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June 28, 2010

Local Government Energy Program
Energy Audit Report

Township of Livingston
Well Houses No. 3, 4, 9 and 11)
Livingston, NJ 07039

Project Number: LGEA50

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INTRODUCTION

As an approved energy consulting firm under the Local Government Energy Audit Program (LGEA), Steven Winter Associates, Inc. (SWA) was selected to perform an energy audit and assessment for the Township of Livingston. The audit included a review of the following buildings located in the Township of Livingston for which separate energy audit reports are issued:

- Municipal Court
- Main Fire Department
- Northfield Fire Station
- Circle Fire Station
- Township Garage
- Livingston Free Public Library
- Senior & Community Center
- Water Department
- Monmouth Court Community Center
- Well House No. 3, Building 1
- Well House No. 3, Building 2
- Well House No. 4
- Well House No. 9
- Well House No. 11
- Okner Field Concession Building
- Storage Shed
- Northland Pool and Recreation Center
- Sewage Treatment Plant
- Animal Shelter
- Pump House
- Booster Station
- Sewer Station

This report addresses Well House No. 11, 9, 4, and 3 (Building 1 and 2) located throughout Livingston NJ. The current conditions and energy-related information were collected in order to analyze and suggest the implementation of building improvements and energy conservation measures.

Well house No. 3 consists of two single story buildings, building 1 the deep well and building 2 the clear well. Building 1 the deep well is 530 gross square feet and approximately 50 years old. Building 2 clear well is 700 gross square feet and approximately 20 years old. Well house No. 4 consists of two single story buildings, building 1 the deep well and building 2 the clear well. Clear well is a single story brick building of 700 gross square feet and deep well is a 300 gross square feet single story building, and is attached to the pool recreation building. Well No. 9 consists of two single story buildings, building 1 the deep well and building 2 the clear well. The clear well appears to be approximately 30 years old, while the deep well is about 15 years old. The clear well is 530 gross square feet and deep well is 550 gross square feet. Well No. 11 consists of two single story buildings, deep well and clear well. The original building, deep well, is 600 gross square feet. An addition was constructed to the east side for the Clear Well of almost 700 gross square feet. The original building appears to be 25 years old while the addition is less than 10 years old. All of these buildings operate 24 hours per day, 7 days per week and 52 weeks per year. The facilities are essentially unoccupied except for approximately 1 hour per day when a member of the Water Department will check on the equipment operation and perform testing and during emergency conditions.

The goal of this Local Government Energy Audit (LGEA) is to provide sufficient information to the Township of Livingston to make decisions regarding the implementation of the most appropriate and most cost effective energy conservation measures for the building.

Launched in 2008, the LGEA Program provides subsidized energy audits for municipal and local government-owned facilities, including offices, courtrooms, town halls, police and fire stations, sanitation buildings, transportation structures, schools and community centers. The Program will subsidize 75% of the cost of the audit. If the net cost of the installed measures recommended by the audit, after applying eligible NJ SmartStart Buildings incentives, exceeds the remaining cost of the audit, then that additional 25% will also be paid by the program. The Board of Public Utilities (BPU's) Office of Clean Energy has assigned TRC Energy Services to administer the Program.

- Section 1 and section 2 of the report cover a description and analysis of the building existing conditions.
- Section 3 provides a detail inventory of major electrical and mechanical systems in the building.
- Sections 4 through 5 provide a description of our recommendations.
- Appendices include further details and information supporting our recommendations.

EXECUTIVE SUMMARY

This audit encompasses four well houses used by the Township of Livingston. Well house No. 3 consists of two single story buildings, building 1 the deep well and building 2 the clear well. Building 1 the deep well is 530 gross square feet and approximately 50 years old. Building 2 clear well is 700 gross square feet and approximately 20 years old. Well house No. 4 consists of two single story buildings, building 1 the deep well and building 2 the clear well. Clear well is a single story brick building of 700 gross square feet and deep well is a 300 gross square feet single story building, and is attached to the pool recreation building. Well No. 9 consists of two single story buildings, building 1 the deep well and building 2 the clear well. The clear well appears to be approximately 30 years old, while the deep well is about 15 years old. The clear well is 530 gross square feet and deep well is 550 gross square feet. Well No. 11 consists of two single story buildings, deep well and clear well. The original building, deep well, is 600 gross square feet. An addition was constructed to the east side for the Clear Well of almost 700 gross square feet. The original building appears to be 25 years old while the addition is less than 10 years old. All of these buildings operate 24 hours per day, 7 days per week and 52 weeks per year. The facilities are essentially unoccupied except for approximately 1 hour per day when a member of the Water Department will check on the equipment operation and perform testing and during emergency conditions.

Based on the field visits performed by the SWA staff on January 25th, 26th and 27th, 2010 and the results of a comprehensive energy analysis, this report describes the site's current conditions and recommendations for improvements. Suggestions for measures related to energy conservation and improved comfort are provided in the scope of work. Energy and resource savings are estimated for each measure that results in a reduction of heating, cooling, and electric usage.

Existing conditions

<u>Well House No. 3:</u>
From January 2009 through December 2009, the period of analysis for this audit, the building consumed 1,079,280 kWh or 3,683 MMBTU of electricity at a cost of $169,537 at an annual aggregate rate of $0.157/kWh.

SWA has entered energy information about Well House No. 3 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 2,994.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Well House No. 4:
From March 2008 through February 2009, the period of analysis for this audit, the building consumed 334,800 kWh or 1,142 MMBTU of electricity at a cost of $55,921 at an annual aggregate rate of $0.167/kWh.

SWA has entered energy information about Well House No. 4 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,162.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Well House No. 9:
From January 2009 through December 2009, the period of analysis for this audit, the building consumed 402,360 kWh or 1,373 MMBTU of electricity at a cost of $64,171 at an annual aggregate rate of $0.159/kWh.

SWA has entered energy information about Well House No. 9 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,271.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Well House No. 11:
From March 2008 through February 2009, the period of analysis for this audit, the building consumed 470,220 kWh or 1,605 MMBTU of electricity at a cost of $65,704 at an annual aggregate rate of $0.140/kWh.

SWA has entered energy information about Well House No. 11 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,275.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Recommendations

Many of the well house buildings are over fifty years old, most HVAC equipment have exceeded their recommended useful life cycles. Additionally, much of the lighting is inefficient. In Appendix C, SWA has included a mechanical inventory list of equipment for the well houses. Based on the assessment of the building, SWA has separated the recommendations into three categories (See Section 4 for more details). These are summarized as follows:

Category I Recommendations: - Capital Improvements

<u>Well House #3:</u>

- Repair or replace stucco veneer with on both buildings
- Repair the damaged coping on Deep Well #1
- Apply tapered insulation
- Window replacements
- Replace the skylights
- Replace door assembly on Deep Well 1
- Replace doors on the Clear Well Building
- Replace existing 2 HP air compressor
- Replace electric unit heaters
- Replace exhaust fans
- Install NEMA premium motors

<u>Well House #4:</u>

- Install expansion joints in both walls containing large cracks
- Increase Clear Well Building ceiling insulation to R-30
- Install a layer of rigid roof insulation below a new EPDM membrane
- Repair crack at the base of the Deep Well Building
- Replace windows
- Replace the skylight on the Clear Well Building
- Replace doors on both buildings with insulated metal doors
- Replace existing 1 HP air compressor
- Replace electric unit heaters
- Install NEMA premium motors

<u>Well House #9:</u>

- Install downspout on gutter of Deep Well Building.

- Replace the skylight on the Clear Well Building with energy efficient, double glazed unit.
- Increase ceiling insulation in both buildings to R-30.
- Replace windows
- Replace door on the Deep Well Building with insulated metal door.
- Replace electric unit heaters
- Install NEMA premium motors

Well House #11:

- Replace the skylights on both buildings with energy efficient, double glazed units.
- Increase ceiling insulation in both buildings to R-30 and insulate roof access panels
- Replace doors on both buildings with insulated metal doors
- Replace existing 3/4 HP air compressor with a more modern and energy efficient model
- Install NEMA premium motors

Category II Recommendations: - Operations and Maintenance

- Maintain roofs
- Maintain downspouts
- Provide weather-stripping and air sealing
  Repair/seal wall cracks and penetrations

Category III Recommendations: Energy Conservation Measures

At this time, SWA highly recommends a total of **9** Energy Conservation Measures (ECMs) for the Well Houses as summarized in the following Table 1. The total investment cost for these ECMs with incentives is **$23,672**. SWA estimates a first year savings of **$6,951** with a simple payback of **3.4 years**. SWA also recommends **3** ECMs with a 5-10 year payback that have a first year savings of **$1,191** as summarized in Table 2.

The implementation of all the recommended ECMs would reduce the combined well house usage by 47,000 kWh annually. SWA estimates that implementing these ECMs will reduce the carbon footprint of the Monmouth Court Community Center by **42,542 lbs of CO_2**, which is equivalent to removing approximately 5 cars from the roads each year or avoiding the need of 118 trees to absorb the annual CO_2 produced. SWA also recommends that Township of Livingston contacts third party energy suppliers in order to negotiate a lower electricity rate. Comparing the current electric rate to average utility rates of similar type buildings in New Jersey, it may be possible to save up to $0.02/kWh, which would have equated to $775 for the past 12 months.

There are various incentives that Township of Livingston could apply for that could also help lower the cost of installing the ECMs. SWA recommends that the Township of Livingston apply for the NJ SmartStart program through the New Jersey Office of Clean Energy. This incentive can help provide technical assistance for the building in the implementation phase of any energy conservation project. A new NJ Clean Power program, Direct Install could also assist to cover up to 80% of the capital investment.

Renewable ECMs require application approval and negotiations with the utility and proof of performance. There is also a utility-sponsored loan program through PSE&G that would allow the building to pay for the installation of the PV system through a loan issued by PSE&G

The following three tables summarize the proposed Energy Conservation Measures (ECMs) and their economic relevance.

Table 1 - Highly Recommended 0-5 Year Payback ECMs																		
ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.2	4 New CFL fixtures to be installed with incentives	22	0	22	58	0.0	0	0.0	18	27	5	134	0.8	511	102	120	100	80
2.2	replace (2) 20 Hp pump motors with Premium Efficiency	2,478	250	2,228	5,932	1.2	0	26.1	0	991	20	19,813	2.2	789	39	44	12,510	8,127
2.5	replace (1) 20 Hp Clear Well pump motor with Premium Efficiency	1,239	125	1,114	2,966	0.6	0	14.5	0	415	20	8,305	2.7	645	32	37	5,064	4,063
2.3	replace (1) 30 Hp Deep Well pump motor with Premium Efficiency	1,958	150	1,808	4,165	0.9	0	22.7	0	662	20	13,245	2.7	633	32	37	8,044	5,706
3.1	replace (2) 5 Hp stripper fan motors with Premium Efficiency	1,008	162	846	1,928	0.4	0	10.5	0	303	20	6,054	2.8	616	31	36	3,657	2,641
3.3	replace (1) 5 Hp stripper tower fan motor with Premium Efficiency	504	54	450	964	0.2	0	5.3	0	153	20	3,066	2.9	581	29	34	1,830	1,321
2.4	replace (1) 40 Hp Deep Well pump motor with Premium Efficiency	2,541	180	2,361	5,139	1.1	0	25.1	0	719	20	14,389	3.3	509	25	30	8,343	7,040

2.1	replace (2) 100 Hp Clear Well pump motors with Premium Efficiency	11,390	800	10,590	19,466	4.1	0	106.3	0	3,037	20	60,734	3.5	474	24	28	34,588	26,668
1.3	9 New pulse start metal halide fixtures to be installed with incentives	4,478	225	4,253	1,403	0.3	0	0.5	434	644	15	9,660	6.6	127	8	13	3,326	1,923
	TOTALS	**25,618**	**1,946**	**23,672**	**42,021**	**8.8**	**0**	**211**	**452**	**6,951**	**-**	**135,400**	**3.4**	**-**	**-**	**-**	**77,462**	**35,720**

Assumptions: Discount Rate: 3.2% per DOE FEMP; Energy Price Escalation Rate: 0% per DOE FEMP Guidelines
Note: A 0.0 electrical demand reduction / month indicates that it is very low / negligible

Table 2 - Recommended 5-10 Year Payback ECMs

ECM #	ECM description	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.4	replace (2) 12.5 Hp blower motors with Premium Efficiency	1,550	200	1,350	1,875	0.4	0	9.1	0	263	20	5,250	5.1	289	14	19	2,555	2,569
1.3	9 New pulse start metal halide fixtures to be installed with incentives	4,478	225	4,253	1,403	0.3	0	0.5	434	644	15	9,660	6.6	127	8	13	3,326	1,923
3.2	Replace (3) 10 Hp stripper tower fan motors with Premium Efficiency	2,346	300	2,046	1,701	0.4	0	7.5	0	284	20	5,681	7.2	178	9	13	2,180	2,330
	TOTALS	**8,374**	**725**	**7,649**	**4,979**	**1.1**	**0**	**17**	**434**	**1,191**	**-**	**20,591**	**6.4**	**-**	**-**	**-**	**8,061**	**6,822**

1. HISTORIC ENERGY CONSUMPTION

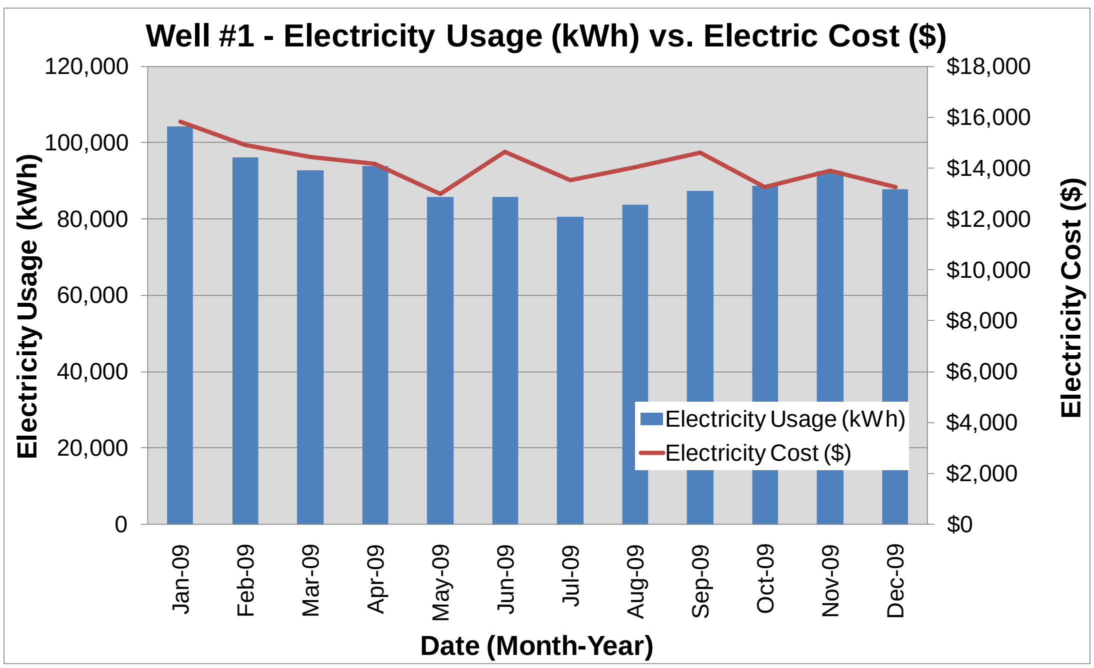
1.1. Energy usage, load profiles and cost analysis

Well House # 3:

SWA analyzed utility bills for well house No. 3 for the 24 months between January 2008 and December 2009 with an analysis period of **January 2009 through December 2009**.

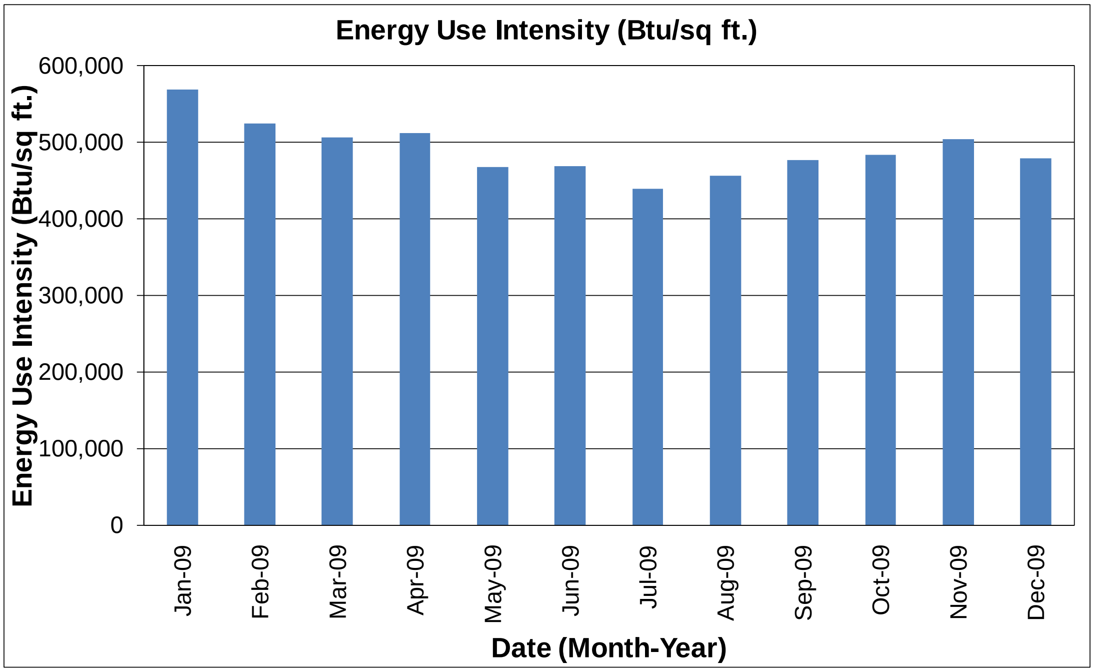
Electricity - The well house buys electricity from JCP&L at **an average rate of $0.157/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 1,079,280 kWh or $169,537 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill. The building had an average monthly demand of **135kW** and an annual peak demand of **146.6 kW**.

The following chart shows electricity use versus cost for the well house based on utility bills for the 12 month period of January 2009 through December 2009.



