



Consumption Performance Reporting

Heating Fuel Model and Savings Demonstration

Samletown - Middle School

Usage Model	Model Coefficients (MC)	Base Year		Current Year	
		PV Value (PVVb)	Modeled Usage (MMB) = * PVVb	PV Value (PVVc)	Modeled Usage (MMB) = * PVVc
DIP- Days In Period	0.120	364	44	364	44
OCD- Occupied Days	0.315	183	58	184	58
HD- Heating Days	6.073	210	1,275	206	1,249
HDD- Heating Degree Days	1.016	2638	2,681	3644	3,704
CD - Cooling Days	0.000	114	0	114	0
CDD- Cooling Degree Days	0.000	1451	0	1378	0
Total MMBs per Model			4,057		5,055

Usage Savings

Annual MMBs - Modeled		5,055
Annual MMBs - Actual		3,704
Annual MMBs - Saved		1,351
Savings Valued at Current \$	\$ 8.70	\$ 11,754
Savings Valued at Contract \$	\$ 11.00	\$ 14,861

Methodology

To determine energy management performance, consumption for the current period is analyzed with reference to a Base Year (the year before the program started). The analysis requires more than simple comparisons of monthly utility bills because of differences in days in the billing period, number of occupied days, degree-days and other factors.

EFA developed a method which removes these non-controllable factors from the comparison. The method uses a linear equation to model the Base Year consumption for electric and heating fuel consumption. The forms of the equations are as follows.

$$\text{KWH (electric)} = e_1 \cdot \text{DIP} + e_2 \cdot \text{OCCD} + e_3 \cdot \text{HTGD} + e_4 \cdot \text{HTGDD} + e_5 \cdot \text{CLGD} + e_6 \cdot \text{CLGDD} + \text{Variance}$$

$$\text{MMBTU (heating fuel)} = h_1 \cdot \text{DIP} + h_2 \cdot \text{OCCD} + h_3 \cdot \text{HTGD} + h_4 \cdot \text{HTGDD} + h_5 \cdot \text{CLGD} + h_6 \cdot \text{CLGDD} + \text{Variance}$$

KWH and MMBTU are called Period Usages; the factors ending in "D" Period Variables; and the factors e_1 - e_6 and h_1 - h_6 Usage Coefficients. See the Glossary section for further definition of terms.

The Base Year

The Period Usages are as recorded on utility bills; the Period Variables are as recorded in weather data and occupancy schedules. The Usage Coefficients are determined using linear regression and analytical techniques. The model equation variances must be small for each month of the base year and exactly zero for the base year as a whole.

The Current Year

With the Usage Coefficients determined for the Base Year, performance variances can be calculated for any later billing period as follows. Period Usages are first entered from the utility bills. Period Variables then are entered while Usage Coefficients remain unchanged. Variances are then calculated and indicate the saving (if negative) or over-consumption (if positive) compared to the Base Year. To calculate the dollar value of a variance, the variance energy units are then multiplied times the current average energy unit prices.

Consumption Performance Reporting Glossary

Cooling Days in Period (CLGD) - e_5 & h_5 represent the energy consumed to start-up and keep the cooling plant in service at no load each day in the cooling season.

Cooling Degree Days in Period (CLGDD) - Cooling degree days for any day are calculated as Average Outside Temperature - 65 F. NJ has an average of 1,201 CLGDD per year. e_6 & h_6 represent the extra energy required once the cooling equipment is operating to meet loads dependent on ambient temperatures.

Days in Period (DIP) - Coefficients e_1 & h_1 represent the Base Year usage required on a Sunday and each and every other day in the billing period.

Heating Days in Period (HTGD) - e_3 & h_3 represent the energy consumed to warm-up and keep the heating plant in service at no load each day in the heating season.

Heating Degree Days in Period (HTGDD) - Heating degree days for any day are calculated as 65 - Average Outside Temperature. NJ has an average of 4,843 HTGDD per year. e_4 & h_4 represent the extra energy required once the plant is operating to meet loads dependent on ambient temperature.

Kilowatt-hour (KWH) - This is the billed electrical usage unit. One KWH at a cost of \$0.08 is about the energy required to light one classroom for one hour.

KW Demand - Peak demand is metered and billed and can be considered to add about another \$0.05 to the cost of a KWH.

MMBTU - An MMBTU, one million BTUs, is a common unit for energy and is equivalent to 10 therms of gas or 7.2 gallons of #2 fuel oil or 293 kilowatt-hours of electricity.

Occupied Days in Period (OCCD) - e_2 & h_2 represent the additional energy used for each occupied day.

Therms - Gas consumption is billed per therm (100,000 BTUs) of energy but metered in hundreds of cubic feet (CCF). The energy in one cubic foot is about 1.04 therms.

Typical Heating Consumption

Heating BTU/Year/Square Foot (H-BYS) - A typical NJ school consumes 75,000 H-BYS in heating fuel without energy management. H-BYS as low as 40,000 are possible.

Heating Dollars/Year/Square Foot (H-DYS) - A typical NJ elementary school spends \$0.48 H-DYS for gas heating fuel without energy management. H-DYS as low as \$0.24 are possible.