



*Manufacturers of Green Heating & Cooling Control Systems*  
Established 1985

# WSFSSH

WEST SIDE FEDERATION OF SENIOR AND SUPPORTIVE HOUSING

REPORT ON FUEL SAVINGS  
ATTRIBUTED TO THE INSTALLATION  
OF THE  
ENERGUARD and HEAT-MASTER  
HEAT CONTROL COMPUTER  
MANUFACTURED BY PEPCO

March 12, 2009

PREPARED FOR:  
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DIRECTOR OF FACILITIES



## CASE STUDY

### OVERVIEW

This is a summary report of the fuel savings documented as a result of the installation of the ENERGY MANAGEMENT SYSTEM (“EMS”) ENERGUARD™ and HEAT-MASTER™ manufactured by PEPCO installed in 8 buildings owned and operated by West Side Federation Of Senior and Supportive Housing (“WSFSSH”). This report includes the fuel (oil and gas) delivered to each building and compares the previous years energy usage before the EMS was installed to the 2 years following the installation.

To compensate for weather and demonstrate a apples to apples comparison the report incorporates Heating Degree Days obtained from the NYSERDA web site at La Guardia Airport vs actual Fuel Usage. This report further describes the heating plants in general and the optimization methods used to achieve the savings.

The average fuel saved over the past 2 years is 25.06% with 19.29% average savings in 2007/2008 and through on going fine tuning and adjustments 2008/2009 improved to 31.58%.

In 2004 WSFSSH contracted with NYSERDA through Community Environmental Center ( “CEC” ) to install its first of 8 Energy Management Systems. Seven more sites were added over the past 3. The sites are listed below.

<b><u>Building</u></b>	<b><u>Address</u></b>	<b><u>Year EMS Installed</u></b>	
Kowal House	149 Manhattan Ave.	December	2004
Fania Gersham	140 West 105th Street	December	2006
129th Street Residence	109 West 129th Street	September	2007
West 74th Street Home	300 Amsterdam	September	2007
Ben Michaelski Residence	206 West 84th Street	September	2007
Red Oak	135 West 106 Street	September	2007
The Westbourne	930 West End Ave.	September	2007
Valley Lodge	149 West 108th Street	September	2007

**NOTE:** Project funding came thru New York State Energy Research And Development Authority (“NYSERDA”) under the Weatherization Program.

### ENERGUARD™ and HEAT-MASTER™

#### Brief Description

The ENERGUARD™ and HEAT-MASTER™ products are Energy Management Systems (“EMS”) designed using state-of-the-art computer technology. The heart of the system is DELTA Controls <http://www.deltacontrols.com/> . DELTA manufactures a wide range of Building Automation hardware and software with world wide distribution through a PARTNER network in over 40 countries and six continents. PEPCO is an authorized DELTA Partner since 1996. PEPCO products were developed on DELTA’s BACnet platform. BACnet is a non-propriety open protocol

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software platform. PEPCO developed application specific products for EMS utilizing information management to control facility temperatures and reduce energy usage (Go Green).

The ENERGUARD™ is designed for large facilities with 50 or more apartments. The HEAT-MASTER™ is designed for smaller facilities with 2 to 49 apartments. Both systems are Internet ready and can be connected to using a Laptop or Desktop PC. They optimize energy usage by controlling pumps, boilers and valves through a computer. These system are DIRECT Temperature Control systems because they employ wireless remote room temperature sensors to provide feedback to the EMS as the means to regulate facility temperature. INDIRECT Control systems rely on out door air temperature and cause the heating system to make more heat on colder days.

Under the NYSERDA grant PEPCO engineered custom control systems designed to make the facility temperatures at WSFSSH more comfortable while reducing energy costs and providing 24/7 Remote Monitoring.

What follows is a brief description of the heating plants in the WSFSSH facilities. There are three distinct types of heating plants represented below and the existing control systems found in each, a description of what was installed and the OPTIMIZATION methods PEPCO used to make the facility temperatures more comfortable while reducing energy usage.

