



# Building Operator Certification – Level I



*A Partnership of the  
NYC Department of Education  
Division of School Facilities,  
International Union of Operating  
Engineers, and the  
City University of New York*



Class 22

# Objectives and Agenda

- Portfolio Manager – Benchmark & Baseline
- Split into 2 sections:
  - Computer Lab section
  - Classroom section
- Computer Lab section:
  - Create your account
  - Access and review your school's data
  - Use Reports and export data to Excel
- Classroom section:
  - Discussion of Portfolio Manager (ESPM)
  - Data from ESPM for Practical Project
  - Further functions, beyond ESPM

# Quiz and Exercise

Quiz

*Handout*

| VARIANCE CHART |              |               |          |
|----------------|--------------|---------------|----------|
|                | Current Year | Previous Year | % Change |
| \$\$           | 357,000      | 326,000       | 9.5%     |
| SF             | 265,000      | 250,000       | 6.0%     |
| \$/SF          | 1.35         | 1.30          | 3.3%     |
| BTU/SF         | 92,800       | 98,700        | -6.0%    |
| DD             | 4,300        | 3,955         | 8.7%     |
| BTU/SF/DD      | 21.58        | 24.96         | -13.5%   |
|                |              |               |          |



# Energy Star Portfolio Manager Rating System for *Buildings*



Compare this vehicle to others in the FREE FUEL ECONOMY GUIDE available at the dealer.

**CITY MPG**  
**60**

**Fuel Economy Information**

**HIGHWAY MPG**  
**51**

2004 PRIUS  
FUEL TYPE: GAS  
MPG: CITY 24, HIGHWAY 34, COMBINED 28

2004 TOYOTA PRIUS  
FUEL TYPE: GAS  
MPG: CITY 24, HIGHWAY 34, COMBINED 28

2004 TOYOTA PRIUS  
FUEL TYPE: GAS  
MPG: CITY 24, HIGHWAY 34, COMBINED 28

see [www.fueleconomy.gov](http://www.fueleconomy.gov)

**Fuel Efficiency**

**MPG**

**Is 60 MPG high or low for an automobile?**



**Is 80 kBtu/SF/YR high or low for a building?**

**Statement of Energy Performance**

**EPA Rating**

**STATEMENT OF ENERGY PERFORMANCE**  
Margrave High School  
Building ID: 102110  
For 12-month Period Ending January 31, 2007

| Facility System Use Summary | Energy Type | Quantity | Number of Buildings | Number of FTEs | Condition |
|-----------------------------|-------------|----------|---------------------|----------------|-----------|
| Complete Gas System         | Gas         | 954      | 1                   | 100            | Good      |
| Electricity                 | Electricity | 301,228  | 1                   | 100            | Good      |

**Energy Performance Rating** (1-100): **84**

**Energy Intensity**  
kBtu/SF/yr: **80**

**Energy Cost**  
Cost/SF/yr: **\$11**

**Additional Information**  
Number of buildings covered: Yes  
Margrave: condition good: Yes  
Report available online: Yes  
Report available printed: Yes



# Review: Benchmarking Energy Performance

- What is “benchmarking”?
  - Common Index for comparison **Btu/SF**
  - Compare your school to other schools
  - Compare your school across time periods

**Normalize** for Square Footage **Btu/SF**

**Normalize** for Weather **Btu/SF/DD**

Take into account the weather for that period.  
Adjustment for the number of Degree Days.  
Compare your school year to year.

# Who's Involved

- DCAS & Department of Education  
Responsible for entering the schools energy data
- CE's/DDF's:
  - Can now access school data in PM
    - Access to PM analytic capabilities
    - Find out your rating today
    - How do you compare nationally?
  - Can review the school info and make corrections
    - Energy usage data – Energy bills
    - Operating months per year
    - What if your electric bill is sky-high? Actual use?

