Energy Cost
Reduction Plan

St. John's Memorial Episcopal Church
40 Market Street
Ellenville, NY 12428

July 26, 2014

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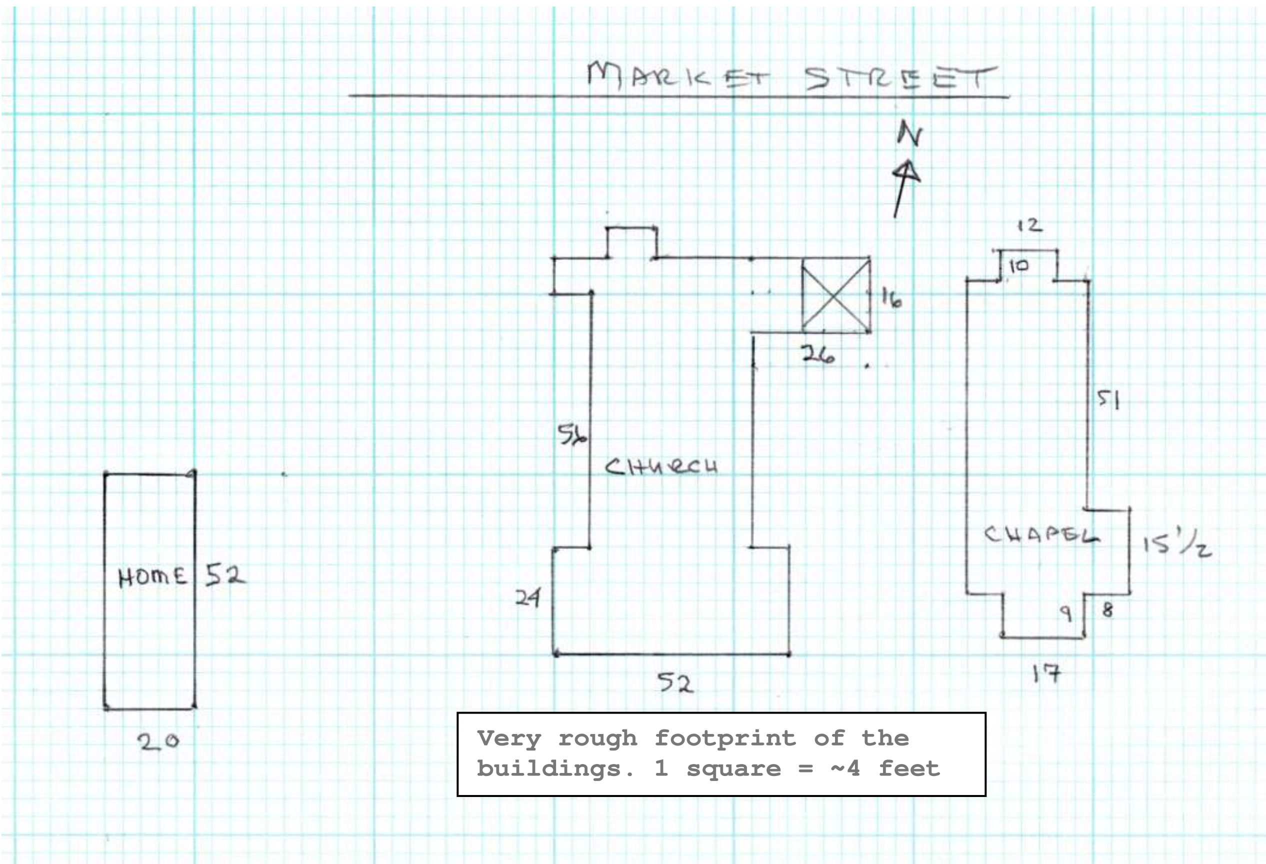
Description:

Description of the Facilities

I visited St. John's Church on July 23, 2014. The parish has three buildings – a church, chapel and rented house. All of their roofs are covered with asphalt shingles. The windows in the chapel and church have second layers of glazing.



Very rough footprint of the buildings. 1 square = ~4 feet

The chapel was built in 1866 as the original church. Its interior was completely renovated in 1993. The chapel now contains a single floor on a concrete slab and with a furnace room that is accessible only from the outside, two smaller rooms on the northern end of the building, a reception area on the south end, and a mostly open multipurpose space in between. The floor area of the chapel building is about 2,000 square feet. Walls are stucco-covered, thick masonry. The ceiling is insulated, but the insulation needs to be re-done because parts have fallen down.

The church was built in 1874 as a single story, wood-framed building containing a nave, chancel, office and sacristy. In the 1950s, the basement undercroft was excavated, creating a full basement containing a kitchen, two restrooms, and a multipurpose room roughly divided into a chapel area and conference area. The floor area of the church is about 7,400 square feet. Its cathedral ceiling is not insulated.

The rented house is a double-wide modular home moved onto the property in the late 1950s to replace an existing rectory. Its basement is open unheated storage space and laundry, with a garage door on one end. The first floor has a living-dining area, kitchen, bedroom, office, bathroom and powder room. The floor area of this house is about 1,000 square feet, excluding the unheated basement.

In July 2012, substantial mold was found in the basement ceiling insulation and floor joists. It was removed, along with a portion of the first floor ceiling and insulation above the stairway to the first floor. This allows heated air to escape into the attic space, bypassing the ceiling insulation over the rest of the first floor.

Description of Facility Use

The worship space is generally not used between Christmas and Easter. Services are held in the undercroft chapel area instead. Sunday worship is from 10am to noon for about 60 participants. The undercroft is also used for Alcoholics Anonymous and Narcotics Anonymous meetings Monday, Tuesday and Wednesday evenings with about 30 participants each.

The chapel is rented to a music education program. One of the two rooms on the northern end is used as a practice room, and the other is used as an office and storage. The main multipurpose space is used for lessons and performances. The building is not used overnight.

The rented house is the full time residence of one occupant who works during the day during the school year.

Description of the Energy Systems

The church and chapel share electric meters. Water to both buildings is measured through a meter in the church boiler room, and then submetered in the boiler room to each building.

The rented house is all-electric and separately metered. Electricity is purchased from Central Hudson Gas and Electric Corporation and from a third party supplier -- Hudson Energy Services -- whose costs are not included in my tally of the home's electricity use. Natural gas is not available from the utility for any of the buildings.

