

**New York Energy Smart<sup>SM</sup>  
Energy Audit Program**

# **Energy Audit Report**

**for**

## **First Congregational Church of Chappaqua**

**June 15, 2007**

**Any questions regarding this energy report may be directed to  
The Daylight Savings Company at 1-800-337-2192.**

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## 1

# Executive Summary

This report presents the findings of an energy survey conducted on May 16, 2007 by Yigit Guctas for:

First Congregational Church of Chappaqua  
210 Orchard Ridge Road  
Chappaqua, NY 10514  
(914) 238-4411

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New York State Energy Research and Development Authority (NYSERDA) conducts energy surveys to promote NYSEDA's mission, which is to use innovation and technology to solve some of New York's most difficult energy and environmental problems in ways that improve the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Fuel Oil	\$18,360
Electricity	\$10,493
Natural Gas	\$2,302
<b>Total</b>	<b>\$31,155</b>

The potential annual energy cost savings are shown below in Table 1-1.

**Table 1-1**  
**Energy Cost Reduction Opportunities (ECRO's)**

Description	Cost	Annual Savings	Payback (years)	% of Annual Energy Cost
Upgrade the Lighting	\$6,274	\$1,401	4.5	4.5%
Install Lighting Controls	\$750	\$165	4.5	0.5%
Improve Temperature Control		\$2,340	Immediately.	7.5%
Improve the Building Envelope	\$74,700	\$9,210	8.1	29.6%
Other Measures	\$650	\$210	3.1	0.7%
<b>Totals</b>	<b>\$82,374</b>	<b>\$13,326</b>	<b>6.2</b>	<b>42.8%</b>

# 1

## Executive Summary

An estimated cashflow analysis is shown below in Table 1-2. This analysis is based on the information found in Table 1-1.

**Table 1-2**  
**Estimated Cashflow Analysis**

Year	Savings	Payment	Net	Cumulative
1	\$13,326	(\$18,604)	(\$5,278)	(\$5,278)
2	\$13,526	(\$18,604)	(\$5,078)	(\$10,356)
3	\$13,729	(\$18,604)	(\$4,875)	(\$15,231)
4	\$13,935	(\$18,604)	(\$4,669)	(\$19,900)
5	\$14,144	(\$18,604)	(\$4,460)	(\$24,360)
<b>Totals:</b>	<b>\$68,659</b>	<b>(\$93,019)</b>	<b>(\$24,360)</b>	

Assumptions: loan term of 5.0 years, principal of \$82,374, APR of 5.0%, average utility price increase of 1.5% annually.

The estimated demand and energy savings are shown below in Table 1-3. The information in this table corresponds to the recommendations in Table 1-1.

**Table 1-3**  
**Estimated Energy Savings**

Recommendation	Total kW Reduction	Total Annual kWh Reduction	Total Annual Gallons of Oil Reduced
Upgrade the Lighting	8.6	8,763	
Install Lighting Controls		1,022	
Improve Temperature Control			936
Improve the Building Envelope			3,684
Other Measures	0.4	1,310	
<b>Totals</b>	<b>9.1</b>	<b>11,095</b>	<b>4,620</b>

The remainder of the report is organized as follows: Section 2 explains the details of the Energy Cost Reduction Opportunities, Section 3 shows the historical energy usage and costs for this facility. Section 4 gives an equipment inventory and discusses the building characteristics (architectural, mechanical, electrical, etc.), and Section 5 is the methodology used to survey and analyze your facility.

# 1

## *Executive Summary*

### Auditor's Comments

Two Buderus Logano GE315/8 hot water boilers provide your heating. Boilers are on a lead-lag control and in general, one boiler is enough to satisfy the heating requirements of your building. Two Riello #2 Oil burners fire the existing boilers. Your domestic hot water is provided by a Rheem 21VR75 75-gallon capacity natural gas fired storage tank type domestic hot water maker. There are two additional insulated 75-gallon storage tanks, supplied by the Rheem domestic hot water maker. Existing outdoor reset temperature control consists of a Buderus Logamatic digital control system. Existing oil tank is located behind the boiler room, outside, on a concrete pad. Tank was installed in 1999 and has a capacity of 1000 gallons.

There are a total of 8 zone pumps in the boiler room, and one main boiler room loop pump. We did not model the building with 8 different zones due to similarities in temperature settings and exposures for each zone. Please note that you provided us with a total annual oil consumption figure, however, no dollar amount for the corresponding consumption. We estimated the gallon of #2 oil to be \$2.50 for our calculations.

Please note that even though you mentioned that the kitchen stove is used approximately 4 hours a week, we had to increase this assumption to account for your natural gas use.

### Audit Disclaimer

This report was prepared pursuant to the **New York Energy \$mart<sup>SM</sup>** Energy Audit Program (hereafter "Audit Program") administered by the New York State Energy Research and Development Authority (hereafter the "Energy Authority"). The opinions expressed in this report do not necessarily reflect those of the Energy Authority or the State of New York, and reference to any specific product, service, process, or method does not constitute an implied or expressed recommendation or endorsement of it. Further, the Energy Authority and the State of New York make no warranties or representations, expressed or implied, as to the fitness for particular purpose or merchantability of any product, apparatus, or service, or the usefulness, completeness, or accuracy of any processes, methods, energy savings, or other information contained, described, disclosed, or referred to in this report. The Energy Authority and the State of New York make no representation that the use of any product, apparatus, process, method, or other information will not infringe privately owned rights and will assume no responsibility for any loss, injury, or damage resulting from, or occurring in connection with, the use of information contained, described, disclosed, or referred to in this report.

# 2

## Energy Cost Reduction Opportunities

### Upgrade the Lighting

#### Upgrade the Fluorescent Lighting

New fluorescent lamps and ballasts are available as direct replacements for your existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling layin fixture with four, 4-foot lamps (34 Watt lamps) has a total wattage of about 164 Watts. By using the new lamps and ballasts the total wattage would be about 110 Watts, the light levels would increase by about 15%, and the light quality would increase by 35%.

The new lamps are called T8 lamps and they can fit right into the existing fixtures without any fixture modifications. The lamps are 1" in diameter instead of the 1.5" diameter of the existing T12 lamps. (The number after the "T" indicates the diameter in 8ths of an inch. Hence, T8=8/8 or 1", while T12=12/8 or 1.5".) The reduced surface area allows the use of more costly inside coatings (phosphors). The improved phosphors provide a greatly improved color rendering index (CRI). A T12 typically has a CRI of about 55. A typical T8 has a CRI of about 75.

The new ballasts are called "electronic ballasts" and they, too, can fit right into the existing fixtures without any fixture modifications. The existing ballasts add wattage to the lighting system due to its operating characteristics. An electronic ballast subtracts wattage from the lighting system due to its operating characteristics. In addition, a single electronic ballast can operate one, two, three, or four lamps in a fixture. The existing ballasts can only operate up to two lamps. The electronic ballasts could reduce the amount of ballasts in your facility by half. This can be taken advantage of with "tandem wiring" of ballasts. Instead of using one electronic ballast for every one fixture it is sometimes feasible to use one ballast for every two or more fixtures. The electrician wires a single ballast to operate the lamps in adjacent light fixtures which further reduces the amount of ballasts needed.