# Why Portfolio Manager is Important

The City has set targets to reduce energy usage:

- Reduce by 30% by the year 2017
- Schools comprise 40% of the City's total square footage
- Benchmarking is required by Local Law 84

Smart/improved school energy management:

- Energy is typically a school district's *2<sup>nd</sup> largest operating expense after salaries*
- Greater than cost of computers + textbooks combined.
- *Reductions of 10%* in energy use can be possible *with little or no cost.*

# Results from other school districts

**Loudon County, VA:** 8.4 million SF, \$5.7 mil saved

**Council Rock, PA:** 1.8 mil SF, \$7.1 mil saved in 4 yrs

**Gresham Barlow, OR:** 1.6 mil SF, 12,000 students,  
30+% improvement, \$1.5 mill saved

**Evergreen, WA:** 21% reduction, \$720,000 saved over 9 mo

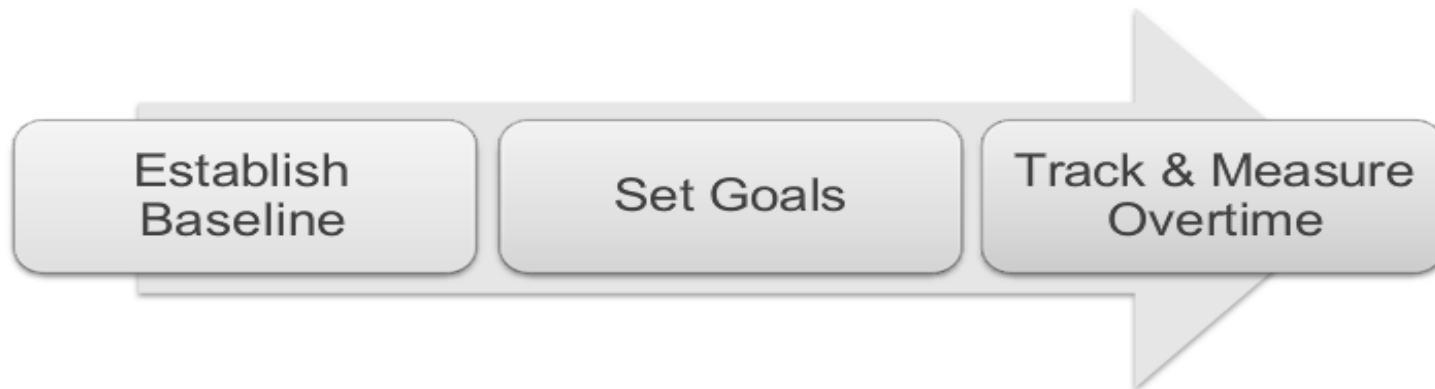
**Phoenix, AZ:** 33 schools, 3 million SF, 24,000 students,  
27% reduction in electricity, \$2mil saved over two years

> [Video clip](#): Phoenix AZ





# Assess Performance for Smart Energy Management



- Verify gains from upgrade efforts
- Require specific rating gains from service providers in select building types such as office or warehouse



# Using Portfolio Manager for your Project 2B

**Show the energy consumption of your school on two levels:**

- Table 1 – Whole Building Level
  - Table 2 – System Level: End-Use Function
- 
- Your Portfolio Manager account is set up for your school. You will access Portfolio Manager to get the energy data for your school.

# TABLE 1 - Practical Project 2B

TABLE 1 SUMMARY OF ANNUAL ENERGY USE BY ENERGY TYPE

GROSS FLOOR AREA = \_\_\_\_\_ SF

FOR THE YEAR SEPT 1, 2009 - AUGUST 31, 2010 UNLESS OTHERWISE NOTED

| (1)           | (2)    | (3) | (4)   | (5) | (6)       | (7)      | (8)        | (9)      | (10)     | (11)      |
|---------------|--------|-----|-------|-----|-----------|----------|------------|----------|----------|-----------|
|               | unit   | QTY | MMBTU | \$  | unit cost | \$/MMBTU | MMBTU / SF | \$ / SF  | % of BTU | % of Cost |
|               |        |     |       |     | (5)/(3)   | (5)/(4)  | (4)/(12)   | (5)/(12) | (4)/(13) | (5)/(14)  |
| Electricity   | kwh    |     |       |     |           |          |            |          |          |           |
| Nat Gas       | therm  |     |       |     |           |          |            |          |          |           |
| Fuel Oil, #__ | gallon |     |       |     |           |          |            |          |          |           |
| Steam         | mlb    |     |       |     |           |          |            |          |          |           |
|               |        |     |       |     |           |          |            |          |          |           |
| Total         |        |     |       | 0   |           |          |            |          | 100%     | 100%      |

