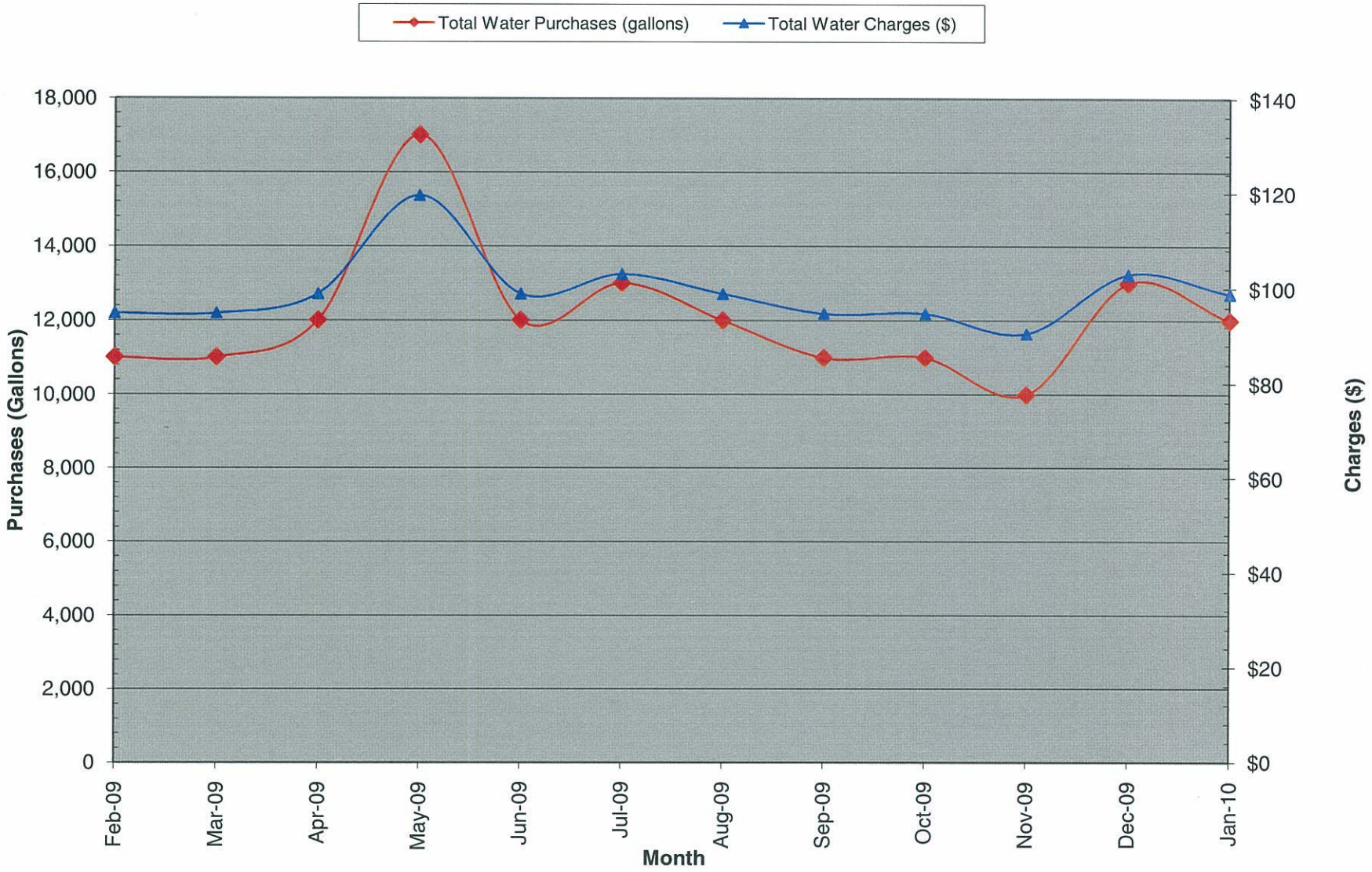
Water Usage - Hamilton Township Fire District #9



Utility Data - Hamilton.xls
Water Chart

ELECTRIC MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell electricity to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

American Powernet Management
867 Berkshire Blvd, Suite 101
Wyomissing, PA 19610
www.americanpowernet.com

BOC Energy Services
575 Mountain Avenue
Murray Hill, NJ 07974
www.boc-gases.com

Commerce Energy Inc.
535 Route 38, Suite 138
Cherry Hill, NJ 08002
(888) 817-8572 or
(858) 910-8099
www.commerceenergy.com

ConEdison Solutions
701 Westchester Avenue
Suite 201 West
White Plains, NY 10604
(800) 316-8011
www.ConEdSolutions.com

Constellation NewEnergy, Inc.
1199 Route 22 East
Mountainside, NJ 07092
908 228-5100
www.newenergy.com

Credit Suisse (USA), Inc.
700 College Road East
Princeton, NJ 08450
www.creditsuisse.com

Direct Energy Services, LLC
One Gateway Center, Suite 2600
Newark, NJ 07102
(973) 799-8568
www.directenergy.com

FirstEnergy Solutions
395 Ghent Road Suite 407
Akron, OH 44333
(800) 977-0500
www.fes.com

Gerdau Ameristeel Energy Co.
North Crossman Road
Sayreville, NJ 08872

Gexa Energy LLC New Jersey
20 Greenway Plaza, Suite 600
Houston, TX 77046
(866) 304-GEXA
Beth.miller@gexaenergy.com

Glacial Energy of New Jersey
2602 McKinney Avenue, Suite 220
Dallas, TX 75204
www.glacialenergy.com

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
www.hess.com

Integrys Energy Services, Inc
99 Wood Avenue, Suite 802
Iselin, NJ 08830
www.integrysenergy.com

Liberty Power Delaware, LLC
1901 W Cypress Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Liberty Power Holdings, LLC
1901 W Cypress Creek Road, Suite 600
Fort Lauderdale, FL 33309
(866) Power-99
(866) 769-3799
www.libertypowercorp.com

Pepco Energy Services, Inc.
d/b/a Power Choice
23 S. Kinderkamack Rd Ste D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
http://www.pplenergyplus.com/

Sempra Energy Solutions
The Mac-Cali Building
581 Main Street, 8th Floor
Woodbridge, NJ 07095
(877) 273-6772
www.SempraSolutions.com

South Jersey Energy Company
1 South Jersey Plaza, Route 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com

Strategic Energy, LLC
6 East Main Street, Suite 6E
Ramsey, NJ 07446
(888) 925-9115
www.sel.com

Suez Energy Resources NA
333 Thornall Street FL6
Edison, NJ 08818
866.999.8374(toll free)
www.suezenergyresources.com

UGI Energy Services, Inc.
d/b/a POWERMARK
1 Meridian Blvd. Suite 2C01
Wyomissing, PA 19610
(800) 427-8545
www.ugienergyservices.com

Jan 14, 2009

GAS MARKETERS LIST

The following is a listing of marketers/suppliers/brokers that have been licensed by the NJ Board of Public Utilities to sell natural gas to residential, small commercial and industrial customers served by the Public Service Electric and Gas Company distribution system. **This listing is provided for informational purposes only and PSE&G makes no representations or warranties as to the competencies of the entities listed herein or to the completeness of this listing.**

Gateway Energy Services
44 Whispering Pines Lane
Lakewood, NJ 08701
(800) 805-8586
www.gesc.com

Metro Energy Group, LLC
14 Washington Place
Hackensack, NJ 07601
www.metroenergy.com

RPL Holdings, Inc
601 Carlson Pkwy
Minnetonka, MN 55305

Great Eastern Energy
3044 Coney Island Ave. PH
Brooklyn, NY 11235
888-651-4121
www.greateasterngas.com

Metromedia Energy, Inc.
6 Industrial Way
Eatontown, NJ 07724
(800) 828-9427
www.metromediaenergy.com

South Jersey Energy Company
One South Jersey Plaza, Rte 54
Folsom, NJ 08037
(800) 756-3749
www.sjindustries.com/sje.htm

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095
(800) 437-7872
www.hess.com

Mitchell- Supreme Fuel
(NATGASCO)
532 Freeman Street
Orange, NJ 07050
(800) 840-4GAS
www.mitchellsupreme.com

Sprague Energy Corp.
Two International Drive, Ste 200
Portsmouth, NH 03801
800-225-1560
www.spragueenergy.com

Hudson Energy Services, LLC
545 Route 17 South
Ridgewood, NJ 07450
(201) 251-2400
www.hudsonenergyservices.com

MxEnergy Inc.
P.O. Box 177
Annapolis Junction, MD 20701
800-375-1277
www.mxenergy.com

Stuyvesant Energy LLC
642 Southern Boulevard
Bronx, NY 10455
(718) 665-5700
www.stuyfuel.com

Intelligent Energy
7001 SW 24th Avenue
Gainesville, FL 32607
Sales: 1 877 I've Got Gas
(1 877 483-4684)
Customer Service:
1 800 927-9794
www.intelligentenergy.org

Pepco Energy Services, Inc.
23 S Kinderkamack Rd, Suite D
Montvale, NJ 07645
(800) 363-7499
www.pepco-services.com

Tiger Natural Gas, Inc.
1422 E. 71st Street, Suite J.
Tulsa, OK 74136
1-888-875-6122
www.tigernaturalgas.com

Systrum Energy
877-SYSTRUM
(877-797-8786)
www.systrumenergy.com

Plymouth Rock Energy, LLC
165 Remsen Street
Brooklyn, NJ 11201
866-539-6450
www.plymouthrockenergy.com

UGI Energy Services, Inc.
d/b/a GASMARK
704 E. Main Street, Suite I
Moorestown, NJ 08057
856-273-9995
www.ugienergyservices.com

Macquarie Cook Energy, LLC
10100 Santa Monica Blvd, 18th
Fl
Los Angeles, CA 90067

PPL EnergyPlus, LLC
Energy Marketing Center
Two North Ninth Street
Allentown, PA 18101
1-866-505-8825
www.pplenergyplus.com/natural+gas/

Woodruff Energy
73 Water Street
P.O. Box 777
Bridgeton, NJ 08302
(856) 455-1111
www.woodruffenergy.com

APPENDIX B

ECM-1 Install Demand Control Ventilation

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-1 Install Demand Control Ventilation **Meeting Room**

Description:
Outside air can be significantly reduced for most of the time that the building is occupied.
Savings will result from the avoided heating and cooling of excessive outside air.

Method:
The outdoor air introduced into the spaces is currently constant based on design occupancy conditions.
This ECM proposes the installation of CO2 sensors in the space to allow for reduced outdoor air flows when conditions allow.
Average reduction in outdoor air is based on an assumed occupancy of the space and local code requirements.
The DCV system will automatically adjust the outdoor air damper position through a controller to reduce outdoor air flows based on indoor CO2 levels.

