Btuh)	Misc. CLF
1	BRIGGS HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	1 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	1 Block	0	0	0.000	0	0.000	0	0	0.000
System	1 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	1 Block	0	0	0.000	0	0.000	0	0	0.000
2	OWEN HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	2 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	2 Block	0	0	0.000	0	0.000	0	0	0.000
System	2 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	2 Block	0	0	0.000	0	0.000	0	0	0.000
3	AUDITORIUM	0	0	0.000	0	0.000	0	0	0.000
Zone	3 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	3 Block	0	0	0.000	0	0.000	0	0	0.000
System	3 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	3 Block	0	0	0.000	0	0.000	0	0	0.000
4	SENIOR HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	4 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	4 Block	0	0	0.000	0	0.000	0	0	0.000
System	4 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	4 Block	0	0	0.000	0	0.000	0	0	0.000
5	SPECIAL TRAINING	0	0	0.000	0	0.000	0	0	0.000
Zone	5 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	5 Block	0	0	0.000	0	0.000	0	0	0.000
System	5 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	5 Block	0	0	0.000	0	0.000	0	0	0.000
6	GYMNASIUM	0	0	0.000	0	0.000	0	0	0.000
Zone	6 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	6 Block	0	0	0.000	0	0.000	0	0	0.000
System	6 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	6 Block	0	0	0.000	0	0.000	0	0	0.000
7	OWENS BASEMENT	0	0	0.000	0	0.000	0	0	0.000
Zone	7 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	7 Block	0	0	0.000	0	0.000	0	0	0.000
System	7 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	7 Block	0	0	0.000	0	0.000	0	0	0.000

EATING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- INTERNAL HEATING LOADS -----

(At time of Space Peak)

Room Number	Description	Lights		People		Misc.			
		Room Sensible (Btuh)	Ret. Air Sensible (Btuh)	Lites CLF	People Sensible (Btuh)	Peopl CLF	Space Sensible (Btuh)	Misc. Ret. Air Sensible (Btuh)	Misc. CLF
1	BRIGGS HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	1 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	1 Block	0	0	0.000	0	0.000	0	0	0.000
System	1 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	1 Block	0	0	0.000	0	0.000	0	0	0.000
2	OWEN HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	2 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	2 Block	0	0	0.000	0	0.000	0	0	0.000
System	2 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	2 Block	0	0	0.000	0	0.000	0	0	0.000
3	AUDITORIUM	0	0	0.000	0	0.000	0	0	0.000
Zone	3 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	3 Block	0	0	0.000	0	0.000	0	0	0.000
System	3 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	3 Block	0	0	0.000	0	0.000	0	0	0.000
4	SENIOR HALL	0	0	0.000	0	0.000	0	0	0.000
Zone	4 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	4 Block	0	0	0.000	0	0.000	0	0	0.000
System	4 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	4 Block	0	0	0.000	0	0.000	0	0	0.000
5	SPECIAL TRAINING	0	0	0.000	0	0.000	0	0	0.000
Zone	5 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	5 Block	0	0	0.000	0	0.000	0	0	0.000
System	5 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	5 Block	0	0	0.000	0	0.000	0	0	0.000
6	GYMNASIUM	0	0	0.000	0	0.000	0	0	0.000
Zone	6 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	6 Block	0	0	0.000	0	0.000	0	0	0.000
System	6 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	6 Block	0	0	0.000	0	0.000	0	0	0.000
7	OWENS BASEMENT	0	0	0.000	0	0.000	0	0	0.000
Zone	7 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
Zone	7 Block	0	0	0.000	0	0.000	0	0	0.000
System	7 Total/Ave.	0	0	0.000	0	0.000	0	0	0.000
System	7 Block	0	0	0.000	0	0.000	0	0	0.000

LOADING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   C O O L I N G   L O A D S -----

(Roof - Skylight)

(At time of Coil Peak)

Room Number	Description	Roof				Skylight			Skylight			
		Return Air Sensible Load (Btuh)	R.A. CLTD (F)	Space Sensible Load (Btuh)	Space CLTD (F)	Return Air Solar (Btuh)	Space Solar (Btuh)	Skylt CLF	Return Air Conduction Load (Btuh)	Skylt R.A. CLTD (F)	Space Conduction Load (Btuh)	Skylt Space CLTD (F)
2	OWEN HALL	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
Zone	2 Total/Ave.	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
Zone	2 Block	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
System	2 Total/Ave.	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
System	2 Block	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
3	AUDITORIUM	0	0.0	10,768	64.4	0	0	0.000	0	0.0	0	0.0
Zone	3 Total/Ave.	0	0.0	10,768	64.4	0	0	0.000	0	0.0	0	0.0
Zone	3 Block	0	0.0	10,768	64.4	0	0	0.000	0	0.0	0	0.0
System	3 Total/Ave.	0	0.0	10,768	64.4	0	0	0.000	0	0.0	0	0.0
System	3 Block	0	0.0	10,768	64.4	0	0	0.000	0	0.0	0	0.0

----- B U I L D I N G   E N V E L O P E   C O O L I N G   L O A D S -----

(Wall - Window)

(At time of Coil Peak)

Room Number	Description	Wall		Wall		Glass		Glass		Glass		Glass	
		Plenum Load (Btuh)	Plenm CLTD (F)	Space Load (Btuh)	Space CLTD (F)	Space Solar (Btuh)	Return Air Solar (Btuh)	Solar CLF	Space Conduction (Btuh)	Space CLTD (F)	Return Air Conduction (Btuh)	R.A. CLTD (F)	
2	OWEN HALL	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0	
Zone	2 Total/Ave.	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0	
Zone	2 Block	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0	
System	2 Total/Ave.	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0	
System	2 Block	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0	
3	AUDITORIUM	0	0.0	11,785	17.7	8,910	0	0.630	1,782	6.0	0	0.0	
Zone	3 Total/Ave.	0	0.0	11,785	17.7	8,910	0	0.630	1,782	6.0	0	0.0	
Zone	3 Block	0	0.0	11,785	17.7	8,910	0	0.630	1,782	6.0	0	0.0	
System	3 Total/Ave.	0	0.0	11,785	17.7	8,910	0	0.630	1,782	6.0	0	0.0	
System	3 Block	0	0.0	11,785	17.7	8,910	0	0.630	1,782	6.0	0	0.0	

----- B U I L D I N G   E N V E L O P E   C O O L I N G   L O A D S -----

(Exposed Floor - Partitions - Infiltration)

(At time of Coil Peak)

Room Number	Description	Exposed Floor		Expsd Floor		Partition		Part.		Infilt.		Infilt.		Infilt.		Plenm		Ceiling		Envelope	
		Sensible (Btuh)	CLTD (F)	Sensible (Btuh)	CLTD (F)	Sensible (Btuh)	CLTD (F)	Airflow (Cfm)	Sensible (Btuh)	Sensible (Btuh)	Latent (Btuh)	Temp. (F)	Dry B (Btuh)	Sensible Load (Btuh)	Envelope Total (Btuh)						
2	OWEN HALL	0	0.0	0	0.0	0	0	0	0	0	76.0	0	0	284,620							
Zone	2 Total/Ave.	0	0.0	0	0.0	0	0	0	0	0	76.0	0	0	284,620							
Zone	2 Block	0	0.0	0	0.0	0	0	0	0	0	76.0	0	0	284,620							
System	2 Total/Ave.	0	0.0	0	0.0	0	0	0	0	0	76.0	0	0	284,620							

LOADING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   C O O L I N G   L O A D S -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Coil Peak)

Room Number	Description	Exposed	Expsd	Partition	Part.	Infilt.	Infilt.	Infilt.	Plenn	Ceiling	Envelope Total
		Floor Sensible (Btuh)	Floor CLTD (F)	Sensible (Btuh)	CLTD (F)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Dry B Temp. (F)	Sensible Load (Btuh)	
System	2 Block	0	0.0	0	0.0	0	0	0	76.0	0	284,620
	3 AUDITORIUM	0	0.0	0	0.0	0	0	0	76.0	0	33,244
Zone	3 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	33,244
Zone	3 Block	0	0.0	0	0.0	0	0	0	76.0	0	33,244
System	3 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	33,244
System	3 Block	0	0.0	0	0.0	0	0	0	76.0	0	33,244

LOADING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- BUILDING ENVELOPE COOLING LOADS -----  
(Roof - Skylight)  
(At time of Space Peak)