(13) (14)

NOTES:

- MMBTU of all energy types are calculated at the Site Value
- Building area (SF) is gross square footage, including basement

|         | per million |              |
|---------|-------------|--------------|
| kwh     | 3414        | 0.003414 kwh |
| nat gas | 100000      | 0.100 therm  |
| oil, #2 | 140000      | 0.140 gal    |
| oil, #4 | 145000      | 0.145 gal    |
| oil, #6 | 152500      | 0.153 gal    |

- Do you know how to obtain this data?
- Where is the bulk of your energy use? Of your energy cost? Why do they differ?



# Unit Cost = Cost per Unit

Cost per Therm = \$ / Quantity                      \$ / Therms

= \$82,740 / 75,000 Therms

Cost per Gallon = \$ / Quantity                      \$ / Gallons

Cost per kilowatt-hour = \$ / Quantity                      \$ / kw-hours

= \$68,750 / 500,000

# TABLE 1 – As EXCEL Spreadsheet

| TABLE 1 SUMMARY OF ANNUAL ENERGY USE BY ENERGY TYPE                |        |         |       |              |           | GROSS FLOOR AREA = |                    | 125,000  | SF       |           |
|--|--------|---------|-------|--------------|-----------|--------------------|--------------------|----------|----------|-----------|
| FOR THE YEAR SEPT 1, 2009 - AUGUST 31, 2010 UNLESS OTHERWISE NOTED |        |         |       |              |           |                    |                    | (12)     |          |           |
| (1)  | (2)    | (3)     | (4)   | (5)          | (6)       | (7)                | (8)                | (9)      | (10)     | (11)      |
|  | unit   | QTY     | MMBTU | \$           | unit cost | \$/MMBTU           | BTU / SF           | \$ / SF  | % of BTU | % of Cost |
|  |        |         |       |              | (5)/(3)   | (5)/(4)            | (4)/(12)*1,000,000 | (5)/(12) | (4)/(13) | (5)/(14)  |
| Electricity  | kwh    | 500,000 | 1,707 | \$ 68,750.00 | \$ 0.14   | \$ 40.28           | 13,656             | \$ 0.55  | 19%      | 45%       |
| Nat Gas  | therm  | 75,000  | 7,500 | \$ 82,740.00 | \$ 1.10   | \$ 11.03           | 60,000             | \$ 0.66  | 81%      | 55%       |
| Fuel Oil, #__  | gallon |         | -     |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
| Steam  | mlb    |         |       |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
|  |        |         |       |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
| Total  |        |         | 9,207 | 151,490      |           | \$ 16.45           | 73,656             | \$ 1.21  | 100%     | 100%      |
|  |        |         | (13)  | (14)         |           |                    |                    |          |          |           |

| NOTES:  |  | per million |                    |
|---|--|-------------|--------------------|
| 1. MMBTU of all energy types are calculated at the Site Value     |  | kwh         | 3414 0.003414 kwh  |
| 2. Building area (SF) is gross square footage, including basement |  | nat gas     | 100000 0.100 therm |
|   |  | oil, #2     | 140000 0.140 gal   |
|   |  | oil, #4     | 145000 0.145 gal   |
|   |  | oil, #6     | 152500 0.153 gal   |