## 1. KOWAL HOUSE (INSTALLED 2004)

### The Existing Heating Plant and Controls

The heating plant consists of 4 Hydrotherm hot water generators used to produce heat and hot water for this multifamily residential apartment building. 2 hot water circulation pumps maintain a constant flow of water through the boilers and domestic hot water tank coils. Two heating pumps circulate hot water for heat to the facility.

The existing controls consisted of wall mounted ON/OFF switches to manually Start / Stop the 4 pumps at the direction of the building superintendent. The burners cycled on and off to maintain constant loop temperature of 180 degrees. Boiler lead lag was controlled using Honeywell Aquastats that were set 3 degrees apart. If the temperature at the first burner dropped to 177 degrees (180 set point - 3 degrees = 177) the second burner started. If the temperature at the second burner dropped to 174 the third burner started. Burner rotation was accomplished when the aquastat temperature settings on the Honeywell Aquastats were manually adjusted. A four way diverting valve modulated to regulate the discharge temperature to the facility based on outdoor air temperature (OAT). When the OAT was 30 degrees the valve was opened to deliver 180 degree water temperature to the facility. When the OAT was 55 degrees the temperature was adjusted to deliver 120 degree water to the facility.

The facility was often over heated because many days the building space temperatures were 80 degrees and the heating system continued to produce more heat. Pumps constantly ran all winter

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long even when the OAT was above 55 degrees. Excessive burner wear resulted on the lead burners due to constant operation. The lack of rotation caused the lead burner to fail more frequently. On very cold days and during peak hot water usage the domestic hot water at the tap would drop below 90 degrees.

#### PEPCO Installed Controls

The project involved installing the ENERGUARD to take over complete control of the heating plant including Start/Stop of burners, pumps and diverting valve. The ENERGUARD commands the burners to cycle ON and OFF to maintain a loop temperature between 130 and 180 depending on domestic hot water demand and heat demand as sensed by the wireless room temperatures and OAT. The 4 way diverting valve was replaced with a new 3 way valve to provide more precise control of the water temperature being delivered to the facility. Facility supply water temperature is regulated based on feedback from the wireless remote room sensors. As the indoor space temperature drops the 3 way valve is modulated OPEN to deliver hotter water. As the space temperature rises to the desired SET POINT temperature, the valve modulates CLOSED. When the indoor temperatures are satisfied the heating circulation pumps are commanded to STOP and will automatically RE-START when the space temperature falls .5 degrees below set point. The heating plant automatically shuts down when the OAT rises above 56 degrees except to make domestic hot water and automatically RE-STARTS when the OAT drops to 55 degrees.

This was the first installation and fuel records were not available to create a savings report.

## 2. THE WESTBOURNE (INSTALLED 2007)

#### The Existing Heating Plant and Controls

This plant consists of a single boiler two pipe system that produces steam to heat this multi-residential facility. Domestic hot water is produced from a submerged coil. The coil water mixes with city water at a HOLBY valve and domestic water is tempered to 125 degrees to the facility.

The existing control system consisted of a HEAT-TIMER. This control system caused the boiler to run longer on colder days. When the OAT drops below 55 degrees the boiler will cycle for approximately 7 to 10 minutes, remaining on until the condensate return temperature reaches a setting of 90 to 180 degrees. No actual condensate return temperature can be set. Heat is regulated by a dial indicating "MORE HEAT" or "LESS HEAT" . During very cold days the HEAT-TIMER commands the burner to run all the time regardless of indoor space temperatures.

Overheating constantly occurred because when the indoor space temperatures reached a comfortable level the HEAT-TIMER continued to cause the burner to operate thereby overheating. Tenants opened windows because of excessive heat.