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM*	3,000	1,000	33%	
Derated CFM**	3,000	31	1%	
SA Enthalpy	26.4	BTU/lbma		
SA Set point, Winter	68.0	°F		
SA Set point, Summer	73.0	°F		
Heating "On" Point	60.0	°F		
Cooling System Eff.	1.21	kW/Ton		(Includes ancillary equipment)
Heating System Eff.	68%			(Includes distribution losses)

*Per building drawings
**Per 2006 International Mechanical Code 15 CFM/person, average 20 people, 2.5 hrs/day
CFM is average over a 24 hour period.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
					Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Bin HOURS	Equipment Operating Time %	Equipment HOURS (Note 1)	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	100%	0	1,000	102	0	0	-	31	3	0	0	-	0	-
97.5	42.5	3	85%	3	1,000	72	0	19	-	31	2	0	1	-	18	-
92.5	39.5	34	70%	24	1,000	59	0	141	-	31	2	0	4	-	137	-
87.5	36.6	131	55%	72	1,000	46	0	333	-	31	1	0	10	-	323	-
82.5	34	500	40%	200	1,000	34	0	690	-	31	1	0	22	-	668	-
77.5	31.6	620	25%	155	1,000	23	0	366	-	31	1	0	11	-	354	-
72.5	29.2	664	10%	66	1,000	13	0	84	-	31	0	0	3	-	82	-
67.5	27	854	10%	85	1,000	3	0	23	-	31	0	0	1	-	23	-
62.5	24.5	927	15%	139	1,000	0	0	0	-	31	0	0	0	-	0	-
57.5	21.4	600	20%	120	1,000	0	11	0	20	31	0	0	0	1	0	19
52.5	18.7	610	25%	153	1,000	0	17	0	38	31	0	1	0	1	0	36
47.5	16.2	611	30%	183	1,000	0	22	0	60	31	0	1	0	2	0	58
42.5	14.4	656	35%	230	1,000	0	28	0	93	31	0	1	0	3	0	90
37.5	12.6	1,023	40%	409	1,000	0	33	0	198	31	0	1	0	6	0	192
32.5	10.7	734	45%	330	1,000	0	38	0	186	31	0	1	0	6	0	180
27.5	8.6	334	50%	167	1,000	0	44	0	107	31	0	1	0	3	0	104
22.5	6.8	252	55%	139	1,000	0	49	0	100	31	0	2	0	3	0	97
17.5	5.5	125	60%	75	1,000	0	55	0	60	31	0	2	0	2	0	58
12.5	4.1	47	65%	31	1,000	0	60	0	27	31	0	2	0	1	0	26
7.5	2.6	22	70%	15	1,000	0	65	0	15	31	0	2	0	0	0	14
2.5	1	13	75%	10	1,000	0	71	0	10	31	0	2	0	0	0	10
-2.5	0	0	80%	0	1,000	0	76	0	-	31	0	2	0	-	0	-
-7.5	-1.5	0	85%	0	1,000	0	82	0	-	31	0	3	0	-	0	-
Total		**8,760**	**30%**			**352**		**1,657**	**914**		**11**		**52**	**29**	**1,605**	**886**

100% Energy Cost Savings		
Heating Savings	886	therms
Cooling Savings	1,605	kWh

Notes:
1. Building personnel indicated that the doors to the meeting room are often left open and a fan is placed in the doorways to help cool the corridors. Therefore, the actual operating time of the equipment during cooling hours is considerably greating than that required to cool the room alone.

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-1 Install Demand Control Ventilation **Weight Room**

Description:
Outside air can be significantly reduced for most of the time that the building is occupied.
Savings will result from the avoided heating and cooling of excessive outside air.

Method:
The outdoor air introduced into the spaces is currently constant based on design occupancy conditions.
This ECM proposes the installation of CO2 sensors in the space to allow for reduced outdoor air flows when conditions allow.
Average reduction in outdoor air is based on an assumed occupancy of the space and local code requirements.
The DCV system will automatically adjust the outdoor air damper position through a controller to reduce outdoor air flows based on indoor CO2 levels.

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM*	1,200	180	15%	
Derated CFM**	1,200	13	1%	
SA Enthalpy	26.4	BTU/lbma		
SA Set point, Winter	68.0	°F		
SA Set point, Summer	73.0	°F		
Heating "On" Point	60.0	°F		
Cooling System Eff.	1.21	kW/Ton		(Includes ancillary equipment)
Heating System Eff.	68%			(Includes distribution losses)

*Per building drawings
**Per 2006 International Mechanical Code 20 CFM/person, average 4 people, 4 hrs/day
CFM is average over a 24 hour period.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
					Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Bin HOURS	t Operating Time %	Equipment Operating HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	70%	0	180	18	0	0	-	13	1	0	0	-	0	-
97.5	42.5	3	60%	2	180	13	0	2	-	13	1	0	0	-	2	-
92.5	39.5	34	50%	17	180	11	0	18	-	13	1	0	1	-	17	-
87.5	36.6	131	40%	52	180	8	0	44	-	13	1	0	3	-	40	-
82.5	34	500	30%	150	180	6	0	93	-	13	0	0	7	-	86	-
77.5	31.6	620	20%	124	180	4	0	53	-	13	0	0	4	-	49	-
72.5	29.2	664	10%	66	180	2	0	15	-	13	0	0	1	-	14	-
67.5	27	854	10%	85	180	0	0	4	-	13	0	0	0	-	4	-
62.5	24.5	927	15%	139	180	0	0	0	-	13	0	0	0	-	0	-
57.5	21.4	600	20%	120	180	0	2	0	4	13	0	0	0	0	0	3
52.5	18.7	610	25%	153	180	0	3	0	7	13	0	0	0	1	0	6
47.5	16.2	611	30%	183	180	0	4	0	11	13	0	0	0	1	0	10
42.5	14.4	656	35%	230	180	0	5	0	17	13	0	0	0	1	0	15
37.5	12.6	1,023	40%	409	180	0	6	0	36	13	0	0	0	3	0	33
32.5	10.7	734	45%	330	180	0	7	0	34	13	0	1	0	2	0	31
27.5	8.6	334	50%	167	180	0	8	0	19	13	0	1	0	1	0	18
22.5	6.8	252	55%	139	180	0	9	0	18	13	0	1	0	1	0	17
17.5	5.5	125	60%	75	180	0	10	0	11	13	0	1	0	1	0	10
12.5	4.1	47	65%	31	180	0	11	0	5	13	0	1	0	0	0	4
7.5	2.6	22	70%	15	180	0	12	0	3	13	0	1	0	0	0	2
2.5	1	13	75%	10	180	0	13	0	2	13	0	1	0	0	0	2
-2.5	0	0	80%	0	180	0	14	0	-	13	0	1	0	-	0	-
-7.5	-1.5	0	85%	0	180	0	15	0	-	13	0	1	0	-	0	-
Total		**8,760**	**29%**	**2,497**		**63**		**229**	**165**		**5**		**17**	**12**	**212**	**152**

100% Energy Cost Savings		
Heating Savings	152	therms
Cooling Savings	212	kWh

Comments:

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-1 Install Demand Control Ventilation **Lounge**

Description:
Outside air can be significantly reduced for most of the time that the building is occupied.
Savings will result from the avoided heating and cooling of excessive outside air.

Method:
The outdoor air introduced into the spaces is currently constant based on design occupancy conditions.
This ECM proposes the installation of CO2 sensors in the space to allow for reduced outdoor air flows when conditions allow.
Average reduction in outdoor air is based on an assumed occupancy of the space and local code requirements.
The DCV system will automatically adjust the outdoor air damper position through a controller to reduce outdoor air flows based on indoor CO2 levels.

	Total CFM	O.A. CFM	O.A. %	
Org. scheduled CFM*	1,800	520	29%	
Derated CFM**	1,800	30	2%	
SA Enthalpy	26.4	BTU/lbma		
SA Set point, Winter	68.0	°F		
SA Set point, Summer	73.0	°F		
Heating "On" Point	60.0	°F		
Cooling System Eff.	1.21	kW/Ton		(Includes ancillary equipment)
Heating System Eff.	68%			(Includes distribution losses)

*Per building drawings
**Per 2006 International Mechanical Code 15 CFM/person, average 4 people/12 hrs/day
CFM is average over a 24 hour period.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
					Existing					Proposed Demand Ventilation					Savings	
Avg. DB Bin Temp °F	OA Enthalpy Btu/lb	Bin HOURS	Equipment Operating Time %	Equipment Operating HOURS	OA CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Derated O.A. CFM	Cooling Load MBH	Heating Load MBH	Cooling kWh	Heating therms	Cooling kWh	Heating therms
102.5	49.1	0	70%	0	520	53	0	0	-	30	3	0	0	-	0	-
97.5	42.5	3	60%	2	520	38	0	7	-	30	2	0	0	-	6	-
92.5	39.5	34	50%	17	520	31	0	53	-	30	2	0	3	-	50	-
87.5	36.6	131	40%	52	520	24	0	126	-	30	1	0	7	-	119	-
82.5	34	500	30%	150	520	18	0	269	-	30	1	0	16	-	253	-
77.5	31.6	620	20%	124	520	12	0	152	-	30	1	0	9	-	143	-
72.5	29.2	664	10%	66	520	7	0	44	-	30	0	0	3	-	41	-
67.5	27	854	10%	85	520	1	0	12	-	30	0	0	1	-	11	-
62.5	24.5	927	15%	139	520	0	0	0	-	30	0	0	0	-	0	-
57.5	21.4	600	20%	120	520	0	6	0	10	30	0	0	0	1	0	10
52.5	18.7	610	25%	153	520	0	9	0	20	30	0	1	0	1	0	18
47.5	16.2	611	30%	183	520	0	12	0	31	30	0	1	0	2	0	29
42.5	14.4	656	35%	230	520	0	14	0	48	30	0	1	0	3	0	46
37.5	12.6	1,023	40%	409	520	0	17	0	103	30	0	1	0	6	0	97
32.5	10.7	734	45%	330	520	0	20	0	97	30	0	1	0	6	0	91
27.5	8.6	334	50%	167	520	0	23	0	56	30	0	1	0	3	0	53
22.5	6.8	252	55%	139	520	0	26	0	52	30	0	1	0	3	0	49
17.5	5.5	125	60%	75	520	0	28	0	31	30	0	2	0	2	0	29
12.5	4.1	47	65%	31	520	0	31	0	14	30	0	2	0	1	0	13
7.5	2.6	22	70%	15	520	0	34	0	8	30	0	2	0	0	0	7
2.5	1	13	75%	10	520	0	37	0	5	30	0	2	0	0	0	5
-2.5	0	0	80%	0	520	0	40	0	-	30	0	2	0	-	0	-
-7.5	-1.5	0	85%	0	520	0	42	0	-	30	0	2	0	-	0	-
Total		**8,760**	**29%**	**2,497**		**183**	**296**	**663**	**475**		**11**		**38**	**27**	**624**	**448**

100% Energy Cost Savings		
Heating Savings	448	therms
Cooling Savings	624	kWh

Comments:

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-1 Install Demand Control Ventilation

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

	QTY	UNIT	UNIT COSTS MAT.	UNIT COSTS LABOR	UNIT COSTS EQUIP.	SUBTOTAL COSTS MAT.	SUBTOTAL COSTS LABOR	SUBTOTAL COSTS EQUIP.	TOTAL COST	REMARKS
CO2 sensor	3	EA	$ 400	$ 100	$ -	$ 1,176	$ 363	$ -	$ 1,539	
Replace damper actuators	3	EA	$ 300	$ 50	$ -	$ 882	$ 182	$ -	$ 1,064	
PLC Controller and Programming	1	LS	$ 1,000	$ 1,500	$ -	$ 980	$ 1,815	$ -	$ 2,795	Common PLC
Electrical/wiring	1	LS	$ 1,200	$ 2,400	$ -	$ 1,176	$ 2,904	$ -	$ 4,080	
						$ -	$ -	$ -	$ -	

Subtotal	$ 9,478
10% OH, 10% Profit	$ 1,896
10% Contingency	$ 1,137
Total	**$ 12,510**

APPENDIX C

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Existing Fuel	Nat.Gas
Proposed Fuel	Nat.Gas

Item	Value	Units	Formula/Comments
Baseline Fuel Cost	$ 1.10		
Proposed Fuel Cost	$ 1.10		
Baseline Fuel Use	7,360	Therms	Based on historical utility data
Existing Boiler Plant Efficiency	68%		Per boiler nameplate
Baseline Boiler Load	500,480	Mbtu/yr	Baseline Fuel Use x Existing Efficiency x 100 Mbtu/Therms
Baseline Fuel Cost	$ 8,118		
Proposed Boiler Plant Efficiency	92.3%		New Boiler Efficiency
Proposed Fuel Use	5,422	Therms	Baseline Boiler Load / Proposed Efficiency / 100 Mbtu/Therms
Proposed Fuel Cost	$ 5,981		
Annual Savings	1,938	Therms	
Annual Savings	**$ 2,137**	**/yr**	

Annual NG Usage per Utility Bills	8,500	Therms
Annual NG Usage Generator	240	Therms
Annual NG Usage DHW Heater	900	Therms
Annual NG Usage Boiler	**7,360**	Therms

Hamilton Township
CHA #21180
Building: Borough Hall Municipal Building

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Description
Existing heating hot water (HHW) supply setpoint is 170°F.
Proposed:
Vary heating hot water supply temperature as building heating load decreases in relation to outside air temperature.