Formulas allow #'s to be updated with auto re-calc



# Electrical Demand Assessment using Unit Cost

| TABLE 1 SUMMARY OF ANNUAL ENERGY USE BY ENERGY TYPE                |        |         |       |              |           | GROSS FLOOR AREA = |                    | 125,000  | SF       |           |
|--|--------|---------|-------|--------------|-----------|--------------------|--------------------|----------|----------|-----------|
| FOR THE YEAR SEPT 1, 2009 - AUGUST 31, 2010 UNLESS OTHERWISE NOTED |        |         |       |              |           |                    |                    |          |          |           |
| (1)  | (2)    | (3)     | (4)   | (5)          | (6)       | (7)                | (8)                | (9)      | (10)     | (11)      |
|  | unit   | QTY     | MMBTU | \$           | unit cost | \$/MMBTU           | BTU / SF           | \$ / SF  | % of BTU | % of Cost |
|  |        |         |       |              | (5)/(3)   | (5)/(4)            | (4)/(12)*1,000,000 | (5)/(12) | (4)/(13) | (5)/(14)  |
| Electricity  | kwh    | 500,000 | 1,707 | \$ 93,800.00 | \$ 0.19   | \$ 54.95           | 13,656             | \$ 0.75  | 19%      | 53%       |
| Nat Gas  | therm  | 75,000  | 7,500 | \$ 82,740.00 | \$ 1.10   | \$ 11.03           | 60,000             | \$ 0.66  | 81%      | 47%       |
| Fuel Oil, #__  | gallon |         | -     |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
| Steam  | mlb    |         |       |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
| other  |        |         |       |              | #DIV/0!   | #DIV/0!            | -                  | \$ -     | 0%       | 0         |
| Total  |        |         | 9,207 | 176,540      |           | \$ 19.17           | 73,656             | \$ 1.41  | 100%     | 100%      |
|  |        |         | (13)  | (14)         |           |                    |                    |          |          |           |

|   |  |  |  |  |  |  |  |  |              |
|---|--|--|--|--|--|--|--|--|--------------|
| NOTES:  |  |  |  |  |  |  |  |  | per million  |
| 1. MMBTU of all energy types are calculated at the Site Value     |  |  |  |  |  |  |  |  | kwh          |
| 2. Building area (SF) is gross square footage, including basement |  |  |  |  |  |  |  |  | 0.003414 kwh |
|   |  |  |  |  |  |  |  |  | 3414         |
|   |  |  |  |  |  |  |  |  | 100000       |
|   |  |  |  |  |  |  |  |  | 0.100 therm  |
|   |  |  |  |  |  |  |  |  | 140000       |
|   |  |  |  |  |  |  |  |  | 0.140 gal    |
|   |  |  |  |  |  |  |  |  | 145000       |
|   |  |  |  |  |  |  |  |  | 0.145 gal    |
|   |  |  |  |  |  |  |  |  | 152500       |
|   |  |  |  |  |  |  |  |  | 0.153 gal    |

- Check your unit cost of electricity.
- Is it high compared to others?
- If so, you may be incurring a high demand charge



# TABLE 2 - Energy Allocation for Practical Project 2B

| TABLE 2 ANNUAL ENERGY USE BY END-USE FUNCTION                      |            |            |            |       |          |                  |    |         |               |
|--|------------|------------|------------|-------|----------|------------------|----|---------|---------------|
| FOR THE YEAR SEPT 1, 2009 - AUGUST 31, 2010 UNLESS OTHERWISE NOTED |            |            |            |       |          |                  |    |         |               |
|  | FUELS USED | default %  | adjusted % | MMBTU | MMBTU/SF | % of TOTAL MMBTU | \$ | \$ / SF | % OF TOTAL \$ |
| <b>OIL, GAS, STEAM</b>   |            |            |            |       |          |                  |    |         |               |
| HEATING  |            | 70%        |            |       |          |                  |    |         |               |
| HOT WATER  |            | 20%        |            |       |          |                  |    |         |               |
| COOKING  |            | 10%        |            |       |          |                  |    |         |               |
| OTHER  |            | 0%         |            |       |          |                  |    |         |               |
| SUB-TOTAL  |            | 100%       | 100%       |       |          |                  |    |         |               |
| <b>ELECTRICITY</b>   |            |            |            |       |          |                  |    |         |               |
| LIGHTING   |            | 45%        |            |       |          |                  |    |         |               |
| MOTORS   |            | 25%        |            |       |          |                  |    |         |               |
| COMPUTERS & OFF EQUIP  |            | 10%        |            |       |          |                  |    |         |               |
| AC   |            | 10%        |            |       |          |                  |    |         |               |
| KITCHEN-REFRIG   |            | 10%        |            |       |          |                  |    |         |               |
| HEATING & HOT WATER  |            | see Note 1 |            |       |          |                  |    |         |               |
| OTHER  |            | 0%         |            |       |          |                  |    |         |               |
| SUB-TOTAL  |            | 100%       | 100%       |       |          |                  |    |         |               |
| TOTAL  |            |            |            |       |          | 100%             |    |         | 100%          |



# LOAD PROFILES AND END-USE ALLOCATION

What is the goal of end-use allocation?