The church and chapel have separate oil storage tanks. The church is heated by a pair of oil-fired Baisi model B/40, 7-section cast iron sectional hot water boilers piped in parallel. Inspection documents in the boiler room show they were installed in 2007. The instructions for this boiler are at **http://www.qhtinc.com/wp/wp-content/uploads/2013/08/B-40-Installation-Manual.pdf**. I have included several pages from that manual in the Supplements section of this report.

My tests of the flue gases from each boiler revealed that the steady-state combustion efficiency for the boiler on the left was 87%. That for the right was 83%. The boilerplate efficiency of each is about 86.7%.

The rector and I opened a louvered window to introduce combustion air into the boiler room. One of the sheets in the Supplements shows the manufacturer's recommendations for combustion air.

Another sheet states that no barometric damper is required on this boiler unless it is attached to a chimney that creates high suction. No barometric damper was installed. The chimney is about 40 feet high, but I measured only -0.04 inches water column of suction when it was about 90°F outside. That chimney suction may increase during the cold weather.

The church heating distribution system has two zones, each with an independent circulator. A standard, manual thermostat controls temperature in the nave. The thermostat for the undercroft is controlled by a pair of manual thermostats. Labels state that one is for unoccupied temperatures and the other for occupied. The face of the locked thermostat box has a wind-up timer that apparently was meant to shift control from the lower unoccupied temperature (currently 50°F) to the higher one (currently 68°). The function of the low limit thermostat is to prevent freezing water in pipes, but neither the boiler nor circulator responded to my raising the temperature of the low limit thermostat. Instead, the boilers were already hot when I arrived, and an oil burner fired while I was there to maintain water temperature when there was no call for heat from either thermostat.

A small, wall-mounted electric fan coil unit heats the first floor office. There is no air conditioning in the church, but the nave has ceiling fans. Cooking is with a 10-burner, 2-oven commercial propane range. The exit signs in both the church and chapel are lit with light emitting diodes. The church kitchen has several fluorescent ceiling fixtures that use the more efficient T-8 tubes and electronic ballasts. Some of the incandescent bulbs have been replaced with compact fluorescent lamps. Domestic hot water is heated electrically.

The chapel is heated by an oil-fired Newmac model NL2DD warm air furnace controlled by the same type of thermostat configuration as in the undercroft, except that the controls are open and the wind-up timer disconnected from the face of the thermostat locking cover. The flue pipe was so badly corroded that a piece of it dropped onto the floor by my merely touching it. Therefore, I could not test the efficiency of this appliance.

There is no air conditioning in the chapel, but there are ceiling fans. The dimmable 75-watt incandescent bulbs can be replaced with light emitting diode lamps. A small electric water heater in a corner of the restroom heats domestic hot water. The reception area has a small refrigerator and microwave oven.

The rental home is all electric – for cooking food, drying clothes, space heat, domestic hot water, dehumidification, etc.

Evaluation:

The energy used by St. John's Church is in the section of this report labeled "Energy Data." Those data are summarized in the table below:

ENERGY PERFORMANCE ANALYSIS

Building (area)	Energy	Units	Cost	BTU/SF/Yr	%E	$/SF/Yr	%$
Church	#2 Fuel Oil	3,248	$12,772	60,571		$1.73	
7,400	Propane	13	$65	161		$0.01	
Chapel	#2 Fuel Oil	842	$3,318	58,098		$1.66	
2,000							
Church/Chapel	Electricity	12,756	$1,679	4,632	7%	$0.18	9%
9,400	Propane	13	$65	127	0%	$0.01	1%
	#2 Fuel Oil	4,090	$16,090	60,045	93%	$1.71	90%
	All sources		$17,834	64,803	100%	$1.90	100%
Rented home	Electricity	22,192	$1,588	75,741	100%	$1.59	100%
1,000			(plus)				
All buildings	Electricity	34,948	$9,903	8,283	17%	$0.69	38%
14,400	Propane	13	$65	83	0%	$0.00	0%
	#2 Fuel Oil	4,090	$16,090	39,196	82%	$1.12	62%
	All sources		$26,058	47,562	100%	$1.81	100%

St. John's Church spent about $26,000 for energy last year, not counting third party electricity purchase for the rented home. About a third of the total cost was for electricity, and about two thirds was for #2 fuel oil. The only invoice I saw revealed that Hudson Energy Services was charging about 5 cents more than Central Hudson for electricity. If that holds true for all kilowatthours, the third party supplier over-billed the tenant for about $1,100 last year.

Because of mold infestation, the insulation on the basement ceiling and part of the first floor ceiling was removed in July 2012. The table below shows the changes in electric use from December through March for four winters:

	Prev.Dec.	Curr.Jan	Curr.Feb.	Curr.Mar.	4-mo. total
2010-11	1,162	1,347	1,065	847	4,421
2011-12	933	1,119	946	841	3,839
2012-13	922	1,129	1,013	896	3,960
2013-14	1,085	1,318	1,189	1,068	4,660

	kWh	HDD	kWh/HDD	Change
2010-11	10,625	4,421	2.40	-
2011-12	10,399	3,839	2.71	13%
2012-13	11,663	3,960	2.95	9%
2013-14	13,214	4,660	2.84	-4%