A	B	C	D	E	F	G	H	I	J
					Proposed Usage			Utility Usage	
Amb. Bin Temp °F	Avg. DB Bin Temp °F	Bin Hours	Heating Bin HOURS	Existing Heat Loss In Piping MBH	Avg. HHW Temp @ OA Temp °F	Proposed Heat Loss In Piping MBH	Proposed Boiler Efficiency	Existing Utility Use Therms/Yr	Proposed Utility Use Therms/Yr
100-104	102.0	0	0	0	0	0	0.0%	0	0
95-99	97.0	3	0	0	0	0	0.0%	0	0
90-94	92.0	34	0	0	0	0	0.0%	0	0
85-89	87.0	131	0	0	0	0	0.0%	0	0
80-84	82.0	500	0	0	0	0	0.0%	0	0
75-79	77.0	620	0	0	0	0	0.0%	0	0
70-74	72.0	664	0	0	0	0	0.0%	0	0
65-69	67.0	854	0	0	0	0	96.0%	0	0
60-64	62.0	927	927	13,575	80	8,068	96.0%	141	84
55-59	57.0	600	600	8,786	87	5,222	95.0%	92	55
50-54	52.0	610	610	8,933	93	5,309	94.0%	95	56
45-49	47.0	611	611	8,947	100	5,318	93.4%	96	57
40-44	42.0	656	656	9,606	107	5,709	92.0%	104	62
35-39	37.0	1,023	1,023	14,981	113	8,904	90.6%	165	98
30-34	32.0	734	734	10,749	120	6,388	89.8%	120	71
25-29	27.0	334	334	4,891	127	2,907	89.0%	55	33
20-24	22.0	252	252	3,690	133	2,193	88.5%	42	25
15-19	17.0	125	125	1,830	140	1,088	88.0%	21	12
10-14	12.0	47	47	688	147	409	87.6%	8	5
5-9	7.0	22	22	322	153	191	87.2%	4	2
0-4	2.0	13	13	190	160	113	86.8%	2	1
-5- -1	-3.0	0	0	0	160	0	86.8%	0	0
-10- -6	-8.0	0	0	0	160	0	86.8%	0	0
Totals		**8,760**	**5,954**	**87,190**		**51,820**		**945**	**562**

Annual Energy Savings	**384**	**Therms/yr**
Annual Cost Savings	**$ 458**	**/yr**

Existing Boiler Efficiency	68%	
Avg. Proposed Boiler Efficiency	92.3%	

Building HHW Piping System		
Heating On Temperature	65	°F
Total Length of Pipe	1535	LF
Existing HHW Setpoint High	170	°F
Existing HHW Setpoint Low	150	°F
Avg HHW Temp	160	°F
Avg Pipe Size	1	Inches
Avg Insul Thickness	1 1/2	Inches
Existing Heat Loss	10.6	Btu/Hr/LF
Percent in Uncond. Space	90%	
Existing System Heat Loss	14,644	Btu/Hr
Proposed Min HHW Return*	70	°F
Avg Prop HHW Supply Temp	105	°F
Proposed Heat Loss	6.3	Btu/Hr/LF
Proposed System Heat Loss	8,703	Btu/Hr

*Refer to proposed boiler capabilities

Size (in)	Length (ft)
1/2	290
3/4	350
1	315
1 1/4	215
1 1/2	65
2	300
2 1/2	0
3	0
1	**Average**

Comments:

A-C	Newark, NJ weather bins
D	Based on building balance points and bin data.
E	Existing heat loss in piping system based on current average HHW temperature.
F	Estimated Average HHW temperature with HW reset based on OA temperature.
G	Proposed heat loss in piping system based on estimated average HW temperature. Return HHW temp min 70 deg F
H	Proposed boiler efficiency based return water temperature and boiler efficiency curve.
I-J	Utility usage to overcome heat loss in HHW piping system based on boiler efficiency.

Hamilton Township
CHA #21180
Building: Fire District #9

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

ECM-2 Boiler Replacement with Hot Water Temperature Reset

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Boiler Removal	1	EA		$ 500		$ -	$ 605	$ -	$ 605	
						$ -	$ -	$ -	$ -	
1,500 MBH Gas-Fired Condensing HW Boiler*	1	EA	$ 25,000	$ 4,000		$ 24,500	$ 4,840	$ -	$ 29,340	Includes freight and startup
Condensate Neutralization Kit	1	EA	$ 300	$ 250		$ 294	$ 303	$ -	$ 597	
Flue Replacement	20	LF	$ 10	$ 8.50		$ 196	$ 206	$ -	$ 402	6" PVC Piping
Miscellaneous Electrical	1	LS	$ 400	$ 300		$ 392	$ 363	$ -	$ 755	
Miscellaneous HW Piping	1	LS	$ 250	$ 200		$ 245	$ 242	$ -	$ 487	
Miscellaneous Gas Piping	1	LS	$ 250	$ 200		$ 245	$ 242	$ -	$ 487	
Boiler Energy Management System**	1	EA	$ 2,300	$ 1,500		$ 2,254	$ 1,815	$ -	$ 4,069	Controls HW temp reset
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

*Pricing based on Aerco Benchmark 1.5 boiler
**Pricing based on Aerco Boiler Management System II

$	36,741	Subtotal
$	3,674	10% Contingency
$	4,042	10% Contractor O&P
$	-	Engineering
$	**44,457**	**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIVE	Cost W/ INCENTIVE
					$ -	$ -
NG Boilers ≥ 300 - 1500 MBH	1,500	MBH	$1.75	$2,625	$ 29,340	$ 26,715
				$2,625	$29,340	$26,715

Total ECM Cost w/ Incentives	**$41,832**

APPENDIX D

ECM-3 Replace Rooftop Condensing Units

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-3 Replace Rooftop Condensing Units
Three original cooling units in use. 4 Tons, 4 Tons, & 10 Tons; Total 18 tons capacity.

ASSUMPTIONS			Comments
Electric Cost	$0.163	/ kWh	
Average occupied hours per Week	168	Hours	Building is occupied 24 hours per day
Space Balance Point	60	F	
Space Temperature Setpoint	73	deg F	Average cooling setoints per T-stats
BTU / Hr Rating of existing AC units	216,000	Btu / Hr	18 Tons total cooling per three older units
Derated Average EER	7.5		Average 8.9 when new. Units >20 years old.

Item	Value	Units	Comments
Total Number of Units	1		Analyzing three units as one.
Existing Annual Electric Usage	18,242	kWh	
Proposed EER	12.8		Average EER of three new condensing units @ existing capacities. 11.4, 11.4, 14.0
Proposed Annual Electric Usage	10,689	kWh	Unit will cycle on w/ temp of room. Possible operating time shown below

ANNUAL SAVINGS		
Annual Savings	7,553	kWh
Annual Cost Savings	$1,231	

OAT - DB Bin Temp F	Annual Hours	Cooling Hrs at Temp Above setpoint	Assumed % of time of operation	Assumed hrs of Operation
102.5	0	0	100%	0
97.5	3	3	88%	3
92.5	34	34	76%	26
87.5	131	131	65%	85
82.5	500	500	53%	265
77.5	620	620	41%	255
72.5	664	0	0%	0
67.5	854	0	0%	0
62.5	927	0	0%	0
57.5	600	0	0%	0
52.5	610	0	0%	0
47.5	611	0	0%	0
42.5	656	0	0%	0
37.5	1,023	0	0%	0
32.5	734	0	0%	0
27.5	334	0	0%	0
22.5	252	0	0%	0
17.5	125	0	0%	0
12.5	47	0	0%	0
7.5	22	0	0%	0
2.5	13	0	0%	0
-2.5	0	0	0%	0
-7.5	0	0	0%	0

Total	8,760	1,288	49%	633

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-3 Replace Rooftop Condensing Units

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Condensing Unit Removal	3	EA		$ 600		$ -	$ 2,178	$ -	$ 2,178	
						$ -	$ -	$ -	$ -	
4 Ton Condensing Unit	2	EA	$ 1,775	$ 830		$ 3,479	$ 2,009	$ -	$ 5,488	Standard Controls
10 Ton Condensing Unit	1	EA	$ 4,750	$ 1,500		$ 4,655	$ 1,815	$ -	$ 6,470	Standard Controls
Miscellaneous Electrical	3	LS	$ 100	$ 100		$ 294	$ 363	$ -	$ 657	
Miscellaneous Piping	3	LS	$ 100	$ 100		$ 294	$ 363	$ -	$ 657	
Crane/Lift Rental (Per Day)	1	EA	$ 355	$ 870		$ 348	$ 1,053	$ -	$ 1,401	Removal / Install
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 16,850	Subtotal
$ 2,528	15% Contingency
$ 1,938	10% Contractor O&P
$ -	Engineering
$ 21,316	**Total**

New Jersey Smart Start Incentive Program	QTY	UNIT	$ / UNIT	TOTAL SAVINGS	Cost W/O INCENTIV	Cost W/ INCENTIVE
					$ -	$ -
Split System < 5.4 Tons	4	Tons	$92	$368	$ 2,744	$ 2,376
Split System < 5.4 Tons	4	Tons	$92	$368	$ 2,744	$ 2,376
Split System ≥ 5.4 Tons < 11.25 Tons	10	Tons	$73	$730	$ 6,470	$ 5,740
				$1,466	$11,958	$10,492

Total ECM Cost w/ Incentives	**$19,850**

APPENDIX E

ECM-4 Install Infrared Heaters – Engine Room

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-4 Install Infrared Heaters - Engine Room

Building Footprint	6,900	SF	Ex Occupied Htg Temp.	62	*F
Natural Gas Heat Content	100,000	Btu/Therm	Ex Unoccupied Htg Temp.	62	*F
Building Balance Temp.	60	*F	Occupied Heating UA	1,414	btu/hr/*F
Internal Gains	18,840	btu/h	Unoccupied Heating UA	1,414	btu/hr/*F
Unocc Internal Gain factor	0.03				
Ave Occ Internal Gain Factor	0.70				