Room Number	Description	Roof		Roof		Skylight			Skylight		Skylight	
		Return Air Sensible Load (Btuh)	R.A. CLTD (F)	Space Sensible Load (Btuh)	Space CLTD (F)	Return Air Solar (Btuh)	Space Solar (Btuh)	Skylt Solar CLF	Return Air Conduction Load (Btuh)	R.A. CLTD (F)	Space Conduction Load (Btuh)	Skylt CLTD (F)
2	OWEN HALL	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
Zone	2 Total/Ave.	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
Zone	2 Block	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
System	2 Total/Ave.	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
System	2 Block	0	0.0	37,678	64.5	0	0	0.000	0	0.0	0	0.0
3	AUDITORIUM	0	0.0	9,848	58.9	0	0	0.000	0	0.0	0	0.0
Zone	3 Total/Ave.	0	0.0	9,848	58.9	0	0	0.000	0	0.0	0	0.0
Zone	3 Block	0	0.0	9,848	58.9	0	0	0.000	0	0.0	0	0.0
System	3 Total/Ave.	0	0.0	9,848	58.9	0	0	0.000	0	0.0	0	0.0
System	3 Block	0	0.0	9,848	58.9	0	0	0.000	0	0.0	0	0.0

----- BUILDING ENVELOPE COOLING LOADS -----  
(Wall - Window)  
(At time of Space Peak)

Room Number	Description	Wall	Wall	Wall	Wall	Glass	Glass	Glass	Glass	Glass	Glass	Glass
		Plenum Load (Btuh)	Plenm CLTD (F)	Space Load (Btuh)	Space CLTD (F)	Space Solar (Btuh)	Return Air Solar (Btuh)	Solar CLF	Conduction (Btuh)	Space CLTD (F)	Return Air Conduction (Btuh)	R.A. CLTD (F)
2	OWEN HALL	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0
Zone	2 Total/Ave.	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0
Zone	2 Block	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0
System	2 Total/Ave.	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0
System	2 Block	0	0.0	79,052	23.9	156,376	0	0.440	11,515	5.4	0	0.0
3	AUDITORIUM	0	0.0	14,248	21.4	9,405	0	0.660	1,129	3.8	0	0.0
Zone	3 Total/Ave.	0	0.0	14,248	21.4	9,405	0	0.660	1,129	3.8	0	0.0
Zone	3 Block	0	0.0	14,248	21.4	9,405	0	0.660	1,129	3.8	0	0.0
System	3 Total/Ave.	0	0.0	14,248	21.4	9,405	0	0.660	1,129	3.8	0	0.0
System	3 Block	0	0.0	14,248	21.4	9,405	0	0.660	1,129	3.8	0	0.0

----- BUILDING ENVELOPE COOLING LOADS -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Space Peak)

Room Number	Description	Exposed	Expsd	Partition	Part.	Infilt.	Infilt.	Infilt.	Plenm	Ceiling	Envelope
		Floor Sensible (Btuh)	Floor CLTD (F)	Sensible (Btuh)	CLTD (F)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Dry B Temp. (F)	Sensible Load (Btuh)	Total (Btuh)
2	OWEN HALL	0	0.0	0	0.0	0	0	0	76.0	0	284,620
Zone	2 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	284,620
Zone	2 Block	0	0.0	0	0.0	0	0	0	76.0	0	284,620
System	2 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	284,620



LOADING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   C O O L I N G   L O A D S -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Space Peak)

Room Number	Description	Exposed	Expsd	Partition	Part.	Infilt.	Infilt.	Infilt.	Plenm	Ceiling	Envelope Total
		Floor Sensible (Btuh)	Floor CLTD (F)	Sensible (Btuh)	CLTD (F)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Dry B Temp. (F)	Sensible Load (Btuh)	
System	2 Block	0	0.0	0	0.0	0	0	0	76.0	0	284,620
3	AUDITORIUM	0	0.0	0	0.0	0	0	0	76.0	0	34,630
Zone	3 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	34,630
Zone	3 Block	0	0.0	0	0.0	0	0	0	76.0	0	34,630
System	3 Total/Ave.	0	0.0	0	0.0	0	0	0	76.0	0	34,630
System	3 Block	0	0.0	0	0.0	0	0	0	76.0	0	34,630



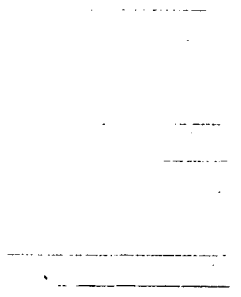
1 BRIGGS HALL

0 0.0 -195,124 -87.0

0

0 0.000 -104,333 -87.0

0 0.0



LOADING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----  
(Wall - Window)  
(At time of Coil Peak)

Room Number	Description	Wall Plenum Load (Btuh)	Wall Plenum CLTD (F)	Wall Space Load (Btuh)	Wall Space CLTD (F)	Glass Space Solar (Btuh)	Glass Return Air Solar (Btuh)	Glass Solar CLF	Glass Space Conduction (Btuh)	Glass Space CLTD (F)	Glass Return Air Conduction (Btuh)	Glass R.A. CLTD (F)
Zone 1	Total/Ave.	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
Zone 1	Block	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
System 1	Total/Ave.	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
System 1	Block	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
2	OWEN HALL	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
Zone 2	Total/Ave.	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
Zone 2	Block	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
System 2	Total/Ave.	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
System 2	Block	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
3	AUDITORIUM	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
Zone 3	Total/Ave.	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
Zone 3	Block	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
System 3	Total/Ave.	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
System 3	Block	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
4	SENIOR HALL	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
Zone 4	Total/Ave.	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
Zone 4	Block	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
System 4	Total/Ave.	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
System 4	Block	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
5	SPECIAL TRAINING	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
Zone 5	Total/Ave.	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
Zone 5	Block	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
System 5	Total/Ave.	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
System 5	Block	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
6	GYMNASIUM	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
Zone 6	Total/Ave.	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
Zone 6	Block	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
System 6	Total/Ave.	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
System 6	Block	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
7	OWENS BASEMENT	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
Zone 7	Total/Ave.	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
Zone 7	Block	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
System 7	Total/Ave.	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
System 7	Block	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Coil Peak)

Room Number	Description	Exposed Floor Sensible (Btuh)	Expsd Floor CLTD (F)	Partition Sensible (Btuh)	Part. CLTD (F)	Infilt. Airflow (Cfm)	Infilt. Sensible (Btuh)	Infilt. Latent (Btuh)	Plenum Dry B Temp. (F)	Ceiling Sensible Load (Btuh)	Envelope Total (Btuh)
1	BRIGGS HALL	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454

HEATING LOADS AT COIL PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Coil Peak)

Room Number	Description	Exposed Floor Sensible (Btuh)	Expsd Floor CLTD (F)	Partition Sensible (Btuh)	Part. CLTD (F)	Infilt. Airflow (CFm)	Infilt. Sensible (Btuh)	Infilt. Latent (Btuh)	Plenm Dry B Temp. (F)	Ceiling Sensible Load (Btuh)	Envelope Total (Btuh)
Zone	1 Total/Ave.	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
Zone	1 Block	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
System	1 Total/Ave.	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
System	1 Block	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
	2 OWEN HALL	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
Zone	2 Total/Ave.	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
Zone	2 Block	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
System	2 Total/Ave.	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
System	2 Block	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
	3 AUDITORIUM	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
Zone	3 Total/Ave.	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
Zone	3 Block	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
System	3 Total/Ave.	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
System	3 Block	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
	4 SENIOR HALL	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
Zone	4 Total/Ave.	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
Zone	4 Block	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
System	4 Total/Ave.	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
System	4 Block	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
	5 SPECIAL TRAINING	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
Zone	5 Total/Ave.	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
Zone	5 Block	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
System	5 Total/Ave.	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
System	5 Block	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
	6 GYMNASIUM	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
Zone	6 Total/Ave.	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
Zone	6 Block	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
System	6 Total/Ave.	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
System	6 Block	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
	7 OWENS BASEMENT	0	0.0	0	0.0	0	0	0	72.0	0	0
Zone	7 Total/Ave.	0	0.0	0	0.0	0	0	0	72.0	0	0
Zone	7 Block	0	0.0	0	0.0	0	0	0	72.0	0	0
System	7 Total/Ave.	0	0.0	0	0.0	0	0	0	72.0	0	0
System	7 Block	0	0.0	0	0.0	0	0	0	72.0	0	0



1 BRIGGS HALL

0 0.0 -195,124 -87.0

0

0 0.000 -104,333 -87.0

0 0.0

LOADING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----

(Wall - Window)  
(At time of Space Peak)