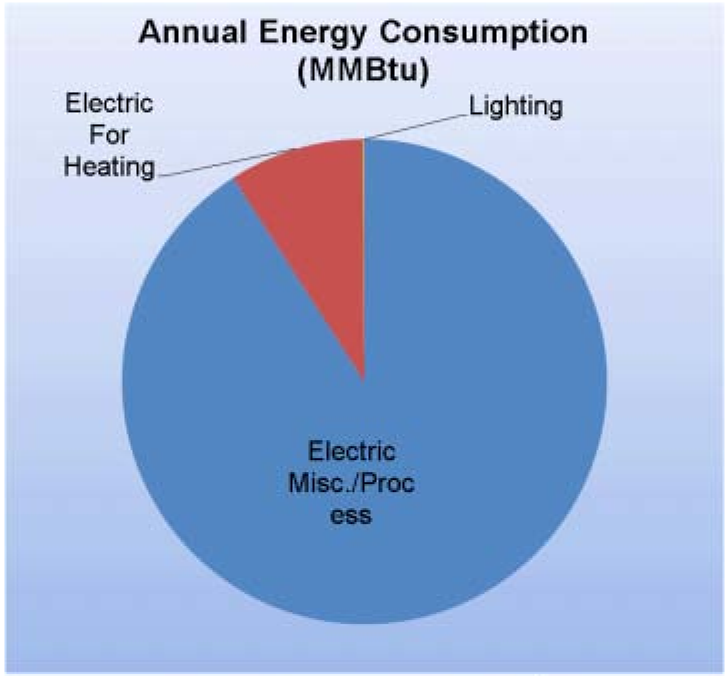
Electricity usage follows a trend that is expected for this building with nearly constant usage and a small peak in the winter. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

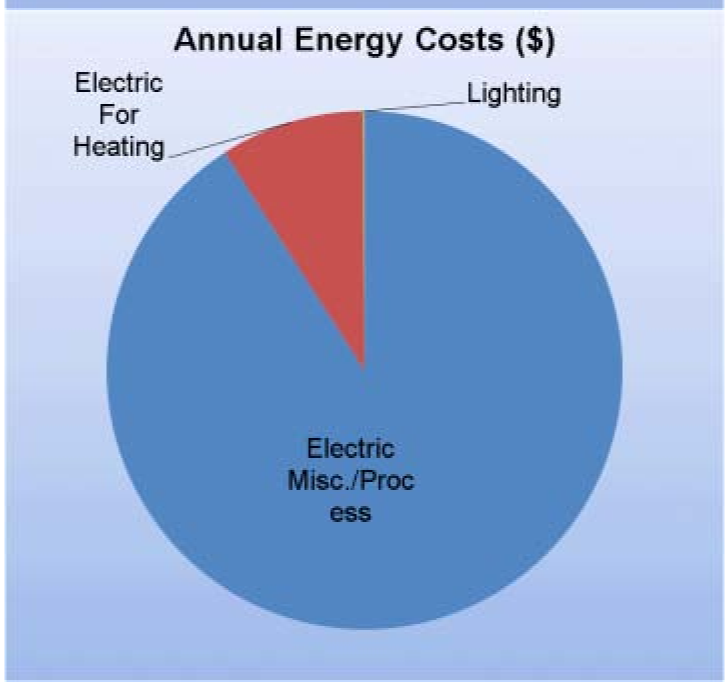
The following chart shows electric consumption in Btu/sq ft for the Well House #3 based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie chart show energy use for the Well House #3 based on utility bills for the 12 month period of March 2008 to February 2009.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Miscellaneous	3,347	91%	$154,070	91%	46
Electric For Heating	332	9%	$15,283	9%	46
Lighting	4	0%	$184	0%	46
Totals	3,683	100%	$169,537	100%	46
Total Electric Usage	3,683	100%	$169,537	100%	46
Totals	3,683	100%	$169,537	100%	46





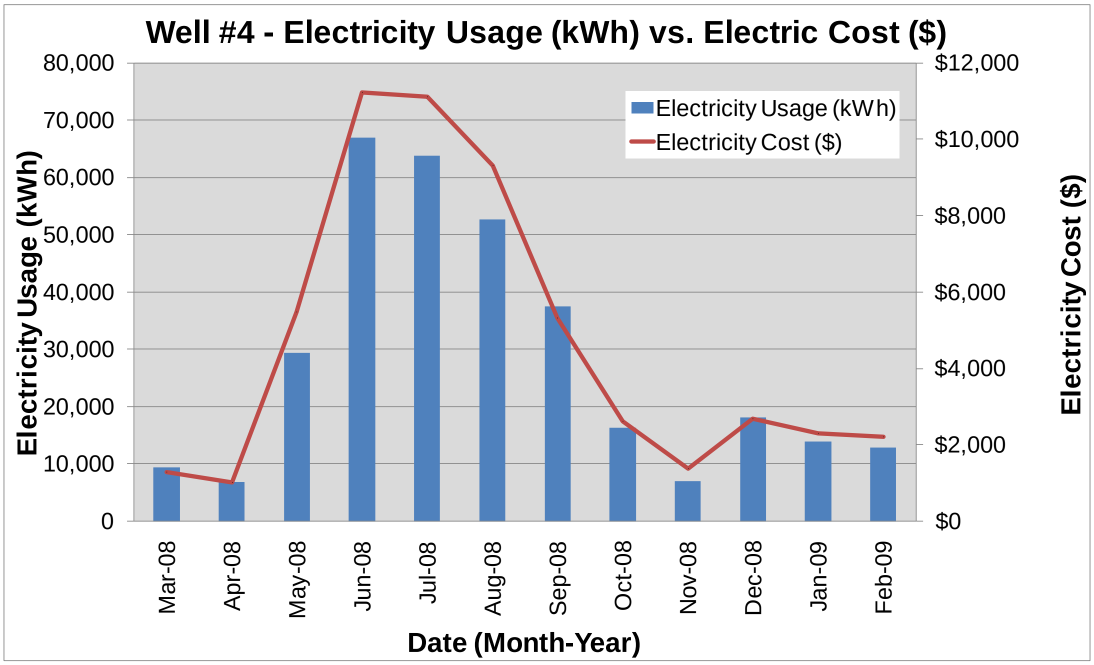
Well House # 4:

SWA analyzed utility bills for well house No. 4 for the 24 months between March 2007 and February 2009 with an analysis period of **March 2008 through February 2009**.

Electricity - The well house buys electricity from PSE&G at **an average rate of $0.167/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 334,800 kWh or $55,921 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill.

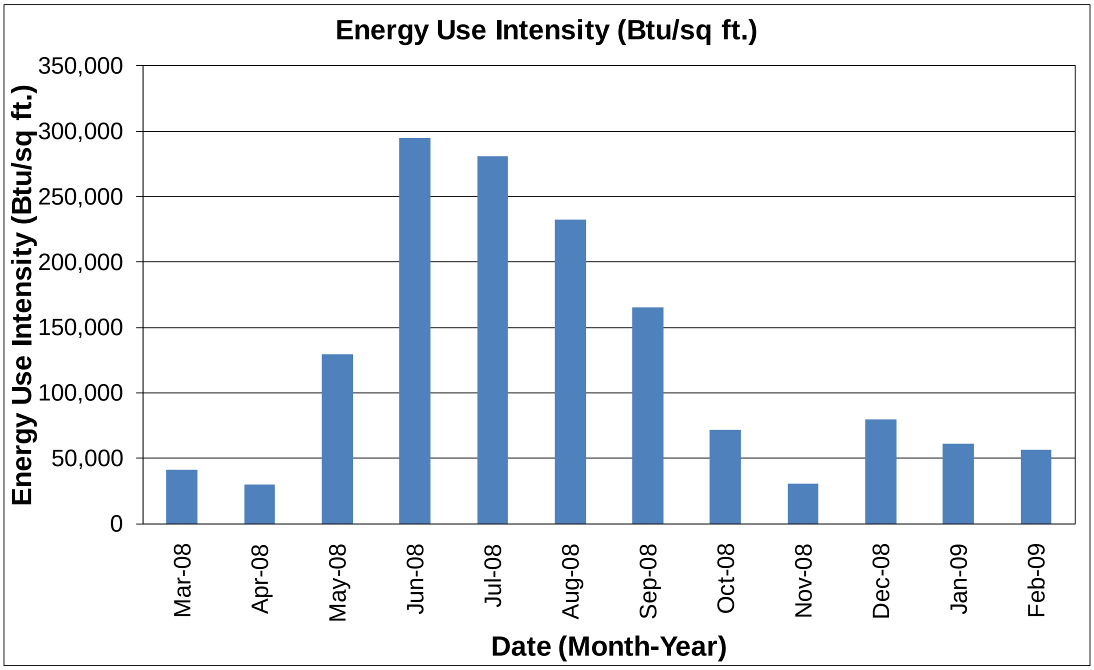
The building had an average monthly demand of **54.7kW** and an annual peak demand of **100.8 kW**.

The following chart shows electricity use versus cost for the well house based on utility bills for the 12 month period of March 2008 through February 2009.



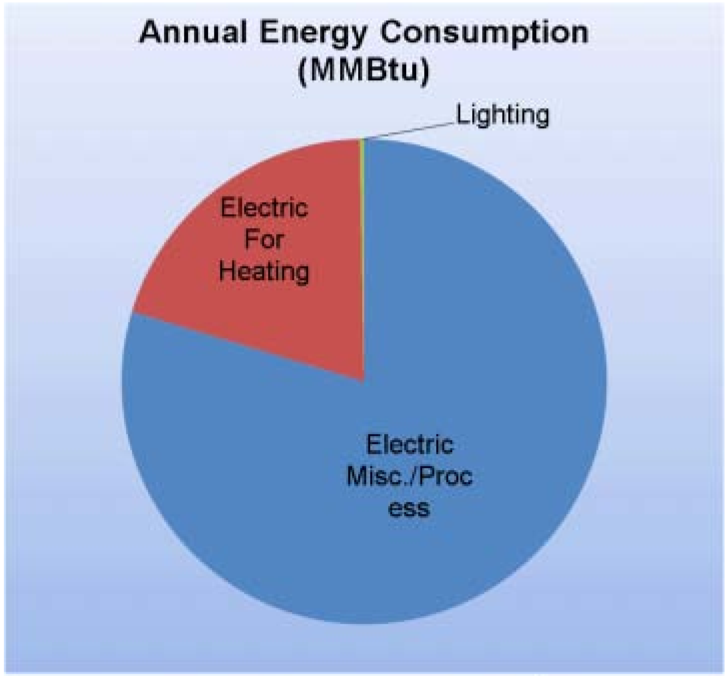
Electricity usage follows a trend that is expected for this building with usage peaking in the summer due to its use by the neighboring outdoor community pool. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

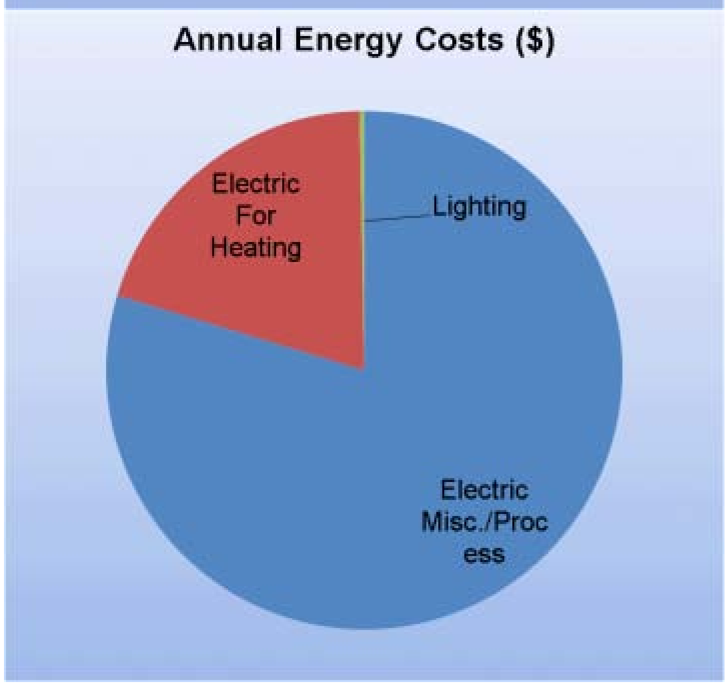
The following chart shows electric consumption in Btu/sq ft for the Well House #4 based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie chart show energy use for the Well House #4 based on utility bills for the 12 month period of March 2008 to February 2009.

March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc./Process	910	80%	$44,543	80%	49
Electric For Heating	229	20%	$11,204	20%	49
Lighting	3	0%	$167	0%	49
Totals	1,142	100%	$55,915	100%	
Total Electric Usage	1,142	100%	$55,921	100%	49
Totals	1,142	100%	$55,921	100%	49





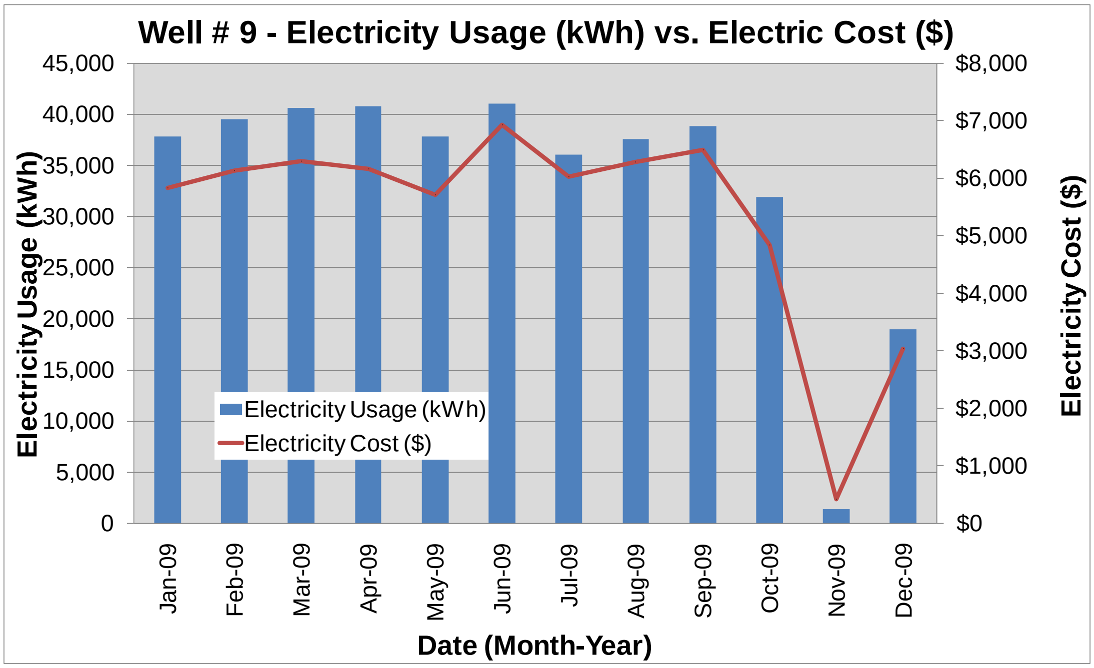
Well House # 9:

SWA analyzed utility bills for well house No. 9 for the 24 months between March 2007 and February 2009 with an analysis period of **January 2009 through December 2009**.

Electricity - The well house buys electricity from JCP&L at **an average rate of $0.159/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 402,360 kWh or $64,171 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill.

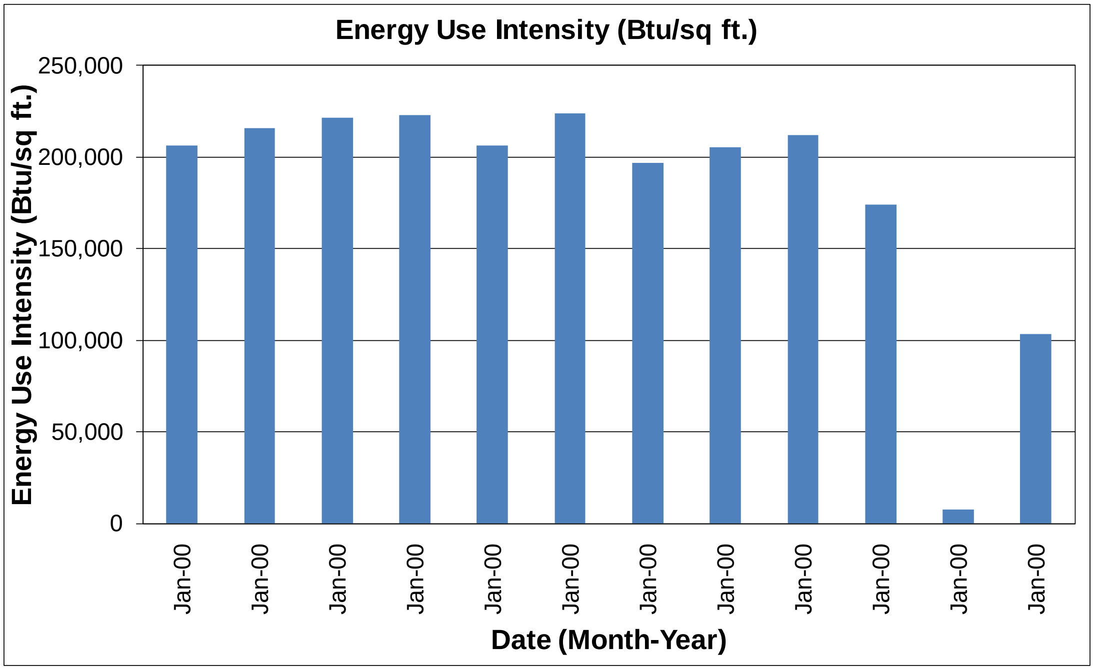
The building had an average monthly demand of **57.7kW** and an annual peak demand of **62 kW**.

The following chart shows electricity use versus cost for the well house based on utility bills for the 12 month period of January 2009 through December 2009.



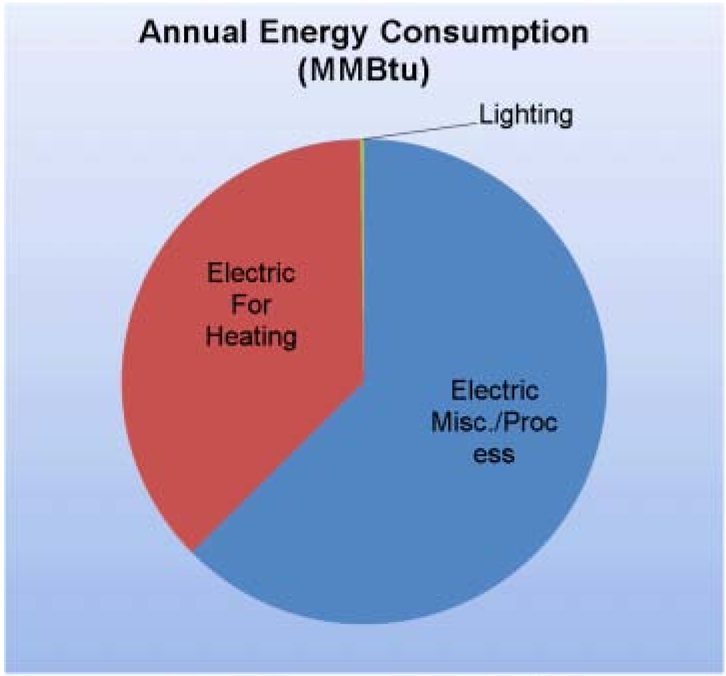
Electricity usage follows a trend that is expected for this building with constant usage except for a drop off in the month of November as the process equipment at this location was taken out of operation. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

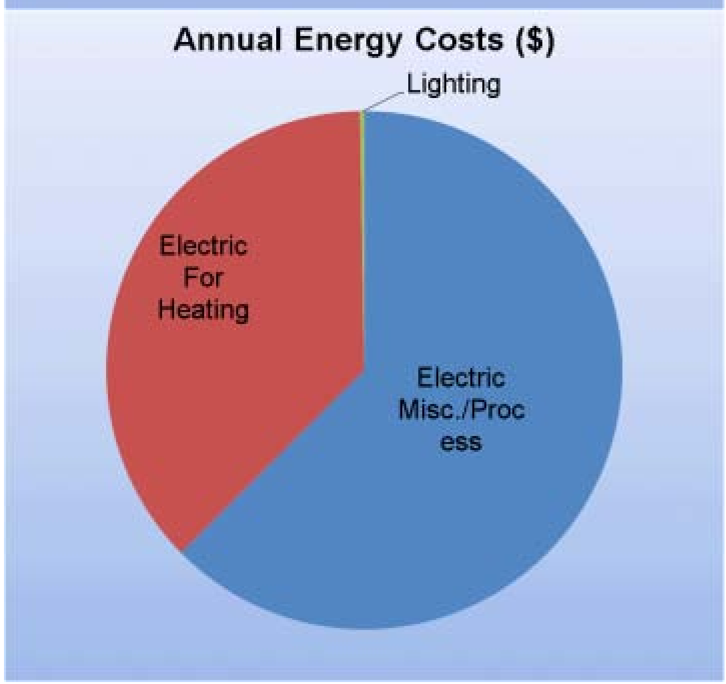
The following chart shows electric consumption in Btu/sq ft for the Well House #9 based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie chart show energy use for the Well House #9 based on utility bills for the 12 month period of March 2008 to February 2009.