Heating Energy Savings	1,085	**Therms/yr**
Electric Energy Savings	1,068	**kWh/yr**

Existing Burner Efficiency	68.0%	Existing thermal efficiency (Boiler)
Existing Heat Distribution Effectiveness	85.0%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Unit Heaters
Proposed Burner Efficiency	85.0%	Based on Reznor Infrared Tube Heaters
Proposed Heat Distribution Effectiveness	100%	Heat Distribution Factor per ASHRAE Handbook - Fundamentals for Infrared Heaters

				EXISTING LOADS						PROPOSED LOADS							
				Occupied			Unoccupied			Occupied			Unoccupied				
Avg Outdoor Air Temp. Bins *F	Avg Outdoor Air Enthalpy	Existing Equipment Bin Hours	Occupied Equipment Bin Hours	Unoccupied Equipment Bin Hours	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Unoccupied Envelope Load BTUH	Ventilation Load BTUH	Internal Gain BTUH	Existing Heating Energy Therms	Proposed Heating Energy Therms
A		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	M	N
102.5	49	0	0	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
97.5	43	3	3	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
92.5	40	34	34	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
87.5	37	131	131	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
82.5	34	500	500	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
77.5	32	620	620	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
72.5	29	664	664	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
67.5	27	854	854	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
62.5	25	927	927	0	0	0	-13,188	0	0	-565	0	0	-13,188	0	0	-565	0	0
57.5	21	600	600	0	6,363	4,485	-13,188	6,363	3,588	-565	6,363	4,485	-13,188	6,363	3,588	-565	0	0
52.5	19	610	610	0	13,434	9,467	-13,188	13,434	7,574	-565	13,434	9,467	-13,188	13,434	7,574	-565	103	70
47.5	16	611	611	0	20,504	14,450	-13,188	20,504	11,560	-565	20,504	14,450	-13,188	20,504	11,560	-565	230	156
42.5	14	656	656	0	27,574	19,433	-13,188	27,574	15,546	-565	27,574	19,433	-13,188	27,574	15,546	-565	384	261
37.5	13	1,023	1,023	0	34,644	24,416	-13,188	34,644	19,533	-565	34,644	24,416	-13,188	34,644	19,533	-565	812	552
32.5	11	734	734	0	41,715	29,399	-13,188	41,715	23,519	-565	41,715	29,399	-13,188	41,715	23,519	-565	736	500
27.5	9	334	334	0	48,785	34,382	-13,188	48,785	27,505	-565	48,785	34,382	-13,188	48,785	27,505	-565	404	275
22.5	7	252	252	0	55,855	39,365	-13,188	55,855	31,492	-565	55,855	39,365	-13,188	55,855	31,492	-565	358	243
17.5	6	125	125	0	62,925	44,347	-13,188	62,925	35,478	-565	62,925	44,347	-13,188	62,925	35,478	-565	203	138
12.5	4	47	47	0	69,996	49,330	-13,188	69,996	39,464	-565	69,996	49,330	-13,188	69,996	39,464	-565	86	59
7.5	3	22	22	0	77,066	54,313	-13,188	77,066	43,450	-565	77,066	54,313	-13,188	77,066	43,450	-565	45	31
2.5	1	13	13	0	84,136	59,296	-13,188	84,136	47,437	-565	84,136	59,296	-13,188	84,136	47,437	-565	29	20
-2.5	0	0	0	0	91,206	64,279	-13,188	91,206	51,423	-565	91,206	64,279	-13,188	91,206	51,423	-565	0	0
-7.5	-2	0	0	0	98,277	69,262	-13,188	98,277	55,409	-565	98,277	69,262	-13,188	98,277	55,409	-565	0	0
TOTALS		8,760	8,760	0													3,390	2,305

Existing Building Ventilation & Infiltration (occ)	**738**	**cfm**
Overheat Ventilation Factor	1.25	Due to opening garage doors
Additional ventilation to offset overheat	**185**	**cfm**
Existing Building Ventilation & Infiltration (unocc)	**738**	**cfm**

Electrical Requirements for Heating Equipment

Existing Equipment

Unit	Htng Hrs	HP	Efficiency	Amps	Volts	Phase	Power Factor	Annual kWh
UH-1	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-2	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-3	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-4	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-5	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-6	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-7	1,795	0.125	79.0%	1.3	115	1	0.8	212
UH-8	1,795	0.125	79.0%	1.3	115	1	0.8	212
Total								1,695

Proposed Equipment

Unit	Htng Hrs	Amps	Volts	Phase	Power Factor	Annual kWh
125 MB Infrared	1,795	0.8	115	1	0.8	132
125MBh Infrared	1,795	0.8	115	1	0.8	132
75MBh Infrared	1,795	1.1	115	1	0.8	182
75MBh Infrared	1,795	1.1	115	1	0.8	182
Total						628

*Electrical data based on Reznor VR Series Infrared Heaters

Avg. OA Temp *F	Heating Hrs	Assumed % Time of Operation	hrs of Operation
102.5	0	0%	0
97.5	0	0%	0
92.5	0	0%	0
87.5	0	0%	0
82.5	0	0%	0
77.5	0	0%	0
72.5	0	0%	0
67.5	0	0%	0
62.5	0	0%	0
57.5	0	8%	0
52.5	610	17%	102
47.5	611	25%	153
42.5	656	33%	219
37.5	1023	42%	426
32.5	734	50%	367
27.5	334	58%	195
22.5	252	67%	168
17.5	125	75%	94
12.5	47	83%	39
7.5	22	92%	20
2.5	13	100%	13
-2.5	0	100%	0
-7.5	0	100%	0
	4,427	41%	1795

HEAT GAIN/LOSS WORKSHEET

Project Name:	Hamilton Township	**Project No.:**	CHA #21180		
Location	Hamilton, NJ	**Site Elevation:**	460 Feet	**Specific Volume**	13.50 CF/#
Building Name	Fire District #9	**Date:**	04/12/10		
Engineer:	CAA				

Building/Facility Designation Engine Room

Outdoor Winter Design DB Temperature	14 *F	**Indoor Winter Design DB Temperature**	62 *F
Outdoor Summer Design DB Temperature	91 *F	**Indoor Summer Design DB Temperature**	73 *F
Outdoor Summer Design WB Temperature	73 *F	**Indoor Summer Design WB Temperature**	60 *F
Outdoor Summer Humidity Ratio	0.0121 #/#	**Indoor Air (70*F) Humidity Ratio**	0.0078 #/#

ENVELOPE DESCRIPTIONS (Descriptions are from Interior to Exterior)

Walls (Select One - Type X)

		R Value	Wall Type
	Steel Siding, 4" Insulation, Steel Siding	15.2	1
	Plaster or Gypsum, frame construction, 5" Insulation, 1" stucco	18.2	1
	4" WH CMU, 1" Insulation, Finished Exterior	5.2	2
	Plaster or Gypsum, frame construction, 3" Insulation, 8" LW CMU	7.8	5
	4" Face Brick, 2" Concrete, 1" Insulation, Exterior Finish	5.1	12
	4" Face Brick, 4" Concrete, 1" Insulation, Exterior Finish	4.0	11
	Interior Finish, 2" Insulation, 8" CMU, 4" Face Brick	10.9	16
	Finished Surface, 8" LW CMU (filled), Air Space, 4" Face Brick	11.1	16
	Stucco or Gypsum, 2.5" Insul, Face Brick	14.3	10
	4" Block, 1" insulation, 8" Block	19.9	16
x	12" Block, 1" Rigid Insulation, 4" Decorative Rib Block	7.5	

Roofs (Select One)

		R Value	Roof Type
	Tectum Deck, 3.3" Insul., BU Roof	13.0	1
	Steel Deck, 5" Insul., BU Roof	18.2	1
	Attic Roof with 6" Insul.	25.0	4
	4" HW Concrete Deck, BU Roof	2.7	2
	Ceiling, 3" Insulation, 4" Concrete Deck, BU Roof	14.9	4
	Ceiling, 4" Concrete Deck, 3" Insulation, BU Roof	18.5	13
	Ceiling, 4" Concrete Deck, 6" Insulation, BU Roof	21.7	14
	Ceiling, Wood Deck, 6" Insulation, Felt & Membrane	22.7	10
	Wood Deck, 6" insulation, Felt & Membrane	18.0	
x	Steel deck, 2" Rigid Insulation, Felt & Membrane, Stone Ballasts	11.50	

Windows (Select One)

		U Value
	Aluminum Frame, 1/8" SP Glazing	1.05
	Aluminum Frame, 1/4" DP Glazing	0.60
x	Aluminum Frame, 3/16" DP Glazing	0.62
	Aluminum Frame, 1/2" DP Glazing	0.50
	Skylights	0.90
	Other	

	No Storm
Flat Glass	1.05
Flat Glass (e=.6)	1.00
Flat Glass (e=0.4)	0.90
Flat Glass (e=0.2)	0.77
Double Glaze (3/16 in air)	0.63
Double Glaze (1/4 in air)	0.60
Double Glaze (1/2 in air)	0.53
Double Glaze (e=.6)	0.50
Double Glaze (e=0.4)	0.42
Double Glaze (e=0.2)	0.35
Triple Glaze (1/4 in air)	0.42
Triple Glaze (1/2 in air)	0.35

BUILDING CHARACTERISTICS

Roof Area	6,900 SF		
Occupied Area	6,900 SF	**Return Plenum?**	n

	Gross Wall Length	Average Wall Height	Ceiling Height	Window Area	Door Area	Net Wall Area
North Exposure	100 Ft	20.5 Ft	20.5 Ft	0 SF	42 SF	2,008 SF
East Exposure	80 Ft	20.5 Ft	20.5 Ft	0 SF	784 SF	856 SF
South Exposure	100 Ft	9.0 Ft	20.5 Ft	0 SF	0 SF	900 SF
West Exposure	40 Ft	20.5 Ft	20.5 Ft	0 SF	196 SF	624 SF

Forced Ventilation 0 cfm

HEAT GAIN/LOSS WORKSHEET

Project Name:	Hamilton Township	Project No.:	CHA #21180		
Location	Hamilton, NJ	Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Fire District #9	Date:	04/12/10		
Engineer:	CAA				

Building/Facility Designation: Engine Room

COOLING HEAT GAINS TO THE ROOM - SENSIBLE

SOLAR GAINS

WINDOWS	AREA (SF)	SHGF	Shade Coef	Cooling Load Factor		Solar Heat Gain
North Exposure	0	38 btu/h/sf	0.8	0.75	Glass Type C	0 Btu/hr
East Exposure	0	216 btu/h/sf	0.8	0.31	Glass Type C	0 Btu/hr
South Exposure	0	109 btu/h/sf	0.8	0.58	Glass Type C	0 Btu/hr
West Exposure	0	216 btu/h/sf	0.8	0.29	Glass Type C	0 Btu/hr
						0 Btu/h

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	2,008	0.13	20 *F	1.0	5,355 Btu/hr
East Exposure	856	0.13	39 *F	1.0	4,451 Btu/hr
South Exposure	2,050	0.13	27 *F	1.0	7,380 Btu/hr
West Exposure	624	0.13	22 *F	1.0	1,830 Btu/hr
Roof	6,900	0.09	73 *F	1.0	43,800 Btu/hr
Fenestration	0	0.62	18 *F		0 Btu/hr
Doors	1,022	0.14	27 *F		3,854 Btu/hr
Ceiling	6,900	0.14	0 *F		0 Btu/hr
Partition		0.05	0 *F		0 Btu/hr
Floor	6,900	0.04	0 *F		0 Btu/hr
					66,670 Btu/h