Why is it important?



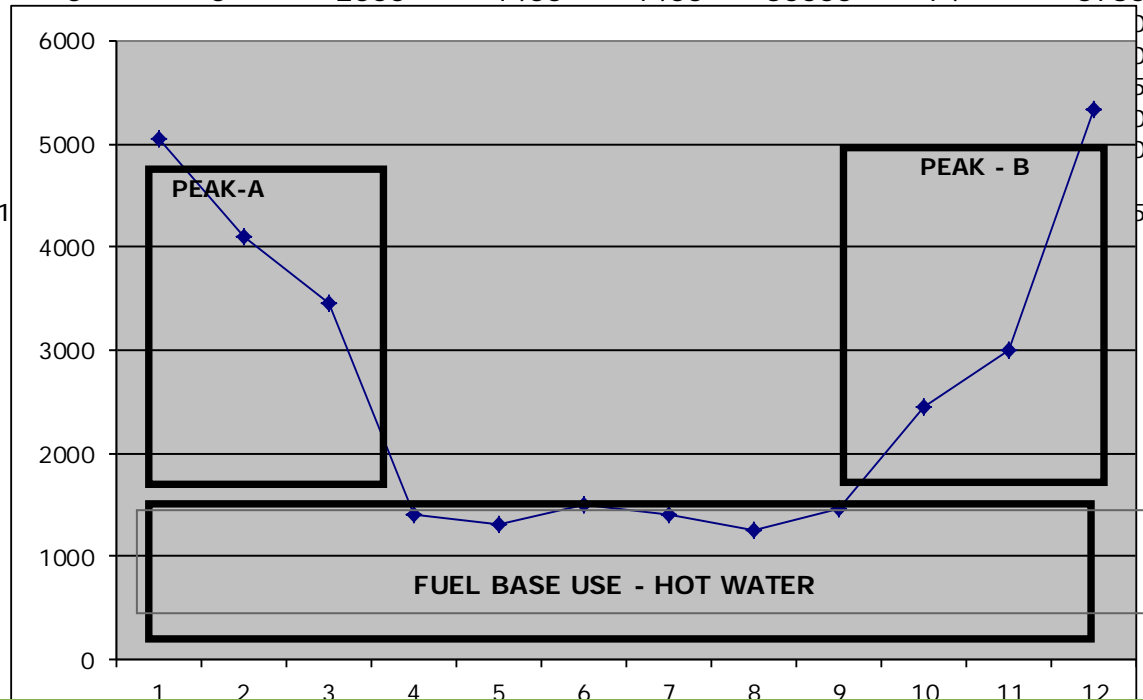
# Load Profile for End-Use Allocation (fuel)