Although the T8 lamps and the electronic ballasts can fit into your existing fixtures, it is sometimes recommended to replace the fixtures. The reflective surfaces degrade over time and as they reach the end of their useful life it becomes more practical to install new fixtures, especially since modern fixture designs are much more efficient - meaning they are more effective at getting the light "out" of the fixture.

NOTE: fluorescent ballasts that are to be used in cold locations need to be specified as such. These "cold temperature" ballasts can be rated as low as zero degrees Fahrenheit.

## 2

# *Energy Cost Reduction Opportunities*

### *Install Compact Fluorescent Lighting*

Compact fluorescent lamps (CFL's) were created to be replacements for the standard incandescent lamps that are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to look like the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. In some instances, this is still not the desired ambiance, but in most cases the significant energy savings and the "near incandescent" effect is welcomed.

The CFL buyer should spend some time shopping around, since the CFL is available in a myriad of shapes and sizes depending on the specific application. But for almost any application, there is a lamp that fits the need. Typical replacements are: a 13-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 25-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. Then there is a 3000K, a 3500K, and a 4100K. The 4100K would be the "brightest" or "coolest" output. It would be wise to see an example of each before making a purchase, and even to see a sample of the lamp you are buying since Kelvin ratings vary between manufacturers.

A CFL can be chosen to screw right into your existing fixtures, or to be hardwired into your existing fixtures, or a new CFL fixture could be purchased.

NOTE: fluorescent ballasts that are to be used in cold locations need to be specified as such. These "cold temperature" ballasts can be rated as low as zero degrees Fahrenheit.

### *Install Halogen Lamps Utilizing Infrared Coatings*

Halogen is a type of incandescent lighting that provides bright white light, higher efficiency than standard incandescent and increased beam control. Like all incandescent lighting, it has a color-rendering index (CRI) of 100, which is the best available. An improvement has been made to the halogen lamps, which increases the output and the efficiency. The improvement is a heat-reflecting coating on the inner halogen capsule. Normally, only 10-15% of the energy consumed is emitted as visible light; the rest is lost as heat. The coating reflects an important part of the waste heat back into the filament, which burns hotter and brighter on fewer watts. When shopping for these lamps look for the designation HIR (halogen infrared) or IRC (infrared coated).

# 2

## Energy Cost Reduction Opportunities

### Install LED Exit Signs

LED stands for light-emitting-diode. LED's are very small light sources that people most readily associate with electronic equipment. LED exit signs have been made in a variety of shapes and sizes and there are also retrofit kits that allow you to simply modify your existing exit signs to accommodate the LED technology. The benefits of LED are twofold. First, you are installing an exit sign that will last for 20-30 years without maintenance. This results in tremendous maintenance savings because the incandescent or fluorescent lamps that you are currently using need to be replaced at a rate of 1-5 times per year. Lamp costs (\$2-\$7 each) and labor costs (\$8-\$20 per lamp) add up rapidly. The second benefit of LED is that it only uses 2 Watts. In comparison, your existing sign uses 10-40 or even 60 Watts! It is highly recommended that you install samples of the products that you are interested in purchasing. This will confirm that they are compatible with your electrical system.

The following table lists the details of the lighting upgrade. Applicable areas and the recommended action are shown. The first column identifies the line number that corresponds to the detailed lighting inventory at the end of this report.

It is strongly suggested that you contact a qualified contractor prior to implementing any of the recommendations outlined in this report. Many items are not included in our costs, such as removal and disposal of the existing equipment, bringing the new equipment installation up to code, asbestos abatement, lighting ballast PCB and lamp mercury handling, etc. In addition, the costs shown in this section are the basic costs you would incur if you were to install the project on your own. If you decide to use a contractor, then you most likely will see costs about 20-30% higher, plus the miscellaneous costs mentioned previously.

### Upgrade the Lighting - Details

Line # - Area	Action	Costs and Savings
1 - Boiler Room	For the existing 3 fixtures, each using 150-Watt, incandescent "flood" lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$81 Labor Cost: None Total Cost: \$81 Savings: \$10
2 - Boiler Room	For the existing 1 fixture using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$27 Labor Cost: None Total Cost: \$27 Savings: \$3
3 - Staircase to Boiler Room	For the existing 1 fixture using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$27 Labor Cost: None Total Cost: \$27 Savings: \$3

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
4 - Kitchen Hood	For the existing 2 fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 2)	Mat'l Cost: \$40 Labor Cost: None Total Cost: \$40 Savings: \$14
6 - Parish Hall	For the existing 16 recessed fixtures, each using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 16)	Mat'l Cost: \$432 Labor Cost: None Total Cost: \$432 Savings: \$172
7 - Parish Hall	For the existing 6 wall sconce fixtures, each using 2, 150-Watt, incandescent lamps, retrofit with 2 42-Watt compact fluorescent screw-in lamps and a "Y" adapter. (New qty: 6)	Mat'l Cost: \$335 Labor Cost: None Total Cost: \$335 Savings: \$164
8 - Main Entrance Foyer	For the existing 2 round fixtures, each using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 2, 18-Watt lamps. (New qty: 2)	Mat'l Cost: \$99 Labor Cost: \$81 Total Cost: \$180 Savings: \$3
11 - Hallway	For the existing 12 exit sign fixtures, each using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 12)	Mat'l Cost: \$648 Labor Cost: \$378 Total Cost: \$1,026 Savings: \$287
13 - Hallway	For the existing 6 surface-mounted lensed 1X1 fixtures, each using 2, 60-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 6)	Mat'l Cost: \$194 Labor Cost: None Total Cost: \$194 Savings: \$26
16 - Classroom #1	For the existing 1 exit sign fixture using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 1)	Mat'l Cost: \$54 Labor Cost: \$32 Total Cost: \$86 Savings: \$24
18 - Classroom #2 - Crib Room	For the existing 2 pendant-mounted fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 2)	Mat'l Cost: \$40 Labor Cost: None Total Cost: \$40 Savings: \$24
19 - Classroom #2 - Crib Room	For the existing 1 exit sign fixture using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 1)	Mat'l Cost: \$54 Labor Cost: \$32 Total Cost: \$86 Savings: \$24

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
27 - Men's Room	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$2
28 - Men's Room	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$2
30 - Ladies Room	For the existing 3 vanity fixtures, each using 30-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$49 Labor Cost: None Total Cost: \$49 Savings: \$4
31 - Ladies Room	For the existing 5 vanity fixtures, each using 25-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 5)	Mat'l Cost: \$81 Labor Cost: None Total Cost: \$81 Savings: \$4
32 - Ladies Room	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$2
33 - Ladies Room	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$2
34 - Library	For the existing 4 chandelier fixtures, each using 5, 25-Watt, incandescent lamps, retrofit each fixture with 5, 7 Watt compact fluorescent screw-in lamps. (New qty: 4)	Mat'l Cost: \$324 Labor Cost: None Total Cost: \$324 Savings: \$24
35 - Staircase to Downstairs	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$7
36 - Staircase to Downstairs	For the existing 1 round fixture using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 1)	Mat'l Cost: \$41 Labor Cost: \$41 Total Cost: \$81 Savings: \$7