INTERNAL HEAT GAINS

								Room Heat Gain
Lights	0.80 w/sf x	6,900	Occ Area =	5.5	kW x 3.4x	1.0	RAF =	18,840 Btu/h
Plug Load	0.00 w/sf x	6,900	Occ Area =	0.0	kW x 3.4x	1.0	RAF =	0 Btu/h
People	0 people x	255	btu/person x	100%	time in space =			0 Btu/h
Computer Work Stations		0	Units x	120	W/Unit x 3414 =			0 Btu/h
Equipment	0.0 kW x 3.413 =							0 Btu/h
Misc.								0 Btu/h
								18,840 Btu/h

VENTILATION AND INFILTRATION

		Infiltration Factor	Perimeter Ratio	Coef	Temp. Diff.	Room Heat Gain
Walls	5,538 SF	0.15 CFM/SF		1.08	18 *F	17,477 Btu/h
Doors	1,022 SF	0.25 CFM/LF	0.31 LF/SF	1.08	18 *F	1,683 Btu/h
Windows	0 SF	0.20 CFM/LF	0.00 LF/SF	1.08	18 *F	0 Btu/h
Ventilation	0 cfm			1.08	18 *F	0 Btu/h
						19,160 Btu/h

COOLING HEAT GAINS TO THE RA PLENUM - SENSIBLE

4,950

CONDUCTION

	NET AREA (SF)	U-VALUE	Cooling Load Temp. Dif.	Return Air Factor	Room Heat Gain
North Exposure	0	0.13	20	1.0	0 Btu/hr
East Exposure	0	0.13	39	1.0	0 Btu/hr
South Exposure	-1,150	0.13	27	1.0	-4,140 Btu/hr
West Exposure	0	0.13	22	1.0	0 Btu/hr
Roof	6,900	0.09	73	0.0	0 Btu/hr
					-4,140 Btu/h

INTERNAL HEAT GAINS

							Room Heat Gain
Lights	0.80 w/sf x	6,900	Occ Area =	5.5	kW x3413x	0.00 RAF =	0 Btu/h
Misc.							0 Btu/h
							0 Btu/h

SENSIBLE HEAT GAINS - TEMP. DEPENDENT

Solar	0
Conduction to Room	66,670
Conduction to Plenum	-4,140
Ventilaton and Infiltration	19,160
Sub Total	81,691

SENSIBLE HEAT GAINS - TEMP. INDEPENDENT

Internal Gains to Room	18,840
Internal Gains to Plenum	0
Sub Total	18,840

HEAT GAIN/LOSS WORKSHEET

Project Name:	Hamilton Township	Project No.:	CHA #21180		
Location	Hamilton, NJ	Site Elevation:	460 Feet	Specific Volume	13.50 CF/#
Building Name	Fire District #9	Date:	04/12/10		
Engineer:	CAA				

Building/Facility Designation: Engine Room

LATENT COOLING LOADS

Infiltration

		Infiltration Factor	Air Density	Humidity Ratio Dif.	Room Heat Gain	
Walls	5,750 SF	0.15 CFM/SF	4,800	0.0043 #/#	17,979	Btu/h
Doors	1,022 SF	0.25 CFM/LF	4,800	0.0043 #/#	1,668	Btu/h
Windows	0 SF	0.20 CFM/LF	4,800	0.0043 #/#	0	Btu/h
Ventilation	0 cfm		4,800	0.0043 #/#	0	Btu/h
People	0 people	1.00 time in space		250 Btu/hr/person	0	Btu/h
						19,647 Btu/h

Cooling Load Summary

	Sensible	Latent	Total		
Temperature Dependent Gains	81,691	19,647	101,338		
Temperature Indep. Gains	18,840		18,840	SHR=	0.84
Total	100,530	19,647	120,177		

Building Cooling Load: 10.0 Tons at 689 SF/Ton

Building Air Flow to Condition Space based on a 12*F Temp Rise is: 8,060 CFM (1.17 CFM/sf)

HEATING CALCULATION

CONDUCTION

	NET AREA (SF)	U-VALUE	Heating Load Temp. Dif.	Room Heat Gain	
North Exposure	2,008	0.13	48	12,851	Btu/h
East Exposure	856	0.13	48	5,478	Btu/h
South Exposure	900	0.13	48	5,760	Btu/h
West Exposure	624	0.13	48	3,994	Btu/h
Fenestration	0	0.62	48	0	Btu/h
Roof	6,900	0.09	48	28,800	Btu/h
Doors	1,022	0.14	48	6,851	Btu/h
Ceiling	6,900	0.14	0	0	Btu/h
Partition	0	0.05	0	0	Btu/h
Floor	6,900	0.04	15	4,140	Btu/h

Ventilation and Infiltration

		Infiltration Factor	Coef	Temp. Difference	Air Flow	Room Heat Gain	
Walls	4,388 SF	0.15 CFM/SF	1.08	48	658 cfm	34,193	Btu/h
Doors	1,022 SF	0.25 CFM/LF	1.08	48	80 cfm	4,156	Btu/h
Windows	0 SF	0.20 CFM/LF	1.08	48	0 cfm	0	Btu/h
Ventilation Load	0 cfm		1.08	48	0 cfm	0	Btu/h
Total Ventilation & Infiltration Load					738 cfm	38,349	Btu/h

Building Heating Load: 106,223 btu/h (15.4 btu/sf)

Hamilton Township
CHA #21180
Building: Fire District #9 **Engine Room**

Doors

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North	3.0	7.0	2	42.0	40.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	42.0	40.0	
East	14.0	14.0	4	784.0	224.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	784.0	224.0	
South				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
West	14.0	14.0	1	196.0	56.0	
				0.0	0.0	
			Sub-total	196.0	56.0	
			Total	**1022.0**	**320.0**	LF/SF 0.31

Walls

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet		
North	100.0	20.5	1	2050.0	241.0		All wall quantities must remain equal to 1
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	100.0			2050.0	241.0	20.5	Average height wall automatically linked to
East	80.0	20.5	1	1640.0	201.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	80.0			1640.0	201.0	20.5	Average height wall automatically linked to
South	100.0	9.0	1	900.0	218.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	100.0			900.0	218.0	9.0	Average height wall automatically linked to
West	40.0	20.5	1	820.0	121.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0		
				0.0	0.0	Ave. height	
	40.0			820.0	121.0	20.5	Average height auto linked to block load sheet

Windows

	Width (ft)	Height (ft)	Quantity	Area (SF)	Lineal Feet	
North				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
East				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
South				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
West				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
				0.0	0.0	
			Sub-total	0.0	0.0	
			Total	**0.0**	**0.0**	LF/SF 0.00

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-4 Install Infrared Heaters - Engine Room

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Unit Heater Removal	8	EA		$ 450		$ -	$ 4,356	$ -	$ 4,356	Cap HHW piping in place.
40' NG Infrared Tube Heater 75 MBH	2	EA	$ 1,600	$ 400		$ 3,136	$ 968	$ -	$ 4,104	Includes Controls
60' NG Infrared Tube Heater 125 MBH	2	EA	$ 1,850	$ 500		$ 3,626	$ 1,210	$ -	$ 4,836	Includes Controls
Gas Piping, Valves, etc.	4	EA	$ 500	$ 750		$ 1,960	$ 3,630	$ -	$ 5,590	Pipe from boiler room.
4" Class B Vent Piping	60	LF	$ 6.70	$ 10		$ 394	$ 726	$ -	$ 1,120	2 units per vent
4" Chimney Cap	2	EA	$ 11	$ 10		$ 22	$ 24	$ -	$ 46	2 units per vent
Roof Flashing	2	EA	$ 28	$ 10		$ 55	$ 24	$ -	$ 79	2 units per vent
Miscellaneous electrical	1	LS	$ 1,000	$ 500		$ 980	$ 605	$ -	$ 1,585	
						$ -	$ -	$ -	$ -	

Note: Unit selections and budgetary pricing are per Reznor VR series infrared tube heaters.

$21,716	Subtotal
$3,257	15% Contingency
$3,746	15% Contractor O&P
$0	0% Engineering
$28,719	**Total**

APPENDIX F

ECM-5 Roof Replacement

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-5 Roof Replacement **Single Story Main Building Area**

Existing Roof Area	8,500	sf	
Existing U-value	0.09	Btu/hr/(sf*F)	
Proposed Added R-value	19.2		3" Spray Foam Insulation (R-6.8 per inch)
Proposed U-value	0.033	Btu/hr/(sf*F)	
Heating System Efficiency	68%		
Cooling System Efficiency	1.21	kW/ton	

Existing Cooling			Existing Heating					
Existing Cooling Load Temp Diff.	18	F	Existing Heating Load Temp Diff.	54	F	Existing Heating Total	106,352,739	Btu/yr
Existing Max. Roof Cooling Load	13,304	Btu/hr	Existing Max. Roof Heating Load	39,913	Btu/hr	Proposed Heating Total	39,838,974	Btu/yr
						Savings	66,513,765	Btu/yr
Proposed Cooling			Proposed Heating			Input	978	**therms**
Proposed Cooling Load	4,984	Btu/hr	Proposed Heating Load	14,951	Btu/hr			
						Existing Cooling Total	758	kWh/yr
Occupied Cooling Setpoint	73	F	Occupied Heating Setpoint	68	F	Proposed Cooling Total	284	kWh/yr
Unoccupied Cooling Setpoint*	76	F	Unoccupied Heating Setpoint*	64	F	Savings	474	**kWh/yr**

*Average between areas w/ and w/o setback

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	**Existing Equipment Bin Hours**	**Occupied Equipment Bin Hours**	**Unoccupied Equipment Bin Hours**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Cooling Load**	**Existing Heating Load**	**Proposed Cooling Load**	**Proposed Heating Load**
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
102.5	0	0	0	21,804	8,168	-	-	19,587	7,337	-	-	-	-	-	-
97.5	3	3	0	18,109	6,783	-	-	15,891	5,953	-	-	5	-	2	-
92.5	34	34	0	14,413	5,399	-	-	12,196	4,568	-	-	49	-	19	-
87.5	131	131	0	10,717	4,015	-	-	8,500	3,184	-	-	142	-	53	-
82.5	500	500	0	7,022	2,630	-	-	4,804	1,800	-	-	354	-	133	-
77.5	620	620	0	3,326	1,246	-	-	1,109	415	-	-	208	-	78	-
72.5	664	664	0	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	854	0	-	-	370	138	-	-	-	-	-	315,609	-	118,225
62.5	927	927	0	-	-	4,065	1,523	-	-	1,109	415	-	3,768,457	-	1,411,637
57.5	600	600	0	-	-	7,761	2,907	-	-	4,804	1,800	-	4,656,522	-	1,744,300
52.5	610	610	0	-	-	11,457	4,292	-	-	8,500	3,184	-	6,988,478	-	2,617,834
47.5	611	611	0	-	-	15,152	5,676	-	-	12,196	4,568	-	9,257,978	-	3,467,972
42.5	656	656	0	-	-	18,848	7,060	-	-	15,891	5,953	-	12,364,174	-	4,631,531
37.5	1,023	1,023	0	-	-	22,543	8,445	-	-	19,587	7,337	-	23,061,978	-	8,638,852
32.5	734	734	0	-	-	26,239	9,829	-	-	23,283	8,721	-	19,259,522	-	7,214,479
27.5	334	334	0	-	-	29,935	11,213	-	-	26,978	10,106	-	9,998,217	-	3,745,261
22.5	252	252	0	-	-	33,630	12,598	-	-	30,674	11,490	-	8,474,870	-	3,174,625
17.5	125	125	0	-	-	37,326	13,982	-	-	34,370	12,875	-	4,665,761	-	1,747,761
12.5	47	47	0	-	-	41,022	15,366	-	-	38,065	14,259	-	1,928,022	-	722,223
7.5	22	22	0	-	-	44,717	16,751	-	-	41,761	15,643	-	983,783	-	368,518
2.5	13	13	0	-	-	48,413	18,135	-	-	45,457	17,028	-	629,370	-	235,757
-2.5	0	0	0	-	-	52,109	19,520	-	-	49,152	18,412	-	-	-	-
-7.5	0	0	0	-	-	55,804	20,904	-	-	52,848	19,796	-	-	-	-
TOTALS	**8,760**	**8,760**	**0**									**758**	**106,352,739**	**284**	**39,838,974**