2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc./Process	859	63%	$40,148	63%	47
Electric For Heating	510	37%	$23,837	37%	47
Lighting	4	0%	$172	0%	47
Totals	1,373	100%	$64,157	100%	47
Total Electric Usage	1,373	100%	$64,171	100%	47
Totals	1,373	100%	$64,171	100%	47





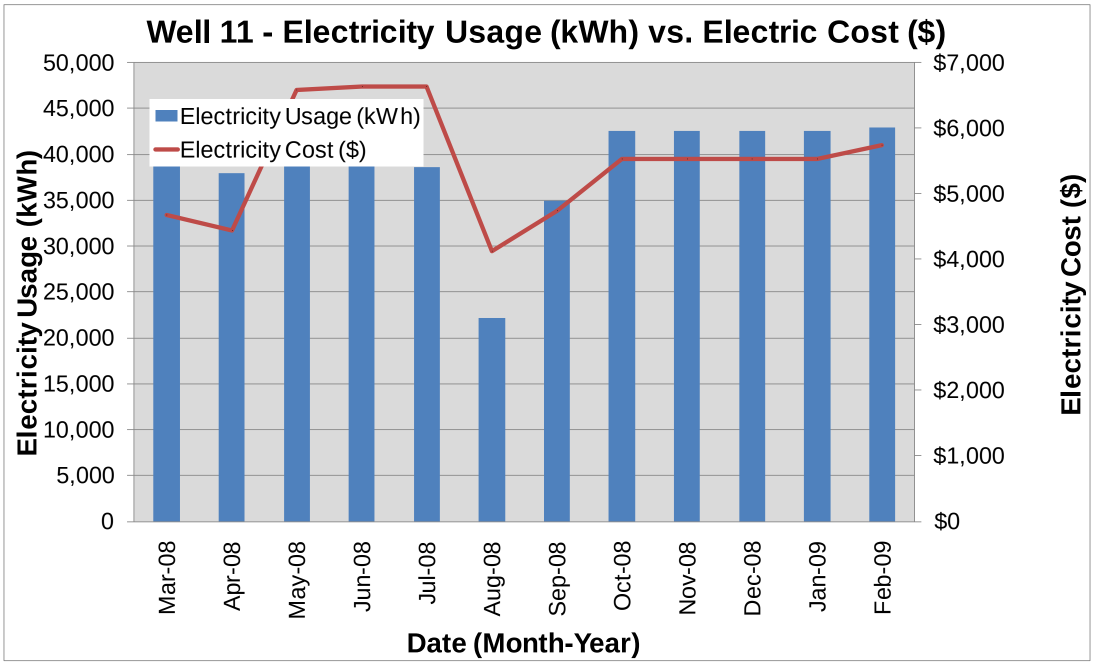
<u>Well House # 11:</u>

SWA analyzed utility bills for well house No. 11 for the 24 months between March 2007 and February 2009 with an analysis period of **March 2008 through February 2009**.

Electricity - The well house buys electricity from PSE&G at **an average rate of $0.140/kWh** based on 12 months of utility bills from **January 2009 through December 2009**. The building purchased **approximately 470,220 kWh or $65,704 worth of electricity** during the analysis period and is currently charged for demand (kW) which has been factored into each monthly bill.

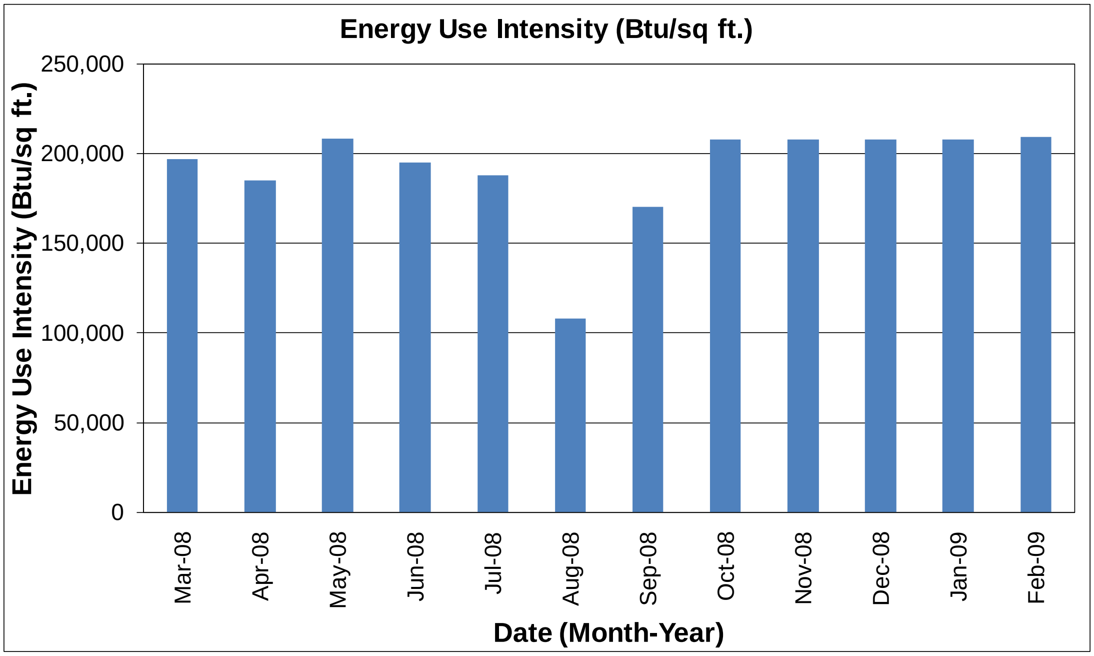
The building had an average monthly demand of **60.1kW** and an annual peak demand of **71.4 kW**.

The following chart shows electricity use versus cost for the well house based on utility bills for the 12 month period of January 2009 through December 2009.



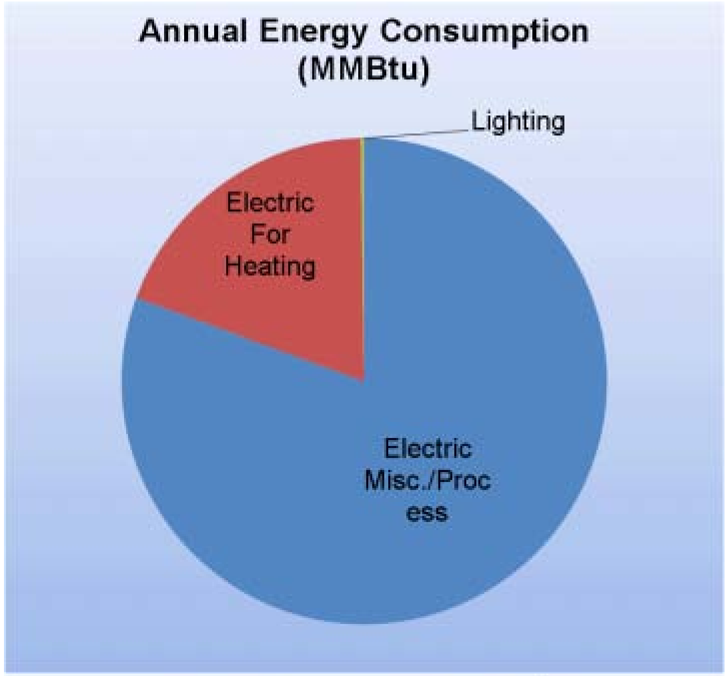
Electricity usage follows a trend that is expected for this building with constant usage except for a drop off in the month of August as the process equipment at this location was taken out of operation. The cost of electricity fluctuates as expected with usage peaking in the summer during the time of highest usage.

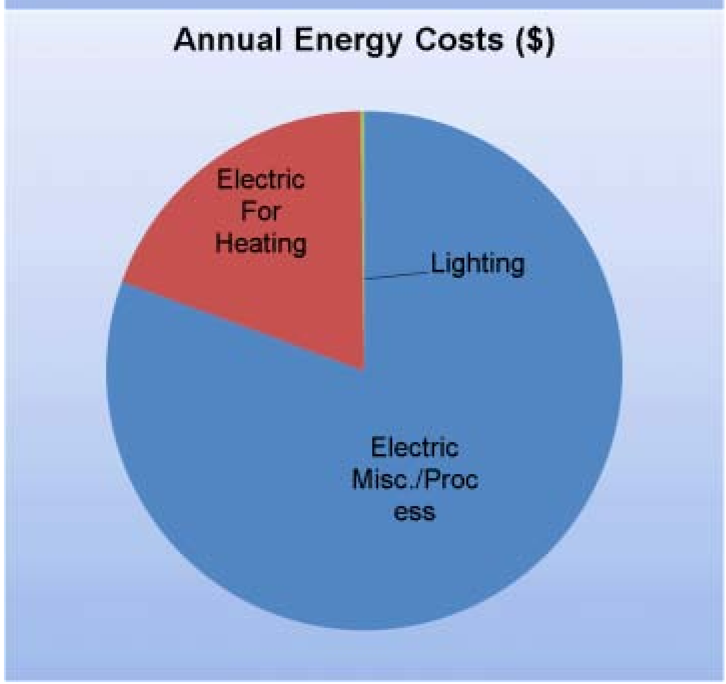
The following chart shows electric consumption in Btu/sq ft for the Well House #11 based on utility bills for the 12 month period of March 2008 to February 2009.



The following table and pie chart show energy use for the Well House #11 based on utility bills for the 12 month period of March 2008 to February 2009.

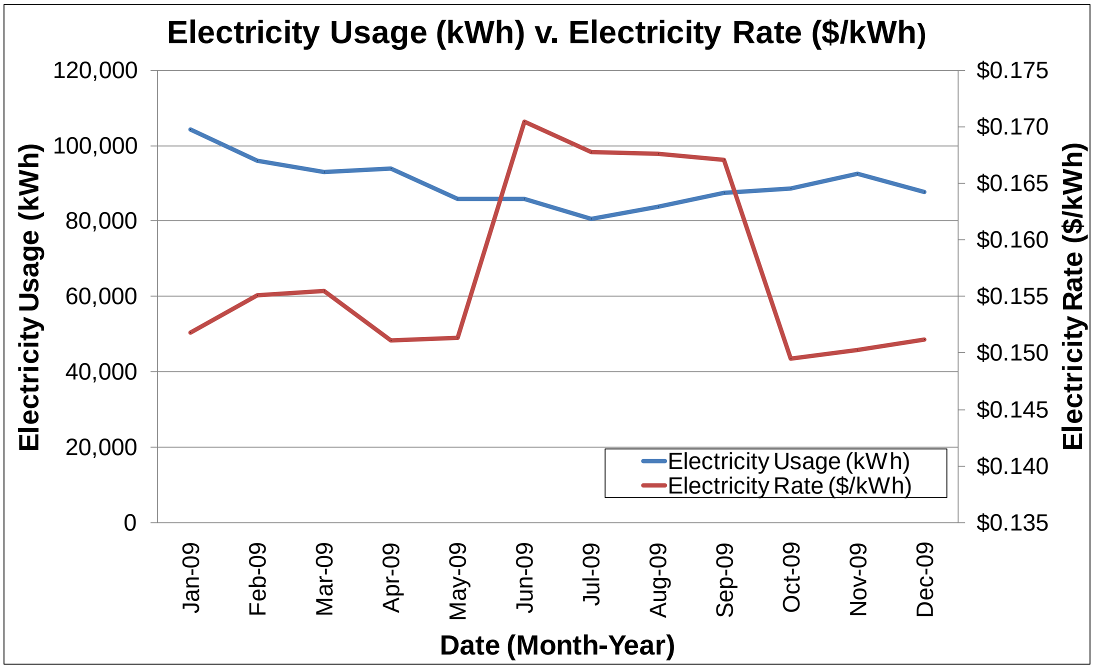
March 2008 - February 2009 Annual Energy Consumption / Costs					
	MMBtu	% MMBtu	$	% $	$/MMBtu
Electric Misc./Process	1,293	81%	$52,947	81%	41
Electric For Heating	308	19%	$12,612	19%	41
Lighting	4	0%	$164	0%	41
Totals	1,605	100%	$65,724	100%	41
Total Electric Usage	1,605	100%	$65,704	100%	41
Totals	1,605	100%	$65,704	100%	41



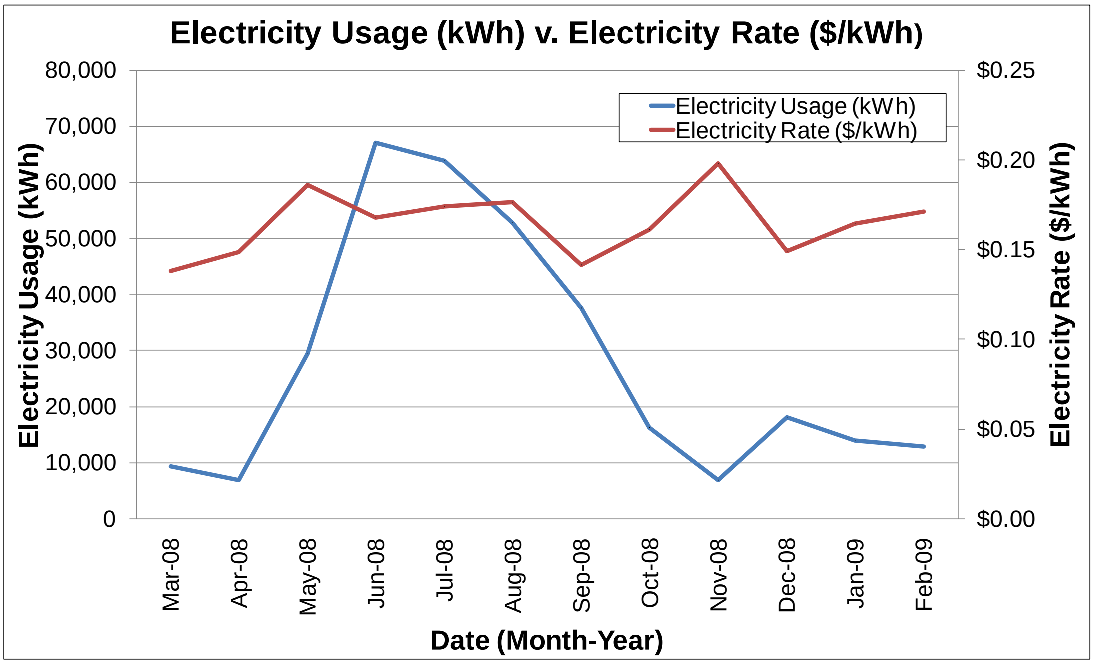


1.2. Utility Rate Analysis

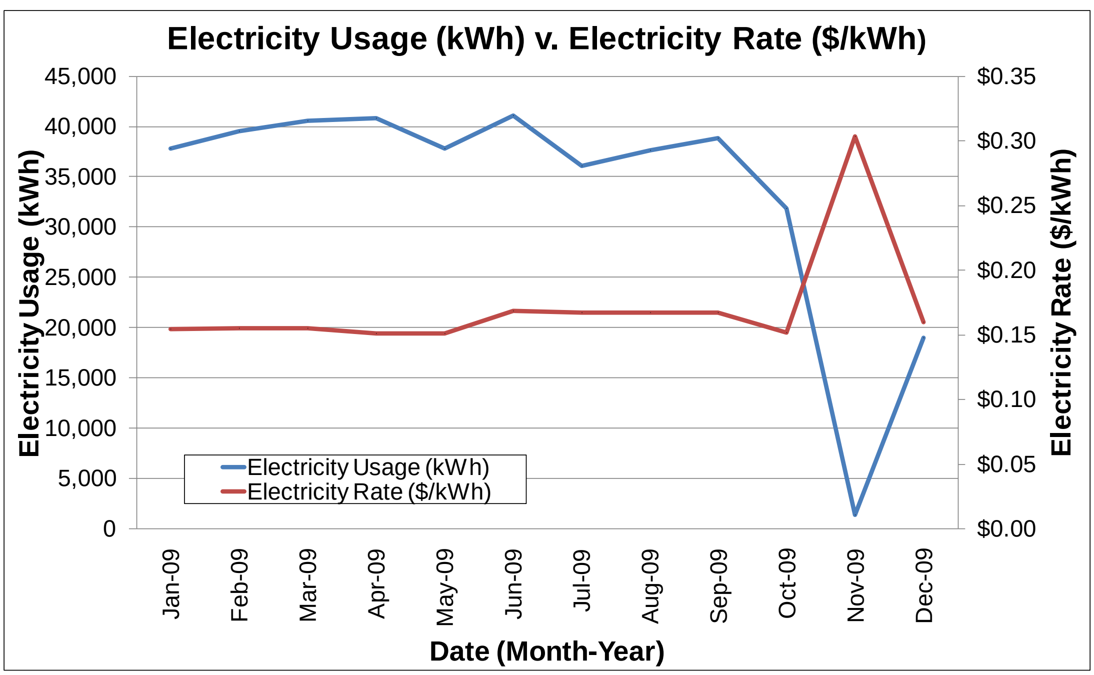
Well House No. 3 currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The well house currently pays an average rate of approximately $0.157/kWh based on the 12 months of utility bills of January 2009 to December 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



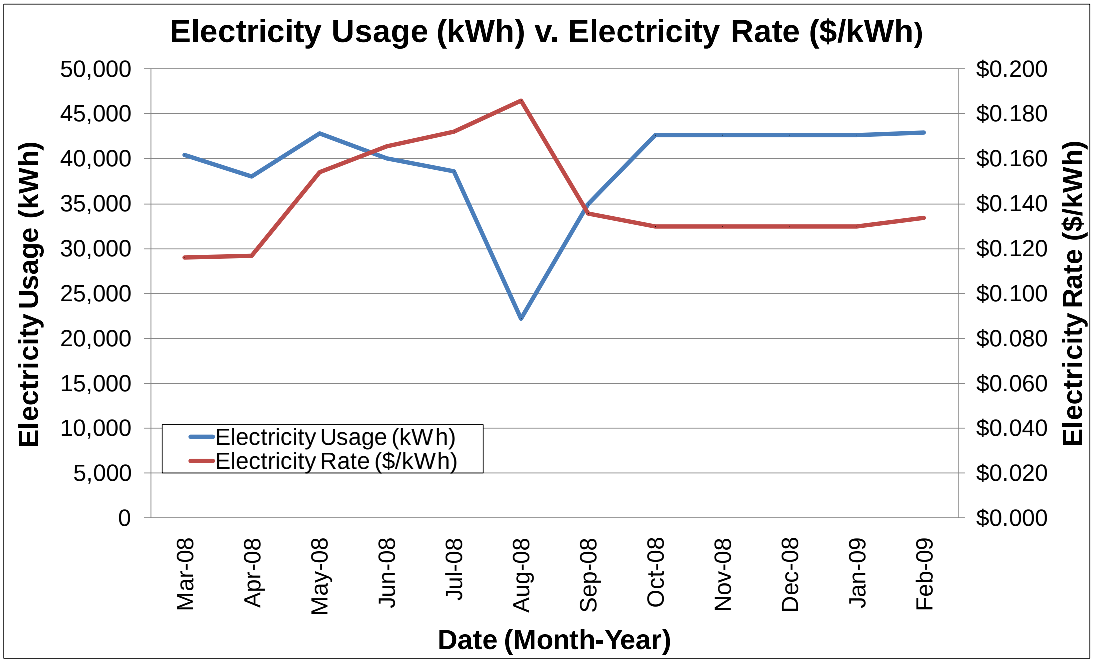
Well House No. 4 currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The well house currently pays an average rate of approximately $0.167/kWh based on the 12 months of utility bills of March 2008 to February 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



Well House No. 9 currently purchases electricity from JCP&L at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The well house currently pays an average rate of approximately $0.159/kWh based on the 12 months of utility bills of January 2009 to December 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



Well House No. 11 currently purchases electricity from PSE&G at a general service market rate for electricity use (kWh) including a separate (kW) demand charge that is factored into each monthly bill. The well house currently pays an average rate of approximately $0.14/kWh based on the 12 months of utility bills of March 2009 to February 2009. Demand prices are reflected in the utility bills and can be verified by observing the price fluctuations throughout the year. The electric rate does not show large fluctuations throughout the year except for an anticipated rise in the summer time. Based on these observations this appears to be the appropriate rate for the building.