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
37 - Staircase to Downstairs	For the existing 2 exit sign fixtures, each using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 2)	Mat'l Cost: \$108 Labor Cost: \$63 Total Cost: \$171 Savings: \$48
38 - Staircase to Downstairs	For the existing 1 round fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$11
39 - Downstairs Hallway	For the existing 5 round fixtures, each using 32-Watt fluorescent circline lamps, install new compact fluorescent fixtures with 18-Watt lamps. (New qty: 5)	Mat'l Cost: \$203 Labor Cost: \$203 Total Cost: \$405 Savings: \$26
40 - Downstairs Hallway	For the existing 2 exit sign fixtures, each using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 2)	Mat'l Cost: \$108 Labor Cost: \$63 Total Cost: \$171 Savings: \$48
43 - Kid's Restroom	For the existing 1 recessed lensed 1X1 fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$8
45 - Adults Restroom	For the existing 1 recessed lensed 1X1 fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$8
47 - Storage Room	For the existing 1 fixture using 40-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$
51 - Main Hallway Display Cabinets	For the existing 2 recessed lensed 1X2 fixtures, each using 2,2' standard lamps and ballasts, install new 1X2 wrap fixtures with 1-T8 lamp and electronic ballasts. (New qty: 2)	Mat'l Cost: \$68 Labor Cost: \$63 Total Cost: \$131 Savings: \$22
54 - Storage Room	For the existing 1 pendant-mounted fixture using 40-Watt, incandescent lamps, retrofit with 23-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$20 Labor Cost: None Total Cost: \$20 Savings: \$1

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
57 - Associate Minister's Office	For the existing 1 table lamp fixture using 60-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$14
59 - Men's Room	For the existing 1 fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$3
60 - Ladies Room	For the existing 1 fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$3
61 - Janitor's Closet	For the existing 1 fixture using 60-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$3
65 - Sanctuary	For the existing 16 hi-hat fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 16)	Mat'l Cost: \$317 Labor Cost: None Total Cost: \$317 Savings: \$76
66 - Sanctuary	For the existing 6 hi-hat fixtures, each using 75-Watt, incandescent lamps, retrofit with 18-Watt compact fluorescent screw-in lamps. (New qty: 6)	Mat'l Cost: \$97 Labor Cost: None Total Cost: \$97 Savings: \$20
67 - Sanctuary	For the existing 1 exit sign fixture using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 1)	Mat'l Cost: \$54 Labor Cost: \$32 Total Cost: \$86 Savings: \$24
69 - Sanctuary	For the existing 3 hi-hat fixtures, each using 100-Watt, incandescent "spotlight" lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$59 Labor Cost: None Total Cost: \$59 Savings: \$14
72 - Sanctuary	For the existing 2 fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 2)	Mat'l Cost: \$40 Labor Cost: None Total Cost: \$40 Savings: \$9

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
73 - Sanctuary	For the existing 1 table lamp fixture using 40-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$16 Labor Cost: None Total Cost: \$16 Savings: \$1
74 - Sanctuary Backstage Access Stairways	For the existing 3 round fixtures, each using 60-Watt, incandescent lamps, retrofit with 13-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$49 Labor Cost: None Total Cost: \$49 Savings: \$9
75 - Sanctuary Backstage Access Stairways	For the existing 1 exit sign fixture using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 1)	Mat'l Cost: \$54 Labor Cost: \$32 Total Cost: \$86 Savings: \$24
77 - Sanctuary - Choir Room	For the existing 2 surface-mounted lensed 2X4 fixtures, each using 4, 4' energy-efficient lamps and ballasts, retrofit with T8 lamps and electronic ballasts.	Mat'l Cost: \$80 Labor Cost: \$45 Total Cost: \$125 Savings: \$9
78 - Sanctuary - Choir Room	For the existing 1 exit sign fixture using 1, 20 Watt incandescent lamp, install new LED exit signs. (New qty: 1)	Mat'l Cost: \$54 Labor Cost: \$32 Total Cost: \$86 Savings: \$24
79 - Entrance to Sanctuary	For the existing 3 pendant-mounted fixtures, each using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$81 Labor Cost: None Total Cost: \$81 Savings: \$24
80 - Entrance to Sanctuary	For the existing 1 recessed lensed 1X1 fixture using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$20 Labor Cost: None Total Cost: \$20 Savings: \$7
81 - Usher's Closet	For the existing 1 fixture using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$27 Labor Cost: None Total Cost: \$27 Savings: \$4
82 - Stairway to Sanctuary Balcony	For the existing 1 recessed lensed 1X1 fixture using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$20 Labor Cost: None Total Cost: \$20 Savings: \$7

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
83 - Sanctuary Balcony	For the existing 3 wall sconce fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 3)	Mat'l Cost: \$59 Labor Cost: None Total Cost: \$59 Savings: \$14
84 - Sanctuary Balcony	For the existing 2 wall sconce fixtures, each using 75-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 2)	Mat'l Cost: \$40 Labor Cost: None Total Cost: \$40 Savings: \$6
86 - Memorial Room	For the existing 2 surface-mounted open industrial 1X4 fixtures, each using 1,4' energy-efficient lamp and ballasts, retrofit with T8 lamps and electronic ballasts.	Mat'l Cost: \$49 Labor Cost: \$45 Total Cost: \$94 Savings: \$1
87 - Memorial Room	For the existing 9 hi-hat fixtures, each using 75-Watt, incandescent "flood" lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 9)	Mat'l Cost: \$178 Labor Cost: None Total Cost: \$178 Savings: \$28
88 - Memorial Room	For the existing 2 table lamp fixtures, each using 100-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 2)	Mat'l Cost: \$40 Labor Cost: None Total Cost: \$40 Savings: \$9
89 - Memorial Room	For the existing 1 table lamp fixture using 75-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$20 Labor Cost: None Total Cost: \$20 Savings: \$3
90 - Copy Room	For the existing 1 surface-mounted open industrial 1X8 fixture using 2, 8' energy-efficient lamps and ballasts, retrofit with T8 lamps and electronic ballasts.	Mat'l Cost: \$50 Labor Cost: \$23 Total Cost: \$72 Savings: \$2
91 - Maintenance Office	For the existing 1 fixture using 150-Watt, incandescent lamps, retrofit with 65-Watt compact fluorescent screw-in lamps. (New qty: 1)	Mat'l Cost: \$27 Labor Cost: None Total Cost: \$27 Savings: \$17
94 - Exterior	For the existing 2 wall-pack fixtures, each using 150-Watt quartz lamps, retrofit with PAR Capsylite HIR lamps, 100-Watt. (New qty: 2)	Mat'l Cost: \$25 Labor Cost: \$11 Total Cost: \$36 Savings: \$22

# 2

## Energy Cost Reduction Opportunities

Line # - Area	Action	Costs and Savings
95 - Exterior	For the existing 4 wall-pack fixtures, each using 75-Watt, incandescent lamps, retrofit with 25-Watt compact fluorescent screw-in lamps. (New qty: 4)	Mat'l Cost: \$79 Labor Cost: None Total Cost: \$79 Savings: \$44

Total Fixtures	
<b>Unaffected Qty:</b>	139
<b>Affected Qty:</b>	160
<b>Total Existing Qty:</b>	299

Totals	
<b>Labor Cost:</b>	\$1,381
<b>Material Cost:</b>	\$4,901
<b>Total:</b>	\$6,274
<b>Total Savings:</b>	\$1,401
<b>Payback:</b>	4.5 years.