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-5 Roof Replacement **Two Story Engine Room Area**

Existing Roof Area	8,000	sf
Existing U-value	0.09	Btu/hr/(sf*F)
Proposed Added R-value	19.2	3" Spray Foam Insulation (R-6.8 per inch)
Proposed U-value	0.033	Btu/hr/(sf*F)
Heating System Efficiency	68%	
Cooling System Efficiency	0.00	kW/ton

Existing Cooling		
Existing Cooling Load Temp Diff.	73	F
Existing Max. Roof Cooling Load	43,800	Btu/hr
Proposed Cooling		
Proposed Cooling Load	16,407	Btu/hr
Occupied Cooling Setpoint	73	F
Unoccupied Cooling Setpoint	80	F

Existing Heating		
Existing Heating Load Temp Diff.	48	F
Existing Max. Roof Heating Load	33,391	Btu/hr
Proposed Heating		
Proposed Heating Load	12,508	Btu/hr
Occupied Heating Setpoint	62	F
Unoccupied Heating Setpoint	62	F

Existing Heating Total	75,270,609	Btu/yr
Proposed Heating Total	28,195,831	Btu/yr
Savings	47,074,778	Btu/yr
Input	692	**therms**
Existing Cooling Total	-	kWh/yr
Proposed Cooling Total	-	kWh/yr
Savings	-	kWh/yr

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	**Existing Equipment Bin Hours**	**Occupied Equipment Bin Hours**	**Unoccupied Equipment Bin Hours**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Cooling Load**	**Existing Heating Load**	**Proposed Cooling Load**	**Proposed Heating Load**
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
102.5	0	0	0	20,522	7,687	-	-	15,652	5,863	-	-	-	-	-	-
97.5	3	3	0	17,043	6,384	-	-	12,174	4,560	-	-	-	-	-	-
92.5	34	34	0	13,565	5,081	-	-	8,696	3,257	-	-	-	-	-	-
87.5	131	131	0	10,087	3,779	-	-	5,217	1,954	-	-	-	-	-	-
82.5	500	500	0	6,609	2,476	-	-	1,739	651	-	-	-	-	-	-
77.5	620	620	0	3,130	1,173	-	-	-	-	-	-	-	-	-	-
72.5	664	664	0	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	854	0	-	-	-	-	-	-	-	-	-	-	-	-
62.5	927	927	0	-	-	-	-	-	-	-	-	-	-	-	-
57.5	600	600	0	-	-	3,130	1,173	-	-	3,130	1,173	-	1,878,261	-	703,583
52.5	610	610	0	-	-	6,609	2,476	-	-	6,609	2,476	-	4,031,304	-	1,510,098
47.5	611	611	0	-	-	10,087	3,779	-	-	10,087	3,779	-	6,163,130	-	2,308,664
42.5	656	656	0	-	-	13,565	5,081	-	-	13,565	5,081	-	8,898,783	-	3,333,420
37.5	1,023	1,023	0	-	-	17,043	6,384	-	-	17,043	6,384	-	17,435,478	-	6,531,205
32.5	734	734	0	-	-	20,522	7,687	-	-	20,522	7,687	-	15,062,957	-	5,642,476
27.5	334	334	0	-	-	24,000	8,990	-	-	24,000	8,990	-	8,016,000	-	3,002,736
22.5	252	252	0	-	-	27,478	10,293	-	-	27,478	10,293	-	6,924,522	-	2,593,876
17.5	125	125	0	-	-	30,957	11,596	-	-	30,957	11,596	-	3,869,565	-	1,449,511
12.5	47	47	0	-	-	34,435	12,899	-	-	34,435	12,899	-	1,618,435	-	606,254
7.5	22	22	0	-	-	37,913	14,202	-	-	37,913	14,202	-	834,087	-	312,443
2.5	13	13	0	-	-	41,391	15,505	-	-	41,391	15,505	-	538,087	-	201,564
-2.5	0	0	0	-	-	44,870	16,808	-	-	44,870	16,808	-	-	-	-
-7.5	0	0	0	-	-	48,348	18,111	-	-	48,348	18,111	-	-	-	-
TOTALS	**8,760**	**8,760**	**0**									-	**75,270,609**	-	**28,195,831**

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-5 Roof Replacement

Description:
Installation of a high reflectivity, high thermal emittance roof to decrease heat island effect.
The new roof covering shall be applied over new added foam insulation.

Existing Roof Area	16,500	sf
Heating System Efficiency	68%	
Cooling System Efficiency	1.21	kW/ton

	Roof Surface Material	Solar Reflectance	Infrared Emmittance	*Cooling Load (Btu/ft^2/yr)	*Heating Load (Btu/ft^2/yr)
Existing Roof	Stone Ballast	12	90	2,010	5,012
****Proposed Roof**	White Elastomeric Coating	82	91	416	5,861

*Values calculated using the DOE Cool Roof Calculator
**Proposed Roof values based on the use of SWD Quick-Shield High Reflectivity Roof Coating

Annual Savings	Load Reduction (Btu/ft^2/yr)	Bldg Load Savings (Btu/yr)	Annual Utility Savings	
Cooling	1,594	13,549,000	**1,366**	**kWh**
Heating	(849)	(14,008,500)	**(21)**	**Therms**

Cooling in Main Building Area only (8,500 sqft).

Hamilton Township
CHA #21180
Building: Fire District #9

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

ECM-5 Roof Replacement

Additional Insulation and Highly Reflective Roof

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Roof Ballast Removal	16,500	SQFT		$ 0.27		$ -	$ 5,391	$ -	$ 5,391	
Roof Membrane Removal	16,500	SQFT		$ 0.18		$ -	$ 3,594	$ -	$ 3,594	
						$ -	$ -	$ -	$ -	
Substrate Primer	16,500	SQFT	$ 0.16	$ 0.25	$ 0.13	$ 2,587	$ 4,991	$ 2,338	$ 9,917	Only if required
3" Spray Foam Insulation	16,500	SQFT	$ 1.66	$ 0.07	$ 0.06	$ 26,842	$ 1,398	$ 1,079	$ 29,319	
White Elastomeric Coating	16,500	SQFT	$ 2.04	$ 0.64	$ 0.09	$ 32,987	$ 12,778	$ 1,619	$ 47,383	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

Descripiton: Existing stone ballasts and roofing memebrane to be completely removed.
Additional foam insulation to be applied to remaining roof substrate or rigid foam insulation.
Final roof coating to be applied to new foam insulation.
Applicaton process is subject to manufacturer's specifications.

$ 95,603	Subtotal
$ 7,170	7.5% Contingency
$ 7,708	7.5% Contractor O&P
$ -	0% Engineering
$ 110,481	**Total**

Hamilton Township
CHA #21180
Building: Fire District #9

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

ECM-5 Roof Replacement

Traditional Membrane Replacement Only

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
Roof Ballast Removal	16,500	SQFT		$ 0.27		$ -	$ 5,391	$ -	$ 5,391	
Roof Membrane Removal	16,500	SQFT		$ 0.18		$ -	$ 3,594	$ -	$ 3,594	
						$ -	$ -	$ -	$ -	
EPDM Membrane Roofing 60 mils, 0.4 P.S.F.	165	100 SQFT	$ 90	$ 25	$ 3.69	$ 14,553	$ 4,991	$ 664	$ 20,208	Loose Laid and Ballasted
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

Descripiton: Existing stone ballasts and roofing memebrane to be completely removed.
Additional foam insulation to be applied to remaining roof substrate or rigid foam insulation.
Final roof coating to be applied to new foam insulation.
Applicaton process is subject to manufacturer's specifications.

$ 29,192	Subtotal
$ 5,838	20% Contingency
$ 7,006	20% Contractor O&P
$ -	0% Engineering
$ 42,037	**Total**

DOE Cool Roof Calculator

Estimates Energy and Peak Demand Savings for Flat Roofs with Non-Black Surfaces

- Developed by the U.S. Department of Energy's Oak Ridge National Laboratory (Version 2.0)

- This version of the calculator is for large facilities that purchase electricity with a demand charge based on peak monthly load. If you have a small or medium-sized facility that purchases electricity without a demand charge, run the CoolCalcEnergy version to estimate the savings in energy charges from using solar radiation control.

- What you get out of this calculator is only as good as what you put in. If you CLICK HERE , you'll find help in figuring out the best input values. Some things, such as the weathering of the solar radiation control properties and the effects of a plenum, are especially important. You'll also find help in figuring out your heating and cooling system efficiencies and proper fuel prices.

- To compare two non-black roofs, print out results of separate estimates for each vs. a black roof. Manually compute the difference in savings to compare the two non-black roofs.

- If your energy costs are determined with both on-peak and off-peak rates, print out results of separate estimates with on-peak then off-peak rates. Use appropriate demand charges for the same roof in both estimates. Judge what fraction of the savings with on-peak rates is appropriate.