Room Number	Description	Wall Plenum Load (Btuh)	Wall Plenum CLTD (F)	Wall Space Load (Btuh)	Wall Space CLTD (F)	Glass Space Solar (Btuh)	Glass Return Air Solar (Btuh)	Glass Solar CLF	Glass Space Conduction (Btuh)	Glass Space CLTD (F)	Glass Return Air Conduction (Btuh)	Glass R.A. CLTD (F)
Zone 1	Total/Ave.	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
Zone 1	Block	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
System 1	Total/Ave.	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
System 1	Block	0	0.0	-195,124	-87.0	0	0	0.000	-104,333	-87.0	0	0.0
2	OWEN HALL	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
Zone 2	Total/Ave.	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
Zone 2	Block	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
System 2	Total/Ave.	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
System 2	Block	0	0.0	-287,761	-87.0	0	0	0.000	-208,549	-87.0	0	0.0
3	AUDITORIUM	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
Zone 3	Total/Ave.	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
Zone 3	Block	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
System 3	Total/Ave.	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
System 3	Block	0	0.0	-57,925	-87.0	0	0	0.000	-29,047	-87.0	0	0.0
4	SENIOR HALL	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
Zone 4	Total/Ave.	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
Zone 4	Block	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
System 4	Total/Ave.	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
System 4	Block	0	0.0	-228,880	-87.0	0	0	0.000	-115,717	-87.0	0	0.0
5	SPECIAL TRAINING	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
Zone 5	Total/Ave.	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
Zone 5	Block	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
System 5	Total/Ave.	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
System 5	Block	0	0.0	-44,905	-87.0	0	0	0.000	-763	-87.0	0	0.0
6	GYMNASIUM	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
Zone 6	Total/Ave.	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
Zone 6	Block	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
System 6	Total/Ave.	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
System 6	Block	0	0.0	-34,104	-87.0	0	0	0.000	-49,291	-87.0	0	0.0
7	OWENS BASEMENT	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
Zone 7	Total/Ave.	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
Zone 7	Block	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
System 7	Total/Ave.	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0
System 7	Block	0	0.0	0	0.0	0	0	0.000	0	0.0	0	0.0

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----

(Exposed Floor - Partitions - Infiltration)  
(At time of Space Peak)

Room Number	Description	Exposed Floor Sensible (Btuh)	Expsd Floor CLTD (F)	Partition Sensible (Btuh)	Part. CLTD (F)	Infilt. Airflow (Cfm)	Infilt. Sensible (Btuh)	Infilt. Latent (Btuh)	Plenum Dry B Temp. (F)	Ceiling Sensible Load (Btuh)	Envelope Total (Btuh)
1	BRIGGS HALL	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454



LOADING LOADS AT SPACE PEAK - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   E N V E L O P E   H E A T I N G   L O A D S -----  
(Exposed Floor - Partitions - Infiltration)  
(At time of Space Peak)

Room Number	Description	Exposed	Expsd	Partition	Part.	Infilt.	Infilt.	Infilt.	Plenm	Ceiling	Envelope Total
		Floor Sensible (Btuh)	Floor CLTD (F)	Sensible (Btuh)	CLTD (F)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Dry B Temp. (F)	Sensible Load (Btuh)	
Zone	1 Total/Ave.	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
Zone	1 Block	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
System	1 Total/Ave.	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
System	1 Block	0	0.0	0	0.0	974	-94,338	0	72.0	0	-425,454
	2 OWEN HALL	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
Zone	2 Total/Ave.	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
Zone	2 Block	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
System	2 Total/Ave.	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
System	2 Block	0	0.0	0	0.0	1,507	-145,894	0	72.0	0	-693,025
	3 AUDITORIUM	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
Zone	3 Total/Ave.	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
Zone	3 Block	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
System	3 Total/Ave.	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
System	3 Block	0	0.0	0	0.0	287	-27,767	0	72.0	0	-129,285
	4 SENIOR HALL	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
Zone	4 Total/Ave.	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
Zone	4 Block	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
System	4 Total/Ave.	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
System	4 Block	0	0.0	0	0.0	1,134	-109,834	0	72.0	0	-487,699
	5 SPECIAL TRAINING	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
Zone	5 Total/Ave.	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
Zone	5 Block	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
System	5 Total/Ave.	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
System	5 Block	0	0.0	0	0.0	775	-75,053	0	72.0	0	-179,176
	6 GYMNASIUM	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
Zone	6 Total/Ave.	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
Zone	6 Block	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
System	6 Total/Ave.	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
System	6 Block	0	0.0	0	0.0	210	-20,332	0	72.0	0	-119,596
	7 OWENS BASEMENT	0	0.0	0	0.0	0	0	0	72.0	0	0
Zone	7 Total/Ave.	0	0.0	0	0.0	0	0	0	72.0	0	0
Zone	7 Block	0	0.0	0	0.0	0	0	0	72.0	0	0
System	7 Total/Ave.	0	0.0	0	0.0	0	0	0	72.0	0	0
System	7 Block	0	0.0	0	0.0	0	0	0	72.0	0	0

LOAD CALCULATION  
 LING LOADS AT COIL PEAK - ALTERNATIVE 1

----- AIR FLOW COOLING LOADS -----  
 (At time of Coil Peak)

Room Number	Description	----- Ventilation -----			----- Optional Ventilation -----			----- Bypass -----			Ov/Undr Sizing (Btuh)
		Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	Airflow (Cfm)	Sensible (Btuh)	Latent (Btuh)	
2	OWEN HALL	2,000	13,799	55,677	0	0	0	0	0	0	0
Zone	2 Total/Ave.	2,000	13,799	55,677	0	0	0	0	0	0	0
Zone	2 Block	2,000	13,799	55,677	0	0	0	0	0	0	0
System	2 Total/Ave.	2,000	13,799	55,677	0	0	0	0	0	0	0
System	2 Block	2,000	13,799	55,677	0	0	0	0	0	0	0
3	AUDITORIUM	2,000	16,693	34,459	0	0	0	0	0	0	0
Zone	3 Total/Ave.	2,000	16,693	34,459	0	0	0	0	0	0	0
Zone	3 Block	2,000	16,693	34,459	0	0	0	0	0	0	0
System	3 Total/Ave.	2,000	16,693	34,459	0	0	0	0	0	0	0
System	3 Block	2,000	16,693	34,459	0	0	0	0	0	0	0



LING AIRFLOW HEAT GAIN/LOSS - ALTERNATIVE 1  
LOAD CALCULATION

----- AIRFLOW HEAT GAIN AND LOSS -----  
(At time of Coil Peak)

		Cooling											
Room Number	Description	Duct	Supply	Return	System	Room						System	
		Heat Pickup (Btuh)	Fan Heat (Btuh)	Fan Heat (Btuh)	Exhaust Heat Loss (Btuh)	System Exhaust	Exhaust	Ducted	Plenum	Run Around	Corridr	Return	
						Total Airflow (Cfm)	Airflow (Cfm)	Airflow (Cfm)	Airflow (Cfm)	Airflow (Cfm)	Airflow (Cfm)	Airflow (Cfm)	
2	OWEN HALL	0	66,897	0	0	66,897	2,000	0	23,519	0	0	0	23,519
Zone	2 Total/Ave.	0	66,897	0	0	66,897	2,000	0	23,519	0	0	0	23,519
Zone	2 Block	0	66,897	0	0	66,897	2,000	0	23,519	0	0	0	23,519
System	2 Total/Ave.	0	66,897	0	0	66,897	2,000	0	23,519	0	0	0	23,519
System	2 Block	0	66,897	0	0	66,897	2,000	0	23,519	0	0	0	23,519
3	AUDITORIUM	0	3,828	0	0	3,828	2,000	0	4,307	0	0	0	4,307
Zone	3 Total/Ave.	0	3,828	0	0	3,828	2,000	0	4,307	0	0	0	4,307
Zone	3 Block	0	3,828	0	0	3,828	2,000	0	4,307	0	0	0	4,307
System	3 Total/Ave.	0	3,828	0	0	3,828	2,000	0	4,307	0	0	0	4,307
System	3 Block	0	3,828	0	0	3,828	2,000	0	4,307	0	0	0	4,307



LE PSYCHROMETRICS - ALTERNATIVE 1  
LOAD CALCULATION

----- PSYCHROMETRIC STATE POINTS -----

Zone 3

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	76.0	64.6	54.4	73.4	29.7	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	76.0	64.6	54.4	73.4	29.7	
Outdoor Air	83.5	71.6	56.6	98.0	35.4	
Return/Outdoor Air Mix	79.5	68.0	55.9	84.8	32.4	
Blow through Fan						0.0
Entering Coil	79.5	68.0	55.9	84.8	32.4	
Leaving Coil	57.2	56.1	93.5	65.6	23.9	
Draw Through Fan						0.3
Duct Frictional Heat						0.5
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	58.0	56.4	90.8	65.6	24.1	
Supply Air	58.0	56.4	90.8	65.6	24.1	
Percent Outside Air	46.44		(%)			
Sensible Heat Ratio (SHR)	0.772					
Percent Supply Air Bypassing Coil	0.00		(%)			
Coil Airflow	4,307		(Cfm)			