# 2

## Energy Cost Reduction Opportunities

### Install Lighting Controls

#### Install Lighting Controls to Reduce the Lighting Use

In some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. In some cases a wind-up timer is what is required. Another type is the timeclock which allows the user to set an on/off schedule. Timeclocks can be a dial clock with on/off indicators on it, or a timeclock can be a small box the size of a thermostat where the user programs the on/off schedule in a digital format like setting the alarm on a wristwatch. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

Details of the lighting controls recommendation are shown in the following table.

Line #	Location	Exist. Hrs.	New Hrs.	Type of Control to Install	Qty	Mat'l Cost	Labor Cost	Total Cost	Annual Savings
26	Storage Room	20	10	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$10
27	Men's Room	30	10	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$3
28	Men's Room	30	10						\$3
30	Ladies Room	30	10	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$7
31	Ladies Room	30	10						\$12
32	Ladies Room	30	10						\$3

# 2

## Energy Cost Reduction Opportunities

Line #	Location	Exist. Hrs.	New Hrs.	Type of Control to Install	Qty	Mat'l Cost	Labor Cost	Total Cost	Annual Savings
33	Ladies Room	30	10						\$3
34	Library	35	10						\$40
41	Room #12 - Storage*	20	10	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$10
46	Storage Room	7	2	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$1
47	Storage Room	7	2						\$1
56	Associate Minister's Office	40	30	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$14
58	Music Director's Office	40	30	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$10
63	Chris Monahan's Office	40	30	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$14
64	Senior Minister's Office	40	25	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$29
91	Maintenance Office	35	25	Wall Occupancy Sensor	1	\$50	\$25	\$75	\$5
<b>Totals:</b>					<b>10</b>	<b>\$500</b>	<b>\$250</b>	<b>\$750</b>	<b>\$165</b>
<i>Payback: 4.5 years.</i>									

# 2

## Energy Cost Reduction Opportunities

### Improve Temperature Control

It is the intention of almost all facilities to keep the thermostat set at the most economical position while providing an appropriate climate for the occupants. However, due to thermostat problems, too many people with access to the thermostat, or faulty setback equipment, many control systems fall short of the optimum energy cost savings.

The following tables show the existing setpoints for each area of the facility and also the recommended or “proposed” setpoints (shown in the shaded rows). It should be noted that the temperature setpoints in the facility may have varied greatly over the past twelve months. The information shown below for the “existing conditions” is based on data collected at the site and is adjusted up or down depending upon the amount of energy used over the past twelve months.

Zone 1		Occupied Periods		Days/ Week	Heating Profile		Cooling Profile	
		From	To		Occupied	Unocc	Occupied	Unocc
Entire Building	<i>existing</i>	7:00 AM	10:00 PM	6	70	60		
	<i>proposed</i>	7:00 AM	10:00 PM	6	70	55		
	<i>existing</i>	8:00 AM	10:00 PM	1	70	60		
	<i>proposed</i>	8:00 AM	10:00 PM	1	70	55		

<i>Zone 1 Summary - Entire Building</i>	
<b>Annual Heating Cost Savings (oil):</b>	\$2,340
<b>Payback:</b>	Immediately.

# 2

## Energy Cost Reduction Opportunities

### Improve the Building Envelope

The word “envelope” refers to the “shell” of the building: walls, roof, windows, and doors. To improve the envelope would mean upgrading or adding materials or equipment to enhance the insulation or to reduce the amount of unconditioned outside air that enters the building.

In some cases, envelope improvements require a significant investment. Although the money gets recovered through energy savings, the payback is typically not very attractive. However, other considerations would add a great deal of value to the improvements. For example, in the case of a drafty building, adding insulation or upgrading the windows would improve human comfort. Human comfort affects your bottom line because uncomfortable or unhappy occupants will have a higher absentee rate and/or will require additional time from maintenance personnel as they search for stopgap solutions to the problem. Another example would be an undersized heating system. Instead of installing a new heating system, the building envelope could be improved to the point where the existing heating system is sufficient. These and other considerations must be taken into account when analyzing envelope measures. However, this report takes into account energy savings, only.

<b><i>Install New Windows:</i></b>	
<b>Area:</b>	Entire Building
<b>Action:</b>	Replace all existing single pane windows with new double pane low-e argon filled thermal windows.
<b>Sq Ft:</b>	1,660
<b>Condition:</b>	Loose
<b>Material Cost:</b>	\$21,580
<b>Labor Cost:</b>	\$53,120
<b>Total Cost:</b>	\$74,700
<b>Savings:</b>	\$9,210
<b>Payback (years):</b>	8.1

# 2

## *Energy Cost Reduction Opportunities*

### **Other Measures**

#### *Reduce Your Electricity Usage Due to the Computers*

Currently your computers use more electricity than necessary. A significant amount of usage charges would be avoided if two strategies were adopted: automatic monitor shutdown during periods of inactivity and completely shutting your computers off after hours. Many people customize their screen savers to display something instead of shutting down and this causes the monitor to continue using full power. Most screensaver programs and/or terminal software programs can be set to automatically shut the monitor off after a period of inactivity. A significant amount of electricity charges can be avoided by changing the settings from 'display' to 'off'. In addition, it is suggested that you institute a policy to shut down any non-critical computers at night in an effort to reduce this unnecessary electricity usage and its associated costs, as well. This recommendation requires no material or labor expenditures. Annual savings are estimated to be \$35. This yields a payback of 0.0 years.

#### *Replace the Old Refrigerators*

This recommendation suggests that you consider replacing your older refrigerators in light of the fact that a newer model will use a fraction of the electricity. A modern, high-efficiency refrigerator will use only 35% of the electricity that would have been used by a similar model manufactured in 1973. When purchasing the new equipment, pay attention to the yellow-and-black Energy Cost labels and compare the yearly energy cost of competing brands and models of similar size with similar features. The following equipment applies: Kitchen - Old Frigidaire Refrigerator. This recommendation will require about \$650 in materials and \$0 in labor. Annual savings are estimated to be \$175. This yields a payback of 3.7 years.

# 3

## Historical Energy Usage and Costs

Table 3-2 and Figure 3-1 represents the electrical energy usage for the surveyed building from Jun-06 to May-07. CONED provides electricity to the facility under Rate EL1. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is measured by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000-Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. Rates used in this report reflect the most current rate structure available. Table 3-1 shows the annualized rate structure:

**Table 3-1**  
**Rate Structure for Rate EL1**

Description	Summer	Winter	Average
Energy Charge	\$0.1800/kWh	\$0.1500/kWh	\$0.1600/kWh

Figure 3-2 is a pie chart reflecting the electrical end-uses and their contribution to the total electricity usage. Table 3-3 is the electrical end-use in data format.

Table 3-4 and Figure 3-3 on the following pages show the natural gas energy usage for the surveyed building from Jun-06 to May-07. Gas is supplied by CONED. The annual usage and cost are 1,326 CCF and \$2,302, respectively. This yields an average cost \$1.73630 / CCF.

Figure 3-4 is a pie chart reflecting the gas end-uses and their contribution to the total gas usage. Table 3-5 is the gas end-use in data format.

Annual oil usage is 7,344 gallons at an annual cost of \$18,360. Average cost per gallon is \$2.50. Oil is used exclusively for space heating.