1.3. Energy benchmarking

SWA has entered energy information about Well House No. 3 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 2,994.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Well House No.3 Building #1 and #2

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Well House No.3 Building #1 and #2

Building ID: 2024336
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

Facility
Township of Livingston - Well House No.3 Building #1 and #2
Dorsa Avenue
Livingston, NJ 07039

Facility Owner
Township of Livingston
357 South Livingston Avenue
Livingston, NJ 07039

Primary Contact for this Facility
Richard Calbi
357 South Livingston Avenue
Livingston, NJ 07039

Year Built: 1955
Gross Floor Area (ft^2): 1,230

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	3,682,503
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	3,682,503
Energy Intensity[5]	
Site (kBtu/ft^2/yr)	2994
Source (kBtu/ft^2/yr)	10000
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	561
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	4595%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

SWA has entered energy information about Well House No. 4 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an “other” space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,162.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Well House No.4

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Well House No.4

Building ID: 2050745
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

Facility	Facility Owner	Primary Contact for this Facility
Township of Livingston - Well House No.4 10 Wahler Road Livingston, NJ 07039	Township of Livingston 357 South Livingston Avenue Livingston, NJ 07039	Richard Calbi 357 South Livingston Avenue Livingston, NJ 07039

Year Built: 1955
Gross Floor Area (ft^2): 1,000

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,161,646
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	1,161,646
Energy Intensity[5]	
Site ($kBtu/ft^2/yr$)	1162
Source ($kBtu/ft^2/yr$)	3880
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	177
Electric Distribution Utility	
Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	1722%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

SWA has entered energy information about Well House No. 9 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an "other" space type which means that at this time, it is ineligible for Energy Star certification.

SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,271.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Well House No.9

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Well House No.9

Building ID: 2025676
For 12-month Period Ending: December 31, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

Facility
Township of Livingston - Well House No.9
646 West Mount Pleasant Avenue
Livingston, NJ 07039

Facility Owner
Township of Livingston
357 South Livingston Avenue
Livingston, NJ 07039

Primary Contact for this Facility
Richard Calbi
357 South Livingston Avenue
Livingston, NJ 07039

Year Built: 1974
Gross Floor Area (ft²): 1,080

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,372,852
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	1,372,852
Energy Intensity[5]	
Site (kBtu/ft²/yr)	1271
Source (kBtu/ft²/yr)	4246
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	209
Electric Distribution Utility	
FirstEnergy - Jersey Central Power & Lt Co	
National Average Comparison	
National Average Site EUI	104
National Average Source EUI	213
% Difference from National Average Source EUI	1893%
Building Type	Other

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**N/A**

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

The government estimates the average time needed to fill out this form is 6 hours (includes the time for entering energy data, PE facility inspection, and notarizing the SEP) and welcomes suggestions for reducing this level of effort. Send comments (referencing OMB control number) to the Director, Collection Strategies Division, U.S., EPA (2822T), 1200 Pennsylvania Ave., NW, Washington, D.C. 20460.

EPA Form 5900-16

SWA has entered energy information about Well House No. 11 in the U.S. Environmental Protection Agency's (EPA) *Energy Star Portfolio Manager* Energy benchmarking system. Currently, the building is not eligible to receive a performance rating because it is classified as an “other” space type which means that at this time, it is ineligible for Energy Star certification. SWA encourages the Township of Livingston to continue entering utility data in *Energy Star Portfolio Manager* in order to track weather normalized source energy use over time.

The Site Energy Use Intensity is 1,275.0 kBtu/sq ft yr compared to the national average of a public assembly building consuming 104.0 kBtu/sq ft yr. The extremely high intensity is a result of this building housing numerous pieces of process equipment that are not present in the average commercial building.

Per the LGEA program requirements, SWA has assisted the Township of Livingston to create an *Energy Star Portfolio Manager* account and has shared the building facility information to allow future data to be added and tracked using the benchmarking tool. SWA is sharing this Portfolio Manager Site information with TRC Energy Services. As per requirements, the account information is provided below:

Username: LivingstonTownship
Password: Livingston
Project Name: Township of Livingston - Well House No.11

Also, below is a statement of energy performance generated based on historical energy consumption from the Portfolio Manager Benchmarking tool.

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Township of Livingston - Well House No.11

Building ID: 2050756
For 12-month Period Ending: February 28, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: March 18, 2010

Facility
Township of Livingston - Well House No.11
3 Elizabeth Avenue
Livingston, NJ 07039

Facility Owner
Township of Livingston
357 South Livingston Avenue
Livingston, NJ 07039

Primary Contact for this Facility
Richard Calbi
357 South Livingston Avenue
Livingston, NJ 07039

Year Built: 1972
Gross Floor Area (ft²): 1,300

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	1,657,743
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	1,657,743
Energy Intensity[5]	
Site (kBtu/ft²/yr)	1275
Source (kBtu/ft²/yr)	4259
Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	252
Electric Distribution Utility	
Public Service Elec & Gas Co	
National Average Comparison	
National Average Site EUI	82
National Average Source EUI	191
% Difference from National Average Source EUI	2130%
Building Type	Retail (Misc)

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards[6] **for Indoor Environmental Conditions:**	
Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Certifying Professional
N/A

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

EPA Form 5900-16

2. FACILITY AND SYSTEMS DESCRIPTION

2.1. Building Characteristics

Well House #3 Buildings #1 and #2

Well House No. 3 consists of two single story buildings, Deep Well #1 and Clear Well #2. Deep Well #1 is 530 gross square feet and approximately 50-60 years old. Clear Well #2 is 700 gross square feet and approximately 20 years old. Both are slab on grade with stucco veneer over CMU walls with a poured in place concrete roof.

Orientation: South Elevation – Faces Dorsa Ave. with main entrance
North Elevation – Building rear (opposite entrance)
East Elevation – Right side (when facing entrance)
West Elevation – Left side (when facing entrance)


Building # 1


Buildings #1 and #2

Well House #4 Buildings #1 and #2

Well #4 consists of two buildings, Clear Well and Deep Well. Clear Well is a single story brick building of 700 gross square feet, slab-on-grade with a gable roof. Deep Well is a 300 gross square feet single story building, and is attached to the pool recreation building. It is also slab on grade with a stucco finish.

Orientation: North Elevation – Entrance door side
South Elevation – Rear opposite entrance
East Elevation – Left side (when facing entrance)
West Elevation – Right (when facing entrance)

Building Entrance

Well House #9

Well #9 consists of two buildings, Clear Well and Deep Well. The Clear Well appears to be approximately 30 years old, while the Deep Well is about 15 years old.. The Clear well is 530 gross square feet and Deep well is 550 gross square feet. Both buildings have a brick masonry exterior over CMU walls. The Clear Well has a gabled roof while the Deep Well has a hip roof. Both buildings have shingle roofing which has been recently installed.

Orientation: Southwest Elevation -Entrance door side
Northeast Elevation –Rear opposite entrance
Southeast Elevation –Right side (when facing entrance)
Northwest Elevation -Left side (when facing entrance)

Building # 1 Front and Side Facade

Building # 1 Main Entrance

Well House #11

The building consists of two structures, Deep Well and Clear Well. The original building, Deep Well, is 600 gross square feet. An addition was constructed to the east side for the Clear Well of almost 700 gross square feet. The original building appears to be 25 years old while the addition is less than 10 years old. Both structures are slab-on-grade, brick walls and gabled roofs.

Orientation: South Elevation - Entrance side faces Elizabeth Avenue
North Elevation – Rear opposite entrance

East Elevation – Right side (when facing entrance)
West Elevation – Left side (when facing entrance)

Partial Front Façade (typ.)

2.2. Building Occupancy Profiles

This building operates 24 hours per day, 7 days per week and 52 weeks per year. The facilities are essentially unoccupied except for approximately 1 hour per day when a member of the Water Department will check on the equipment operation and perhaps perform some testing. Occupancy may be for longer in the case of a power outage.

2.3. Building Envelope

Due to favorable weather conditions (min. 18 deg. F delta-T in/ outside & no/low wind) some exterior envelope infrared (IR) images were taken during the field audit. Thermal imaging/infrared (IR) technology helps to identify energy compromising problem areas in a non-invasive way.

General Note: All findings and recommendations on the exterior envelope (base, walls, roofs, doors and windows) are based on the energy auditors' experience and expertise, on construction document reviews (if available) and on detailed visual analysis, as far as accessibility and weather conditions allowed at the time of the field audit.

2.3.1. Exterior Walls

Well House No. 3

Both buildings are constructed of un-insulated CMU walls with a stucco veneer. The stucco veneer on Deep Well #1 is water marked, stained and deteriorated with significant cracking occurring along the underside of the roof the entire length of the west wall, as were numerous spider cracks on all other sides. Clear Well #2 has significant deterioration of the stucco at the base of the north wall, below the louvers on the east wall and at the N/W corner below the roof.

Serious deterioration of stucco on north and east sides of building

Serious deterioration of stucco on east side of building

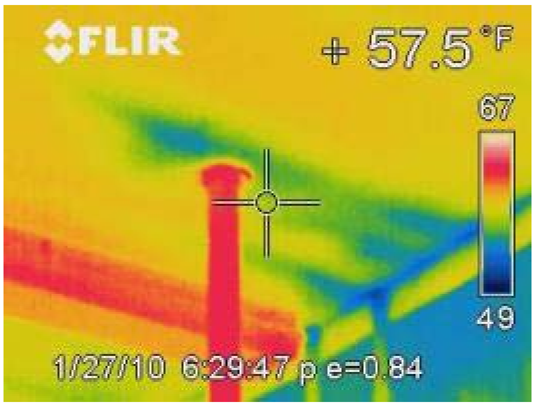
Based on the visual inspection it was noted that the stucco along the base of the south wall and east wall of Clear Well #2 was repaired with a patching material. The area surrounding Well Three is constantly flooded during the wet seasons, but the flood waters have not reached the floor elevation of either building, even during significant hurricanes. Animals such as ground hogs have been a persistent problem, burrowing below the slab.

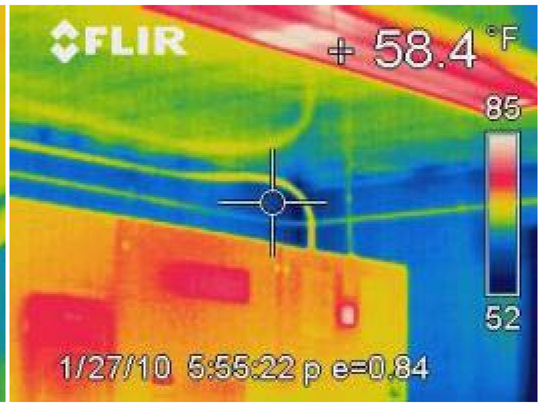
It is recommended that the stucco veneer of both Deep Well #1 and Clear Well #2 be repaired or replaced. Replacement would permit 1" rigid insulation board to be applied to the exterior of the CMU walls and a finished coat of stucco applied over the insulation.

Well House No. 4

The exterior walls of the Clear Well are constructed as a cavity wall with an exterior wythe of brick and interior wythe of acoustical CMU. The brick is in excellent condition. There are no windows on the exterior walls. The Deep Well is constructed with CMU walls and a stucco finish. It appears from the visual observation that the exterior walls are un-insulated. Since the Deep Well is connected to the pool building only two walls (north and east) are exposed exterior walls, the south and west walls are common to the pool building. At the S/W corner of the building there is a large crack through the structure. The IR image indicates the presence of moisture in the wall. There is also a large crack through the north wall at the joint connecting it to the pool building. Both conditions should be corrected with installation of an expansion joint cut into both walls.

Infrared Image at Southwest Corner at Ceiling





Infrared Images at Southwest Corner at Ceiling

Well House No. 9

The exterior walls of both buildings are cavity walls constructed of a double wyeth of brick on the exterior and CMU on the interior separated by a cavity. Although the cavity could not be inspected it is assumed there is 1' rigid insulation within the cavity. The exterior of both building is in excellent condition. The only identifiable flaw is a crack through the N/W wall of the Deep Well at the window sill.

Through Wall Crack In Northwest Wall Of Deep Well

Well House No. 11

The exterior wall construction of both the Clear Well and Deep Well is a conventional cavity wall with brick on the exterior wythe and CMU on the interior wythe. The interior CMU of the Clear Well building is acoustical block. The brick and block back-up is in excellent condition.

2.3.2. Roof

Well House No. 3

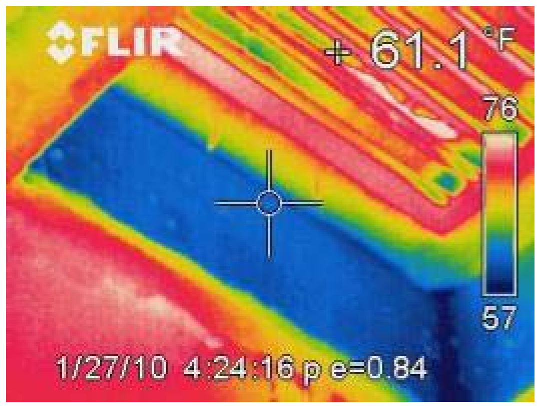
The roof of both Deep Well #1 and Clear Well #2 are single pitch sloped roofs constructed of poured-in-place reinforced concrete. Deep Well #1 has a liquid membrane applied over the concrete but has significant wear and has been spot patched. The ventilator on the roof sits on a curb but rain water has leaked into the building at the base and created water damage to the ceiling below. Clear Well #2 has a single ply EPDM membrane with two roof drains installed, each handling half of the roof surface.. Based on visual observation, significant ponding occurs and leaves clog the drains. There are two skylights and a large ventilator on the roof which appear to be water tight against the roof. No water damage was observed to the ceiling below. Neither building has roof gutters or downspouts.

Deep Well #1 has structural damage to the S/W corner which must be repaired.

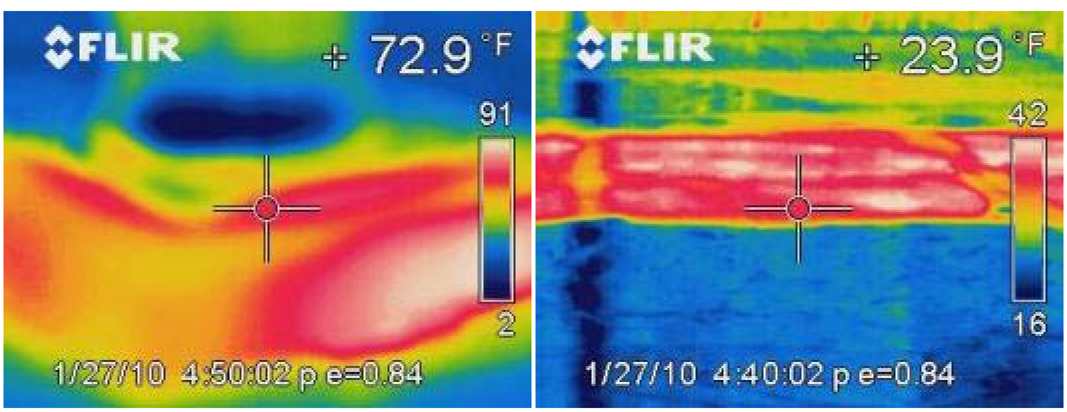
Deterioration of the coping on Deep Well #1

Water Pooling on Clear Well #2

Thermal images of both roofs indicate significant heat loss from the buildings.



Thermal Image of Clear Well Roof



Thermal Images of Deep Well Roof

It is recommended to repair the damaged coping on Deep Well #1 or install a pre-formed aluminum coping and replace the roofing material on both buildings with a single ply EPDM roof over rigid insulation. Clear Well #2 should have tapered insulation to direct rainwater to the drains.

Well House No. 4

The Clear Well building has a gabled roof with asphalt roof shingles in fair condition, over plywood roof sheathing and roof rafter at 16" o.c. There is a cupola mounted on the roof and a skylight. The attic is insulated with R-19 fiberglass batt insulation above the ceiling. However, the insulation is not properly installed to achieve 100% coverage. The attic space is properly vented with gable vents. There are gutters and downspouts properly installed and in good condition on the Clear Well. The roof of the Deep Well is a slightly sloping shed roof with asphalt roll roofing which is in good condition. There is indication of rain water leakage in the building since there is a piece of plywood at the ceiling along the south wall which was necessary because the ceiling was deteriorating from moisture.

Roof of Deep Well; Roof Joint at Pool Building

Digital Photo and Infrared Image of Plywood Panel

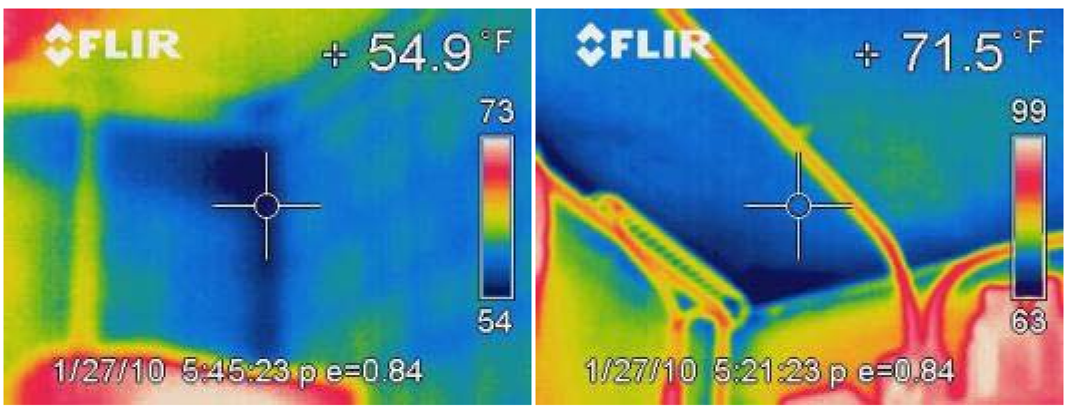
It is recommended that the Clear Well ceiling insulation be increased to a total R-value of R-30. The Deep Well building should have a layer of rigid roof installation installed below a new EPDM membrane.