ITEM PSYCHROMETRICS - ALTERNATIVE 1  
LOAD CALCULATION

----- PSYCHROMETRIC STATE POINTS -----

System 2

	Dry Bulb (F)	Wet Bulb (F)	Relat. Humid. (%)	Humid. Ratio (GR)	Enthalpy (Btu/Lb)	Temp. Diff. (F)
Space	76.0	61.4	43.3	58.2	27.3	
Main System						
Return Air Heat Pickup						0.0
Return Fan						0.0
Return Air	76.0	61.4	43.3	58.2	27.3	
Outdoor Air	82.2	71.2	59.0	98.0	35.1	
Return/Outdoor Air Mix	76.5	62.3	45.0	61.6	28.0	
Blow through Fan						0.0
Entering Coil	76.5	62.3	45.0	61.6	28.0	
Leaving Coil	55.4	53.2	86.8	57.0	22.1	
Draw Through Fan						1.1
Duct Frictional Heat						1.4
Supply Duct Heat Gain						0.0
Cold Deck Supply Air	58.0	54.3	79.1	57.0	22.8	
Supply Air	58.0	54.3	79.1	57.0	22.8	
Percent Outside Air		8.50	(%)			
Sensible Heat Ratio (SHR)		0.949				
Percent Supply Air Bypassing Coil		0.00	(%)			
Coil Airflow		23,519	(Cfm)			

BUILDING U-VALUES - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G U - V A L U E S -----

Room Number	Description	Part.	ExFlr	Room U-Values (Btu/hr/sqft/F)							Room Mass (lb/sqft)	Room Capac. (Btu/sqft/F)
				Summr Skylt	Wintr Skylt	Summr Roof	Wintr Windo	Summr Windo	Wall	Ceill.		
1	BRIGGS HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
System	1 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
2	OWEN HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
3	AUDITORIUM	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
System	3 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
4	SENIOR HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
Zone	4 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
System	4 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
5	SPECIAL TRAINING	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
Zone	5 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
System	5 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
6	GYMNASIUM	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
Zone	6 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
System	6 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
7	OWENS BASEMENT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
Zone	7 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
System	7 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
Building		0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.173	0.000	53.2	11.01



LOADING U-VALUES - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G U - V A L U E S -----

Room Number	Description	Room U-Values (Btu/hr/sqft/F)									Room Mass (lb/ sqft)	Room Capac. (Btu/ sqft/F)
		Part.	ExFlr	Summr Skylt	Wintr Skylt	Summr Roof	Wintr Windo	Windo	Wall	Ceil.		
1	BRIGGS HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
Zone	1 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
System	1 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	49.6	10.14
2	OWEN HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
Zone	2 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
System	2 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	54.6	11.21
3	AUDITORIUM	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
Zone	3 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
System	3 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	80.3	19.42
4	SENIOR HALL	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
Zone	4 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
System	4 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	52.8	10.79
5	SPECIAL TRAINING	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
Zone	5 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
System	5 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.050	0.000	66.4	13.90
6	GYMNASIUM	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
Zone	6 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
System	6 Total/Ave.	0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.200	0.000	71.5	15.21
7	OWENS BASEMENT	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
Zone	7 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
System	7 Total/Ave.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	23.3	4.67
Building		0.000	0.000	0.000	0.000	0.050	0.600	0.674	0.173	0.000	53.2	11.01

LOADING AREAS - ALTERNATIVE 1  
LOAD CALCULATION

----- B U I L D I N G   A R E A S -----

Room Number	Description	Number of		Floor	Total	Partition Area (sqft)	Exposed	Skylight Area (sqft)	Sk1 /Rf (%)	Net Roof Area (sqft)	Window Area (sqft)	Win /Wl (%)	Net Wall Area (sqft)
		Duplicate Flr	Rm	Area/Dupl Room (sqft)	Floor Area (sqft)		Floor Area (sqft)						
1	BRIGGS HALL	1	1	29,112	29,112	0	0	0	0	7,278	1,778	14	11,214
Zone	1 Total/Ave.				29,112	0	0	0	0	7,278	1,778	14	11,214
System	1 Total/Ave.				29,112	0	0	0	0	7,278	1,778	14	11,214
2	OWEN HALL	1	1	36,562	36,562	0	0	0	0	11,683	3,554	18	16,538
Zone	2 Total/Ave.				36,562	0	0	0	0	11,683	3,554	18	16,538
System	2 Total/Ave.				36,562	0	0	0	0	11,683	3,554	18	16,538
3	AUDITORIUM	1	1	3,344	3,344	0	0	0	0	3,344	495	13	3,329
Zone	3 Total/Ave.				3,344	0	0	0	0	3,344	495	13	3,329
System	3 Total/Ave.				3,344	0	0	0	0	3,344	495	13	3,329
4	SENIOR HALL	1	1	29,897	29,897	0	0	0	0	7,648	1,972	13	13,154
Zone	4 Total/Ave.				29,897	0	0	0	0	7,648	1,972	13	13,154
System	4 Total/Ave.				29,897	0	0	0	0	7,648	1,972	13	13,154
5	SPECIAL TRAINING	1	1	19,138	19,138	0	0	0	0	13,438	13	0	10,323
Zone	5 Total/Ave.				19,138	0	0	0	0	13,438	13	0	10,323
System	5 Total/Ave.				19,138	0	0	0	0	13,438	13	0	10,323
6	GYMNASIUM	1	1	3,648	3,648	0	0	0	0	3,648	840	30	1,960
Zone	6 Total/Ave.				3,648	0	0	0	0	3,648	840	30	1,960
System	6 Total/Ave.				3,648	0	0	0	0	3,648	840	30	1,960
7	OWENS BASEMENT	1	1	11,683	11,683	0	0	0	0	0	0	0	0
Zone	7 Total/Ave.				11,683	0	0	0	0	0	0	0	0
System	7 Total/Ave.				11,683	0	0	0	0	0	0	0	0
Building					133,384	0	0	0	0	47,039	8,652	13	56,518

ASHRAE 90 ANALYSIS - ALTERNATIVE 1  
LOAD CALCULATION

----- A S H R A E 9 0   A N A L Y S I S -----

Overall Roof U-Value = 0.050 (Btu/Hr/Sq Ft/F)  
Overall Wall U-Value = 0.229 (Btu/Hr/Sq Ft/F)  
Overall Building U-Value = 0.154 (Btu/Hr/Sq Ft/F)

Roof Overall Thermal Transfer Value (OTTVr) = 2.55 (Btu/Hr/Sq Ft)  
Wall Overall Thermal Transfer Value (OTTVw) = 15.59 (Btu/Hr/Sq Ft)

## Job Card - Job Information

-----  
 Project: MAINE CRIMINAL JUSTICE ACADEMY  
 Location: VASSALBORO, ME  
 Client: PDT ARCHITECTS  
 Program User: SP DOEL  
 Comments: FILE 24081

Card 08----- Climatic Information -----  

	Summer	Winter	Summer	Summer	Winter		Summer	Winter
Weather	Clearness	Clearness	Design	Design	Design	Building	Ground	Ground
Code	Number	Number	Dry Bulb	Wet Bulb	Dry Bulb	Orientation	Reflect	Reflect
PORTLANM	PORTLANM	PORTLANM	PORTLANM	PORTLANM	PORTLANM	-15		

Card 10----- Load Simulation Parameters -----  

Cooling	Heating		Airflow	Airflow	Room	Put Wall
Load	Load	Ventilation	Input	Output	Circulation	RA Load
Method	Method	Method	Units	Units	Rate	to Room

-CLF

----- Load Section Alternative #1 -----

Card 19- Load Alternative -  
 Number Description  
 LOAD CALCULATION

Card 20----- General Room Parameters -----  

Room	Zone		Floor	Floor	Const	Plenum	Acoustic	Floor to	Duplicate	Duplicate	Perimeter
Number	Reference	Room	Length	Width	Type	Height	Ceiling	Floor	Floors	Rooms per	Depth
Number	Number	Descrip					Resistance	Height	Multiplier	Zone	
1		BRIGGS HALL	29112	1	6	0	0	11			
2		OWEN HALL	36562	1	6	0	0	11			
3		AUDITORIUM	3344	1	1	0	0	11			
4		SENIOR HALL	29897	1	6	0	0	11			
5		SPECIAL TRAINING	19138	1	6	0	0	11			
6		GYMNASIUM	3648	1	6	0	0	11			
7		OWENS BASEMENT	11683	1	6	0	0	11			

Card 21----- Thermostat Parameters -----

Room Number	Cooling Room Design DB	Room RH	Cooling T'stat Driftpoint	Cooling T'stat Schedule	Heating Room Design DB	Heating T'stat Driftpoint	Heating T'stat Schedule	T'stat Location Flag	Mass / No. Hrs Average	Carpet On Floor
76	50	50	50	50	72					