#### PEPCO installed controls

PEPCO installed the ENERGUARD system in this facility. The ENERGUARD STARTS the burner to produce steam when the OAT drops below 55 degrees and STOPS the burner any time the OAT rises above 56 degrees. A 365 day time clock automatically toggles between WINTER mode which begins October 1<sup>st</sup> and ends May 15<sup>th</sup> and SUMMER mode. The steam to the building is regulated based on feedback from 10 wireless room temperature sensors placed throughout the

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facility. Steam is produced when 6 out of 10 sensors report they are 1 degree below SET POINT. SET POINT is the desired temperature the building must maintain. The burner remains ON until 6 room temperatures sensors report they are 1 degree above SET POINT.

The SET POINT is automatically adjusted hourly by the ENERGUARD to produce more heat based on occupancy and after 10:00 pm the SET POINT is lowered to 66 degrees. At 5:00 am the SET POINT is raised to 74 degrees so all occupants wake to a warm building.

### 3. RED OAK

#### The Existing Heating Plant and Controls

This plant consists of 2 Steam Boilers that produced 7 Lbs steam pressure. Burner rotation and fuel modulation was controlled by a HEAT-TIMER. The steam produced is directed to a Steam to Hot Water HEAT EXCHANGE Unit ("HX"). The amount of steam is regulated by a 2 way steam valve that modulates Open or Closed to maintain a SET POINT discharge water temperature from the HX. The water temperature SET POINT was automatically adjusted to produce hotter water on colder days (190 degrees @ 30 Degrees OAT and 130 @ 55 OAT) using a HEAT-TIMER HWR. When the Facility Supply Water Temperature reached SET POINT the the 2 way steam valve closed causing steam to build in the supply line resulting in steam pressure reaching 7 lbs. The burner modulated to low fire and the burner shut down on high pressure.

The facility was often over heated because the facility supply water temperature was too hot and the heating plant continued to produce more heat. Maintaining constant 7 lbs steam pressure while the facility temperatures were overheated resulted in wasted fuel from "Stand By Losses". PUMPS were started manually from a wall switch and ran constantly all heating season.

**Note: Standby losses result when a burner cycles ON and OFF to maintain Steam Pressure or Hot Water Temperature when there is no DEMAND. The burner cycles ON at 3 psi and off at 7 psi.**

#### PEPCO installed controls

PEPCO furnished and installed the ENERGUARD system with 30 wireless remote room temperature sensors. The facility supply water temperature is automatically regulated by the ENERGUARD based on feedback from the wireless remote space temperatures. The facility supply water temperature SET POINT is automatically reset to meet desired space temperature set point.

For example if the owner wants the building temperature to be 74 degrees and the building temperature is 70 degrees the facility supply water temperature automatically is raised to 180 degrees by opening the 2 way steam valve, and as the facility temperature rises to 74 degrees, the facility supply water temperature is automatically lowered by closing the 2 way STEAM valve at the HX. When the building temperature meets the SET POINT, the 2 way steam valve is fully closed and the boilers are commanded OFF together with the facility hot water circulation pumps.

On the next HEAT call as determined when the facility temperature drops .5 degrees below SET POINT the lead Pump is commanded to Start. The lead burner is commanded to start in low fire, then ramps to high a higher fire to produce steam. At 3 lbs of steam the burner modulates the fuel input to maintain the 3 lbs of pressure (Lowered from 7). As the return facility water temperature comes back colder, the 2 way steam valve is commanded to gradually OPEN to allow steam flow

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to the HX. This cycle continues until the facility space temperature reaches 74 degrees and the cycle is repeated.

#### **4. THE FANIA GERSHWIN**

##### The Existing Controls

The heating plant consists of a single gas fired burner and 2 hot water pumps that circulate hot water to the fin tube radiators in the apartments. The existing control system enabled the burner to start when the OAT temperature fell below 55 degrees. The pumps were started and operated by hand and ran constantly. The facility water temperature was maintained at a constant 175 degrees. When the temperature inside the boiler fell to 170 the burner Started and when the temperature reached 180 the burner Stopped.