*Where do I look if my winter peak dominates?*

*Where do I look if I seem to have very little winter peak?*

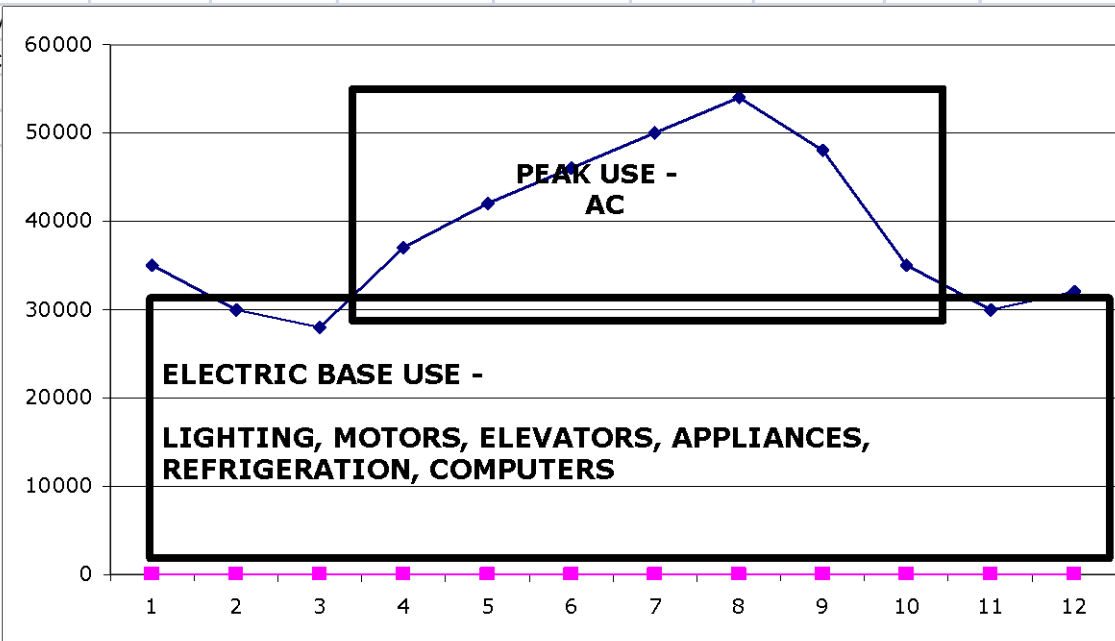
**ENERGY USE RECORD**

|        | Oil, gal | \$-Oil | Gas,therms | \$-Gas | fuel \$ | KWH   | KW | \$-Electricity | Total \$ |
|--------|----------|--------|------------|--------|---------|-------|----|----------------|----------|
| Jan    | 5000     | 4500   | 800        | 560    | 5060    | 35000 | 50 | 3475           | 8535     |
| Feb    | 3000     | 2700   | 2000       | 1400   | 4100    | 30000 | 47 | 3020           | 7120     |
| March  | 1500     | 1350   | 3000       | 2100   | 3450    | 28000 | 46 | 2840           | 6290     |
| April  | 0        | 0      | 2000       | 1400   | 1400    | 37000 | 58 | 3725           | 5125     |
| May    | 0        | 0      | 1870       | 1309   | 1309    | 42000 | 64 | 4210           | 5519     |
| June   | 0        | 0      | 2150       | 1505   | 1505    | 46000 | 69 | 5290           | 6795     |
| July   | 0        | 0      | 2000       | 1400   | 1400    | 50000 | 74 | 5730           | 7130     |
| Aug    |          |        |            |        |         |       |    |                | 7316     |
| Sept   |          |        |            |        |         |       |    |                | 6910     |
| Oct    |          |        |            |        |         |       |    |                | 6005     |
| Nov    |          |        |            |        |         |       |    |                | 6040     |
| Dec    |          |        |            |        |         |       |    |                | 8520     |
| Totals |          |        |            |        |         |       |    |                | 81305    |



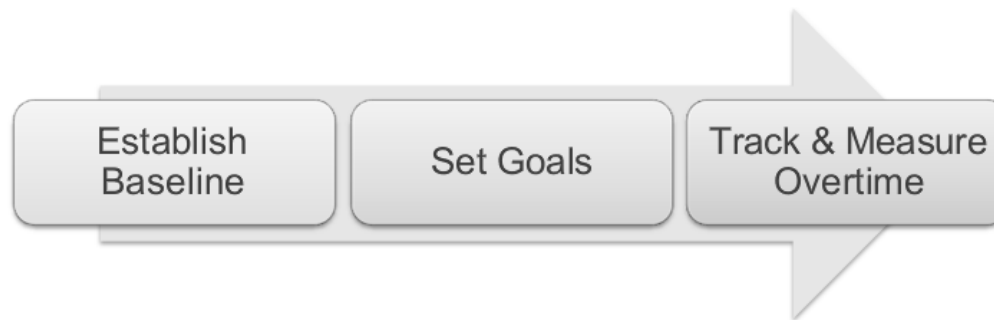
# Load Profile for End-use Allocation (electricity)