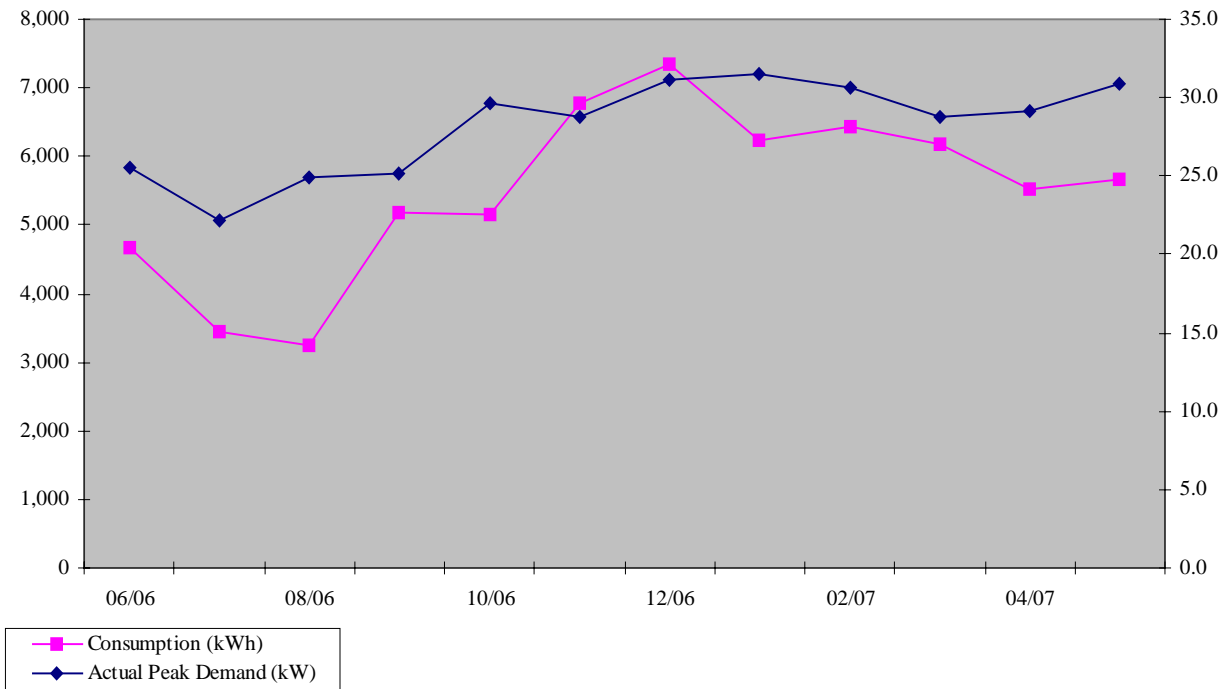
# 3

## Historical Energy Usage and Costs

**Table 3-2  
Electricity Billing Data**

Month of Use	Days in Month	Consumption kWh	Peak Demand		Total Bill
			Actual	Billed	
06/06	32	4,680	25.5	25.5	\$833
07/06	30	3,450	22.2	22.2	\$621
08/06	29	3,240	24.9	24.9	\$592
09/06	32	5,190	25.2	25.2	\$908
10/06	29	5,160	29.7	29.7	\$788
11/06	34	6,780	28.8	28.8	\$935
12/06	29	7,350	31.2	31.2	\$1,111
01/07	31	6,240	31.5	31.5	\$978
02/07	32	6,420	30.6	30.6	\$961
03/07	29	6,180	28.8	28.8	\$980
04/07	29	5,520	29.1	29.1	\$864
05/07	29	5,670	30.9	30.9	\$920
<b>Totals</b>	<b>365</b>	<b>65,880</b>			<b>\$10,493</b>

**Figure 3-1  
Electricity Usage Profile**



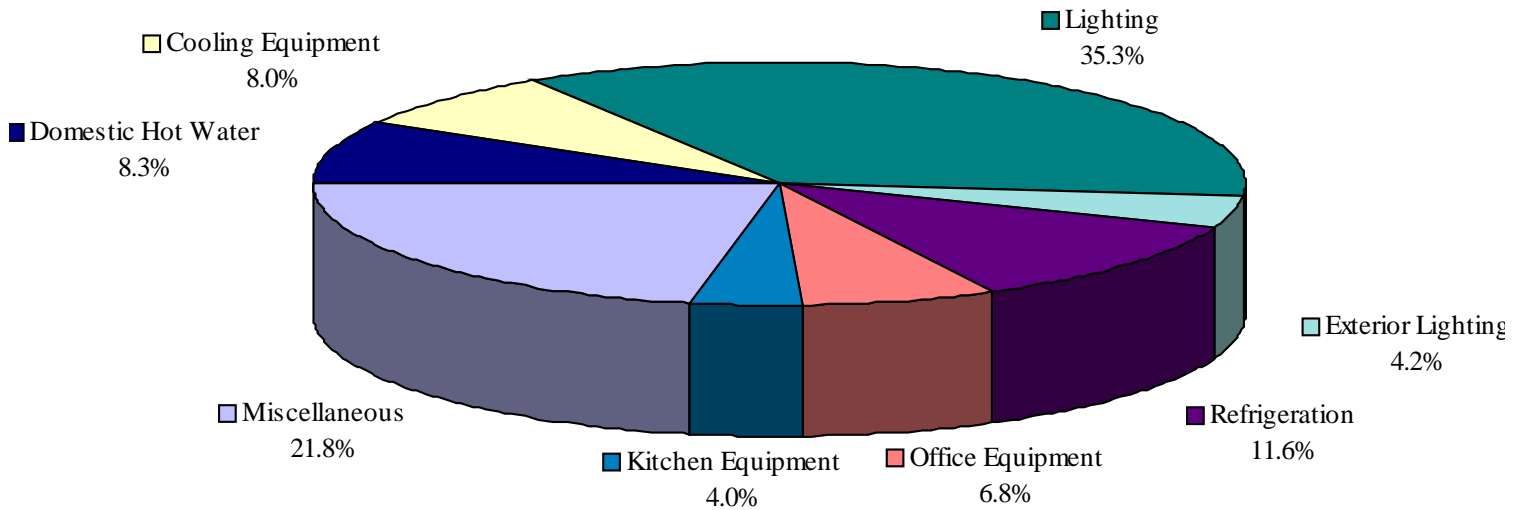
# 3

## Historical Energy Usage and Costs

**Table 3-3  
Electricity End Use**

End Use	Percent of Total
Domestic Hot Water	8.3%
Cooling Equipment	8.0%
Lighting	35.3%
Exterior Lighting	4.2%
Refrigeration	11.6%
Office Equipment	6.8%
Kitchen Equipment	4.0%
Miscellaneous	21.8%
TOTAL	100.0%