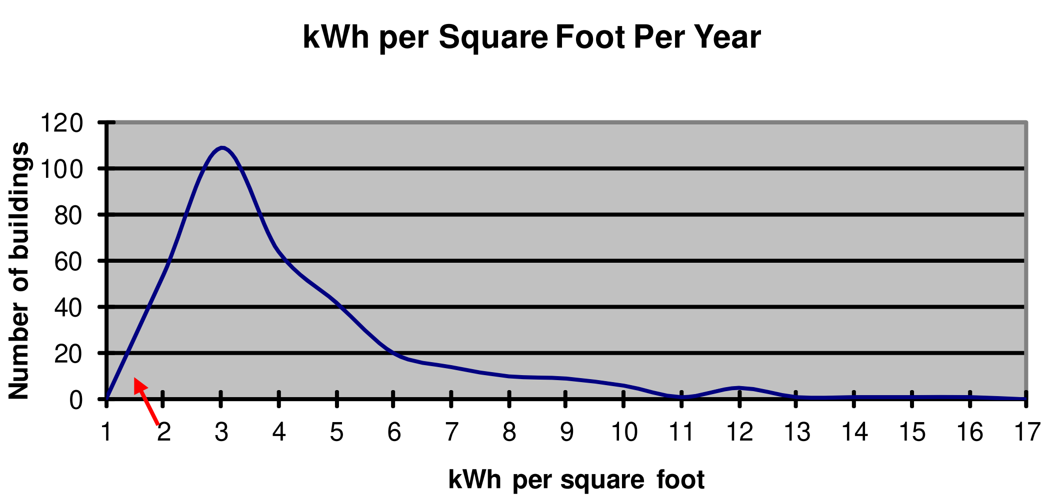
During the winter before the insulation was removed, there was a 13% increase in electric use per heating degree day compared to the previous four winter months. Electric use increased again during the next winter but decreased in the winter. The removal of the basement ceiling insulation had ambiguous changes in electric use. The chapel and church used about the same amount of fuel oil per square foot of heated floor area. The table below compares the heating capacity for each heating system, prorated per square foot of heated floor area:

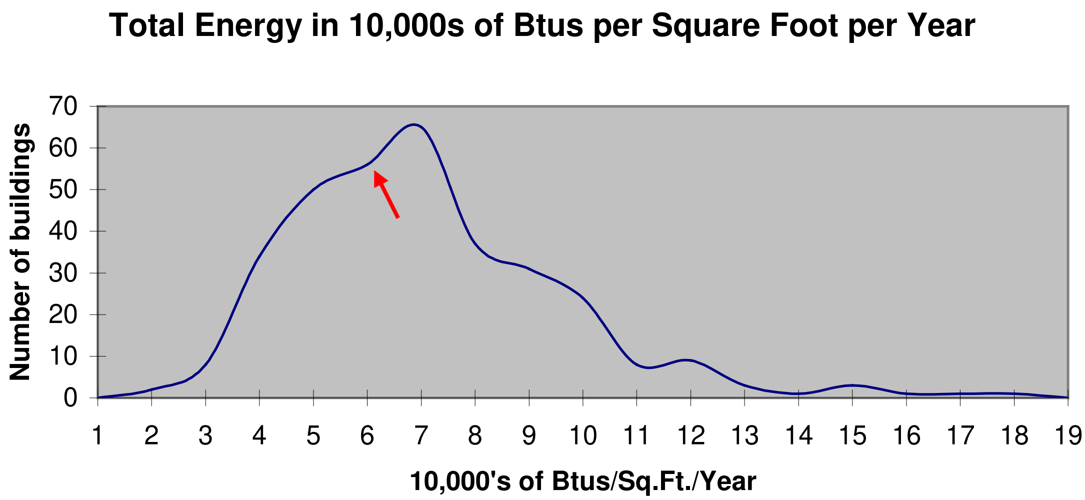
Per Square Foot Heating System Input Capacity

Space	Floor area	Btu input/hr.	Btus per square foot
Church	7,400	800,000	108
Chapel	2,000	100,000	50
Averages	9,400	900,000	96

Note that the prorated heating capacity in the church is double that of the chapel and could therefore heat with one boiler instead of two.

The charts below compare the electricity and fuel used annually per square foot at St. John's church and chapel with that used by similar worship/education buildings:



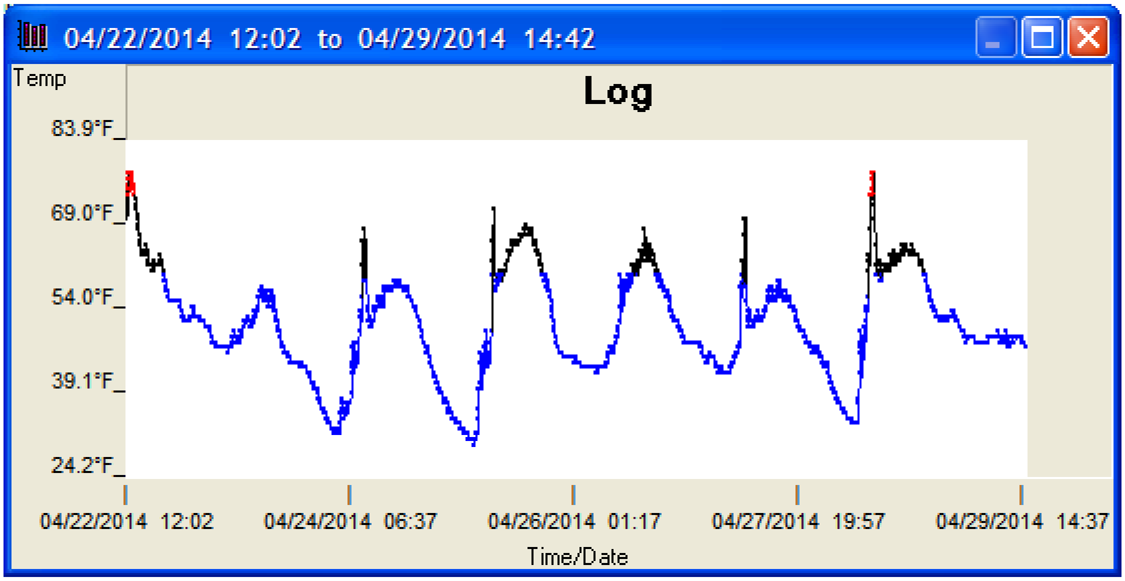


Last year, the two buildings used less than average electricity and total energy per square foot.

Temperature recorders were installed in several locations. They started recording at noon on Tuesday, April 22, 2014 and ended just over one week later. The following are the downloaded results. The lines in these graphs can have three colors. **Red lines** show temperatures over 73.4°F. **Blue lines** show temperatures below 60.8°F, and **black lines** show temperatures from 60.8°F to 73.4°F. The range of the vertical temperature axis varies from chart to chart. The horizontal time axis is the same on each chart. The accuracy of these recorders is 2.7°F.

Note that at the start of each chart there is a spike in temperature, likely due to hand-holding the recorder before hanging it. In my analysis, I ignore these beginning temperature peaks.