Card 22----- Roof Parameters -----

Room Number	Roof Number	Equal to Floor?	Roof Length	Roof Width	Roof U-Value	Const Type	Roof Direction	Roof Tilt	Roof Alpha
	1	NO	7278	1	.05				
	1	NO	7278	1	.05				
	1	NO	11683	1	.05				
	1	NO	3344	1	.05				
	1	NO	7648	1	.05				
	1	NO	13438	1	.05				
	1	1	3648	1	.05				

Card 24----- Wall Parameters -----

Room Number	Wall Number	Wall Length	Wall Height	Wall U-Value	Wall Constuc Type	Wall Direction	Wall Tilt	Wall Alpha	Ground Reflectance Multiplier
	1	1	1	.2	94	0			
	1	4960	1	.2	94	0			
	2	4960	1	.2	94	180			
	3	1408	1	.2	94	90			
	4	1664	1	.2	94	270			
	1	5591	1	.2	94	90			
	2	6745	1	.2	94	270			
	3	3600	1	.2	94	0			
	4	4156	1	.2	94	180			
	1	1896	1	.2	94	0			
	2	800	1	.2	94	270			
	3	1128	1	.2	94	90			
	1	3348	1	.2	94	0			
	2	4124	1	.2	94	180			
	3	3726	1	.2	94	90			
	4	3928	1	.2	94	270			
	1	2684	1	.05	94	90			
	2	2376	1	.05	94	0			
	3	2684	1	.05	94	180			
	4	2592	1	.05	94	270			
	1	1840	1	.2	94	180			
	2	960	1	.2	94	90			

Card 25----- Wall/Glass Parameters -----

Room Number	Wall Number	Glass Length	Glass Height	Pct Glass or No. of Windows	Glass U-Value	Shading Coefficient	External Shading Type	Internal Shading Type	Percent Solar to Ret. Air	Visible Transmittance	Inside Visible Reflectance
	1	1	1	1	.6	.6					
	1	679									
	2	239									
	3	182									
	4	178									
	1	931	1								
	2	1205	1	1							
	3	540	1								
	4	378	1								
	1	460	1								
	2	25	1								
	3	10	1								
	1	460	1								
	2	468	1								
	3	531	1								
	4	513	1	1							
	1	10									
	1	768									
	2	72	1	1							

*2157 SF OF SOUTH-FACING GLASS*

Card 27----- People and Lights -----

Room Number	People Value	People Units	People Sensible	People Latent	Lighting Value	Lighting Units	Lighting Fixture Type	Ballast Factor	Percent Lights to Ret. Air	Daylighting Reference Point 1	Daylighting Reference Point 2
	200	SF-PERS	255	255	2.0	WATT-SF	ASHRAE2				
	100	PEOPLE	PEOPLE	PEOPLE	1						
	100	PEOPLE									

Card 28----- Miscellaneous Equipment -----

Room Number	Misc Equipment Number	Equipment Descrip	Energy Consump Value	Energy Consump Units	Schedule Code	Energy Meter Code	Percent of Load Sensible	Percent Misc. Load to Room	Percent Misc. Sens to Ret. Air	Radiant Fraction	Optional Air Path
	1	MISCELLANEOUS	1	BTUH-SF	CLGONLY						
	1										
	1										

Card 29----- Room Airflows -----

Room Number	Ventilation				Infiltration				Reheat Minimum	
	Cooling Value	Heating Units	Cooling Value	Heating Units	Cooling Value	Heating Units	Cooling Value	Heating Units	Value	Units
	20	CFM-P	20	CFM-P	CFM-P	CFM-P	.075	CFM-SF		

1

4500

CFM

4500

CFM



-----







Utility Description Reference Table

---

Schedules:

50 (Utility file not found)  
CLGONLY COOLING ONLY (DESIGN)

System:

RAD RADIATION HEATING SYSTEM  
SZ SINGLE ZONE SYSTEM  
VRH VARIABLE VOLUME WITH REHEAT

Schedule Name: CLGONLY  
Project: COOLING ONLY (DESIGN)  
Location:  
Client:  
Program User:  
Comments: COOLING ONLY SCHEDULE

Starting Month: JAN Ending Month: DEC  
Starting Day Type: DSGN Ending Day Type: SUN

Hour	Util	Percent
0	100	
24		

Starting Month: HTG Ending Month: HTG  
Starting Day Type: DSGN Ending Day Type: SUN

Hour	Util	Percent
0	0	
24		



PREPARED BY:  
BENNETT ENGINEERING, INC.

FORM "LCA-1"

B.2.0 Required Energy Items

State of Maine

Energy Conservation in Buildings

Building Name/Use: Madison Elementary School

Location: Madison, Maine

Date: 6MAR00

1. Average Number of Occupants:
2. Degree Days: 8000/year (estimate)
3. Inside Design Temperature: 72°F, Outside Design Temperature: -20°F
4. Building Area: 42,300 SQ. FT. (Heated Area)

Energy/Point of Use Per Year

5.	Lighting:	116,920 KWH	(100% Efficiency)	399,281 MBTU
6.	Heating:	14,165 Gal #2 Oil	"	1,983,034 MBTU
7.	Cooling:	5,000 KWH	"	17,075 MBTU
8.	Water Heating:	639 Gal #2 Oil	"	89,400 MBTU
9.	Equipment:	164,412 KWH	"	561,466 MBTU
10.	Other:*	500 GAL Propane	"	4,578 MBTU
11.	Total Energy:		"	3,054,834 MBTU
12.	Yearly Energy Usage			
	Per Building Square			
	Foot Area:	72,218 BTU/SQ. FT./YR.		

\* Kitchen Range, dryer

STATE OF MAINE

PROJECT Madison Elementary School

DISCOUNT RATE: 10%

Item	Estimated First Cost P	Life	Est. Factor	UCR (P-A) X UCR) = A*	(1st Cost
<hr/> Site Development					
Building Structure (All items exclusive of those listed below).					
Roofing					
Mechanical	549,900		30		
Fire Protection	76,140		30		
Electrical	296,100		30		
Equipment Built-In			30		
Miscellaneous			30		

\*Salvage value is assumed to be 0.

TOTAL ESTIMATED  
CONSTRUCTION COST

SUBTOTALS COL. E

<u>ENERGY USAGE</u>		COL. F
AMOUNT	TYPE	ANNUAL COST
14,804 Gal #2 Oil	HEATING FUEL (Oil) (70% Efficiency)	\$18,505
281,332 KWH	ELECTRICITY (Except for Heating)	\$22,506
500 Gal Propane	GAS (Kitchen Use)	\$900

SEWER  
 INSURANCE @ \$.25/SF  
 TAXES (Or Loss of Taxes)  
 MAINTENANCE AND REPAIR @ \$.50/SF  
 MAINTENANCE CONTRACTS  
 OTHER  
 TOTAL UNIFORM ANNUAL SUM  
 UNIFORM ANNUAL SUM/SQ. FT. (New Only)  
 AIA GROSS SQ. FT. 42,300

D.3.0 Life Cycle Cost-Benefit Analysis

Date: MARCH 2000

PREPARED BY: STEPHEN BLATT ARCHITECTS

STATE OF MAINE

Project: MSAD#59, Madison Elementary School, Madison, ME

Discount Rate: 10%

Column Identification:

	A	B	C	D	E
Item	Estimated 1 <sup>st</sup> Cost P	Est. Life	UCR (P-A) Factor	Salvage	(1 <sup>st</sup> Cost x UCR)=A
Site Dev.	\$490,100	30	0.1061	0	\$52,000
Building Structure (All items exclusive of those listed below)	\$2,116,500	30	0.1061	0	\$224,560
Roofing	\$173,500	30	0.1061	0	\$18,400
Mechanical (PBG & HVAC)	\$549,900	30	0.1061	0	\$58,340
Fire Protection (SPKLR)	\$76,100	30	0.1061	0	\$8,100
Electrical	\$296,100	30	0.1061	0	\$31,400
Equipment Built-In	\$282,800	30	0.1061	0	\$30,000
Conveying System	\$0	30	0.1061	0	\$0
<b>Construction Cost =</b>	<b>\$3,985,000</b>	<b>TOTAL ESTIMATED SUBTOTAL</b>			<b>\$422,800</b>
	<b>ENERGY AMOUNT</b>	<b>USAGE</b>	<b>TYPE</b>		<b>ANNUAL COST</b>
	14,800	GAL	#2 Oil Heating Fuel \$1.25/gal		18,500
	5,000	KWH	Electricity for heating & cooling \$0.080/kwh		400
	500	GAL	Propane Gas (Kitchen Use) \$1.80/gal		900
	281,332	KWH	Electricity Non-Heating \$0.080/kwh		22,500
			<b>Total</b>		<b>\$42,300</b>
	Water and sewer				7,200
	Insurance @ \$.18/sf				7,600
	Taxes (or loss of taxes)				0
	Maintenance & Repair @ \$1.95/sf				82,500
	Maintenance Contracts				0
	Other				0
	<b>TOTAL UNIFORM ANNUAL SUM</b>				<b>562,400</b>
	UNIFORM ANNUAL SUM/ SQ. FT.				\$13.29
	AIA Gross Sq. Ft. 42,300				

Note: 1. Bennett Engineering supplied mechanical and utility costs.  
 2. Cost projection for water, sewer, insurance and maintenance.