**Figure 3-2  
Electricity End Use**



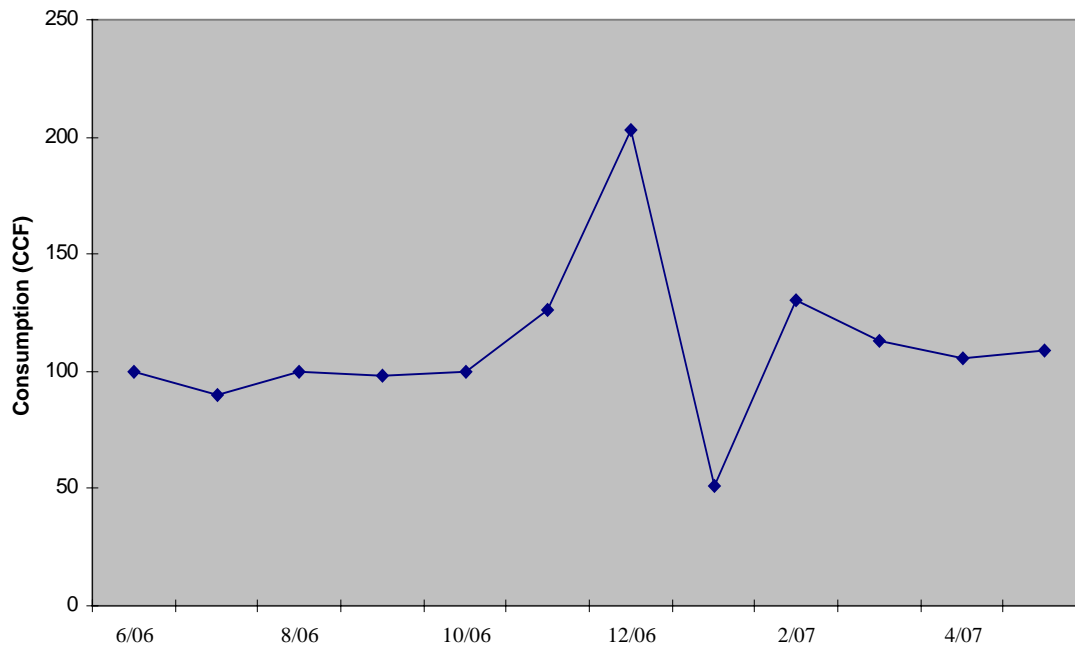
# 3

## Historical Energy Usage and Costs

**Table 3-4  
Natural Gas Billing Data**

Date	Days per Month	Consumption (CCF)	Total Bill
6/06	32	100	\$176
7/06	30	90	\$147
8/06	29	100	\$158
9/06	32	98	\$159
10/06	29	100	\$154
11/06	34	126	\$213
12/06	29	203	\$354
1/07	31	51	\$104
2/07	32	130	\$232
3/07	29	113	\$207
4/07	29	106	\$190
5/07	29	109	\$210
<b>Totals</b>	<b>365</b>	<b>1,326</b>	<b>\$2,302</b>

**Figure 3-3  
Natural Gas Usage Profile**



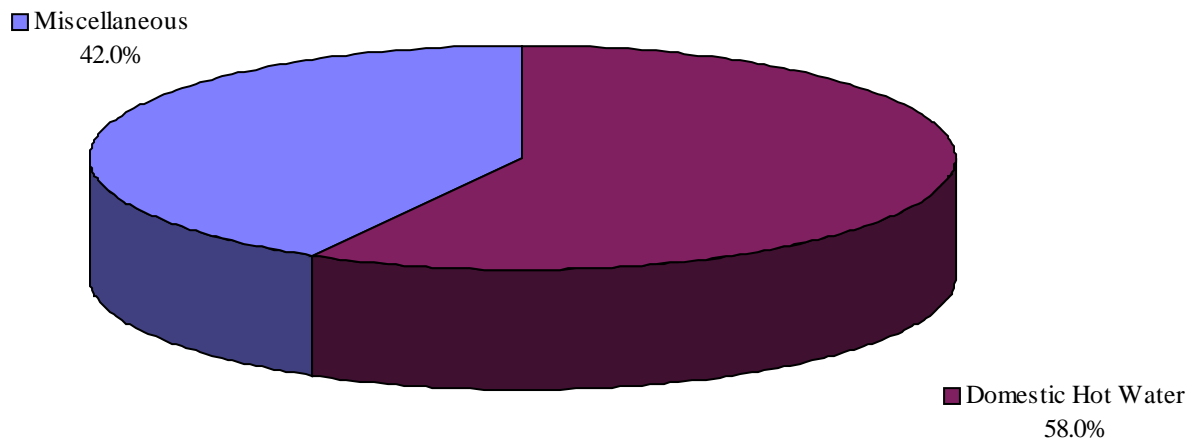
# 3

## Historical Energy Usage and Costs

**Table 3-5**  
**Natural Gas End Use**

End Use	Percent of Total
Domestic Hot Water	58.0%
Miscellaneous	42.0%
TOTAL	100%

**Figure 3-4**  
**Natural Gas End Use**



# 4

## Equipment Inventory

### Building Characteristics

Building Construction						
Description	Age (yrs)	Wall Type	Wall Insulation	Roof Type	Roof Insulation	Window Type
Entire Building	57	Brick and Block	Unknown	Pitched and Flat Sections	Please See Architectural Comments Below	Single Pane and Double Pane

<b>Facility Name:</b>	First Congregational Church of Chappaqua
<b>Total Square Footage:</b>	19,800
<b>Building Type:</b>	Church/ School

Building consists of three sections. Parish Hall was built in 1950, sanctuary was built in 1951, and office wing was built in 1952. Wall construction is brick with block and interior sheet rock with plaster walls. We assumed that the walls are not insulated and based on our observations; the attic is insulated with approximately 4" thick loose rockwool insulation. Flat portion of the roof was not accessible during the audit walkthrough. We estimated 2" of fiberglass board insulation on the flat roof section.

### Equipment Inventory

Equipment denoted by an asterisk indicates an estimate of the equipment ratings due to equipment inaccessibility, worn nameplates, or a lack of nameplates. The Miscellaneous Equipment table ends with a column that shows that line's contribution to the total respective fuel bill (electricity, gas, oil, etc.)

Heating Equipment				
Description	Qty	Capacity	Fuel	Age (yrs)
Buderus Logano GE315/8	2	663 MBH	oil	8

Cooling Equipment			
Description	Qty	Capacity	Age (years)
Church Office Window A/C	1	0.75 Tons	8
Associate Minister's Office Window A/C	1	0.75 Tons	8
Chris Monahan's Office Window A/C	1	0.75 Tons	8

# 4

## Equipment Inventory

Cooling Equipment			
Description	Qty	Capacity	Age (years)
Senior Minister's Office Window A/C	1	0.75 Tons	8
Memorial Room Window A/C	1	2 Tons	8

Ventilation Equipment				
Description	Qty	Capacity	Hrs/Wk Winter	Hrs/Wk Summer

Domestic Hot Water Systems			
Description	Qty	Capacity	Fuel
Rheem 21VR75 Natural Gas Fired Storage Type Water Heater	1	60 MBH	gas
Rheem Electric Storage Type Water Heater	1	4.5 kW	elec

Miscellaneous Equipment						
Description	Qty	Capacity	Fuel	Hrs/Wk Usage	% Fuel Usage	End-Use
Miscellaneous Load	1	3 kW	elec	50	11.8%	Miscellaneous
Boiler Room Circulator Pumps	9	0.2 kW	elec	50	7.1%	Miscellaneous
Kitchen - Old Frigidaire Refrigerator	1	0.7 kW	elec	50	2.8%	Refrigeration
Kitchen - Imperial Heavy Duty Manual Defrost Freezer	1	0.5 kW	elec	50	2.0%	Refrigeration
Kitchen - New Garland Stove/ Oven Combo with 6 Medium Burners	1	120 MBH	gas	9	42.4%	Kitchen Equipment
Kitchen - Hobart Commercial Dishwasher	1	4 kW	elec	4	1.3%	Kitchen Equipment
Kitchen - Coffee Machine	6	0.4 kW	elec	12	2.3%	Kitchen Equipment