My State	New Jersey
My City	Newark
Click to see Data for All 243 Locations	

My Proposed Roof:

R-value (HIGH=20; AVG=10; LOW=5) [h·ft²·°F/Btu]	31.9
Solar reflectance, SR (HIGH=80; AVG=50; LOW=10) [%]	12
Infrared emittance, IE (HIGH=90; AVG=60; LOW=10) [%]	90

My Energy Costs and Equipment Efficiencies:

Summertime cost of electricity (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]	0.1412
Air conditioner efficiency (COP) over cooling season (HIGH=2.5; AVG=2.0; LOW=1.5)	2.9
Energy source for heating (choose one)	○ Electricity ◉ Fuel
If electricity, wintertime cost (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]	
If fuel, cost (Natural gas: HIGH=1.00; AVG=0.70; LOW=0.50) [$/Therm] (Fuel oil: 2002 East coast=0.85; 2002 Midwest=0.70) [$/Therm]	1.10

Heating system efficiency (Furnace or boiler: HIGH=0.8; AVG=0.7; LOW=0.5) (Electric heat pump: HIGH=2.0; AVG=1.5) (Electric resistance: 1.0)	0.75

My Electricity Demand Charges and Duration:

Demand charge during cooling season (HIGH=15.00; AVG=10.00; LOW=5.00) [$/KW]	17.68
Months charged for peak demand (Typical = 6) [-]	4

Calculate My Annual Savings

Total Annual Energy + Demand Savings (relative to a black roof) [$/ft² per year]	0.002
Cooling energy savings [$/ft² per year]	0.002
Heating energy savings (heating penalty if negative) [$/ft² per year]	-0.001
Cooling season demand savings [$/ft² per year]	0.001

Insulation in Black Roof for Same Total Annual Energy Savings (ignores demand savings):

Upgrade from R- 31.9 to R- 32 [h·ft²·°F/Btu]

Details of Energy and Demand Savings:

Heating degree days for location chosen [Annual °F-day]	5122.5
Cooling degree days for location chosen [Annual °F-day]	1061.5
Solar load for location chosen [Annual average Btu/ft² per day]	1226.5
Cooling load for black roof (SR=5%;IE=90%) [Btu/ft² per year]	2163
Heating load for black roof (SR=5%;IE=90%) [Btu/ft² per year]	4951
Cooling load for proposed roof [Btu/ft² per year]	2010
Heating load for proposed roof [Btu/ft² per year]	5012
Average heat load reduction during cooling season [Btu/ft² each month]	0.1
Maximum heat load reduction during cooling season [Btu/ft²]	0.2

DOE Cool Roof Calculator

Estimates Energy and Peak Demand Savings for Flat Roofs with Non-Black Surfaces

- Developed by the U.S. Department of Energy's Oak Ridge National Laboratory (Version 2.0)

- This version of the calculator is for large facilities that purchase electricity with a demand charge based on peak monthly load. If you have a small or medium-sized facility that purchases electricity without a demand charge, run the CoolCalcEnergy version to estimate the savings in energy charges from using solar radiation control.

- What you get out of this calculator is only as good as what you put in. If you CLICK HERE , you'll find help in figuring out the best input values. Some things, such as the weathering of the solar radiation control properties and the effects of a plenum, are especially important. You'll also find help in figuring out your heating and cooling system efficiencies and proper fuel prices.

- To compare two non-black roofs, print out results of separate estimates for each vs. a black roof. Manually compute the difference in savings to compare the two non-black roofs.

- If your energy costs are determined with both on-peak and off-peak rates, print out results of separate estimates with on-peak then off-peak rates. Use appropriate demand charges for the same roof in both estimates. Judge what fraction of the savings with on-peak rates is appropriate.

My State	New Jersey
My City	Newark
Click to see Data for All 243 Locations	

My Proposed Roof:

R-value (HIGH=20; AVG=10; LOW=5) [h·ft²·°F/Btu]	31.9
Solar reflectance, SR (HIGH=80; AVG=50; LOW=10) [%]	82
Infrared emittance, IE (HIGH=90; AVG=60; LOW=10) [%]	91

My Energy Costs and Equipment Efficiencies:

Summertime cost of electricity (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]	0.1412
Air conditioner efficiency (COP) over cooling season (HIGH=2.5; AVG=2.0; LOW=1.5)	2.9
Energy source for heating (choose one)	○ Electricity ◉ Fuel
If electricity, wintertime cost (HIGH=0.20; AVG=0.10; LOW=0.05) [$/KWh]	
If fuel, cost (Natural gas: HIGH=1.00; AVG=0.70; LOW=0.50) [$/Therm] (Fuel oil: 2002 East coast=0.85; 2002 Midwest=0.70) [$/Therm]	1.10

Heating system efficiency (Furnace or boiler: HIGH=0.8; AVG=0.7; LOW=0.5) (Electric heat pump: HIGH=2.0; AVG=1.5) (Electric resistance: 1.0)	0.75

My Electricity Demand Charges and Duration:

Demand charge during cooling season (HIGH=15.00; AVG=10.00; LOW=5.00) [$/KW]	17.68
Months charged for peak demand (Typical = 6) [-]	4

Calculate My Annual Savings

Total Annual Energy + Demand Savings (relative to a black roof) [$/ft² per year]	0.028
Cooling energy savings [$/ft² per year]	0.025
Heating energy savings (heating penalty if negative) [$/ft² per year]	-0.013
Cooling season demand savings [$/ft² per year]	0.017

Insulation in Black Roof for Same Total Annual Energy Savings (ignores demand savings):

Upgrade from R- 31.9 to R- 33.1 [h·ft²·°F/Btu]

Details of Energy and Demand Savings:

Heating degree days for location chosen [Annual °F-day]	5122.5
Cooling degree days for location chosen [Annual °F-day]	1061.5
Solar load for location chosen [Annual average Btu/ft² per day]	1226.5
Cooling load for black roof (SR=5%;IE=90%) [Btu/ft² per year]	2163
Heating load for black roof (SR=5%;IE=90%) [Btu/ft² per year]	4951
Cooling load for proposed roof [Btu/ft² per year]	416
Heating load for proposed roof [Btu/ft² per year]	5861
Average heat load reduction during cooling season [Btu/ft² each month]	2.3
Maximum heat load reduction during cooling season [Btu/ft²]	2.9

SWD Quik-Shield® |1929F
High Reflectivity Roof Coating

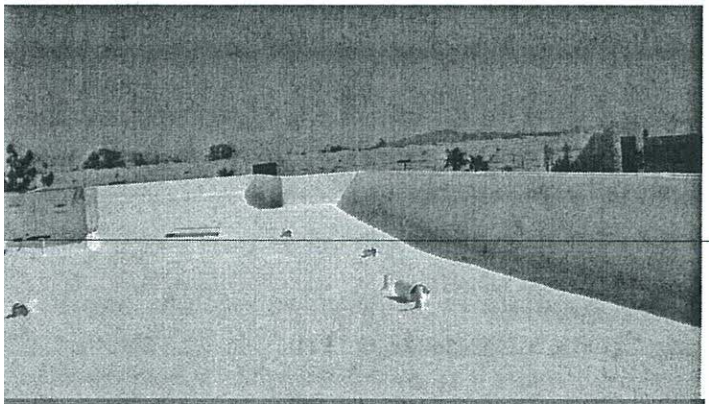
SWD Quik-Shield® |1929F is a high solids, heat resistant, water based, elastomeric coating material made from 100% acrylic polymers.

It is an ideal coating for all types of roofing including:

- Spray polyurethane foam (SPF)
- Built-up
- Single-ply
- Metal
- Concrete

SWD Quik-Shield® |1929F prevents degradation to roofing caused by normal weathering, aging and ultraviolet exposure. It includes special fire retardants , mildew retardants and rust inhibitors that help extend the service life of any roofing system.

SWD Quik-Shield® |1929F is easy and convenient to apply. It is fast drying, odor free and environmentally safe. It is also ideal for applications to walls, tanks, silos and many other surfaces.



Tested & Approved

SWD Quik-Shield® |1929F is CRRC, Energy Star & LEED compliant.

ICC, UL, FM, Miami-Dade, California Fire Marshall approved

SWD Quik-Shield® |1929 coatings were tested by the US Navy Civil Engineering Lab (NCEL) in an on-going environmental test from 1977-1990. Rated "excellent" and "recommended for use at any and all locations."

SWD Quik-Shield® |1929F
an ideal cool roofing solution

A cool roof reflects and emits the sun's heat back into the sky instead of transferring it into the building.

A cool roof can:

- Increase indoor comfort by keeping a building cooler in the summer months.
- Reduce energy costs. Studies have shown that cool roof coating can lead to energy savings of 30-40%.
- Address air pollution and global warming concerns by lowering CO_2 and other emissions associated with fossil fuel generated electricity.
- Reduce "urban heat island effect" by reflecting heat back into the atmosphere.
- Pay for itself. The California energy commission cites cases of a 2-5 yr payback for installing a cool roof.

Source: Cool Roof Rating Council

SWD Urethane Company 222 S. Date St. Mesa, AZ 85210
swdurethane.com (800) 828-1394 sales@swdurethane.com

SWD Quik-Shield® | 1929F

High Reflectivity Roof Coating - Specifications

CHARACTERISTICS:

FLAME RETARDANT:
- ICC rated Class A
- UL 723rated Class I
- UL 790 rated Class A
- Meets coating requirements for UL Roof Systems #136, 181 and 206
- California Fire Marshall listed as a component of Class A rated roof systems and as a "general purpose fire retardant chemical coating."

CRRC & ENERGY STAR COMPLIANT:
- Solar Reflectance Index (SRI) 103%.
- 82% Solar Reflectance
- 91% Thermal Emittance

ADHESION:
- Rigid polyurethane roofing and insulation foam
- Asphalt shingle roofing
- Concrete, masonry, wood, metal

MOISTURE PROOF-VAPOR RETARDANT.
- Perm rating of 3.5 allows the dried film to "breathe"

WEATHER RESISTANT:
- Acrylic polymers extend durability
- Titanium dioxide blocks ultra-violet light effects
- Tested "Excellent" in on-going Naval Civil Engineering Laboratory study.
- Meets ASTM D-6083 standards

MILDEW RESISTANT:
- Contains mildew retardants to inhibit or prevent mildew growth.

APPROVALS/CODE COMPLIANCE:
- ICC : Research Report # 3182
- UL: File # R-8671, R-9303 Construction # 136, 181, 206
- CALIFORNIA FIRE MARSHALL:
  - ID# 4175-1321:100
  - ID#2280-1321:102
  - Class A rated roof system component
  - General purpose fire retardant coating
- CITY OF LOS ANGELES: Report # RR 24072
- MIAMI-DADE: #06-1204.03

SHELF LIFE: Unopened containers @ 50°-89°F 6 months

COLORS: White, Buff, Santa Fe Buff, Lt. Grey, Dk. Grey

CAUTION: Do not take internally. Keep out of reach of children.

PHYSICAL PROPERTIES:

SOLIDS CONTENT:		
By Weight		70+ 5%
By Volume		60+ 5%
WEIGHT /GAL:		11.9 lbs
COVERAGE:		
(Mils/100 sf./gal)		9.3
VISCOSITY: (Krebs)		96-102
ULTIMATE TENSILE STRENGTH:		
psi @ 75°F	ASTM D-412	280
psi @ 0°F	ASTM D-2370	299
ELONGATION AT BREAK:		
% @ 75°F	ASTM D-412	355
% @ 0°F	ASTM D-2370	255
SURFACE BURNING CHARACTERISTICS:		
Flame Spread ASTM E-84		10
Smoke Developed UL 723		15
PERMEANCE:		
(Perms @ 20 mils)	ASTM E-96(Procedure B)	3.5
SOLAR REFLECTANCE INDEX:		
ASTM E-1980		103%
SOLAR REFLECTANCE:		
ASTM E-903		82%
THERMAL EMITTANCE:		
ASTM E-408		91%
HARDNESS:		
ASTM D-2240 (Shore A)		60
ADHESION TO POLYURETHANE FOAM:		
ASTM D-413 (Cohesive Peak Failure)		
Dry 6.1	Wet	3.5
LOW TEMPERATURE FLEXIBILITY:		
(-150F) 1800 Bend-		
After 3000 hrs.		Pass
After 1 yr Outside		Pass
WATER ABSORPTION:		
ASTM D-2842 (168 hr. @ 75°F)		5%

INSTALLATION:

May be applied by brush, roller, or conventional airless spray equipment. Tools can be cleaned with a thorough water flush. Surface should be dry, clean and free of contaminants or oxidation. When applying over foam (SPF): to avoid damaging the skin of the foam, operator should wear soft soled shoes. The coating should be applied 2-72 hours after foam installation. It is recommended that operators wear sunglasses to avoid temporary blinding effects due to glare. Do not apply at ambient temperatures below 50°F.