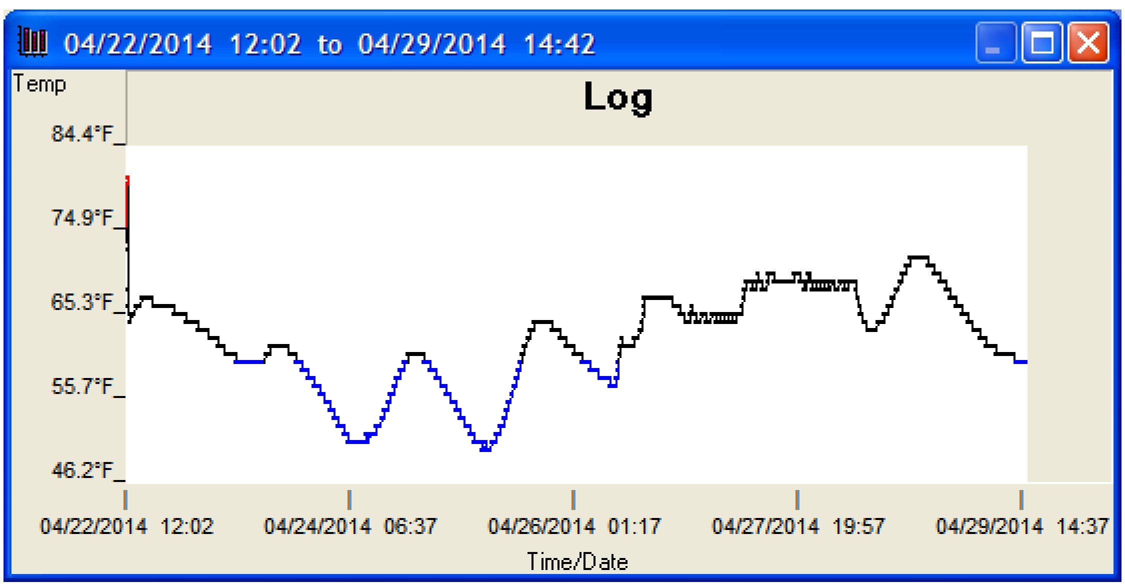
Recorder DF – Outside



. **Tues. Wed. Thurs. Fri. Sat. Sun. Mon Tues.**

The lowest temperature of the outside air was 30°F at 6am on Friday April 25, 2014. The highest was 78° at 9:30am on Monday 4/28. Several of the peaks occur exactly at 9:17am, which may indicate solar heating of the recorder. The average outside temperature was 55° during the recording period.

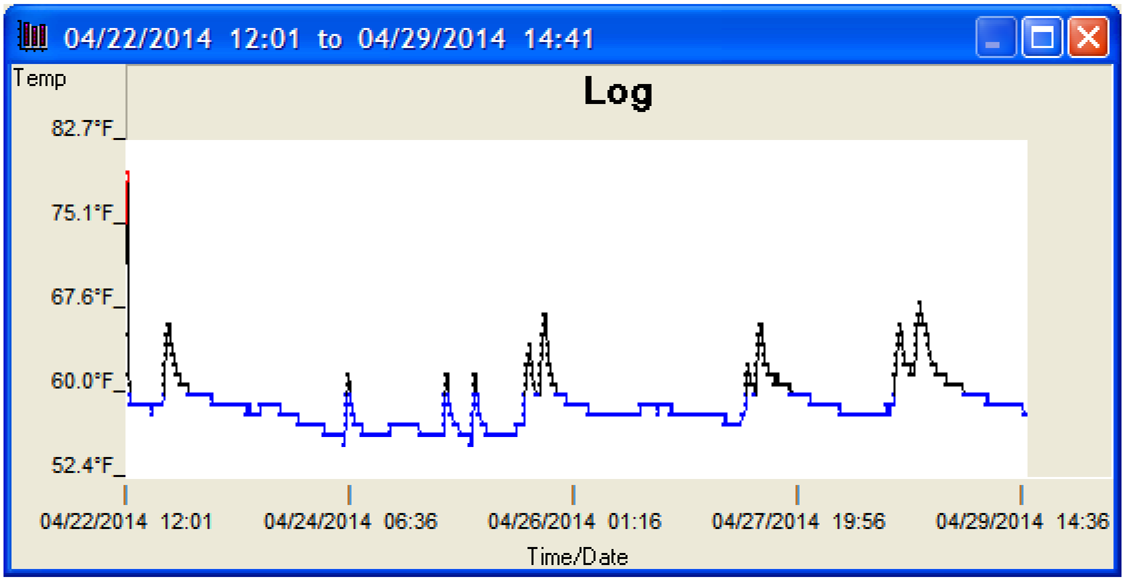
Recorder NN – Sanctuary



. **Tues. Wed. Thurs. Fri. Sat. Sun. Mon Tues.**

The lowest temperature in the sanctuary was 50°F at 9am on Friday 4/25. The highest was 72° at 12:30pm on Monday 4/28. The average sanctuary temperature was 62°.

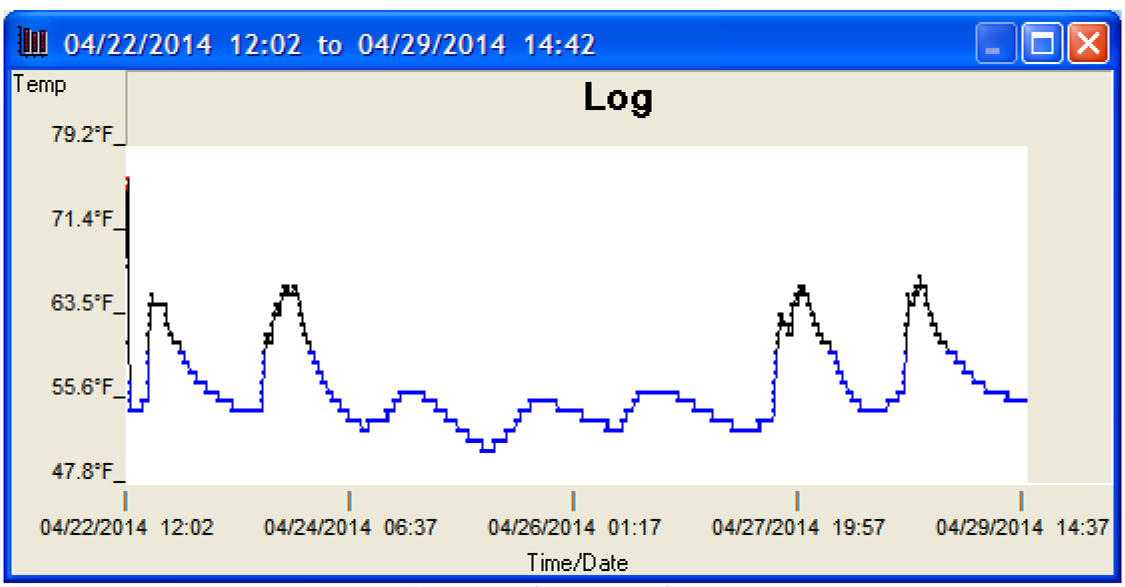
Recorder J9 – Undercroft



Tues. Wed. Thurs. Fri. Sat. Sun. Mon Tues.