Well House No. 9

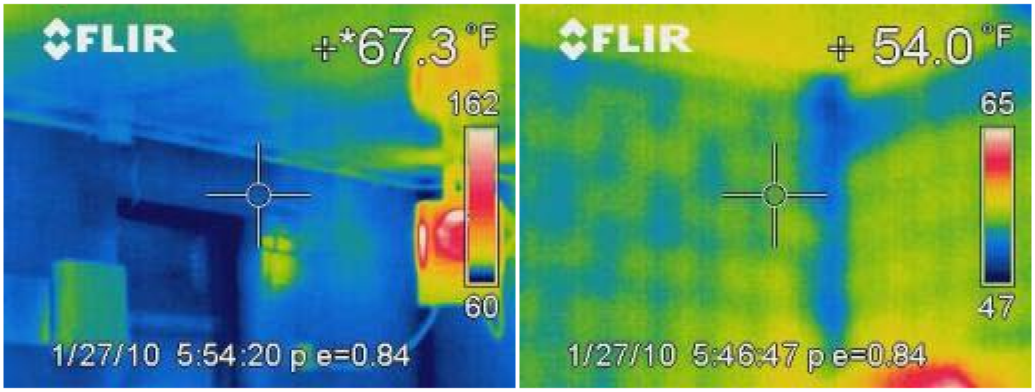
The roof of the Clear Well is asphalt shingles over plywood sheathing. The Clear Well building appears to have been re-roofed when the Deep Well was re-roofed. Gutters and downspouts are installed on the Clear Well Building. The ceiling of the attic space has R-11 fiberglass batt insulation. The attic space is properly vented with gable vents. The Deep Well building has a hip roof structure. It has asphalt roof shingles over plywood sheathing. The roof was built with large overhangs, a single gutter collects rainwater along the southwest elevation. The gutter slopes west with no end cap or downspout. Rainwater spills out the west end of the gutter. The ceiling of the Deep Well has R-19 fiberglass batt insulation.


Typical water damage at the ceiling of the Deep Well building

The skylight on Clear Well is single glazed and should be replaced with a double glazed unit.



Infrared Images – West Corner Clear Well; South Corner Clear Well



Infrared Images – North Corner Deep Well; South Corner Deep Well

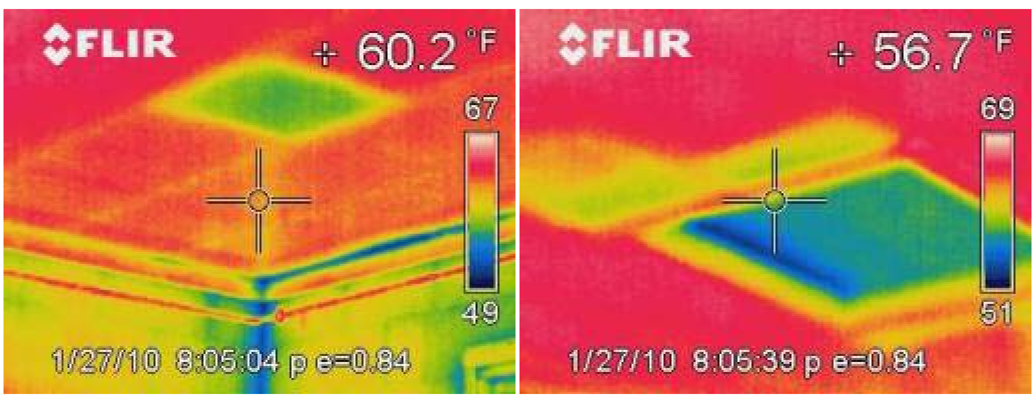
It is recommended that the insulation in both ceilings be increased to achieve an R-value of R-30.

Well House No. 11

The roof of the original building, Deep Well, was re-roofed when the new addition, Clear Well, was built. Both buildings have a random pattern asphalt roof shingle over plywood roof sheathing. The roofing material is in excellent condition. Gutters and Downspouts are installed completely around the perimeter. R-11 fiberglass batt insulation is installed in each building above the ceiling. The installation of the insulation was not careful to include 100% coverage. Attic ventilation is provided by gabled vents. There is a skylight on the Clear Well roof.

Skylights on both buildings are single glazed and should be replaced with double glazed units.

It is recommended to install additional ceiling insulation for a total R-value of R-30 and completely cover the entire surface. The access panels are un-insulated and should be boxed out with an insulated cover.



Infrared Images of Access Panels In Ceilings

2.3.3. Base

Well House No. 3

Both buildings are built slab-on-grade with wells below. The slabs are 8” thick and epoxy coated. Based on the visual observation there doesn’t appear to be any significant deterioration to the concrete. However, there is paint peeling at the base of the wall surrounding the storage room. This may have been caused by moisture, but no other conditions indicate a moisture problem.

Peeling Paint

Well House No. 4

The Clear Well is built on an 8” concrete base and is in excellent condition. The Deep Well has a basement stair alongside its east wall leading to a basement below the pool building. There is deterioration along the east wall below the floor line of the Deep Well.

Deterioration Below Floor Line along East Wall of Deep Well

Both buildings have epoxy flooring in good condition.

Well House No. 9

The buildings are slab-on-grade each built over a well. The flooring is an epoxy material in good condition. The threshold of the door is approximately 4” above grade to prevent surface rainwater from leaking into the buildings. Grading around both buildings slopes sufficiently away from the base of the building.

Well House No. 11

Both the Clear Well and Deep Well buildings are slab-on-grade with epoxy flooring. The threshold of the exterior doors is on grade, rather than elevated 4” – 8” to prevent rainwater from leaking into the building. However, there were no signs of water leakage under the door. There are no significant issues with the base.

2.3.4. Windows

Well House No. 3

Windows installed in Deep Well #1 are steel industrial single hung with single glazing and no thermal break. Significant water infiltration was noticed along the jamb of the window on the west wall. It is recommended to replace the windows with fixed aluminum frame windows with a thermal break, double glazed.

There were no windows in Clear Well #2, however the two skylights through the roof are single glazed and should be replaced with energy efficient double glazed units when the roof is replaced.

Window Jamb

Well House No. 4

The only windows are in the Deep Well building. They are clearstory wood framed hopper windows on the east wall. The windows should be replaced with fixed sash, aluminum frame, thermal broken, double glazed windows. The skylight on the Clear Building is single glazed and should be replaced with a double glazed unit.

Well House No. 9

The windows in Clear Well are blocked up. The windows in the Deep Well are single hung industrial steel frames with single glazing. It is recommended that the windows be replaced with fixed sash, aluminum framed windows with thermal break and double glazing.

Well House No. 11

The windows in both buildings are operable aluminum framed, double glazed. There are no significant issues with the windows. The skylight should be replaced.

2.3.5. Exterior doors

Well House No. 3

The exterior steel doors on Deep Well #1 are not insulated or weather-stripped. Replace the door assembly with insulated steel doors and steel frames. The insulated doors on Clear Well #2 are in need of replacing with an insulated metal door.

Well House No. 4

The exterior door to the Clear Well building is insulated but in need of replacement. The Deep Well steel door should be replaced with insulated steel doors and new steel frames with appropriate weather-stripping.

Well House No. 9

The exterior doors on the Clear Well building are insulated and Deep Well is un-insulated steel doors without weather-stripping. The doors should be replaced with steel clad insulated doors and steel frame, with weather-stripping.

Well House No. 11

The exterior doors are steel and un-insulated. Consideration should be given to replacing them with insulated steel doors.

2.3.6. Building air-tightness

Well House No. 3

Overall the field auditors found the building to be reasonably air-tight, considering the building's use and occupancy, as described in more detail earlier in this chapter.

In addition to all the above mentioned findings SWA recommends air sealing, caulking and/or insulating around all structural members, recessed lighting fixtures, electrical boxes that are part of or penetrate the exterior envelope and where air-leakage can occur.

The air tightness of buildings helps maximize all other implemented energy measures and investments and minimizes potentially costly long term maintenance/repair/replacement expenses.

Well House No. 4

The Clear Well building does not appear to have any significant air tightness issues. In general caulking and sealants should be applied around door and louver frames. There are issues with the Deep Well as mentioned previously with large cracks through the building at the joint with the pool building. These need to be saw cut and expansion joints installed. There are other cracks in the stucco finish on the north wall, and at the base on the east wall adjacent to the stair to the basement that must also be repaired. Caulking and sealants should be applied around doors and windows. There is a blocked up vent through the north wall that should be properly sealed against weather or removed entirely if not currently functional.

Large Crack Through Wall At Joint With Pool Building

Well House No. 9

There is a significant crack through the N/W wall of the Deep Well beside the window sill (see 2.4.2.1. Exterior Walls). This crack must be filled with expandable insulation foam. Generally the buildings should be caulked around each window and door opening and around wall louvers. There is a pipe penetration through the S/E wall of the Deep Well that needs to be sealed. On the S/E wall of Deep Well there is an exposed pipe stuffed with a cloth. The pipe should be properly capped. The base of the vent on the roof of Deep Well is severally rusted and causing staining of the roofing material. The base should be coated after the oxidizing material is cleaned away.

Well House No. 11

Generally, re-caulking and sealing around door frames, window frames, and louvers is recommended.

2.4. HVAC Systems

2.4.1 Well House #3 Buildings #1 and #2

General

Well house #3 is composed of two separate buildings, a Deep Well (Building #1) and a Clear Well (Building #2). The structures are heated and ventilated but they do not contain mechanical cooling. The ventilation system provides heat rejection for protection of the pumps and pump controls during the cooling season. There is no natural gas service at the site and there is a sizeable diesel emergency generator.

Heating

The heating for Building #1 is provided by a 7.5 kW electric unit heater that is mounted from the ceiling. The unit heater is controlled by a thermostat located on the pump control switchgear, opposite the front door. The unit heater is beyond its expected service life but is still in good condition.

Electric Unit Heater In Deep Well (Left) and Electric Baseboard in Clear Well

The heating for Building #2 is provided by two (2) wall-mounted electric baseboard heaters, one mounted on the North wall and one mounted on the East wall. Each heater is controlled by an integral thermostat with a dial selector on the front cover of the heater. The heaters are beyond their expected service life but are still in fair to good condition.

There does not appear to be a viable opportunity for energy cost savings with respect to the heating systems since there is no natural gas service available at the site. Conversion to propane-fired heaters was considered but is likely not a good option due to the round-the-clock operation of these buildings.

Cooling

The buildings do not contain any mechanical cooling systems. Heat rejection for the pumps and pump control panels and switchgear is provided by a roof-mounted exhaust fan with makeup air provided via window-mounted louvers. The fans are controlled by a wall-mounted thermostat.

Ventilation

Ventilation for the buildings is provided by a roof-mounted exhaust fan with makeup air provided via window-mounted louvers. Each fan is controlled a wall-mounted thermostat. The louvers and fan on Building #1 are original to the building. The louvers are in good condition, but the fans are in fair to poor condition. The louvers on Building #2 are original to the building and are in fair to good condition. The rooftop fan appears to have been replaced recently and is in good condition.

Rooftop Exhaust Fans for Deep Well (Left) and Clear Well Buildings

Domestic Hot Water

There is no domestic hot water system inside either of these buildings.

Process Equipment

The Deep Well Building contains one (1) 40 HP well pump with a premium efficiency, high thrust motor. In addition, the building contains a 2 HP air compressor that serves the pneumatic controls for the deep well pump. The air compressor is beyond its service life and savings can be realized by replacing the compressor motor with a premium efficiency motor.

The Clear Well Building contains two (2) 100HP motors that were installed in 1993. In addition, there are three (3) small, fractional horsepower chlorine injection pumps. Aside from this equipment, this facility contains (2) blowers that serve a Stripper Tower behind Building #2. These blowers are served by standard efficiency, 5 HP motors.

It was reported by the Water Department personnel that the water pumps operate from 5 to 15 hours per day on average, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an average operating time of 10 hours per day, or 3,650 hours per year. In addition, it is assumed that the stripper tower blowers operate for the same time approximately periods as the pumps.

Deep Well Pump (Left) and Clear Well Pumps (Right)

2.4.2 Well House #4

General

Well #4 is composed of two separate buildings, a Deep Well that is connected to a pool equipment building, and a Clear Well that is contained in a dedicated structure. The structures are heated and ventilated but they do not contain mechanical cooling. The ventilation system provides heat rejection for protection of the pumps and pump controls during the cooling season. There was no natural gas service noted at the site and there is no emergency generator. It is assumed that natural gas is available at this site if desired, since it is adjacent to Livingston High School, which has a natural gas service.

Heating

The Clear Well building is heated by a 10 kW electric unit heater that is suspended from the ceiling.. The unit heater is beyond its expected service life but is still in good condition. The Deep Well building is heated by a 7.5 kW electric unit heater that is suspended from the ceiling. The unit heater was installed in 1967 and is in fair to poor condition.

Photo – Electric Unit Heater (circa 1967) in Deep Well Building

Cooling

The buildings do not contain any mechanical cooling systems. Heat rejection for the Clear Well pumps is provided by two (2) wall-mounted exhaust fans located in the attic. The fans are controlled by a thermostat that located on the ground level.

Ventilation

Ventilation for the Clear Well building is provided by two (2) wall-mounted exhaust fans located in the attic. The makeup air for these fans enters the building via a wall-mounted louver. The fans and louver are in very good condition.

Ventilation for the Deep Well building is provided via a wall-mounted fan adjacent to the entry door. No intake louver was noted. This fan was in poor condition. SWA recommends that the fan is replaced with a fan containing a premium efficiency motor, and that a louver is installed to provide makeup air for the fan.

Domestic Hot Water

There is no domestic hot water system inside either of these buildings.

Process Equipment

The Deep Well Building contains one (1) 20 HP well pump with a standard efficiency motor. In addition, the building contains a 1 HP air compressor that serves the pneumatic controls for the deep well pump. The air compressor is beyond it service life and savings can be realized by replacing the compressor with a compressor that utilizes a premium efficiency motor.

The Clear Well Building contains one (1) 20 HP well pump that was installed in 1993. In addition, there is one (1) small, fractional horsepower chlorine injection pump. Aside from this equipment, this facility contains (3) blowers in a small closet. These blowers are served by standard efficiency, 10 HP motors.

It was reported by the Water Department personnel that the water pumps operate from 5 to 15 hours per day on average, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an average operating time of 10 hours per day, or 3,650 hours per year. In addition, it is assumed that the blowers operate for the same time approximately periods as the pumps.

2.4.3 Well House #9

General

Well #9 consists of two buildings, a Clear Well Building and a Deep Well Building. The structures are heated and ventilated but do not contain a mechanical cooling system. The ventilation system provides heat rejection for the two buildings.

Heating

The Clear Well and Deep Well buildings are each heated by an electric unit heater located in one corner of the building. The heaters are mounted on a wall bracket. The heaters are in very good condition and can be retained. The Township could see operating cost savings by replacing these heaters with gas-fired heaters, but there is no natural gas service at the facility so the cost of this measure could not be justified by the potential energy savings.

Cooling

The buildings do not contain any mechanical cooling systems.

Ventilation

Ventilation for each of the buildings is provided by one (1) roof-mounted exhaust fan, with makeup air provided via a wall-mounted louver (two (2) louvers total).

Domestic Hot Water

There are no domestic water heating systems in these buildings.

Process Equipment

The Deep Well Building contains one (1) 30 HP well pump with a standard efficiency motor. In addition, the building contains a 1 HP air compressor that serves the pneumatic controls for the deep well pump. The air compressor is beyond it service life and savings can be realized by replacing the compressor with a compressor that utilizes a premium efficiency motor.

The Clear Well Building contains one (1) 40 HP well pump that was installed in 1993. The pump motor is a premium efficiency unit. In addition, there are two (2) small, fractional horsepower chlorine injection pumps. Aside from this equipment, this facility contains one (1) blower ducted to an exterior stripper tower and also to a dedicated intake louver. This blower had no visible nameplate, but it is estimated that it is served by a standard efficiency, 5 HP motor.

Clear Well Pump Nameplate

It was reported by the Water Department personnel that the water pumps operate from 5 to 15 hours per day on average, depending on demand. For the purposes of calculating energy conservation measures, SWA will assume an average operating time of 10 hours per day, or 3,650 hours per year. In addition, it is assumed that the stripper tower blowers operate for the same time approximately periods as the pumps.

2.4.4 Well House #11

General

Well #11 consists of one building, with one portion of the building dedicated to Clear Well equipment and one portion of the building dedicated to Deep Well equipment. The structure is heated and ventilated but does not contain a mechanical cooling system. The ventilation system provides heat rejection for the building.

Heating

The Clear Well and Deep Well portions of the building are each heated by a 10 kW electric unit heater. In addition, there is a blower closet with a 3.3 kW electric unit heater, and an equipment closet with a 3 kW electric unit heater. The heaters are mounted on wall brackets. The heaters are in very good condition and can be retained. Since there is no natural gas service at the facility, the option of converting the unit heaters to the natural gas type was not investigated.

Electric Unit Heater

Cooling

The buildings do not contain any mechanical cooling systems.

Ventilation

Ventilation for each of the buildings is provided by two (2) roof-mounted exhaust fans, with makeup air provided via (3) wall-mounted louvers in the Deep Well area, and an additional wall louver adjacent to the Clear Well pump (four (4) louvers total).

Rooftop Exhaust Fans

Domestic Hot Water

There are no domestic water heating systems in these buildings.

Process Equipment

The Deep Well area contains one (1) 40 HP well pump with a standard efficiency motor. In addition, the building contains a 3/4 HP air compressor that serves the pneumatic controls for the deep well pump. The air compressor is beyond it service life and savings can be realized by replacing the compressor with a compressor that utilizes a premium efficiency motor.

The Clear Well area contains one (1) 20 HP well pump that was installed in 1993 and was rehabilitated in 2002. It is believed that this pump has a standard efficiency motor. Aside from this equipment, this facility contains two (2) blowers. These blowers are each served by a standard efficiency, 12.5 HP motor (two (2) motors total).

It was reported by the Water Department personnel that the water pumps operate from 5 to 15 hours per day on average, depending on demand. For the purposes of calculating engy conservation measures, SWA will assume an average operating time of 10 hours per day, or 3,650 hours per year. In addition, it is assumed that the blowers operate for the same time approximately periods as the pumps.

2.5. Electrical systems

2.5.1 Well House #3 Buildings #1 and #2

Lighting

Interior Lighting – The lighting for Building #1 consists of three (3) 8 ft long fluorescent fixtures and (3) 4 ft long fluorescent fixtures. The lighting for Building #2 consists of six (6) 4 ft long fluorescent fixtures. All fixtures utilize magnetic ballasts and two (2) T12 lamps. SWA recommends replacing these fixtures with more efficient T8 lamp fixtures (ECM #1). SWA also recommends installing an occupancy sensor to control the light fixtures to avoid the possibility of the fixtures being energized when the building is unoccupied.