SWD Urethane Company 222 S. Date St. Mesa, AZ 85210 swdurethane.com (800) 828-1394

4/18/08

SWD Quik-Shield® |125 Roof Foam

SWD Quik-Shield® |125 is a low viscosity, two component, 2.5 - 3.0 lb closed-cell, spray-applied rigid polyurethane foam . This product meets building codes for roofing and is ideal for use as an insulating air barrier and as part of an energy efficient building envelope.

SWD Quik-Shield® |125 creates a monolithic, water resistant barrier that stops air infiltration. It also provides excellent insulation with an R-Value of 6.8 per inch.

SWD Quik-Shield® |125 quickly adheres to roofing substrates to strengthen and waterproof new and existing roofs (many times without a costly tear off).

SWD Quik-Shield® |125 roof systems are environmentally friendly because they reduce energy use, reduce a building's carbon footprint, and reduce landfill space requirements. They also contain no CFC's, or HCFC's .

Tested & Approved

SWD Quik-Shield® |125 is ICC, UL, and California Fire Marshall approved.
It is California Bureau of Home Furnishings & LEED compliant. It is also a qualifying material for an Energy Star qualified home.

SWD Quik-Shield® |125
an ideal roofing solution

Up to 50% of all energy used in a building can be literally lost through the roof.

SWD Quik-Shield® |125 can significantly reduce that loss and increase the performance of your building by creating a seamless monolithic roofing system.

SWD Quik-Shield® |125 is able to add structural stability and increase resistance to wind uplift and hail damage.

SWD Quik-Shield® |125 also provides high R-value insulation, reduces air infiltration and 'bellowing' and restricts water and vapor transmission.

As a self adhering system, **SWD Quik-Shield® |125** requires no mechanical fasteners which increases installation efficiency as well as structural waste.

Underwriters Laboratories

SWD Urethane Company 222 S. Date St. Mesa, AZ 85210
swdurethane.com (800) 828-1394 sales@swdurethane.com

SWD Quik-Shield® | 125
Roof Foam - Specifications

CHARACTERISTICS:

INSULATION PROPERTIES:
- R-Value: 6.8 per inch.
- Noise Reduction Coefficient: 20%
- Performs equally in hot or cold temperatures.

SEAMLESS INSULATION:
- Stops air infiltration
- No joints or seams to leak air or water.
- Reduce dust, gas, odor and noise penetration

MONOLITHIC:
- Solid, one-piece construction.
- Increases structural stability.

SELF-ADHESIVE:
- No fasteners needed
- Attaches chemically to wood, metal, plastic, tile, pipe, etc.
- No unnecessary holes in roof substrates from fasteners

WATER MOISTURE RESISTANT:
- Undamaged, closed cell foam will not absorb water
- Water vapor can pass through foam, allowing roof to breathe and help prevent condensation and mold.

LIGHT WEIGHT:
- Weight Per Square (at 1"): 30 lbs
- High strength to weight ratio.

SAFE TO USE:
- Contains no urea formaldehyde or carcinogens.
- Does not give off toxic fumes after application.

ENVIRONMENTALLY FRIENDLY:
- Reduces energy and fossil fuel requirements.
- No CFC's or HCFC's
- Low VOC's
- No adverse impact on ozone layer.
- Finished product may be recycled or landfill disposed.

SHELF LIFE:
- Six months from date of manufacture in unopened containers when stored at 50-80°F.

APPROVALS/ COMPLIANCE:
- ICC-ES #3182
- E-108, UL 790 Class A Roof System:
  Construction # 136, 181, 206, UL file R-9303.
- California Fire Marshal Listing No. 040175-1321:100
- California Bureau of Home Furnishings: Reg#. CA – T030

PHYSICAL PROPERTIES:

RELATIVE INSULATION VALUES (initial values):

k-Factor	R Value/ in.	Thickness
0.16	6.8	1"

HANDLING PROPERTIES :
(Based on regular grade formulation at 75°F.)

	"A" Compound	"B" Compound
Viscosity, cps	500	770
Specific Gravity	1.23	1.18
Mixing Ratio	50	50

REACTIVITY PROFILE:	Winter	Inter.	Summer
Cream Time (seconds)	1-3	3-4	4-6
Tack Free Time (seconds)	7-9	9-11	11-13
Cure Time @ 75° (hours)	4	4	4
Rise Time (seconds)	12-14	14-18	18-24

	Procedure*	Values
Core Density, pcf nominal	D-1622	2.5 - 3.0
Compressive Strength,psi	D-1621	42
Tensile Strength	D-1623	75
Closed Cell, content, %	D-2856	95
Thermal Resistance	C-1770	14.8
Dimensional Stability	D-2126	1.07

*NOTES: ASTM Test Method Reference Number

PROCESSING INFORMATION:
Under normal operation conditions, primary heater setting should be 120°F -140°F. Hose temperatures are dependent on weather conditions and processing equipment, with 120°F-140°F for most types of plural component 1:1 dispensing equipment to achieve proper atomization of liquid components. Hose pressure should be 800 to 1500 psi depending upon equipment. Remove bung covers with caution.

WARNING: Polyurethane products produced from these chemicals may present a serious fire hazard if improperly used or allowed to remain exposed or unprotected. Specific hazards will depend upon a broad range of factors, which are controlled or influenced by the manufacturing process, the mode of application or installation, and the function and usage of the particular product. Each person, firm or corporation engaged in the manufacture, production, application, installation, or use of any polyurethane product should carefully determine whether there is a fire hazard associated with such product in a specific usage, and utilize all appropriate precautionary and safety measures.

SWD Urethane Company 222 S. Date St. Mesa, AZ 85210 swdurethane.com (800) 828-1394

4/18/08

APPENDIX G

ECM-6 Increase Wall Insulation – Engine Room

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-6 Increase Wall Insulation - Engine Room

Total Existing Wall Area	4,388	sf	
Existing U-value	0.133	Btu/hr/(sf*F)	
Proposed U-value	0.047	Btu/hr/(sf*F)	W/ additional 2" Polyisocyanurate Board Insulation (R-14)
Heating Efficiency	68%		
Cooling Efficiency	1.21	kW/ton	

Existing Cooling		
Max. North Wall Cooling Load	5,355	Btu/hr
Max. East Wall Cooling Load	4,451	Btu/hr
Max. South Wall Cooling Load	7,380	Btu/hr
Max. West Wall Cooling Load	1,830	Btu/hr

Existing Heating		
Existing Heating Load Temp Diff	48	F
Existing Max. Wall Heating Load	28,083	Btu/hr

Proposed Cooling		
Max. North Wall Cooling Load	1,888	Btu/hr
Max. East Wall Cooling Load	1,569	Btu/hr
Max. South Wall Cooling Load	2,601	Btu/hr
Max. West Wall Cooling Load	645	Btu/hr
Occupied Cooling Setpoint	73	F
Unoccupied Cooling Setpoint	73	F
Existing Cooling Total	796	kWh/yr
Proposed Cooling Total	281	kWh/yr
Savings	516	kWh/yr

Proposed Heating		
Proposed Max. Heating Load	9,899	Btu/hr
Occupied Heating Setpoint	62	F
Unoccupied Heating Setpoint	62	F
Existing Heating Total	63,305,091	Btu/yr
Proposed Heating Total	22,315,045	Btu/yr
Savings	40,990,046	Btu/yr
Input	603	**therms**

				Occupied				Unoccupied							
Avg Outdoor Air Temp. Bins °F	**Existing Equipment Bin Hours**	**Occupied Equipment Bin Hours**	**Unoccupied Equipment Bin Hours**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Heat Gain**	**Proposed Heat Gain**	**Existing Heat Loss**	**Proposed Heat Loss**	**Existing Cooling Load**	**Existing Heating Load**	**Proposed Cooling Load**	**Proposed Heating Load**
				(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(Btu/hr)	(kWh/yr)	(Btu/yr)	(kWh/yr)	(Btu/yr)
97.5	3	3	0	19,016	6,703	-	-	19,016	6,703	-	-	6	-	2	-
92.5	34	34	0	15,135	5,335	-	-	15,135	5,335	-	-	52	-	18	-
87.5	131	131	0	11,255	3,967	-	-	11,255	3,967	-	-	149	-	52	-
82.5	500	500	0	7,374	2,599	-	-	7,374	2,599	-	-	372	-	131	-
77.5	620	620	0	3,493	1,231	-	-	3,493	1,231	-	-	218	-	77	-
72.5	664	664	0	-	-	-	-	-	-	-	-	-	-	-	-
67.5	854	854	0	-	-	-	-	-	-	-	-	-	-	-	-
62.5	927	927	0	-	-	-	-	-	-	-	-	-	-	-	-
57.5	600	600	0	-	-	2,633	928	-	-	2,633	928	-	1,579,680	-	556,837
52.5	610	610	0	-	-	5,558	1,959	-	-	5,558	1,959	-	3,390,461	-	1,195,138
47.5	611	611	0	-	-	8,483	2,990	-	-	8,483	2,990	-	5,183,398	-	1,827,148
42.5	656	656	0	-	-	11,409	4,022	-	-	11,409	4,022	-	7,484,173	-	2,638,171
37.5	1,023	1,023	0	-	-	14,334	5,053	-	-	14,334	5,053	-	14,663,818	-	5,168,996
32.5	734	734	0	-	-	17,259	6,084	-	-	17,259	6,084	-	12,668,449	-	4,465,628
27.5	334	334	0	-	-	20,185	7,115	-	-	20,185	7,115	-	6,741,723	-	2,376,457
22.5	252	252	0	-	-	23,110	8,146	-	-	23,110	8,146	-	5,823,754	-	2,052,873
17.5	125	125	0	-	-	26,035	9,178	-	-	26,035	9,178	-	3,254,433	-	1,147,188
12.5	47	47	0	-	-	28,961	10,209	-	-	28,961	10,209	-	1,361,158	-	479,808
7.5	22	22	0	-	-	31,886	11,240	-	-	31,886	11,240	-	701,495	-	247,277
2.5	13	13	0	-	-	34,811	12,271	-	-	34,811	12,271	-	452,549	-	159,524
-2.5	0	0	0	-	-	37,737	13,302	-	-	37,737	13,302	-	-	-	-
-7.5	0	0	0	-	-	40,662	14,333	-	-	40,662	14,333	-	-	-	-
TOTALS	**8,760**	**8,760**	**0**									**796**	**63,305,091**	**281**	**22,315,045**

Hamilton Township
CHA #21180
Building: Fire District #9

ECM-6 Increase Wall Insulation - Engine Room

Multipliers	
Material:	0.98
Labor:	1.21
Equipment:	1.09

Description	QTY	UNIT	UNIT COSTS			SUBTOTAL COSTS			TOTAL COST	REMARKS
			MAT.	LABOR	EQUIP.	MAT.	LABOR	EQUIP.		
						$ -	$ -	$ -	$ -	
2" Polyisocyanurate Board Insul	4,388	SQFT	$ 1.05	$ 0.50	$ -	$ 4,515	$ 2,655	$ -	$ 7,170	W/ Flame Resistant Backing
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	
						$ -	$ -	$ -	$ -	

$ 7,170	Subtotal
$ 717	10% Contingency
$ 1,183	15% Contractor O&P
$ -	Engineering
$ 9,070	**Total**

APPENDIX H

ECM-7 Install Door Seals