The lowest temperature in the undercroft under the sanctuary was 55ºF at 5:30am on Friday 4/25. The highest was 67° at 6:15pm on Monday 4/28. The average undercroft temperature was 61°.

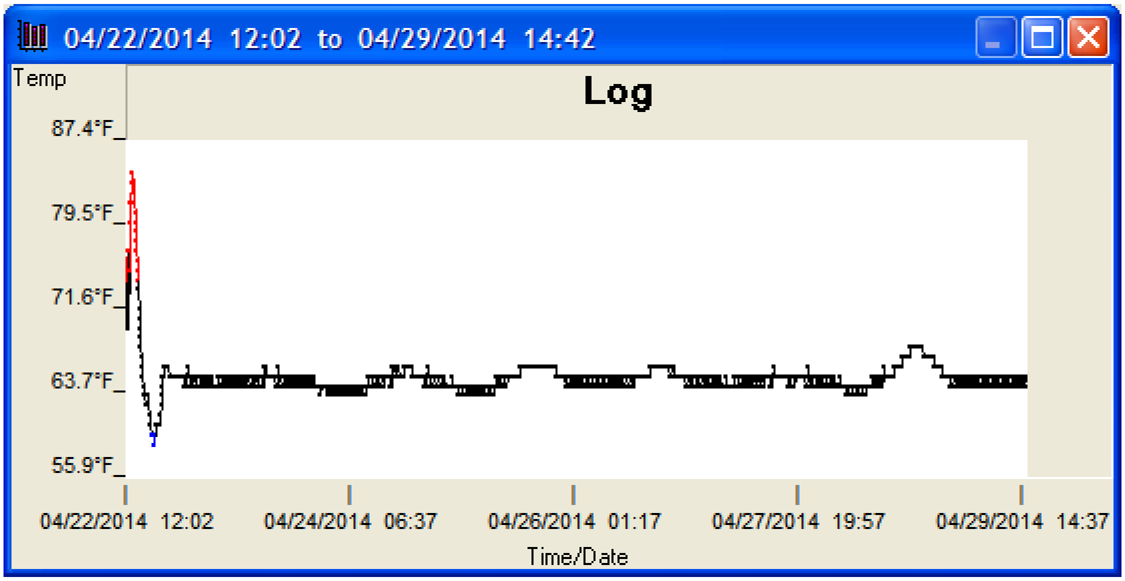
Recorder 45 – Chapel



Tues. Wed. Thurs. Fri. Sat. Sun. Mon Tues.

The lowest temperature in the chapel was 51ºF at 10am on Friday 4/25. The highest was 66° at 6:15pm on Monday 4/28. The other temperature peaks were also in the evening. The average chapel temperature was 60°.

Recorder 18 – Rental home living-dining area



Tues. Wed. Thurs. Fri. Sat. Sun. Mon Tues.

Starting at 7pm, after the initial peak, the temperature in the rented house living area consistently varied between 62° and 64°. There are four other electric heat zones in the house.

All of the highest interior temperatures occurred on the same day as the highest outside temperature - Monday 4/28. Similarly, all of the lowest temperatures inside and outside occurred during the morning of Friday 4/25.

If you have any questions about the contents of this report, or about this energy program, please call Andrew Rudin at (215) 635-1122.

Summary:

NOTE: The following costs are based on the assumption that the congregation buys the material and uses its own labor to install it unless the item is marked with *.

Cost Reduction Item	First Cost Investment	Energy Costs Avoided	Payback Years
All Buildings			
Sign up for rebates	0	?	–
Church			
Heat with one boiler	0	900	–
Rewire circulator relays *	200	400	0.5
2 clock thermostats	300	300	1.0
10 LED bulbs	90	70	1.3
Isolate boilers *	1,500	1,000	1.5
Investigate barometric damper *	200	50	4.0
Replace tubes/ballasts *	300	50	6.0
Replace refrigerator	430	50	9.0
Chapel			
Repair insulation	50	200	0.3
Replace 10 incandescent bulbs	90	70	1.3
Clock thermostat	150	100	1.5
Install heat pump *	7,000	1,000	7.0
Rented house			
Revert to Central Hudson elec.	0	1,100	–
Cover opening to attic	100	300	0.3
Control dehumidifier use	50	100	0.5
Clock thermostat	140	40	3.5
Insulate basement ceiling	3,000	200	15.0
Limit drainage problem	?	?	–
Totals	$13,600	$5,930	2.3

Energy Costs 2011–12

Electricity	–	$9,903+
Propane	–	$65
#2 Fuel Oil	–	$16,090
Totals	–	$26,058

Annual Cost Reduction Potential = $5,930 / $26,058 = 23%

Recommendations:

Here are some general guidelines for controlling energy cost:

Monitor Energy Usage and Cost. The first step in reducing your energy costs is to know what you are now spending. This report lists your current usage and costs. Continual monitoring can help to spot billing errors, provide feedback on your progress, and help determine if your actions are achieving results. You should keep records on the cost, energy units (i.e. kWh, CCF, gallons of oil, etc.), and demand charges on your electric bill (kW). Simply paying attention to your energy use and cost will usually result in lower bills. Otherwise, your congregation will not know the results of its efforts to lower energy use and cost.