## Current Energy Management Processes

The Building Control Center monitors security, proximity access, temperatures, HVAC Equipment, lighting, and fire safety in State Buildings which have been equipped with the controls and interface to allow this to happen. The BCC is manned 24 hours a day/ 7 days a week. Examples of the ability of the system are: all overhead lighting on each floor of the MDOT Building are turned on and off at specific times. Temperature readings along with fan and valve controls can be used to adjust temperatures in the Tyson Building. Proximity card access to the Cultural Building allows control of who enters the building and when they do. It, also, provides a record of when areas were opened.

The Property Management Division along with the Professional Service Division have partnered, in the past, to do lighting and oil conservation projects. The most recent major project was bid in 1997, but not completed until late 1999. It focused on buildings that the State managed on the East Campus. This project included lighting conservation, building tune-up, HVAC Load Reduction, Improved Fans and Air Handling Systems, and Improved Heating and Cooling Plants. Bid selection was made on the project and estimated cost savings. Other major projects have been reviewed and audited such as the shutting down of the Central East Campus Heat Plant for the summer. It has been determined that we use over \$29,000 just to heat Hot water in those months. Conversion to electric hot water heaters would enable us to shut down and service the Central Heat Boilers, use the 24/7 staffing for other maintenance, and provide direct energy savings.

Internal Energy Improvements by the Bureau of General Services are ongoing. Over the last year, energy efficient thermopane replacement windows have been installed at the State Police Barracks, the Baker Building (Marine Resources), and the Hayden House (Hallowell). The Central Heat Plant at the Hallowell Campus, which burned #6 oil, was eliminated and replaced by individual boilers in each of the buildings. Energy efficient lighting and controls are installed on an ongoing basis, most recently old surface mounted fluorescent lighting was replaced at the Maine Arts Commission at the Daschlager House.

The Bureau of General Services, also, proactively consolidates and bids utilities for State Facilities. The #2 Oil Bid not only includes quantities projected to be used in Augusta Facilities, but includes quantities from across the State such as the Baxter School for the Deaf. This enables BGS to acquiring pricing leverage for over 2 million gallons of #2 oil. Electric pricing can be acquired the same way, however, the State is currently using the Standard offer price for electricity.

Currently, the Bureau of General Services has two initiatives in progress. The first is a review of the Building Control Center. The review is being done by Ames and Hewitt Engineers from Winthrop. The purpose of this study is to determine the feasibility of alternate and/or competing building control systems so that overall equipment purchase and maintenance costs can be minimized while meeting operational needs for standardization. This will help us expand our controls at a quicker pace than we are now able to by having open interface at the Building Control Center with all systems rather than just priority interface with our current Honeywell System. We received a draft report in early December, 2000. We met and reviewed and, currently, Ames and Hewitt are



making report changes. We will reconvene with our vendor to insure we are all on board with equipment and direction for open interface.

Our second initiative has been the installation of the Powerlogic Power Management System. It was determined that with the State's potential increase in electric energy consumption, it is increasingly necessary that we are able to monitor and control electric consumption. This system, when fully installed will enable the State to do:

- **Bill Analysis:** onsite identification of power being used, optimize efficiency, and take advantage of lower rates.
- **Power Factor Improvement:** Identify system capacity limits and identify advantages.
- **Equipment Utilization:** identify equipment electric use and cost, determine extra system capacity or over-stressed equipment, and load balancing.
- **Peak Avoidance/Demand Management:** Control non-critical load, predict real-time demand monitoring, control staggered start of equipment, and be able to target demand avoidance areas.
- **Utility Bill Reconciliation:** the ability to distribute costs to the tenant and control on and off peak energy use.

The goal of these two initiatives is to help the Bureau of General Services control and optimize energy use. These systems will enable us to identify the impact, determine whether we have sufficient resources to allow departments to add equipment, and best service the customer.

FIVE EXISTING PROJECTS FOCUSING ON  
ENERGY CONSERVATION

1. Tyson Center, East Campus
2. Marquardt Building, East Campus
3. Burton M. Cross Building
4. Maine Criminal Justice Academy, Vassalboro
5. Psychiatric Treatment Center, East Campus



**Maine Governmental Facilities Authority Projects**  
**Project Summaries**

**Tyson Center, AMHI Campus**  
**Augusta**

**Project Description**

This project consisted of the complete renovation of a hospital building built in the early nineteen hundreds converting it into a modern office space for State Government in compliance with current life safety and accessibility codes.

The renovation of the existing 35,000 square foot building consisted of:

- asbestos and lead abatement,
- structural repairs to the roof,
- complete replacement and upgrade to the electrical and heating systems
- addition of an air conditioning system
- new data/communications systems
- new fire suppression sprinkler system
- new elevator
- new stair case
- new ADA Compliant rest rooms
- new interior finishes throughout including acoustical ceilings, flooring and wall finishes
- creation of 28 private offices, 3 conference rooms, 15 utility/mechanical rooms and 11 work areas housing 97 work stations
- The exterior of the building was repaired in keeping with it's historical significance
- A new main entry was added as well as pedestrian pathways and site lighting.

The Tyson Center is now the new home to the following departments:

- |   |              |
|---|--------------|
| • Departments of Corrections                        | 38 employees |
| • Division of Financial & Personnel Services (DAFS) | 33 employees |
| • Treasurer's Office                                | 17 employees |
| • Bureau of Accounts & Control                      | 35 employees |

**Project Schedule**

The Project is now substantially complete with all agencies moved in. Punch list is in progress.

**Project Budget**

The Project has been brought in on budget.



**Maine Governmental Facilities Authority Projects**  
**Project Summaries**

**Marquardt – Second Floor, AMHI Campus**

**Augusta**

This project consisted of partial renovation of existing office space on the AMHI Campus. This work upgraded the existing space to bring it into compliance with current life safety and accessibility codes.

The renovation of the existing 20,000 square foot space consisted of:

- asbestos abatement
- structural upgrades to support new air conditioning units
- upgrades to the electrical and heating systems
- addition of an air conditioning system on the second floor
- upgrades to the data/communications systems
- modifications to fire suppression sprinkler system
- upgrades to the existing elevator
- ADA Compliant rest rooms
- new interior finishes throughout including acoustical ceilings, flooring and wall finishes
- the renovated second floor has 22 private offices and 62 work stations

The Second Floor Marquardt Building is now the home to the following departments:

- Department of Mental Health, Mental Retardation & Substance Abuse Services with 82 people on the second floor

**Project Schedule**

The Project is now substantially complete with all agencies moved in. Punch list is in progress.

**Project Budget**

The Project has been brought in on budget.



## State Office Building Renovation Augusta Maine

### A Brief Sample of Building Improvements:

- New East Entry
- New Legislative Hearing Rooms and Offices on the Second Floor
- New Electrical Distribution Systems
- New Data and Communications Systems
- New Air Conditioning Systems
- New Energy Efficient Exterior Glazing
- Structural Repairs to Roof Decks
- New Roofs and Insulation Over the Entire Building
- Structural Repairs of Parapets
- New Energy Efficient Lighting
- Upgrade of all Elevators
- New Kitchen and Cafeteria
- New Ergonomic Modular Furniture Systems
- Improved Life Safety Systems and Egress Routes
- Upgraded Security Systems
- Improved ADA Access between the State Office Building and the State House





Maine Criminal Justice Academy  
Vassalboro, Maine

Completion Schedule:

- December 2000
  - Building A - Dormitory
  - Building B - Class Rooms and Administration
  - Building C - Food Service
- Spring 2001
  - Building D - Training Center
  - Building C - Stair Tower

The Project Team:

- Owner: State of Maine, Bureau of General Services
- Owner's Representative: Alliance Construction - Scarborough, Maine
- Architect: PDT - Portland, Maine
- General Contractor: Wright Ryan Construction - Portland, Maine

A Brief Sample of Building Improvements:

- New Training Building
- New Stair Towers and Elevators for Fire Egress and ADA Access
- New Electrical Distribution Systems
- New Data and Communications Systems
- New Air Conditioning Systems in Building B
- New Energy Efficient Windows and Exterior Glazing Through Out
- New Energy Efficient Heating System
- Structural Repairs to Building A and Building B
- New Roofs and Insulation Over the Entire Building
- Structural Repairs of Parapets on Building A
- New Energy Efficient Lighting
- Upgrade of Existing Elevator
- New Kitchen and Cafeteria
- Improved Life Safety Systems and Egress Routes
- New Security Systems
- Improved ADA Access Between Buildings
- Exterior Masonry Repairs Through Out
- New Septic System
- New Water Supply System
- New Fire Suppression System



## FIVE PROPOSED PILOT PROGRAM BUILDINGS

1. Harlow Building, East Campus
2. CETA Building, East Campus
3. DHS Building, State Street
4. Greenlaw Building, East Campus
5. Stone Buildings, East Campus  
(Current AMHI), available Fall 2003



## Development of Rules and Process

The BGS is authorized to produce rules and procedures to establish a formal competitive procedure to award performance based contracts to accomplish a comprehensive approach to the achievement of energy savings. The BGS already has detailed rules governing the award of contracts and grants under other authorizing language<sup>4</sup> in other sections of law. These rules were promulgated under the Administrative Procedures Act.