##### PEPCO Controls

PEPCO installed the ENERGUARD in the boiler room of the building. The facility supply water temperature is now controlled by adjusting the Start Stop of the burner based on feedback from 5 wireless remote temperature sensors installed throughout the building. When three of the five temperature sensors report they are 1 degree below SET POINT the pump is started. The facility hot water temperature is constantly adjusted based on actual building space temperatures. When the space temperature SET POINT is satisfied or the OAT rises above 55 degrees the burner shuts down and the pumps are command OFF. When the OAT falls below 55 and the apartment temperatures report below SET POINT the ENERGUARD automatically Starts the heating plant and the cycle continues.

#### **5. REMOTE CONTROL AND MONITORING 24/7**

WSFSSH Management and PEPCO monitor the facility remotely via the internet. Adjustments are periodically made to fine tune the control parameters such as lowering the facility temperature at night, giving extra heat during bitter cold days and giving a boost of heat every morning when the outdoor air temperature drops below 45 degrees.

<http://71.249.208.126/deltaweb/login.asp?logout=true>

User Name: wsfssh

Password: demo

All heating related equipment are monitored for operation and includes Daily Burner Runtime and Cycles, Winter -Summer Operation, Pump Runtime and Cycles, Equipment operated in BYPASS including Date and Time Stamp when switched and Degree Days. Space Temperature and Domestic Hot Water Temperatures are monitored and recorded every hour and uploaded to PEPCO Servers for achieving.

Annual efficiency reports documenting savings are produced detailing the savings.

#### **6. COLOR GRAPHIC DISPLAY**

Monitoring and control settings are accomplished from easy to use color graphics. Screen to screen scrolling is accomplished at the click of the mouse. Space temperatures of all 8 facilities,

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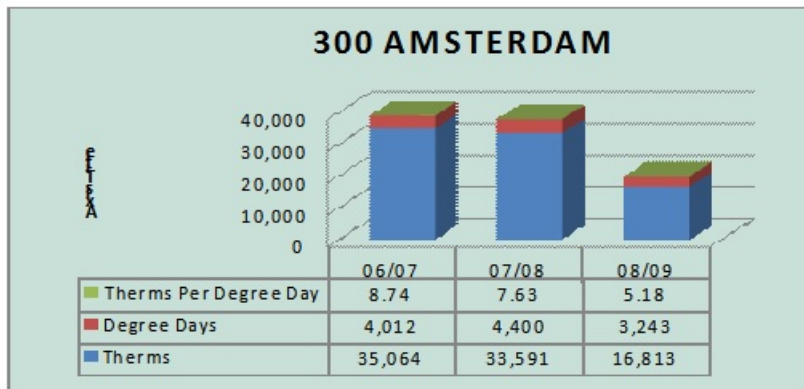
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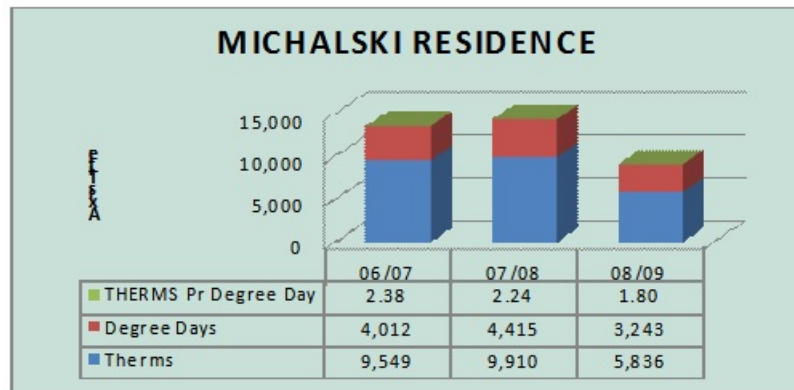


which are scattered throughout the upper west side of NY are viewed from 1 custom graphic in real time. Alarms, temperature histories, burner run times and cycles, outdoor air temperature, degree days, stack temperatures, make-up water usage and if any pumps or burners are manually bypassed are viewed from the central PC.