Turn things off because nothing is better than 'off'. It doesn't matter how small or efficient a lamp, appliance, boiler, air conditioner or motor is – the greatest savings comes from turning it off and keeping it off. The more inefficient an appliance is, the greater the savings from keeping it off. Since religious buildings are used intermittently, keeping things off matters even more than in more heavily-used buildings. The temperature of unoccupied rooms should be kept as low as 45°F during the heating season. If you lower the temperature to 45°F in the winter, you create changes in relative humidity and temperature similar to those that naturally occur in the spring, summer, and fall. As long as water in pipes does not freeze, the building and its contents should not be harmed by the cooler temperatures.

Buy the least expensive energy. There are many forms of energy – green electricity, brown electricity, natural gas, propane, fuel oil, gasoline, and so on. Once a facility has chosen the type of energy they want, they should continually seek to purchase the least expensive energy. Factors continually change. Electric suppliers change their terms in a deregulated market. Each utility offers different types of rates; for example, some organizations can save money with time-of-use electric rates. They can purchase contracts of fixed-price fuel oil. Other factors are how energy costs are included in leasing space, whether or not an account needs to pay state sales tax or federal excise tax. Whatever choice they make in the type of energy purchased, they need to continually shop for better deals.

Tune systems to optimal performance. Building operators should continually adjust water temperatures, air temperatures, dampers, the height of pilot light flames, and so on. Tune oil and gas burners with the help of a contractor. Use natural ventilation instead of compressor air conditioning on appropriate days.

Purchase efficient replacements. Everything is crumbling into dust. Facility will replace eventually replace motors, air conditioners, heating systems, lamps, ballasts, and so on. The premium cost of more efficient equipment is usually justified when purchasing replacement equipment. Be very wary of cutting-edge technology without a track record of measured performance.

A single person should accept responsibility for controlling energy use. Building a new building may require a committee, but the energy-using systems in existing buildings are usually best controlled by a single person. That person should be given a copy of every electric and fuel invoice so that he or she can keep records of changes in energy use. Hundreds of facilities have followed this advice and have realized the estimated savings.

These activities cost almost nothing yet are responsible for most of the reductions in energy cost. They should serve as basic goals for your efforts at St. John's Church.

All buildings:

SIGN UP FOR REBATES

The New York Energy Research and Development Authority (NYSERDA) and the Central Hudson Gas and Electric Corporation offer rebates for retrofits that will reduce energy use. For the NYSERDA rebates, sign up via their website **http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Commercial-and-Industrial/CI-Programs/Existing-Facilities-Program.aspx**

Central Hudson may offer up to 70% rebates for this work. Start by visiting **http://www.centralhudson.com/savemoney/** to request a free energy audit. This should qualify you for rebates for the chapel and church. They describe their process as 1-2-3:

1. Call (855) 236-4832 to schedule your **FREE energy audit.**

2. Our lighting partner – Lime Energy – will perform the energy audit, install the new lights for qualified projects and **handle all the paperwork**.

3. **Central Hudson pays up to 70% of the project** and you can cover the rest with up to 24 month financing. Enjoy reduced utility bills year-after-year.

The rented house will qualify for rebates after the tenant reverts to Central Hudson to purchase electricity.

Church:

HEAT WITH ONE BOILER

The table below shows data from 60 non-residential buildings I have surveyed. The heating capacity in BTU input per square foot is listed in relation to the amount of energy used per square foot per year:

Input Heating Capacity and Non-residential Heating Energy Use

Capacity in BTU/SF input	Number of Bldgs.	Fuel BTU/SF/Yr	Fuel Full load hours	Electric Hours use of demand
Up to 40	8	40448	1445	122
41 to 60	7	53322	952	119
61 to 80	10	52456	896	140
81 to 100	12	53605	560	123
101 to 120	10	57070	524	114

The hours use of demand is the annual average use of the monthly peak electric demand. This is derived by dividing the monthly kilowatthours by the peak kilowatts, and is some indication of the hours that the facility is used. Note that these buildings have approximately the same hours use of demand. Therefore, the hours use of the buildings in these five categories is about the same.

The fuel input to St. John's church heating system is about 108 Btus per square foot of heated floor area. That for the chapel is about 50. Heating the church with just one of the two boilers should therefore save at least 8%. Our experience is that the fuel use could be decreased by about a third in some cases.

The simplest way to accomplish this is to turn off the switch on the front of the boiler on the right, which is slightly less efficient than the boiler on the left. The left boiler will heat when just one thermostat calls for heat because both boilers are piped in parallel. For additional savings, the boilers can be isolated. See below.

REWIRE THE CIRCULATOR CONTROLS

Whether heating with one boiler or two, the thermostats need to communicate with the oil burners so they operate only when there is a call for heat from one or both thermostats. Currently, the oil burners maintain water temperature inside the boilers, which needlessly increases heat losses through the boiler jacket and up the chimney. The TACO relays on the side of the right boiler can be rewired. A qualified electricity may be able to add wires from the normally-open tap in parallel to both oil burners.

INSTALL TWO PROGRAMMABLE THERMOSTATS

Two Honeywell VisionPro 8000 thermostats can replace the standard thermostat for the sanctuary and the pair of thermostats for the undercroft. This particular thermostat starts the heating of the zones earlier on colder and windier days. They are relatively simple to install, but the "intelligent recovery" feature has to be enabled according to Honeywell's manual. Once enabled, this feature allows each thermostat to "learn" the thermal characteristics of each heating zone to assure occupants will be comfortable on arrival.

REPLACE TEN INCANDESCENT LAMPS WITH LEDs

As an experiment, several of the incandescent and compact fluorescent bulbs in the ceiling light fixtures in can be replaced with light emitting diode lamps. I have included a description of one LED bulb in the Supplements section. Ten of them cost about $90. Each uses 10½ watts, with light output equal to a 60-watt incandescent lamp, although I think they would replace a 75-incandescent bulb as well. Try ten before you buy dozens for all three buildings. The NYSERDA rebate is $15 per lamp, which more than pays for each bulb, but you need the NYSERDA and Central Hudson audits to confirm that.

ISOLATE THE BOILERS

There is a valve on the top and between the boilers that isolates both from the heating zones they serve. Similar valves can be installed at the rear of each of the two boilers so that the one that is turned off is not heated by the circulating water supplied by the boiler that remains on. My estimate of the cost of this is very rough, but an accurate proposal from a qualified contractor would be free. My estimate of the savings is based on our database of energy used by similar buildings.