There are two rules which have been determined to be appropriate to meet the necessary procedures. The first, Chapter 110 (included as Appendix X), allows the statement of award criteria, establishes a component related to cost of a proposal and establishes clear process requirements such as advertising, minimum response guidelines and notifications. The process outlined in this rule has been used for over 10 years, covering contract awards as large as \$200,000,000. The second rule, Chapter 120 (included as Appendix X+1), establishes a formal appeal process. This allows an aggrieved party to challenge an award in a formal and defined mechanism.

A process is now established that all performance based contracts to achieve energy savings shall be awarded by a request for proposal process under Chapter 110 of the BGS rules. Each RFP shall contain, in addition to the basic requirements of the rules, a specific requirement must be included that each proposal include a feasibility analysis and commitment of energy savings to be achieved. A life cycle analysis must be included within the feasibility analysis. The type and form of contract shall be determined by the Director of the BGS.



18-123

DEPARTMENT OF ADMINISTRATION  
BUREAU OF PURCHASES

CHAPTER 110 RULES FOR THE PURCHASE OF SERVICES AND AWARDS

Summary: This chapter outlines the procedures to be used in the purchase of services and the awarding of grants and contracts pursuant to 5 M.R.S.A. 1825-C.

Section 1. DEFINITIONS

A. REQUEST FOR PROPOSAL: Means a document listing the scope of work, requirements of the state and all evaluation criteria for a service needed by the state. This document is also known by the initials "RFP".

B. CONTRACT REVIEW COMMITTEE: Means the committee established by Executive Order which reviews agency documents and actions related to contracts for special services.

C. CONTRACT: Means the agreement between a vendor and the State of Maine, describing the service to be performed, the terms and conditions agreed to by the parties, the cost of the service and how payment will be made.

D. GRANT: Means an agreement between a group organization or other recipient and the state which describes terms and conditions and scope of performance or action which is expected of the recipient.

Section 2. REQUEST FOR PROPOSAL PROCEDURE

A. All contracts issued under the review of the Contract Review Committee which do not qualify as sole source or emergency procurements must be competitively bid using the Request for Proposal.

i. The request for proposal must contain at a minimum a clear definition (scope) of the project, the evaluation criteria and relative scoring weights to be applied, the proposal opening date and time, and agency contact person.

aa. Cost of the contract must be included in the evaluation criteria and must receive a minimum of 25% of the total weight of all criteria.

bb. All proposals shall be opened publicly at the Bureau of Purchases, main office. Proposals received at the Bureau of Purchases main office after the advertised opening time



shall be rejected, unless the advertised opening date and time have been extended by the State Purchasing Agent due to circumstances requiring such an extension of time.

ii. Request for proposals must be submitted to the Contract Review Committee for review prior to release. Review includes, but is not limited to appropriateness of scope and clearly defined evaluation criteria with cost at a minimum of 25%. Agencies will be notified of approval.

iii. Request for proposals must be advertised for a minimum of three consecutive days in the Kennebec Journal of Augusta, allowing a minimum of fifteen (15) calendar days from the final day of advertising to the proposal opening date. This section does not limit advertising in any other publication, trade publication or other media.

aa. Advertisements must include at a minimum a brief description of the service requirements of the state, the name of the department and division issuing the RFP, the name of the contact person and address where copies of the RFP can be obtained, the opening date, the opening time and the opening location: Bureau of Purchases, Room 119 State Office Building, State House Station #9, Augusta, Maine 04333.

iv. Pre-Bidders conferences are allowed, but are not required. These conferences are used to be certain that all bidders have an equal understanding of the state requirements.

aa. Pre-Bidders conferences must be advertised within the RFP advertisement, including location, day and time. Conference must be scheduled a minimum of seven calendar days from the final day of advertising and a minimum of two weeks prior to proposal opening date. The State Purchasing Agent may authorize a pre-bidders conference on shorter notice that has not been advertised in the RFP. The contracting agency shall notify all prospective bidders who requested the RFP of the date and time of the conference under these circumstances.

bb. Conferences must be open to the public, questions raised must be documented in writing and responses must be written and

forwarded to each prospective bidder who received an RFP, whether in attendance or not.

cc. No alterations or changes to any requirement or specification within the original RFP can be made without notifying all bidders in writing a minimum of seven (7) calendar days before opening date.

v. Proposals shall be opened publicly at the Bureau of Purchases or a nearby appropriate facility at the discretion of the Bureau of Purchases. The opening of proposals shall be open to public attendance. The name of the respondent will be read aloud. No other information will be made available prior to evaluation and award notification. All proposals shall be sequestered from this time until notification of award by the contracting agency after which time they become public record.

Proposals received at the Bureau of Purchases later than the date and time specified will not be accepted and will be returned unopened or held at the Bureau to be picked up by the respondent. Late proposals not picked up within seven (7) calendar days will be destroyed.

vi. All opened proposals shall be turned over to the contracting agency's representative after the opening. A written record of the vendor names, date and time received, cost/price and agency representative shall be kept at the Bureau of Purchases.

### Section 3. AWARD

a. The contracting agency is responsible for reviewing all RFP's based on the criteria established within the original Request for Proposal document. The agency shall document the scoring, substantive information that supports the scoring, and make the award decision which shall be subject to the Contract Review Committee approval.

i. Interviews/Presentations: Interviews and/or presentations may be considered within the review for information and scoring, if that provision was included within the original RFP documentation.

ii. Pricing/Negotiations: Pricing changes, alterations or negotiations are not allowed prior to the award decision and must not be used in

scoring. Minor negotiations after notice of award are allowed and if agreement cannot be reached, the proposal may be rejected and the award made to the next highest rated bidder who was in compliance with all terms, conditions and requirements.

iii. Documentation: Written records must be kept by each person reviewing or ranking proposals. These records must be made available upon request.

iv. Award: Award must be made to the highest rated proposal which conforms to the requirements of the state as contained in the RFP.

v. Proposed Award Decision Notification: Contracting agency must notify all bidders responding to an RFP of the award decision in writing, postmarked or delivered a minimum of fourteen (14) calendar days prior to contract effective date. This notice must include a statement that the award is conditional pending Contract Review Committee approval.

The award decision, a copy of the award notification to bidders, supporting justification of award, individual and summarized scoring and a minimum of four contracts with the state agency head and vendor authorized original signatures must be sent to the Contract Review Committee for final review and approval a minimum of fourteen (14) calendar days prior to contract effective date.

B: Upon final approval by the Contract Review Committee, the Chairman shall affix an original signature to the contracts, keep one copy, and forward to Accounts and Control for final approval of encumbrance, terms, and account coding. The Controller will keep one copy and the remaining copies shall be returned to the contracting agency for distribution to vendor.

i. Contracts are not considered fully executed and valid before completing final approval of encumbrance. No contract will be approved based on an RFP which has an effective date less than fourteen (14) calendar days after award notification to bidders.

ii. Attorney General approval is not required unless changes have been made to existing boilerplate or at the request of the Contract Review Committee. Nothing within this paragraph

prevents agency requests for Attorney General  
review of any contract.



**DEPARTMENT OF ADMINISTRATIVE & FINANCIAL SERVICES**

**BUREAU OF GENERAL SERVICES**

**CHAPTER 120      RULES FOR APPEAL OF CONTRACT AND GRANT AWARDS**

**Summary:** This chapter defines the procedures and criteria to be used in the appeal of contract or grant awards, outlines the appointment of an Appeal Committee, describes procedures to be used in hearing an appeal and how appellants will be notified of final agency action pursuant to 5 M.R.S.A. 1825-(C) (D) (E) (F).