## 4

## Equipment Inventory

Miscellaneous Equipment						
Description	Qty	Capacity	Fuel	Hrs/Wk Usage	% Fuel Usage	End-Use
Kitchen - Old Kitchenaid Dishwasher	1	1 kW	elec	4	0.3%	Kitchen Equipment
Kitchen - Microwave	1	1 kW	elec	1	0.1%	Kitchen Equipment
Kitchen - Toaster Oven	1	0.5 kW	elec	1	0.0%	Kitchen Equipment
Desktop PCs	14	0.3 kW	elec	10	3.3%	Office Equipment
Main Hallway Soda Vending Machine	1	0.8 kW	elec	50	3.2%	Refrigeration
Printers	7	0.4 kW	elec	5	1.1%	Office Equipment
Ceiling Fans	1	0.4 kW	elec	20	0.6%	Miscellaneous
Copiers	3	0.8 kW	elec	5	1.0%	Office Equipment
Fax Machines	1	0.4 kW	elec	2	0.1%	Office Equipment
Sanctuary Fan/Coil Unit Fans	2	0.25 HP	elec	8	0.2%	Miscellaneous
Sanctuary Audio System	1	1.6 kW	elec	6	0.8%	Office Equipment
Sanctuary Digital Bell Control System	1	0.05 kW	elec	168	0.7%	Office Equipment
Sanctuary Choir Room Fan/Coil Unit Fans	2	0.125 HP	elec	8	0.1%	Miscellaneous
Sanctuary - Choir Room Dehumidifier	1	1 kW	elec	6	0.5%	Miscellaneous
Sanctuary - Water Coolers	2	0.6 kW	elec	40	3.8%	Refrigeration
Sanctuary Fan/Coil Unit Fans	16	0.2 HP	elec	8	1.5%	Miscellaneous
Sanctuary Ventilation Fan	1	0.75 HP	elec	1	0.0%	Miscellaneous

The second to the last column of the Miscellaneous Equipment Table shows the percentage of the total fuel usage (electricity, natural gas, or fuel oil) which corresponds with the pie charts on the previous pages. The “Hrs/Wk Usage” column values include the equipment load factor and duty cycling (i.e. an air compressor running at 80% capacity and cycling on 30% of the time during a 60 hour week would have an “Hrs/Wk Usage” value of  $60 \times 0.08 \times 0.30 = 14$  Hrs/Wk).

## 4

## Equipment Inventory

Lighting Equipment			
Line #	Area	Description	Hrs/Wk Usage
1	Boiler Room	3 fixtures, each using 150-Watt, incandescent "flood" lamps.	5
2	Boiler Room	1 fixture using 150-Watt, incandescent lamps.	5
3	Staircase to Boiler Room	1 fixture using 150-Watt, incandescent lamps.	5
4	Kitchen Hood	2 fixtures, each using 100-Watt, incandescent lamps.	12
5	Kitchen*	4 surface-mounted open industrial 2X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	12
6	Parish Hall	16 recessed fixtures, each using 150-Watt, incandescent lamps.	16
7	Parish Hall	6 wall sconce fixtures, each using 2, 150-Watt, incandescent lamps.	16
8	Main Entrance Foyer	2 round fixtures, each using 32-Watt fluorescent circline lamps.	20
9	Hallway	6 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
10	Hallway	1 exit sign fixture using LED technology.	168
11	Hallway	12 exit sign fixtures, each using 1, 20 Watt incandescent lamp.	168
12	Hallway	3 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	20
13	Hallway	6 surface-mounted lensed 1X1 fixtures, each using 2, 60-Watt, incandescent lamps.	6
14	Hallway	6 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	35
15	Classroom #1	6 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	20
16	Classroom #1	1 exit sign fixture using 1, 20 Watt incandescent lamp.	168
17	Classroom #2 - Crib Room	2 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20

## 4

## Equipment Inventory

<b>Lighting Equipment</b>			
<b>Line #</b>	<b>Area</b>	<b>Description</b>	<b>Hrs/Wk Usage</b>
18	Classroom #2 - Crib Room	2 pendant-mounted fixtures, each using 100-Watt, incandescent lamps.	20
19	Classroom #2 - Crib Room	1 exit sign fixture using 1, 20 Watt incandescent lamp.	168
20	Classroom #3	6 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	20
21	Classroom #4	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
22	Room #5 - Office	2 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	30
23	Classroom #6	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
24	Classroom #9	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	35
25	Classroom #10	10 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
26	Storage Room	2 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	20
27	Men's Room	1 round fixture using 32-Watt fluorescent circline lamps.	30
28	Men's Room	1 round fixture using 32-Watt fluorescent circline lamps.	30
29	Meeting Room	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	10
30	Ladies Room	3 vanity fixtures, each using 30-Watt, incandescent lamps.	30
31	Ladies Room	5 vanity fixtures, each using 25-Watt, incandescent lamps.	30
32	Ladies Room	1 round fixture using 32-Watt fluorescent circline lamps.	30
33	Ladies Room	1 round fixture using 32-Watt fluorescent circline lamps.	30
34	Library	4 chandelier fixtures, each using 5, 25-Watt, incandescent lamps.	35

## 4

## Equipment Inventory

<b>Lighting Equipment</b>			
<b>Line #</b>	<b>Area</b>	<b>Description</b>	<b>Hrs/Wk Usage</b>
35	Staircase to Downstairs	1 round fixture using 32-Watt fluorescent circline lamps.	35
36	Staircase to Downstairs	1 round fixture using 32-Watt fluorescent circline lamps.	35
37	Staircase to Downstairs	2 exit sign fixtures, each using 1, 20 Watt incandescent lamp.	168
38	Staircase to Downstairs	1 round fixture using 60-Watt, incandescent lamps.	35
39	Downstairs Hallway	5 round fixtures, each using 32-Watt fluorescent circline lamps.	25
40	Downstairs Hallway	2 exit sign fixtures, each using 1, 20 Watt incandescent lamp.	168
41	Room #12 - Storage*	2 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	20
42	Kid's Restroom	1 round fixture using 22-Watt fluorescent circline lamps.	25
43	Kid's Restroom	1 recessed lensed 1X1 fixture using 60-Watt, incandescent lamps.	25
44	Adults Restroom	1 round fixture using 22-Watt fluorescent circline lamps.	25
45	Adults Restroom	1 recessed lensed 1X1 fixture using 60-Watt, incandescent lamps.	25
46	Storage Room	1 round fixture using 22-Watt fluorescent circline lamps.	7
47	Storage Room	1 fixture using 40-Watt, incandescent lamps.	7
48	Classroom #13	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
49	Classroom #14	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
50	Classroom #15	4 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	20
51	Main Hallway Display Cabinets	2 recessed lensed 1X2 fixtures, each using 2,2' standard lamps and ballasts.	35