Once the boilers have been isolated, the unused one needs to be operated perhaps only once per heating season to make sure it is a reliable appliance.

INVESTIGATE THE INSTALLATION OF A BAROMETRIC DAMPER

Barometric dampers are installed in the flue pipe connecting the boilers to the chimney. They allow cooler boiler room air to relieve the suction from the chimney instead of warmer air pulled through a hot boiler. I am not sure whether it would save heating costs because the manufacturer's instructions say it is needed only if there is a lot of suction from the chimney. I measured minus 0.04" of water column suction when it was 92°F outside. That low suction does not justify the damper, but during the winter, the suction may increase, which would justify its installation.

REPLACE THE INSIDES OF FLUORESCENT LIGHT FIXTURES

Fluorescent light fixtures that are lit with the more efficient, lower wattage tubes and electronic ballasts use fewer watts and produce better quality light. These tubes are only one-inch in diameter (T8). The less efficient tubes are 1½ inches in diameter (T12) and are powered by electromagnetic ballasts. These can be replaced with T8s and electronic ballasts. Staff or volunteers may be able to make these changes, or St. John's Church can request bids from qualified lighting contractors identified by the audits from NYSERDA and Central Hudson. The new tubes should have a color-rendering index of 85 or higher and a color temperature of 3500° Kelvin. Use a 2-tube electronic ballast for stand-alone 2-tube fluorescent fixtures because labor costs for running wire between fixtures are higher than ballast costs. If 2-tube fixtures are touching end-to-end, however, a 4-tube ballast can power two 2-tube fixtures. A rough count of the fluorescent ceiling fixtures in St. John's Church was as follows:

- Nine 2-tube, four-foot fixtures
- One 4-tube, four-foot fixture

No change should be made to any fixture that will violate Underwriters' Listing or any applicable codes. The rebate for these changes is $10 or more per fixture, depending on the results of the Central Hudson and NYSERDA lighting surveys.

REPLACE REFRIGERATOR

The following table shows the measured electric use of your kitchen refrigerator:

Appliance	kWh recorded	Elapsed minutes	kWh per year
Church refrigerator	0.11	43	1,345
'' ''	0.25	148	888
'' ''	0.35	232	793

Information about one new appliance from the Lowe's website (www.lowes.com) is in the Supplements section of this report. The annual electric use of most of the refrigerators and freezers on their website can be seen by clicking the energy performance link toward the middle of the web page. The example refrigerator I chose uses an estimated 489 kWh per year. My savings estimate is based on your existing refrigerator using 900 kWh per year.

Chapel:

REPAIR THE ATTIC INSULATION

My photo in the Supplements section shows that the insulation above the chapel ceiling has collapsed in places. Perhaps local volunteers, under supervision of adults from the congregation, could remove the ceiling panels and re-fasten the falling insulation. The best way of doing this is to string wire below the insulation to hold it up between the rafters.

REPLACE TEN INCANDESCENT LAMPS WITH LEDs

As in the church, each incandescent or compact fluorescent bulb in the ceiling-mounted, pendant light fixtures in can be replaced with a fully dimmable light emitting diode lamp. I have included a description of one such LED bulb in the Supplements section. Ten of them cost about $90. Each uses 10½ watts, with light output equal to a 60-watt incandescent lamp, although I think they would replace a 75-watt, 130-volt incandescent bulb as well. Try ten before you buy dozens for all three buildings. The NYSERDA rebate is $15 per lamp, but you need their audit to confirm that.

REPLACE THE CURRENT THERMOSTATS

The pair of thermostats and wind-up timer can be replaced with the same type of thermostat I suggest for the church. See the description of it in the Supplements section.

INSTALL A HEAT PUMP

A heat pump is a way of heating the chapel less expensively with electricity than with fuel oil. First, the parish needs to have a qualified electrician determine if the existing electric service to the church is adequate to power the heat pump. If not, perhaps the original electric service to the chapel could be used instead. This would separate the electricity source from the church so that it could be paid by any tenant renting the chapel.

The heat pump has two parts. The outside part extracts heat from, or adds heat to, the outside air. The inside part is a coil inside the supply air plenum of the existing warm air furnace. A page in the Supplements section shows the pricing for a 3½-ton outside unit, plus an inside air handler so you can see the cost. The ability of a heat pump to pull heat out of the air is rated as its "coefficient of performance." I estimated a COP of 2.5. Some are higher than that. This means that a kilowatthour of electricity will provide about 2½ kilowatthours worth of electric heat to the chapel interior. Since the chapel was comfortably cool on the 92°F day I visited it, I assume that no air conditioning will be needed.

The Honeywell VisionPro 8000 heat pump (not a standard model) thermostat needs to be purchased and installed so that the heat pump is the primary source of heat, using the furnace fan for circulation. If the heat pump cannot satisfy the interior temperature requirements, the oil burner operates as a supplementary source of heat.

My savings estimate is based on the heat pump supplying half the heating requirements for the chapel and no air conditioning. My guess for the installation costs is very, very approximate.

Rented house:

REVERT TO CENTRAL HUDSON ELECTRICITY

The one invoice I have seen indicates that Hudson Energy Services is charging the tenant 5 cents more per kWh than Central Hudson would charge. If this is true for all last year's kilowatthours, the tenant was overcharged about $1,100. There is no refund because the contract to which she agreed probably explains these terms. The tenant should send certified letters, return receipt requested to both Hudson Energy Services and Central Hudson Gas and Electric Corporation requesting the change back to Central Hudson.

CLOSE CEILING OPENING IN THE STAIRWELL

With the remediation of the mold, the ceiling of the stairwell was removed. This allows heated air to enter the attic above the existing fiberglass insulation, defeating its purpose. The ceiling should be re-installed.

CONTROL DEHUMIDIFIER USE

I measured the electricity used by the basement dehumidifier for over an hour. Here are the results.