Suspended T12 Fluorescent Light Fixture

Exit Lights – There are no exit lights in either facility.

Exterior Lighting – The exterior lighting consists of three (3) metal halide fixtures located in various places around the buildings. SWA is not recommending any upgrades at this time, to either fixtures or bulbs.

Appliances and Process

There are no appliances or process equipment, other than the equipment referenced in Section 2.4.1.6 above.

Emergency Generator

There is one (1) 558.5 KW diesel emergency generator on site. The generator serves the entire facility to provide continuous service during a power outage. This generator was installed in 1993 and is in good condition.

Emergency Generator at Well House #3

2.5.2 Well House #4

Lighting

Interior Lighting – The lighting for the Clear Well Building consists of eleven (11) 8 ft long fluorescent fixtures, three (3) of which are in the attic. The lighting for the Deep Well Building consists of one (1) 8 ft long fluorescent fixture and two (2) incandescent fixtures, approximately 100W each. Each fluorescent fixture utilizes a magnetic ballast and two (2) T12 lamps. SWA recommends replacing the fluorescent fixtures with more efficient T8 lamp fixtures (ECM #1), and the incandescent lamps with compact fluorescent lamps. SWA also recommends installing an occupancy sensor to control the light fixture to avoid the possibility of the fixtures being energized when the building is unoccupied.

Surface-mounted fluorescent Light Fixture

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – The exterior lighting consists of two (2) metal halide fixtures on the Clear Well Building, one above each entry door. SWA is not recommending any upgrades at this time, to either fixtures or bulbs.

Appliances and Process

There are no appliances or process equipment, other than the equipment referenced in Section 2.4.2.6 above.

Emergency Generator

There is no emergency generator on site.

2.5.3 Well House #9

Lighting

Interior Lighting – The lighting in the Deep Well Building consists of five (5) 4 ft long fluorescent fixtures that each utilize a magnetic ballast and two (2) T12 lamps. In addition, there are two (2) incandescent fixtures in the interior well. The lighting in the Clear Well Building consists of six (6) 4 ft long fluorescent fixtures that each utilize an magnetic ballast and two (2) T12 lamps. SWA recommends replacing the fluorescent fixtures with more efficient T8 lamp fixtures (ECM #1), and the incandescent lamps with compact fluorescent lamps. SWA also recommends installing an occupancy sensor to control the light fixtures to avoid the possibility of the fixtures being energized when the building is unoccupied.

Exit Lights – There are no exit lights in the facility.

Exterior Lighting – The exterior lighting consists of one (1) metal halide fixture mounted over the entry door to the Clear Well building. This fixture is in good condition. SWA is not recommending any upgrades at this time, to either fixtures or bulbs.

Surface-Mounted Fluorescent Light Fixture Above Pump Control Panel

Appliances and Process

There are no appliances or process equipment, other than the booster pumps referenced in Section 2.4.3.6 above.

Emergency Generator

There is one (1) 125KW diesel emergency generator located outside the Deep Well Building. The generator serves the entire facility to provide continuous service during a power outage. This generator was installed in 2004 and is in good condition.

Diesel Generator at Well House #9

2.5.4 Well House #11

Lighting

Interior Lighting – The lighting in the Deep Well area consists of four (4) 4 ft long fluorescent fixtures. The lighting in the Clear Well area consists of ten (10) 4 ft long fluorescent fixtures. All fixtures utilize magnetic ballasts and two (2) T12 lamps. In addition, there are one (1) 4 ft long fluorescent fixture each in the Blower Room and the Equipment Room. These fixtures are T8 type with electronic ballasts. SWA recommends replacing the T12 fluorescent fixtures with more efficient T8 lamp fixtures (ECM #1). SWA also recommends installing an occupancy sensor to control the light fixtures to avoid the possibility of the fixtures being energized when the building is unoccupied.

Exit Lights – There are three (3) exit lights in the facility.

Exit Sign

Exterior Lighting – The exterior lighting consists of two (2) metal halide fixtures mounted near the entry door to the Clear Well building. These fixtures are in good condition. SWA is not recommending any upgrades at this time, to either fixtures or bulbs.

Appliances and Process

There are no appliances or process equipment, other than the equipment referenced in Section 2.4.3.6 above.

Emergency Generator

There is one (1) 205 KW diesel emergency generator located outside the Clear Well Building. The generator serves the entire facility to provide continuous service during a power outage. This generator was installed in 2001 and is in good condition.

Diesel Generator

3. EQUIPMENT LIST

3.1. Well House #3 Building #1 and #2 - Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Emergency Power	Generator	Well House #3 Building 1	Caterpillar Model #3412 S# 81Z14313 558.5 KW	Diesel	Bldgs #1 & #2	1993	45%
Process - Deep Well Pump	Deep Well Pump	Well House #3 Building 1	No Nameplate Frame #324TP WP1 ID#W04W09804876T-01 Premium Efficiency High Thrust Motor - 40HP	Electric	N/A	1993	15%
Process - Deep Well Pump Controls	Air Compressor	Well House #3 Building 1	No Nameplate 2HP Motor	Electric	N/A	1993	15%
Ventilation	Exhaust Fan	Well House #3 Building 1	Jenn-Air Model #141 CR 115V-1phase, 9.0A	Electric	Building #1	1993	15%
Ventilation	Exhaust Fan	Well House #3 Building 1	Jenn-Air Model #120 AB 115V-1phase, 3.6A	Electric	Building #1	1993	15%
Heating	Electric Unit Heater	Well House #3 Building 1	Trane Model #UHEC073DACA 7.5KW	Electric	Building #1	1993	0% beyond expected useful life
Process - Stripper Tower	(2) Blowers	Well House #3 Building 2	Acme Model #3022 A/10 5HP	Electric	N/A	1993	15%
Process - Clear Well Pump	Clearwell Pump #1	Well House #3 Building 2	Worthington Size: 12M90A-5 Serial #93-70-100954-2 100HP	Electric	N/A	1993	15%
Process - Clear Well Pump	Clearwell Pump #2	Well House #3 Building 2	Worthington Size: 12M90A-5 Serial #93-70-100954-1 100HP	Electric	N/A	1993	15%

Process - Chlorine Pump	Chlorine Pump	Well House #3 Building 2	Stenner Model # 45MH2 115V-1 phase,1.7A	Electric	N/A	1993	15%

continued on the next page

Note: The remaining useful life of a system (in %) is an estimate based on the system date of built and existing conditions derived from visual inspection.

continued from the previous page

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Process - Chlorine Pump	(2) Chlorine Pumps	Well House #3 Building 2	Stenner Model # 85MH2 115V-1 phase,1.7A	Electric	N/A	1993	15%
Heating	Electric Baseboard Heater	Well House #3 Building 2	Chromalox Model #HCH4401 4.0KW	Electric	Building #2	1993	0% beyond expected useful life
Heating	Electric Baseboard Heater	Well House #3 Building 2	Chromalox Model #HCH3501 3.5KW	Electric	Building #2	1993	0% beyond expected useful life
Ventilation	Exhaust Fan	Well House #3 Building 2 Roof	Penn Ventilator Approx. 1HP	Electric	Building #1	Est. 2005	Est. 75%
Lighting	See details - Appendix A	Well House #3 Buildings 1 and 2	-	Electric	Well House #3 Buildings 1 and 2	-	

3.2 Well House #4 - Inventory

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Electric Unit Heater	Clear Well Pump Building	Trane Model # UHEC1030ACA 10 kW	Electric	Clear Well Pump Building	1993	0% beyond expected useful life
Ventilation	(2) Exhaust Fans	Clear Well Pump Building	No Visible Nameplate, approx 2 HP each	Electric	Clear Well Pump Building	1993	15%
Process	(3) Blowers	Clear Well Pump Building	EG&G Rotron Model #DRP75BC72C, 10 HP ea.	Electric	N/A	1993	15%
Process	Clear Well Pump	Clear Well Pump Building	Worthington Model #10122-4 Serial# 93-70-100953-1 20 HP	Electric	N/A	1993	15%
Process	Chlorine Pump	Clear Well Pump Building	Stenner Model# 45MH2 115V-1-phase, 1.7A	Electric	N/A	1993	15%
Heating	Electric Unit Heater	Deep Well Pump Building	Dayton Model 3E053 7.5 kW	Electric	Deep Well Pump Building	1967	0% beyond expected useful life
Ventilation	(1) Wall-Mounted Exhaust Fan	Deep Well Pump Building	No Visible Nameplate, fractional HP	Electric	Deep Well Pump Building	1993	15%

Process	Deep Well Pump	Deep Well Pump Building	Worthington, No Visible Model Number, 20 HP	Electric	N/A	1993	15%
Process	Air Compressor	Deep Well Pump Building	No manufacturer r Model Visible, 1 HP	Electric	N/A	1967	0% beyond expected useful life

3.3 Well House #9

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Heating	Electric Unit Heater	Clear Well Building	Trane, Model Number Not Visible, 7.5 kW	Electric	Clear Well Building	1993	0% beyond expected useful life
Ventilation	Exhaust Fan	Clear Well Building	Nameplate Not accessible, Approx. 1 Hp	Electric	Clear Well Building	1993	15%
Process	Clear Well Pump	Clear Well Building	Worthington Model #10M41-7 Serial #93-70-100256-1 40HP	Electric	N/A	1993	15%
Process	Blower Fan	Clear Well Building	Nameplate Not Accessible, Approx. 5 Hp	Electric	N/A	1993	15%
Process	Chlorine Pumps	Clear Well Building	Stenner, Fractional HP	Electric	N/A	1993	15%
Heating	Electric Unit Heater	Deep Well Building	Dayton Model #2E640B, 5kW	Electric	Deep Well Building	1993	0% beyond expected useful life
Ventilation	Exhaust Fan	Deep Well Building	Nameplate Not accessible, Approx. 1 Hp	Electric	Deep Well Building	1993	15%
Process	Deep Well Pump	Deep Well Building	Worthington, Nameplate Illegible, 30 HP	Electric	N/A	1993	15%
Process	Air Compressor	Deep Well Building	Gardner-Denver, 1 HP	Electric	N/A	1993	15%
Emergency Power	Emergency Generator	Facility	Cummins Model #DGDK-5669746 Serial #D040630299 125 kW	Diesel	N/A	2004	80%

3.4 Well House #9

Building System	Description	Location	Model #	Fuel	Space Served	Year Installed	Estimated Remaining Useful Life %
Process - Deep Well Pump	Deep Well Pump	Well House #11	Peerless Pumps Model#HO30V2BLE-C 40HP	Electric	N/A	2002	60%
Process - Deep Well Pump Controls	Air Compressor	Well House #11	Gardner-Denver Model #ADA100G 3/4HP Motor	Electric	N/A	1972	0% beyond expected useful life
Process - Clear Well Pump	Clear Well Pump	Well House #11	GA Industries No Model or Serial Visible 20HP	Electric	N/A	2002	60%
Ventilation	(2) Exhaust Fans	Well House #11	No Nameplate Observed Est. 2HP ea.	Electric	Well House #11	2002	60%
Heating	(2) Electric Unit Heaters	Well House #11	Trane Model #UHEC103DACA 10.0KW ea.	Electric	Well House #11	2002	40%
Heating	(2) Electric Unit Heaters	Well House #11	Trane Model #UHEC033DACA 3.3KW	Electric	Chemical Room, Blower Room	2002	40%
Emergency Power	Generator	Well House #11	Kohler M# 200RO2J S# 0718188 205 KW	Diesel	Well House #11	2002	75%
Lighting	See details - Appendix A	Well House #11	-	Electric	Well House #11	-	

4. ENERGY CONSERVATION MEASURES

Based on the assessment of the Well Houses, SWA has separated the investment opportunities into three recommended categories:

1. Capital Improvements – Upgrades not directly associated with energy savings
2. Operations and Maintenance – Low Cost/No Cost Measures
3. Energy Conservation Measures – Higher cost upgrades with associated energy savings

Category I Recommendations: - Capital Improvements

Well House #3

- Repair or replace stucco veneer with 1" rigid insulation on Deep Well Building and Clear Well Building. The estimated cost for this upgrade is $18,000.00
- Repair the damaged coping on Deep Well #1 or install pre-formed aluminum coping and replace the roofing materials on both buildings with a single ply EPDM roof over rigid insulation. The estimated cost for this upgrade is $12,500.00
- Apply tapered insulation on roof of Clear Well Building to direct rainwater to the drains. The estimated cost for this upgrade is $12,500.00
- Replace windows - SWA evaluated, as part of a capital improvement plan replacing the windows (3 single-pane) with newer fixed aluminum frame models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows. The estimated cost for this upgrade is $2,000.00. Window replacement rebates and tax incentives are available only for residential buildings at this time.
- Replace the skylights on the Clear Well Building with energy efficient, double glazed units. The estimated cost for this upgrade is $7,500.00.
- Replace door assembly on Deep Well 1 with insulated steel doors and steel frames. The estimated cost for this upgrade is $1,750.00.
- Replace doors on the Clear Well Building with insulated metal doors. The estimated cost for this upgrade is $1,750.00.
- Replace existing 2 HP air compressor with a more modern and energy efficient model. The estimated cost for this upgrade is $2,050.00.
- Replace electric unit heaters – the heaters are beyond their expected service life, although they are in relatively good condition and appear to be operating properly. This measure can be deferred if necessary.
- Replace exhaust fans – The rooftop exhaust fans are beyond their expected life and should be replaced with fans utilizing premium efficiency motors. Replacement will yield negligible energy savings since the fans are fractional horsepower. In addition, there is no NJ Clean Energy rebate available for this measure.

Well House #4

- Install expansion joints in both walls containing large cracks. The estimated cost for this upgrade is $1,500.00.
- Increase Clear Well Building ceiling insulation to R-30. The estimated cost for this upgrade is $500.00.

- Install a layer of rigid roof insulation below a new EPDM membrane. The estimated cost for this upgrade is $4,500.00.
- Repair crack at the base of the Deep Well Building. The estimated cost for this upgrade is $550.00.
- Replace windows - SWA evaluated, as part of a capital improvement plan replacing the windows (2 single-pane) on the Deep Well Building with newer fixed aluminum frame models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows. The estimated cost for this upgrade is $750, based on similar projects. Window replacement rebates and tax incentives are available only for residential buildings at this time.
- Replace the skylight on the Clear Well Building with energy efficient, double glazed unit. The estimated cost for this upgrade is $3,750.00.
- Replace doors on both buildings with insulated metal doors. The estimated cost for this upgrade is $1,350.00.
- Replace existing 1 HP air compressor with a more modern and energy efficient model. The estimated cost for this upgrade is $1,600.00.
- Replace electric unit heaters – the heaters are beyond their expected service life. The heaters in the Clear Well Building are in relatively good condition and appear to be operating properly. Replacement can be deferred if necessary. The heater in the Deep Well Building is over 30 years old and replacement is recommended. The estimated cost for this upgrade is $1,000.00.

Well House #9

- Install downspout on gutter of Deep Well Building. The estimated cost for this upgrade is $750.00.
- Replace the skylight on the Clear Well Building with energy efficient, double glazed unit. The estimated cost for this upgrade is $3,750.00.
- Increase ceiling insulation in both buildings to R-30. The estimated cost for this upgrade is $750.00.
- Replace windows - SWA evaluated, as part of a capital improvement plan replacing the windows on the Deep Well Building with newer fixed aluminum frame models with thermal breaks, dual glazing and a low-e rating. Proper flashing and caulking should be performed upon installation of the new windows. The estimated cost for this upgrade is $3,750, based on similar projects. Window replacement rebates and tax incentives are available only for residential buildings at this time.
- Replace door on the Deep Well Building with insulated metal door. The estimated cost for this upgrade is $1,350.00.
- Replace existing 1 HP air compressor with a more modern and energy efficient model. The estimated cost for this upgrade is $1,600.00.
- Replace electric unit heaters – the heaters are beyond their expected service life. The heaters in the Clear Well Building are in relatively good condition and appear to be operating properly. Replacement can be deferred if necessary.

Well House #11

- Replace the skylights on both buildings with energy efficient, double glazed units. The estimated cost for this upgrade is $7,500.00.
- Increase ceiling insulation in both buildings to R-30 and insulate roof access panels. The estimated cost for this upgrade is $1,000.00.
- Replace doors on both buildings with insulated metal doors. The estimated cost for this upgrade is $5,750.00.
- Replace existing 3/4 HP air compressor with a more modern and energy efficient model. The estimated cost for this upgrade is $1,300.00.

General

- Install premium motors when replacements are required - Select NEMA Premium motors when replacing motors that have reached the end of their useful operating lives.

Category II Recommendations: - Operations and Maintenance

- Maintain roofs – SWA recommends regular maintenance to verify that the rainwater is draining correctly.
- Maintain downspouts – Repair/install missing/disconnected/damaged downspouts as needed to prevent water/moisture infiltration and infiltration damage.
- Provide weather-stripping and air sealing – Doors should be observed annually for deficient weather-stripping and replaced as needed. Perimeter of all window frames should also be regularly inspected and any missing or deteriorated caulking should be re-caulked to provide an unbroken seal around the window frames. Any other accessible gaps or penetrations in the thermal envelope penetrations should be sealed with caulk or spray foam.
- Repair/seal wall cracks and penetrations – SWA recommends as part of the maintenance program to install weep holes, install proper flashing, correct masonry efflorescence and seal wall cracks and penetrations wherever necessary in order to keep insulation dry and effective.

Category III Recommendations: Energy Conservation Measures

ECM#	Description of Highly Recommended 0-5 Year Payback ECMs
1.2	4 New CFL fixtures to be installed with incentives
2.1	Replace (2) 100 Hp Clear Well pump motors with Premium Efficiency
2.2	Replace (2) 20 Hp pump motors with Premium Efficiency
2.3	Replace (1) 30 Hp Deep Well pump motor with Premium Efficiency
2.4	Replace (1) 40 Hp Deep Well pump motor with Premium Efficiency
2.5	Replace (1) 20 Hp Clear Well pump motor with Premium Efficiency
3.1	Replace (2) 5 Hp stripper fan motors with Premium Efficiency
3.3	Replace (1) 5 Hp stripper tower fan motor with Premium Efficiency
	Description of Recommended 5-10 Year Payback ECMs

1.3	**9 New pulse start metal halide fixtures to be installed with incentives**
3.2	**Replace (3) 10 Hp stripper tower fan motors with Premium Efficiency**
3.3	**Replace (2) 12.5 Hp blower motors with Premium Efficiency**

ECM#1: *Lighting Upgrades*

Description:

On the day of the site visit, SWA completed a lighting inventory of the Well Houses (see Appendix A). The existing lighting consists mostly of T12 fluorescent fixtures with magnetic ballasts, incandescent and metal halide lamps. Due to the lack of occupancy in the well houses and the low amount of operating hours many of the typical lighting retrofits that were analyzed have an insufficient payback and thus are not recommended. The labor in all these installations was evaluated using prevailing electrical contractor wages. The Township of Livingston may decide to perform this work with in-house resources from its Maintenance Department on a scheduled, longer timeline than otherwise performed by a contractor to obtain savings.