| ENERGY USE RECORD |          |        |            |        |         |       |    |                |              |
|-------------------|----------|--------|------------|--------|---------|-------|----|----------------|--------------|
|                   | Oil, gal | \$-Oil | Gas,therms | \$-Gas | fuel \$ | KWH   | KW | \$-Electricity | Total \$     |
| Jan               | 5000     | 4500   | 800        | 560    | 5060    | 35000 | 50 | 3475           | 8535         |
| Feb               | 3000     | 2700   | 2000       | 1400   | 4100    | 30000 | 47 | 3020           | 7120         |
| March             | 1500     | 1350   | 3000       | 2100   | 3450    | 28000 | 46 | 2840           | 6290         |
| April             | 0        | 0      | 2000       | 1400   | 1400    | 37000 | 58 | 3725           | 5125         |
| May               | 0        | 0      | 1870       | 1309   | 1309    | 42000 | 64 | 4210           | 5519         |
| June              | 0        | 0      | 2150       | 1505   | 1505    | 46000 | 69 | 5290           | 6795         |
| July              | 0        | 0      | 2000       | 1400   | 1400    | 50000 | 74 | 5730           | 7130         |
| Aug               | 0        | 0      | 1780       | 1246   | 1246    | 54000 | 74 | 6070           | 7316         |
| Sept              | 0        | 0      | 2100       | 1470   | 1470    | 48000 | 68 | 5440           | 6910         |
| Oct               | 0        | 0      | 3500       | 2450   | 2450    | 35000 | 58 | 3555           | 6005         |
| Nov               |          |        |            |        |         |       |    | 0              | 6040         |
| Dec               |          |        |            |        |         |       |    | 0              | 8520         |
| <b>Total</b>      |          |        |            |        |         |       |    | <b>5</b>       | <b>81305</b> |



# Comparison over time for energy management

## Assess Performance for Smart Energy Management



- Verify gains from upgrade efforts
- Require specific rating gains from service providers in select building types such as office or warehouse





# Peer Comparisons

Who will you compare to?

# Class Assignments

## Reading

Continue reading in **Herzog – Chapters 4 and 5**

*You should have already read **Chapters 1,2 and 3;** section in FEMP, and materials on ESPM website*

**Questions on Project – Ask Your Instructor**

*Contact by his email address:*

## Practical Project

Try to complete TABLE 1



# Computer Lab Only – Next 4 Slides

## Welcome/Intro

**What information we will be covering in this lab over the next two weeks:**

### **1. Portfolio Manager (this week)**

- Intro/walk-thru of Portfolio Manager (PM) – how it works, how to use & find data.
- Get your school established in your PM account.
- Learn basic reporting/graphing functions.
- How to find data for class project 2B.

### **2. IBM's i-BEE Energy Analytics Software Tool (next week)**

- Intro/walk-thru of i-BEE – how to use different functions.
- Compare your school's performance to your peers.



# Computer Lab Logistics

## 1. No food or beverages at workstations

Any beverages need to be set on the ledge by the windows, not at computer workstations.

## 2. Log into computers

- > Username: HSTU## (your individual computer #).
- > Password: Panam2 (with a capital P).

## 3. DSF IT Help Desk – for future reference

All CEs should have functioning computers in their offices. If you are experiencing hardware, software or equipment problems, contact the help desk at **718.349.5783**.

# Portfolio Manager Log-in Information

1. **These are YOUR accounts** - Account Username cannot be changed, it is permanently associated with your school.
2. Write down your user/password for future reference.
3. **Log in to PM**

Open Internet Explorer and type in Portfolio Manager website:  
<http://www.energystar.gov/benchmark>

- > Username: benchmark\_M101 (your school ID#)
- > Password: saveenergyM101 (your school ID#)





# Portfolio Manager – Post-Op

- PM has lots of reporting functions, but somewhat limited.
  - > Any important function(s) you might want to have that are not available in PM...?
  - > (energy use broken down by type and by end-use; comparisons between buildings).
- PM tied to i-BEE, why we're showing i-BEE next week
  - > i-BEE uses the data from PM
  - > Expanded reporting/graphing/data analysis, energy types & end use, comparisons between bldgs.
- Accuracy/data verification – Correction Sheets  
Give to your instructor
- Class projects (can get energy data from meter entries OR from Excel – Excel tip sheet available).