Appliance	kWh recorded	Elapsed minutes	kWh per year
Basement dehumidifier	0.29	71	2,147

My article on residential dehumidifiers is in the Supplements section of this report. Dehumidifiers can use large amounts of electricity. Here are some ways to lower that electric use:

- Reduce the humidity entering the area by re-grading the outside, assuring that downspouts direct water away from the building, and sealing the walls and floor with semi-permeable paint.
- Reduce the area that needs to be dehumidified by enclosing just the items and areas that need to remain relatively dry. You can do this by closing doors or hanging 6-mil polyethylene floor to ceiling.
- Install a separate dehumidisat on the wall of the space to be dehumidified. Connect a strip of outlets to the dehumidistat, one of which would control the dehumidifier. Plug in one or more inexpensive box fans to move air around the space to be dehumidified. This will cycle the dehumidifier less, increase its efficiency in removing moisture and assuring that drier air reaches behind shelves and into corners.
- Purchase and install an inexpensive ($20) hygrometer to assure that you do not dry the air more than necessary. 60% or 70% may be dry enough.
- Install a timer on the dehumidifier so that it only operates during off peak times (overnight), or, if you have the Night Service Rider (see below), operate the dehumidifier during its off peak periods.

Reducing your dehumidifier electric use could save over $100 per year.

INSTALL PROGRAMMABLE THERMOSTAT

The manual thermostat for the living/dining/kitchen heating zone can be replaced with a Honeywell VisionPro 8000. See information in the Supplements section. The other four thermostats in this home are line voltage, which means that a 24-volt thermostat could not be used without an expensive relay. In addition, the tenant explained that she adjusts these other four thermostats daily, but leaves the one in the living area at a constant temperature.

INSULATE THE BASEMENT CEILING

The fiberglass insulation in the ceiling of the unheated basement was removed during mold remediation in 2012. Replacing it with more fiberglass invites more mold because the basement is humid. Insulating the ceiling with sprayed-on polyisocyanurate insulation is an effective alternative, but it is expensive. My cost estimate is based on a recent spray-on insulation job at my home.

ADDRESS THE BASEMENT MOISTURE

A qualified specialist could submit a proposal to restrict moisture in the basement. One possible solution is to install a pipe along the uphill side of the rented home. There is a tee in the pipe that runs along the interior northern wall of the basement into which captured water could be drained. That pipe already seems to drain downspouts. The humidity problem in the basement is permanent, unless some successful solution to the drainage is found. There could be many alternative ways to control this moisture. I have no way of estimating its actual cost or any experience to describe any details.

Energy Data:

Church and Chapel
Electricity

Acct. 3762-0930-00-0
Mtr. # - 18558636
Rate E230 General Service

Read date	kWh	Cost	Price
5/24/10	1,596	$204	$0.128
7/20/10	1,444	$194	$0.134
9/20/10	1,776	$266	$0.150
11/18/10	1,786	$213	$0.119
1/20/11	2,630	$301	$0.114
3/23/12	2,083	$266	$0.128
2010-11	11,315	$1,443	$0.128
5/23/11	1,633	$175	$0.107
7/21/11	1,430	$174	$0.122
9/21/11	1,519	$221	$0.145
11/18/11	1,354	$169	$0.124
1/20/12	2,110	$223	$0.106
3/20/12	2,057	$247	$0.120
2011-12	10,103	$1,209	$0.120
5/18/12	3,031	$309	$0.102
7/19/12	1,290	$183	$0.142
9/21/12	2,377	$314	$0.132
11/19/12	2,172	$230	$0.106
1/23/13	2,879	$289	$0.101
3/20/13	2,374	$312	$0.131
2012-13	14,123	$1,638	$0.116
5/24/13	2,557	$264	$0.103
7/25/13	2,159	$263	$0.122
9/18/13	1,282	$205	$0.160
11/18/13	1,837	$225	$0.123
1/22/14	2,774	$310	$0.112
3/21/14	2,147	$411	$0.191
2013-14	12,756	$1,679	$0.132

#2 Fuel Oil Deliveries and Ellenville Heating Degree Days

Years	Deliveries Gallons	Deliveries Cost	Deliveries Cost/Gal.	Heating Deg.Days	Gallons Deg.Day	Chge.in oil use
		Chapel - Acct. 101482				
2011	997	$3,082	$3.09	6,015	0.17	-
2012	811	$3,167	$3.91	5,670	0.14	-14%
2013	842	$3,318	$3.94	6,202	0.14	-5%
		Church - Acct. 502153				
2011	2,305	$7,476	$3.24	6,015	0.38	-
2012	1,828	$7,207	$3.94	5,670	0.32	-16%
2013	3,248	$12,772	$3.93	6,202	0.52	62%

Church Propane Deliveries

Date	Gallons	Propane Cost	Propane Price	Other Costs	Total Cost	Total Price
11/17/11	2.0	$7.20	$3.60	$10.57	$17.77	$8.89
10/18/12	4.4	$12.54	$2.85	$10.97	$23.51	$5.34
8/5/13	14.3	$41.74	$2.92	$11.37	$53.11	$3.71
4/5/14	13.1	$65.12	$4.97	$10.97	$76.09	$5.81
Totals	33.8	$126.60		$43.88	$170.48	
Averages			$3.58			$5.94

Rental Home Electricity
Paula Cameron

Acct. 3762-0940-03-3
Mtr. # -
Rate E116 - Res.Elec.Heat
Purchasing from a third party

Read date	kWh	Cost	Price
5/24/10	1,781	$274	$0.154
7/20/10	827	$150	$0.182
9/20/10	896	$183	$0.204
11/18/10	1,911	$151	$0.079
1/20/11	5,281	$337	$0.064
3/23/11	5,344	$330	$0.062
2010-11	16,040	$1,426	$0.089
5/23/11	2,317	$168	$0.073
7/21/11	571	$74	$0.129
9/21/11	600	$79	$0.132
11/18/11	1,902	$153	$0.080
1/20/12	5,246	$350	$0.067
3/20/12	5,153	$345	$0.067
2011-12	15,789	$1,168	$0.074
5/18/12	2,540	$198	$0.078
7/19/12	1,666	$143	$0.086
9/21/12	1,853	$164	$0.089
11/19/12	2,709	$221	$0.082
1/23/13	5,818	$413	$0.071
3/20/13	5,845	$368	$0.063
2012-13	20,431	$1,507	$0.074
5/24/13	3,308	$256	$0.077
7/25/13	1,751	$155	$0.089
9/18/13	1,423	$129	$0.091
11/18/13	2,496	$198	$0.079
1/22/14	6,630	$449	$0.068
3/21/14	6,584	$401	$0.061
2013-14	22,192	$1,588	$0.072