SUMMARY OF FUEL SAVING AT EACH LOCATION IS LISTED BELOW



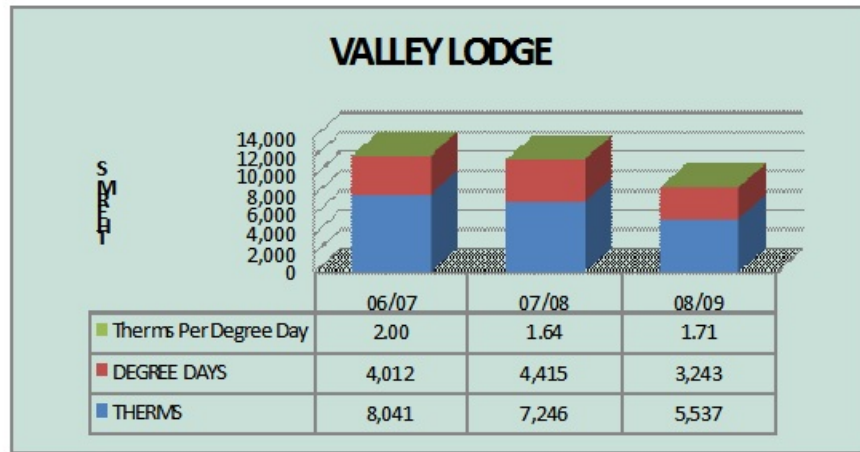
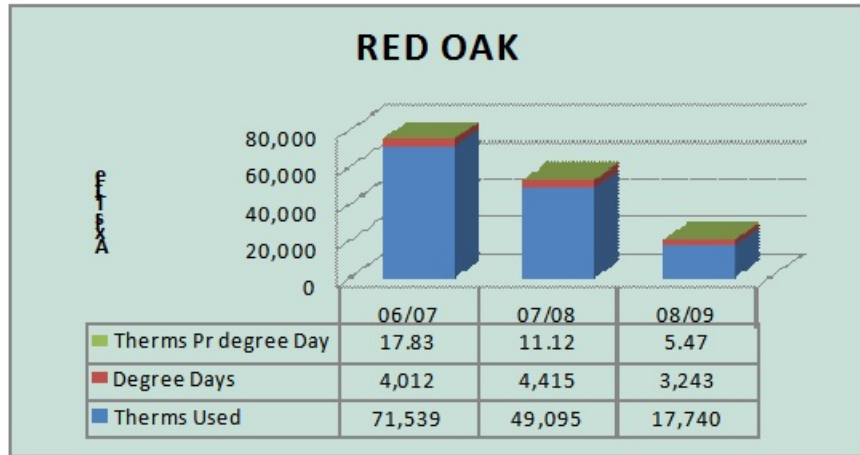
Savings were calculated using THERMS PER DEGREE DAY.



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**SUMMARY OF OVERALL FUEL SAVING AT EACH LOCATION IS LISTED BELOW**

PROPERTY	YEAR INSTALLED	BASE YR THERMS	WINTER 07/08	WINTER 08/09
II. 149 West 108 street, NY NY	9/07	8,041	18.11%	16.59%
III. 206 W 84th Street, NY NY	9/07	9,549	5.69%	16.58%
IV. 300 Amsterdam Ave, NY NY	9/07	35,064	12.65%	18.24%
IV. 300 Amsterdam Ave, NY NY	3/07	71,539	37.64%	80.79%
VI. 149 Manhattan Ave, NY NY	12/04	24,451	15.00%	-0.72%
VII. 109 West 129th Street, NY NY	9/07	24,562	23.46%	17.37%
VIII. 140 W 105th Street, NY NY	11/06	19,410	23.73%	43.21%
IX. 930 Westbourne, NY NY	9/07	30,077	18.01%	60.60%
Average			19.29%	31.58%

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