**Section 1.      DEFINITIONS**

1. **REQUEST FOR PROPOSAL:** Means a document listing the scope of work, requirements of the State and all evaluation criteria for a service needed by the State. This document is also known by the initials "RFP".
2. **STATE PURCHASES REVIEW COMMITTEE:** Means the committee established by Executive Order which reviews agency documents and actions related to contracts for special services.
3. **CONTRACT:** Means the agreement between a vendor/provider and the State of Maine, describing the service to be performed, the terms and conditions agreed to by the parties, the cost of the service and how payment will be made.
4. **GRANT:** Means an agreement between a group, organization or other recipient and the State which describes terms and conditions and scope of performance or action which is expected of the recipient.
5. **STAY OF AWARD:** Means an order issued by the Director of the Bureau of General Services which halts action on a contract or grant pending an appeal hearing.
6. **APPEAL COMMITTEE:** Means a committee of three (3) people, two members are appointed by the Commissioner of Administrative & Financial Services and must not have direct or indirect personal, professional or financial conflict of interest in the appeal and cannot be employees of the department affected by the contract. The third member is the Director of the Bureau of General Services or his designee.

7. **AGGRIEVED PERSON:** Means any person who bids on a contract and who is adversely affected financially, professionally or personally by that contract award decision.

## **Section 2. APPEALS PROCEDURE**

1. **STAY:** The Director of the Bureau of General Services must insure that aggrieved persons have an opportunity to appeal a contract award decision. An aggrieved person may request a stay of contract award within ten (10) calendar days of notification of contract award by the contracting agency.

A. Requests for stay of contract award must be written and addressed to the Director of the Bureau of General Services and must state clearly the specific nature of the grievance, demonstrate irreparable injury to the petitioner, a reasonable likelihood of success on the merits of the appeal, and no substantial harm to adverse parties or to the general public.

B. The Director of the Bureau of General Services shall notify the petitioner in writing of the decision regarding the issuance of a stay within seven (7) days of receipt of request.

C. Failure of the petitioner, to obtain a stay does not affect the petitioner's right to a hearing of appeal as provided by statute and within these rules.

2. **APPEAL:** An aggrieved person may request a hearing of award decision from the Director of the Bureau of General Services in writing within fifteen (15) days of notification of contract award. A written request for appeal hearing must contain at a minimum the specific nature of the grievance, including the Appeal Criteria as defined in Section 3 Paragraph B of this rule and must demonstrate the conditions that make the petitioner an aggrieved person. The Director of the Bureau of General Services shall grant an appeal hearing unless it is determined that:

- A. The petitioner is not an aggrieved person
- B. A prior request by the same petitioner relating to the same contract award has been granted
- C. The request was made more than fifteen (15) days after notification of award; or
- D. The request is capricious, frivolous or without merit

A hearing will not be granted if the contract award is not approved by the State Purchases Review Committee.

1. **NOTIFICATION:** The Director of the Bureau of General Services shall notify the petitioner in writing of the decision regarding a request for a hearing of appeal

within fifteen (15) calendar days of receipt of the request. If a request for a hearing is granted, notification must be made at least ten (10) calendar days before the hearing date. The notification must include the date and location of the hearing and the names of the Appeal Committee members.

2. In the event the request for hearing is denied, the notification shall constitute final agency action. The notification shall include an explanation of the petitioners right to judicial review of final agency action under 5 M.R.S.A. 11001 et seq.

### **Section 3. APPEAL HEARINGS.**

1. **APPEAL COMMITTEE:** The Appeal Committee shall consist of three (3) people, two appointed by the Commissioner of Administrative & Financial Services. The third person is the Director of the Division of Purchases or other designee of the Director of the Bureau of General Services. This Committee shall appoint a person to serve as presiding officer over the hearing. This person may be one of the Committee members or any other person who has no direct or indirect personal, professional or financial conflict of interest in the appeal. This person cannot be an employee of any department affected by the contract. The presiding officer, if not from the ranks of the Appeal Committee shall have no vote in the decision but may provide advice, information or research at the request of the Committee.

The presiding officer shall control all aspects of the hearing, rule on points of order, rule on all objections and may question witnesses.

A recording secretary shall be furnished by the Division of Purchases to record by audio tape or other media the hearing of appeal. This person shall be responsible for scheduling additional hearing days and locations at the request of the Appeal Committee.

2. **APPEAL CRITERIA:** The burden of proof within the hearing of appeal lies with the petitioner. The evidence presented must specifically address and be limited to one or more of the following:

- A. Violation of law;
- B. Irregularities creating fundamental unfairness; or
- C. Arbitrary or capricious award

Evidence of any type that cannot be related to this criteria may be ruled inadmissible by the presiding officer.

In the event multiple appeal hearing requests are granted on a single contract award, the Director of the Bureau of General



Services may assign the Appeal Committee to hear all petitioners within the same hearing as a combined appeal.

3. **PARTICIPANTS:** The petitioners may participate alone or be presented by Counsel or other agent. The State shall be represented by the contracting agency and/or its Counsel.

Other parties of interest may petition to intervene. Such petition shall be presented in writing to the Director of the Division of Purchases who shall determine and allow or disallow participation in writing within seven (7) calendar days of receipt of the request to intervene. Copies of this notification shall be sent to all Appeal Committee members, the presiding officer, the Appellant and the contracting State agency.

4. **PRESENTATION OF EVIDENCE:** The petitioner must present evidence to substantiate the specific grievances stated in the appeal. Brief opening statements directed to the Appeal Committee may be made by the petitioner, the contracting State agency and any intervenors, in that order.

A. The petitioner shall present evidence first, using witnesses and exhibits who may be cross examined by the State and the intervenors. Re-direct questioning related to issues raised during cross examination only may be done by the petitioner, followed by re-cross examination by the State and intervenors.

B. Witnesses may be called who can present factual information related directly to the appeal. All witnesses shall be sworn. To expedite the proceeding, testimony of any witness may be pre-filed in written form. If used, pre-filed testimony must be made available to the State, the Appeal Committee, presiding officer and all intervenors on the preceding work day, a minimum of twenty-four (24) hours prior to the hearing. Every such witness shall be subject to cross examination.

C. **EXHIBITS:** Exhibits relating to any issue of fact in the proceeding may be presented. Documentary evidence may be incorporated into the record by reference when the materials so incorporated are made available for examination by the parties before being received in evidence.

(1) **COPIES:** petitioner must furnish copies of all documentary evidence to the presiding officer, Appeal Committee, contracting State agency and all intervenors. Any costs associated with this subparagraph are the responsibility of the petitioner and shall not be recovered by any judgement of the Committee.

5. **STATE/INTERVENOR EVIDENCE:** The contracting State agency and all intervenors shall have the opportunity to submit evidence relevant to the appeal through witnesses and exhibits. The procedures for presenting this evidence are the same as those for the petitioner, substituting the words "contracting State agency" or "intervenor" for petitioner.

A. The order of examination and cross examination when the State presents evidence is state, all intervenors, and the petitioner.

B. The order of the examination and cross examination when an intervenor presents evidence shall be remaining intervenors (if any), the State and the petitioner.

6. **SUBPOENA OF WITNESSES:** In the event a witness is not willing to voluntarily testify, the Appeal Committee, subject to the approval of the Attorney General, shall issue a subpoena to require attendance, testimony and the production of any evidence relating to any issue of fact in the proceeding.

A. **EXPENSES:** Any expenses incurred by witnesses called by any party or intervenor shall be sole responsibility of the petitioner and shall not be recovered by any judgement of the Committee.

7. **APPEAL COMMITTEE:** The Appeal Committee may ask questions for clarification at any point throughout the direct and cross examinations. In addition, the Appeal Committee may ask questions after the direct and cross examination, may request additional witnesses, and may recall any witness for additional questioning.

8. **RECORD:** All evidence received or considered shall be part of the record. Evidence shall be admitted if it is the kind of evidence upon which reasonable persons are accustomed to rely in the conduct of serious affairs. The presiding officer may exclude irrelevant or unduly repetitious evidence. No sworn written evidence shall be admitted unless the author is available for cross examination or subject to subpoena, except for good cause shown.

#### **Section 4. APPEAL DECISIONS AND ACTIONS**

1. **APPEAL COMMITTEE DECISION:** The Appeal Committee shall consider all evidence entered into the record and shall look for clear and convincing evidence that one or more of the standards set forth in Section 3, subsection B, of these rules has been proven by the petitioner. The actions of the Committee are limited to one of the following:

- A. Validate the contract award decision under appeal
- B. Invalidate the contract award decision under appeal



A written decision and the reasons that support the decision must be submitted to the Director of the Bureau of General Services within fifteen (15) calendar days following the final day of the hearing of appeal.

2. NOTIFICATION OF FINAL AGENCY ACTION: The Director of the Bureau of General Services shall notify the petitioner, the contracting State agency, and all intervenors of this decision within ten (10) calendar days of receipt from the Appeal Committee. Such notification shall include the decision, an explanation of the reasons for the decision and an explanation of the petitioners right to judicial review of final agency action.

- A. This notification is considered final agency action.
- B. In the event the decision of the Appeal Committee is to invalidate the contract under these rules, the contract immediately becomes void and of no legal effect.

Effective Date: February 11, 1991

Amended: May 9, 1995