Installation cost:

Estimated installed cost: $11,254 (Includes $3,151 in labor)
Source of cost estimate: *RS Means; Published and established costs, NJ Clean Energy Program*

Economics (with incentives):

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
1.1	49 New T8 fixtures to be installed with incentives	RS Means, lit search	6,754	1,470	5,284	458	0.1	0	0.2	50	119	15	1,782	44.5	-66	-4	0	-3,886	628
1.2	4 New CFL fixtures to be installed with incentives	RS Means, lit search	22	0	22	58	0.0	0	0.0	18	27	5	134	0.8	511	102	120	100	80
1.3	9 New pulse start metal halide fixtures to be installed with incentives	RS Means, lit search	4,478	225	4,253	1,403	0.3	0	0.5	434	644	15	9,660	6.6	127	8	13	3,326	1,923
	Totals	**-**	**11,254**	**1,695**	**9,559**	**1,919**	**0.4**	**0**	**0.7**	**502**	**790**	**-**	**11,576**	**14.2**	**-**	**-**	**-**	**-460**	**2,631**

Assumptions: SWA calculated the savings for this measure using measurements taken the day of the site visits and using the billing analysis. SWA also assumed an aggregated 1 hr/yr to replace aging burnt out lamps vs. newly installed.

Rebates/financial incentives:
NJ Clean Energy – $15/fixtures for T12 to T8 Replacement; $25/fixture for incandescent to CFL replacement; $20/occupancy sensor Maximum incentive amount is $1,050.

Options for funding ECM:
This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#2: *Install Premium Efficiency Motors on Well Pumps*

Description:

The Well Houses contain Deep Well Pumps and Clear Well Pumps that service the domestic water distribution system for the Township. The following is a summary of the pumps in the Well Houses that are a part of this study:

Well House #3

- (1) 40 HP Deep Well Pump
- (2) 100 HP Clear Well Pumps

Well House #4

- (1) 20 HP Deep Well Pump
- (1) 20 HP Clear Well Pumps

Well House #9

- (1) 30 HP Deep Well Pump
- (1) 40 HP Clear Well Pumps

Well House #11

- (1) 40 HP Deep Well Pump
- (2) 20 HP Clear Well Pumps

In general, the pumps appear to be in relatively good condition. The Deep Well pump motor in Well House #3 and the Clear Well pump motor in Well House #9 are premium efficiency. The other pump motors are standard efficiency. The Township of Livingston will realize energy savings by utilizing premium efficiency motors for the other pumps.

Installation cost:

Estimated installed cost: $19,610 (Includes $6,860 in labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

Well House # 3

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.1	replace (2) 100 Hp Clear Well pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	11,390	800	10,590	19,466	4.1	0	106.3	0	3,037	20	60,734	3.5	474	24	28	34,588	26,668

Well House # 4

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.2	replace (2) 20 Hp pump motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	2,478	250	2,228	5,932	1.2	0	26.1	0	991	20	19,813	2.2	789	39	44	12,510	8,127

Well House #9

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.3	replace (1) 30 Hp Deep Well pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	1,958	150	1,808	4,165	0.9	0	22.7	0	662	20	13,245	2.7	633	32	37	8,044	5,706

Well House #11

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
2.4	replace (1) 40 Hp Deep Well pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	2,541	180	2,361	5,139	1.1	0	25.1	0	719	20	14,389	3.3	509	25	30	8,343	7,040
2.5	replace (1) 20 Hp Clear Well pump motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	1,239	125	1,114	2,966	0.6	0	14.5	0	415	20	8,305	2.7	645	32	37	5,064	4,063

Assumptions: SWA calculated the savings for this measure using nameplate data taken and using the billing analysis. The DOE Motor Master International selection and calculator was based on information from Water Department personnel that the pumps operate from 5-15 hours per day. Based on this information, SWA estimated that the pumps operate for approximately 3,650 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $1,505.

Options for funding ECM:
This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

ECM#3: Replace Stripper Tower Blower Fan Motors with Premium Efficiency Units

Description:

The Well Houses contain blowers that are part of the water treatment process at each facility. The following is a summary of the pumps in the Well Houses that are a part of this study:

Well House #3

- (2) 5 HP Blowers

Well House #4

- (3) 10 HP Blowers

Well House #9

- (1) 5 HP Blower

Well House #11

- (2) 12.5 HP Blowers

In general, the fans appear to be in relatively good condition. The fan motors are standard efficiency. The Township of Livingston will realize energy savings by utilizing premium efficiency motors for these fans.

Installation cost:

Estimated installed cost: $5,410 (Includes $2,160 in labor)
Source of cost estimate: Similar projects and DOE Motor Master International selection & savings analysis

Economics (with incentives):

Well House #3

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.1	replace (2) 5 Hp stripper fan motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	1,008	162	846	1,928	0.4	0	10.5	0	303	20	6,054	2.8	616	31	36	3,657	2,641

Well House #4

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.2	Replace (3) 10 Hp stripper tower fan motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	2,346	300	2,046	1,701	0.4	0	7.5	0	284	20	5,681	7.2	178	9	13	2,180	2,330

Well House #9

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.3	replace (1) 5 Hp stripper tower fan motor with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	504	54	450	964	0.2	0	5.3	0	153	20	3,066	2.9	581	29	34	1,830	1,321

Well House #11

ECM #	ECM description	source	est. installed cost, $	est. incentives, $	net est. ECM cost with incentives, $	kWh, 1st yr savings	kW, demand reduction/mo	therms, 1st yr savings	kBtu/sq ft, 1st yr savings	est. operating cost, 1st yr savings, $	total 1st yr savings, $	life of measure, yrs	est. lifetime energy cost savings, $	simple payback, yrs	lifetime return on investment, %	annual return on investment, %	internal rate of return, %	net present value, $	CO_2 reduced, lbs/yr
3.4	replace (2) 12.5 Hp blower motors with Premium Efficiency	similar projects, DOE International Motor Master selection & savings analysis	1,550	200	1,350	1,875	0.4	0	9.1	0	263	20	5,250	5.1	289	14	19	2,555	2,569

Assumptions: SWA calculated the savings for this measure using data taken the days of the field visits and using the billing analysis. . The DOE Motor Master International selection and calculator was based on similar operating hours as reported for the well pumps. Based on this information, SWA estimated that the pumps operate for approximately 3,000 hours per year.

Rebates/financial incentives:

NJ Clean Energy – Premium three-phase motors ($45-$700 per motor)
Maximum incentive amount is $716.

Options for funding ECM:

This project may benefit from enrolling in NJ SmartStart program with Technical Assistance to offset a portion of the cost of implementation.

http://www.njcleanenergy.com/commercial-industrial/programs/nj-smartstart-buildings/nj-smartstart-buildings

5. RENEWABLE AND DISTRIBUTED ENERGY SYSTEMS

Existing Systems

There aren't currently any existing renewable energy systems.

Wind

A Wind system is not applicable because the area does not have winds of sufficient velocity to justify installing a wind turbine system.

Solar Photovoltaic

Solar photovoltaic panels are not recommended due to the small sizes of these buildings and shadowing from surrounding foliage.

Solar Thermal Collectors

Solar thermal collectors are not cost effective for these building and would not be recommended due to the insufficient use of domestic hot water to justify the expenditure.

Combined Heat and Power

CHP is not applicable for these buildings because of several insufficient domestic hot water usage.

Geothermal

Geothermal is not applicable since these buildings do not have a need for cooling.

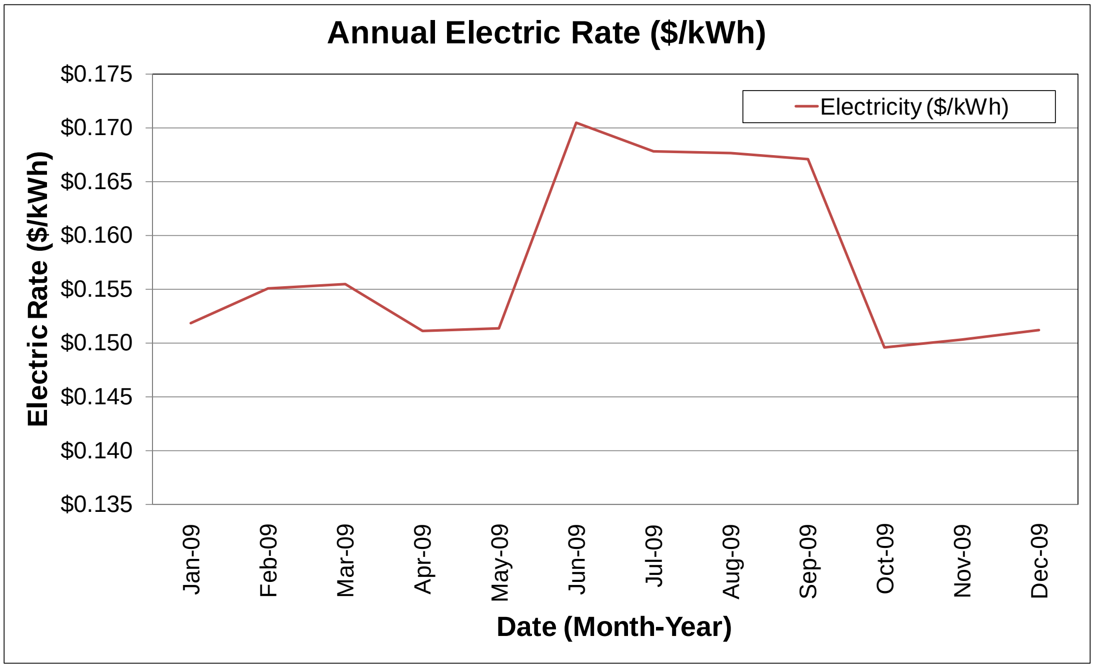
6. ENERGY PURCHASING AND PROCUREMENT STRATEGIES

6.1. Energy Purchasing

Well House No. 3

The Well House receives electricity purchased via one incoming meter directly for the well house from JCP&L without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 66% over the 12 month period between January 2009 and December 2009.

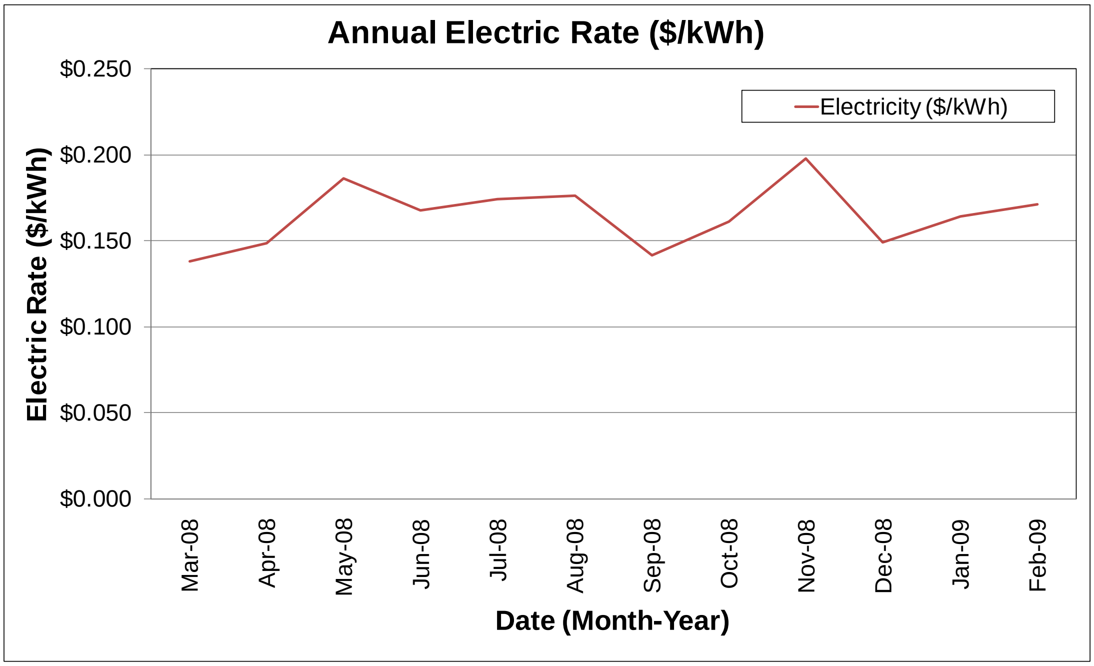
Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the well house is $0.157/kWh, which means there is a potential cost savings of $7,555. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the well house. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.



Well House No. 4

The Well House receives electricity purchased via one incoming meter directly for the well house from PSE&G without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 40% over the 12 month period between March 2008 and February 2009.

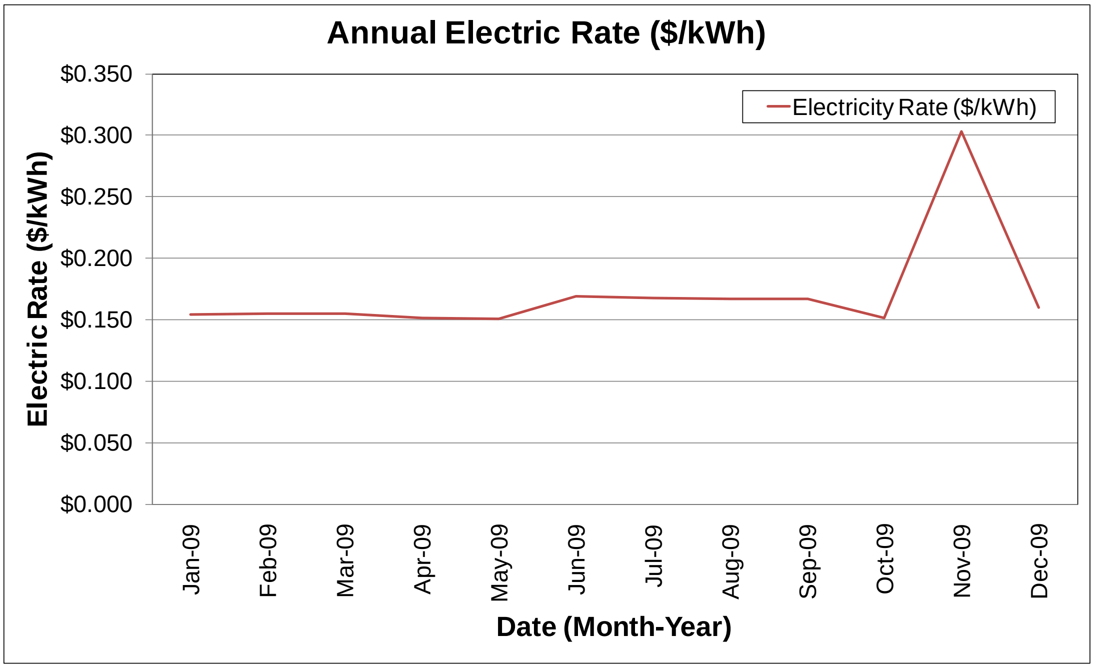
Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the well house is $0.167/kWh, which means there is a potential cost savings of $5,692. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the well house. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.



Well House No. 9

The Well House receives electricity purchased via one incoming meter directly for the well house from JCP&L without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 50% over the 12 month period between January 2009 and December 2009.

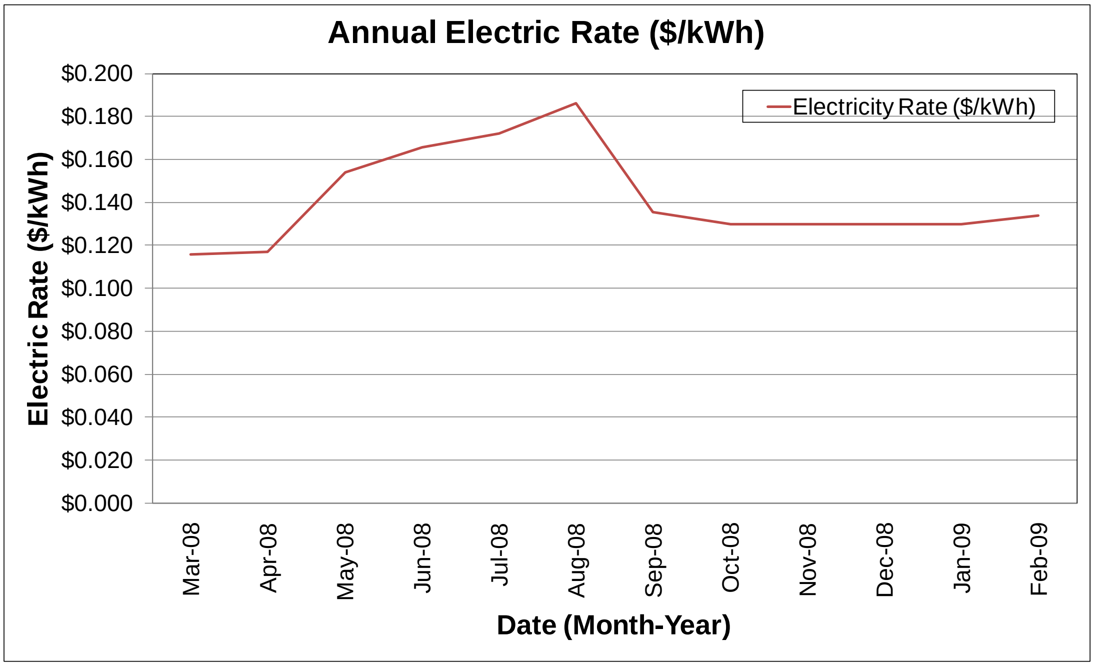
Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the well house is $0.159/kWh, which means there is a potential cost savings of $3,621. A large cost savings potential for electricity exists, however this involves contacting third party suppliers and negotiating utility rates. SWA recommends that the Township of Livingston further explore opportunities of purchasing electricity from third party energy suppliers in order to reduce rate fluctuation and ultimately reduce the annual cost of energy for the well house. Appendix B contains a complete list of third party energy suppliers for the Township of Livingston service area. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.



Well House No. 11

The Well House receives electricity purchased via one incoming meter directly for the well house from PSE&G without an ESCO. An Energy Services Company (ESCO) is a consultancy group that engages in a performance based contract with a client firm to implement measures which reduce energy consumption and costs in a technically and financially viable manner. SWA analyzed the utility rate for electricity supply over an extended period. Electric bill analysis shows fluctuations of 47% over the 12 month period between March 2008 and February 2009.

Currently, New Jersey commercial buildings of similar type pay $0.150/kWh for electricity. The electricity rate for the well house is $0.140/kWh, which means there is no potential cost savings as the pay below market rate. The Township of Livingston may want to consider partnering with other school districts, municipalities, townships and communities to aggregate a substantial electric and natural gas use for better leveraging in negotiations with ESCOs and of improving the pricing structures. This sort of activity is happening in many parts of the country and in New Jersey.



6.2. Energy Procurement strategies

Also, none of the well houses would be eligible for enrollment in a Demand Response Program, because there isn't the capability at this time to shed a minimum of 150 kW electric demand when requested by the utility during peak demand periods, which is the typical threshold for considering this option.

7. METHOD OF ANALYSIS

7.1. Assumptions and tools

Energy modeling tool:	Established / standard industry assumptions, DOE e-Quest
Cost estimates:	RS Means 2009 (Facilities Maintenance & Repair Cost Data) RS Means 2009 (Building Construction Cost Data) RS Means 2009 (Mechanical Cost Data) Published and established specialized equipment material and labor costs Cost estimates also based on utility bill analysis and prior experience with similar projects

7.2. Disclaimer

This engineering audit was prepared using the most current and accurate fuel consumption data available for the site. The estimates that it projects are intended to help guide the owner toward best energy choices. The costs and savings are subject to fluctuations in weather, variations in quality of maintenance, changes in prices of fuel, materials, and labor, and other factors. Although we cannot guarantee savings or costs, we suggest that you use this report for economic analysis of the building and as a means to estimate future cash flow.