## 4

## Equipment Inventory

<b>Lighting Equipment</b>			
<b>Line #</b>	<b>Area</b>	<b>Description</b>	<b>Hrs/Wk Usage</b>
52	Children's Library	2 surface-mounted lensed 2X4 fixtures, each using 4, 4' T8 lamps and electronic ballasts.	35
53	Storage Room	1 pendant-mounted fixture using 23-Watt, compact fluorescent, screw-in lamps .	10
54	Storage Room	1 pendant-mounted fixture using 40-Watt, incandescent lamps.	10
55	Church Office	4 surface-mounted lensed 2X4 fixtures, each using 4, 4' T8 lamps and electronic ballasts.	40
56	Associate Minister's Office	2 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	40
57	Associate Minister's Office	1 table lamp fixture using 60-Watt, incandescent lamps.	40
58	Music Director's Office	2 surface-mounted lensed 2X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	40
59	Men's Room	1 fixture using 60-Watt, incandescent lamps.	10
60	Ladies Room	1 fixture using 60-Watt, incandescent lamps.	10
61	Janitor's Closet	1 fixture using 60-Watt, incandescent lamps.	10
62	Keith's Old Office	2 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	40
63	Chris Monahan's Office	2 surface-mounted lensed 2X4 fixtures, each using 3,4' T8 lamps and electronic ballasts.	40
64	Senior Minister's Office	4 surface-mounted lensed 1X4 fixtures, each using 2, 4' T8 lamps and electronic ballasts.	40
65	Sanctuary	16 hi-hat fixtures, each using 100-Watt, incandescent lamps.	8
66	Sanctuary	6 hi-hat fixtures, each using 75-Watt, incandescent lamps.	8
67	Sanctuary	1 exit sign fixture using 1, 20 Watt incandescent lamp.	168
68	Sanctuary	2 industrial fixtures, each using 3,4' T8 lamps and electronic ballasts.	8

## 4

## Equipment Inventory

<b>Lighting Equipment</b>			
<b>Line #</b>	<b>Area</b>	<b>Description</b>	<b>Hrs/Wk Usage</b>
69	Sanctuary	3 hi-hat fixtures, each using 100-Watt, incandescent "spotlight" lamps.	8
70	Sanctuary	12 track lighting fixtures, each using 100-Watt quartz lamps.	6
71	Sanctuary	2 stage lights fixtures, each using 300-Watt, incandescent lamps.	6
72	Sanctuary	2 fixtures, each using 100-Watt, incandescent lamps.	8
73	Sanctuary	1 table lamp fixture using 40-Watt, incandescent lamps.	6
74	Sanctuary Backstage Access Stairways	3 round fixtures, each using 60-Watt, incandescent lamps.	8
75	Sanctuary Backstage Access Stairways	1 exit sign fixture using 1, 20 Watt incandescent lamp.	168
76	Sanctuary - Choir Room	3 surface-mounted lensed 2X4 fixtures, each using 4, 4' T8 lamps and electronic ballasts.	15
77	Sanctuary - Choir Room	2 surface-mounted lensed 2X4 fixtures, each using 4, 4' energy-efficient lamps and ballasts.	15
78	Sanctuary - Choir Room	1 exit sign fixture using 1, 20 Watt incandescent lamp.	168
79	Entrance to Sanctuary	3 pendant-mounted fixtures, each using 150-Watt, incandescent lamps.	12
80	Entrance to Sanctuary	1 recessed lensed 1X1 fixture using 100-Watt, incandescent lamps.	12
81	Usher's Closet	1 fixture using 150-Watt, incandescent lamps.	6
82	Stairway to Sanctuary Balcony	1 recessed lensed 1X1 fixture using 100-Watt, incandescent lamps.	12
83	Sanctuary Balcony	3 wall sconce fixtures, each using 100-Watt, incandescent lamps.	8
84	Sanctuary Balcony	2 wall sconce fixtures, each using 75-Watt, incandescent lamps.	8

## 4

## Equipment Inventory

<b>Lighting Equipment</b>			
<b>Line #</b>	<b>Area</b>	<b>Description</b>	<b>Hrs/Wk Usage</b>
85	Memorial Room	1 chandelier fixture using 12, 25-Watt, incandescent lamps.	8
86	Memorial Room	2 surface-mounted open industrial 1X4 fixtures, each using 1,4' energy-efficient lamp and ballasts.	8
87	Memorial Room	9 hi-hat fixtures, each using 75-Watt, incandescent "flood" lamps.	8
88	Memorial Room	2 table lamp fixtures, each using 100-Watt, incandescent lamps.	8
89	Memorial Room	1 table lamp fixture using 75-Watt, incandescent lamps.	8
90	Copy Room	1 surface-mounted open industrial 1X8 fixture using 2, 8' energy-efficient lamps and ballasts.	40
91	Maintenance Office	1 fixture using 150-Watt, incandescent lamps.	35
92	Exterior	3 wall-pack fixtures, each using 90-Watt, PAR-capsylite halogen lamps.	28
93	Exterior	16 pole-mounted fixtures, each using 50-Watt metal halide lamps.	28
94	Exterior	2 wall-pack fixtures, each using 150-Watt quartz lamps.	28
95	Exterior	4 wall-pack fixtures, each using 75-Watt, incandescent lamps.	28

# 5

## Methodology

The first step in the energy analysis is the site survey. The auditor walks your entire site to inventory the building envelope (roof, windows, etc.), the heating, ventilation, and air conditioning equipment (HVAC), the lighting equipment, other facility-specific equipment, and to gain an understanding of how each facility is used.

The collected data is then processed with a software package from The Daylight Savings Company in Goshen, NY (1-800-337-2192) that calculates the anticipated energy usage. The actual energy usage is entered directly from your utility bills. The anticipated energy usage is compared to the actual usage. If necessary, corrections are made to the site-collected data until the anticipated energy usage matches the actual usage. This process develops an end-use baseline for all of the fuels used at the facility. The baseline is used to calculate the energy savings for the measures that are recommended in this report.

The savings in this report are not duplicative. The savings for each recommendation may actually be higher if the individual recommendations were installed instead of the entire project. For example, the lighting module calculates the change in wattage and multiplies it by the new operating hours instead of the existing operating hours (if there was a change in the hours at all). The lighting controls module calculates the change in hours and multiplies it by the new system wattage instead of the existing wattage. Therefore, if you chose to install the recommended lighting system but not the lighting controls, the savings achieved with the new lighting system would actually be higher because there would have been no reduction in the hours of use.

The same principal follows for heating, cooling, and temperature recommendations - even with fuel switching. If there are recommendations to change the temperature settings to reduce fuel use, then the savings for the heating/cooling equipment recommendations are reduced, as well.

Our thermal module calculates the savings for temperature reductions using ASHRAE's modified bin method. The savings are calculated in "output" values - meaning energy, not fuel savings. To show fuel savings we multiply the energy values times the fuel conversion factor (these factors are different for electricity, natural gas, fuel oil, etc.) and also take into account the heating/cooling equipment efficiency. The temperature recommendation savings are lower when the heating/cooling equipment is more efficient or is using a cheaper fuel. Also, you may see natural gas savings in this report even if you do not currently have natural gas. This happens when fuel switching was recommended for your heating/cooling equipment and you have temperature reduction recommendations, as well.

Thermal recommendations (insulation, windows, pipe insulation etc.) are evaluated by taking the difference in the thermal load due to reduced heat transfer. Again, the "thermal load" is the thermal load after the other recommendations have been accounted for.

Lastly, installation costs are then applied to each recommendation and simple paybacks are calculated. Costs are derived from Means Cost Data, other industry publications, and local contractors and suppliers.