THE RECOMMENDATIONS PRESENTED IN THIS REPORT ARE BASED ON THE RESULTS OF ANALYSIS, INSPECTION, AND PERFORMANCE TESTING OF A SAMPLE OF COMPONENTS OF THE BUILDING SITE. ALTHOUGH CODE-RELATED ISSUES MAY BE NOTED, SWA STAFF HAVE NOT COMPLETED A COMPREHENSIVE EVALUATION FOR CODE-COMPLIANCE OR HEALTH AND SAFETY ISSUES. THE OWNER(S) AND MANAGER(S) OF THE BUILDING(S) CONTAINED IN THIS REPORT ARE REMINDED THAT ANY IMPROVEMENTS SUGGESTED IN THIS SCOPE OF WORK MUST BE PERFORMED IN ACCORDANCE WITH ALL LOCAL, STATE, AND FEDERAL LAWS AND REGULATIONS THAT APPLY TO SAID WORK. PARTICULAR ATTENTION MUST BE PAID TO ANY WORK WHICH INVOLVES HEATING AND AIR MOVEMENT SYSTEMS, AND ANY WORK WHICH WILL INVOLVE THE DISTURBANCE OF PRODUCTS CONTAINING MOLD, ASBESTOS, OR LEAD.

Appendix A: Lighting Study of the Well Houses

Location			Existing Fixture Information												Retrofit Information													Annual Savings		
Marker	Floor	Room Identification	Fixture Type	Ballast	Lamp Type	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Controls	Operational Hours per Day	Operational Days per Year	Ballast Wattage	Total Watts	Energy Use kWh/year	Category	Fixture Type	Lamp Type	Ballast	Controls	# of Fixtures	# of Lamps per Fixture	Watts per Lamp	Operational Hours per Day	Operational Days per Year	Ballast Watts	Total Watts	Energy Use kWh/year	Fixture Savings (kWh)	Controls Savings (kWh)	Total Savings (kWh)
1	1	Well House	Ceiling Suspended	M	8'T12	3	2	80	Sw	1	365	20	540	197	T8	Ceiling Suspended	8'T8	E	Sw	3	2	59	1	365	7	375	137	60	0	60
2	1	Well House	Ceiling Suspended	M	4'T12	3	2	40	Sw	1	365	12	276	101	T8	Ceiling Suspended	4'T8	E	Sw	3	2	32	1	365	5	207	76	25	0	25
3	1	Well House	Ceiling Suspended	M	4'T12	6	2	40	Sw	1	365	12	552	201	T8	Ceiling Suspended	4'T8	E	Sw	6	2	32	1	365	5	414	151	50	0	50
4	1	Exterior	Flood	S	MH	3	1	70	PC	12	365	20	269	1,177	PSMH	Flood	PSMH	S	PC	3	1	45	12	365	9	162	710	468	0	468
5	1	Well House	Wall Mounted	M	4'T12	8	2	40	Sw	1	365	12	736	269	T8	Wall Mounted	4'T8	E	Sw	8	2	32	1	365	5	552	201	67	0	67
6	Attic	Well House	Wall Mounted	M	4'T12	3	2	40	Sw	1	365	12	276	101	T8	Wall Mounted	4'T8	E	Sw	3	2	32	1	365	5	207	76	25	0	25
7	1	Well House	Ceiling Suspended	M	8'T12	1	2	80	Sw	1	365	20	180	66	T8	Ceiling Suspended	8'T8	E	Sw	1	2	59	1	365	7	125	46	20	0	20
8	1	Well House	Wall Mounted	S	Inc	1	1	60	Sw	1	365	0	60	22	CFL	Wall Mounted	CFL	S	Sw	1	1	20	1	365	0	20	7	15	0	15
9	1	Exterior	Flood	S	MH	2	1	70	PC	12	365	20	179	785	PSMH	Flood	PSMH	S	PC	2	1	45	12	365	9	108	473	312	0	312
10	1	Well House	Wall Mounted	M	4'T12	6	2	40	Sw	1	365	12	552	201	T8	Wall Mounted	4'T8	E	Sw	6	2	32	1	365	5	414	151	50	0	50
11	1	Well House	Wall Mounted	M	4'T12	5	2	40	Sw	1	365	12	460	168	T8	Wall Mounted	4'T8	E	Sw	5	2	32	1	365	5	345	126	42	0	42
12	1	Well House	Wall Mounted	S	Inc	3	1	60	Sw	1	365	0	180	66	CFL	Wall Mounted	CFL	S	Sw	3	1	20	1	365	0	60	22	44	0	44
13	1	Exterior	Flood	S	MH	2	1	70	PC	12	365	20	179	785	PSMH	Flood	PSMH	S	PC	2	1	45	12	365	9	108	473	312	0	312
14	1	Well House	Wall Mounted	M	4'T12	14	2	40	Sw	1	365	12	1,288	470	T8	Wall Mounted	4'T8	E	Sw	14	2	32	1	365	5	966	353	118	0	118
15	1	Well House	Wall Mounted	S	4'T8	2	2	32	Sw	1	365	5	138	50	N/A	Wall Mounted	4'T8	S	Sw	2	2	32	1	365	5	138	50	0	0	0
16	1	Exterior	Flood	S	MH	2	1	70	PC	12	365	20	179	785	PSMH	Flood	PSMH	S	PC	2	1	45	12	365	9	108	473	312	0	312
Totals:						64	26	872				207	6,044	5,444						64	26	594			90	4,309	3,524	1,920	0	1,920

Rows Highlighed Yellow Indicate an Energy Conservation Measure is recommended for that space

Legend

Fixture Type	Lamp Type	Control Type	Ballast Type	Retrofit Category
Exit Sign	LED	N (None)	N/A (None)	N/A (None)
Screw-in	Inc (Incandescent)	S (Switch)	E (Electronic)	T8 (Install new T8)
Pin	1'T5	OS (Occupancy Sensor)	M (Magnetic)	T5 (Install new T5)
Parabolic	2'T5	T (Timer)		CFL (Install new CFL)
Recessed	3'T5	PC (Photocell)		LEDex (Install new LED Exit)
2'U-shape	4'T5	D (Dimming)		LED (Install new LED)
Circline	2'T8	DL (Daylight Sensor)		D (Delamping)
Exterior	3'T8	M (Microphonic Sensor)		C (Controls Only)
	4'T8			PSMH (Install new Pulse-Start Metal Halide)
	6'T8			
	8'T8			
	2'T12			
	3'T12			
	4'T12			
	6'T12			
	8'T12			
	CFL (Compact Fluorescent Lightbulb)			
	Hal (Halogen)			
	MV (Mercury Vapor)			
	MH (Metal Halide)			
	HPS (High Pressure Sodium			
	FL (Fluorescent)			

Appendix B: Third Party Energy Suppliers (ESCOs)

http://www.state.nj.us/bpu/commercial/shopping.html

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
American Powernet Management, LP 437 North Grove St. Berlin, NJ 08009	(877) 977-2636 www.americanpowernet.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
ConEdison Solutions 535 State Highway 38 Cherry Hill, NJ 08002	(888) 665-0955 www.conedsolutions.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Credit Suisse, (USA) Inc. 700 College Road East Princeton, NJ 08450	(212) 538-3124 www.creditsuisse.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Metro Energy Group, LLC 14 Washington Place Hackensack, NJ 07601	(888) 536-3876 www.metroenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com

Third Party Electric Suppliers for PSEG Service Territory	Telephone & Web Site
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Sprague Energy Corp. 12 Ridge Road Chatham Township, NJ 07928	(800) 225-1560 www.spragueenergy.com
Strategic Energy, LLC 55 Madison Avenue, Suite 400 Morristown, NJ 07960	(888) 925-9115 www.sel.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Third Party Electric Suppliers for JCPL Service Territory	Telephone & Web Site
Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095	(800) 437-7872 www.hess.com
BOC Energy Services, Inc. 575 Mountain Avenue Murray Hill, NJ 07974	(800) 247-2644 www.boc.com
Commerce Energy, Inc. 4400 Route 9 South, Suite 100 Freehold, NJ 07728	(800) 556-8457 www.commerceenergy.com
Constellation NewEnergy, Inc. 900A Lake Street, Suite 2 Ramsey, NJ 07446	(888) 635-0827 www.newenergy.com
Direct Energy Services, LLC 120 Wood Avenue, Suite 611 Iselin, NJ 08830	(866) 547-2722 www.directenergy.com
FirstEnergy Solutions 300 Madison Avenue Morristown, NJ 07926	(800) 977-0500 www.fes.com
Glacial Energy of New Jersey, Inc. 207 LaRoche Avenue Harrington Park, NJ 07640	(877) 569-2841 www.glacialenergy.com
Integrys Energy Services, Inc. 99 Wood Ave, South, Suite 802 Iselin, NJ 08830	(877) 763-9977 www.integrysenergy.com
Liberty Power Delaware, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(866) 769-3799 www.libertypowercorp.com
Liberty Power Holdings, LLC Park 80 West Plaza II, Suite 200 Saddle Brook, NJ 07663	(800) 363-7499 www.libertypowercorp.com
Pepco Energy Services, Inc. 112 Main St. Lebanon, NJ 08833	(800) 363-7499 www.pepco-services.com
PPL EnergyPlus, LLC 811 Church Road Cherry Hill, NJ 08002	(800) 281-2000 www.pplenergyplus.com
Sempra Energy Solutions 581 Main Street, 8th Floor Woodbridge, NJ 07095	(877) 273-6772 www.semprasolutions.com
South Jersey Energy Company One South Jersey Plaza, Route 54 Folsom, NJ 08037	(800) 756-3749 www.southjerseyenergy.com
Suez Energy Resources NA, Inc. 333 Thornall Street, 6th Floor Edison, NJ 08837	(888) 644-1014 www.suezenergyresources.com
UGI Energy Services, Inc. 704 East Main Street, Suite 1 Moorestown, NJ 08057	(856) 273-9995 www.ugienergyservices.com

Appendix C: Glossary and Method of Calculations

Glossary of ECM Terms

Net ECM Cost: The net ECM cost is the cost experienced by the customer, which is typically the total cost (materials + labor) of installing the measure minus any available incentives. Both the total cost and the incentive amounts are expressed in the summary for each ECM.

Annual Energy Cost Savings (AECS): This value is determined by the audit firm based on the calculated energy savings (kWh or Therm) of each ECM and the calculated energy costs of the building.

Lifetime Energy Cost Savings (LECS): This measure estimates the energy cost savings over the lifetime of the ECM. It can be a simple estimation based on fixed energy costs. If desired, this value can factor in an annual increase in energy costs as long as the source is provided.

Simple Payback: This is a simple measure that displays how long the ECM will take to break-even based on the annual energy and maintenance savings of the measure.

ECM Lifetime: This is included with each ECM so that the owner can see how long the ECM will be in place and whether or not it will exceed the simple payback period. Additional guidance for calculating ECM lifetimes can be found below. This value can come from manufacturer's rated lifetime or warranty, the ASHRAE rated lifetime, or any other valid source.

Operating Cost Savings (OCS): This calculation is an annual operating savings for the ECM. It is the difference in the operating, maintenance, and / or equipment replacement costs of the existing case versus the ECM. In the case where an ECM lifetime will be longer than the existing measure (such as LED lighting versus fluorescent) the operating savings will factor in the cost of replacing the units to match the lifetime of the ECM. In this case or in one where one-time repairs are made, the total replacement / repair sum is averaged over the lifetime of the ECM.

Return on Investment (ROI): The ROI is expresses the percentage return of the investment based on the lifetime cost savings of the ECM. This value can be included as an annual or lifetime value, or both.

Net Present Value (NPV): The NPV calculates the present value of an investment's future cash flows based on the time value of money, which is accounted for by a discount rate (assumes bond rate of 3.2%).

Internal Rate of Return (IRR): The IRR expresses an annual rate that results in a break-even point for the investment. If the owner is currently experiencing a lower return on their capital than the IRR, the project is financially advantageous. This measure also allows the owner to compare ECMs against each other to determine the most appealing choices.

Calculation References

ECM = Energy Conservation Measure
AOCS = Annual Operating Cost Savings
AECS = Annual Energy Cost Savings
LOCS = Lifetime Operating Cost Savings
LECS = Lifetime Energy Cost Savings
LCS = Lifetime Cost Savings

NPV = Net Present Value
IRR = Internal Rate of Return
DR = Discount Rate

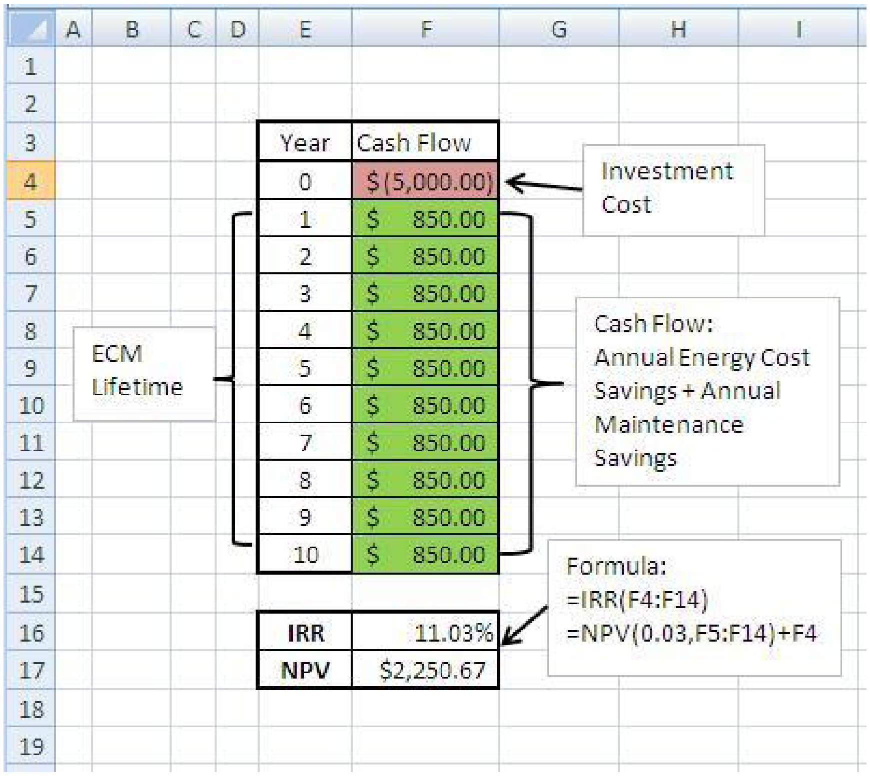
Net ECM Cost = Total ECM Cost – Incentive
LECS = AECS X ECM Lifetime
AOCS = LOCS / ECM Lifetime
LCS = LOCS+LECS

Note: The lifetime operating cost savings are all avoided operating, maintenance, and / or component replacement costs over the lifetime of the ECM. This can be the sum of any annual operating savings, recurring or bulk (i.e. one-time repairs) maintenance savings, or the savings that comes from avoiding equipment replacement needed for the existing measure to meet the lifetime of the ECM (e.g. lighting change outs).

Simple Payback = Net ECM Cost / (AECS + AOCS)
Lifetime ROI = (LECS + LOCS – Net ECM Cost) / Net ECM Cost
Annual ROI = (Lifetime ROI / Lifetime) = (AECS + OCS) / Net ECM Cost – 1 / Lifetime
It is easiest to calculate the NPV and IRR using a spreadsheet program like Excel.

Excel NPV and IRR Calculation

In Excel, function =IRR(values) and =NPV(rate, values) are used to quickly calculate the IRR and NPV of a series of annual cash flows. The investment cost will typically be a negative cash flow at year 0 (total cost - incentive) with years 1 through the lifetime receiving a positive cash flow from the annual energy cost savings and annual maintenance savings. The calculations in the example below are for an ECM that saves $850 annually in energy and maintenance costs (over a 10 year lifetime) and takes $5,000 to purchase and install after incentives:



ECM and Equipment Lifetimes

Determining a lifetime for equipment and ECM's can sometimes be difficult. The following table contains a list of lifetimes that the NJCEP uses in its commercial and industrial programs. Other valid sources are also used to determine lifetimes, such as the DOE, ASHRAE, or the manufacturer's warranty.

Lighting is typically the most difficult lifetime to calculate because the fixture, ballast, and bulb can all have different lifetimes. Essentially the ECM analysis will have different operating cost savings (avoided equipment replacement) depending on which lifetime is used.

When the bulb lifetime is used (rated burn hours / annual burn hours), the operating cost savings is just reflecting the theoretical cost of replacing the existing case bulb and ballast over the life of the recommended bulb. Dividing by the bulb lifetime will give an annual operating cost savings.

When a fixture lifetime is used (e.g. 15 years) the operating cost savings reflects the avoided bulb and ballast replacement cost of the existing case over 15 years minus the projected bulb and ballast replacement cost of the proposed case over 15 years. This will give the difference of the equipment replacement costs between the proposed and existing cases and when divided by 15 years will give the annual operating cost savings.

NJCEP C & I Lifetimes

Measure	Measure Life
Commercial Lighting — New	15
Commercial Lighting — Remodel/Replacement	15
Commercial Custom — New	18
Commercial Chiller Optimization	18
Commercial Unitary HVAC — New - Tier 1	15
Commercial Unitary HVAC — Replacement - Tier 1	15
Commercial Unitary HVAC — New - Tier 2	15
Commercial Unitary HVAC — Replacement Tier 2	15
Commercial Chillers — New	25
Commercial Chillers — Replacement	25
Commercial Small Motors (1-10 HP) — New or Replacement	20
Commercial Medium Motors (11-75 HP) — New or Replacement	20
Commercial Large Motors (76-200 HP) — New or Replacement	20
Commercial VSDs — New	15
Commercial VSDs — Retrofit	15
Commercial Comprehensive New Construction Design	18
Commercial Custom — Replacement	18
Industrial Lighting — New	15
Industrial Lighting — Remodel/Replacement	15
Industrial Unitary HVAC — New - Tier 1	15
Industrial Unitary HVAC — Replacement - Tier 1	15
Industrial Unitary HVAC — New - Tier 2	15
Industrial Unitary HVAC — Replacement Tier 2	15
Industrial Chillers — New	25
Industrial Chillers — Replacement	25
Industrial Small Motors (1-10 HP) — New or Replacement	20
Industrial Medium Motors (11-75 HP) — New or Replacement	20
Industrial Large Motors (76-200 HP) — New or Replacement	20
Industrial VSDs — New	15
Industrial VSDs — Retrofit	15
Industrial Custom — Non-Process	18
Industrial Custom — Process	10
Small Commercial Gas Furnace — New or Replacement	20
Small Commercial Gas Boiler — New or Replacement	20
Small Commercial Gas DHW — New or Replacement	10
C&I Gas Absorption Chiller — New or Replacement	25
C&I Gas Custom — New or Replacement (Engine Driven Chiller)	25
C&I Gas Custom — New or Replacement (Gas Efficiency Measures)	18
O&M savings	3
Compressed Air (GWh participant)	8