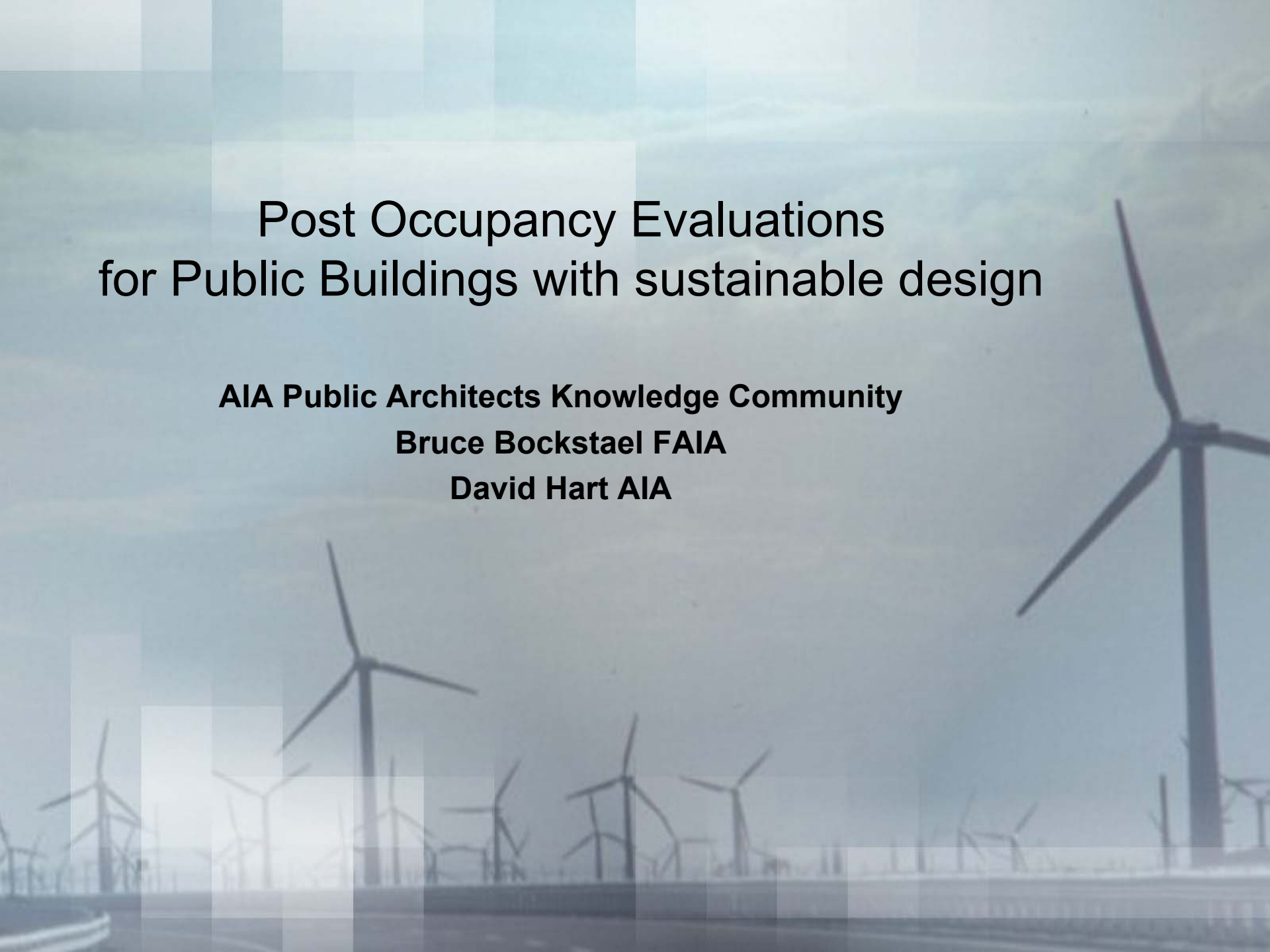

Post Occupancy Evaluations for Public Buildings with sustainable design

AIA Public Architects Knowledge Community

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Post Occupancy Evaluations for Public Buildings with sustainable design

- **It became obvious that the Public Sector has been at the fore-front of the development and encouragement of sustainable design over the past decade.**
- **We collectively have the greatest number of delivered projects than any other building development in the country**
- **No one has developed an easy to use system to evaluate the actual performance of the stated goals in most of the existing sustainable design programs**
- **Where do we start?**
  - **Develop a common vocabulary**
  - **Develop a simple approach to getting results**
  - **Develop a simple methodology to present the results**

Post Occupancy Evaluations for Public Buildings with sustainable design

- **Post Occupancy Evaluations**
  - **An analysis of a completed building's ability to function**
  - **Generally the evaluation is applied to buildings over one year of operation**
  - **A means by which positive outcomes may be enhanced and negatives changed, corrected or improved**
  - **An ability to provide valuable information about the specific technical features of the building**
  - **Ability to provide a measure of customer satisfaction**

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- **Why is POE not Generally Used?**
  - **–Limited Trained Staff**
  - **–Inability to dedicate staff time and other resources**
  - **–If core work not regularly repeated, little benefit learned**
  - **–Poor cooperation of user and delivery staff**
- **What is Involved to get Started?**
  - **–Establishment of a Base Standard upon which to measure**
  - **–During the Design to have at least a performance Modeling having been done for the building**
  - **–The facility managers have maintained records of usage over the year**

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- **Concentration on Operational and/or Design objectives of the user or agency requirements**
  - **Achievement of Operational objectives**
  - **Achievement of Building Design Objectives**

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- **Four Step Process**
  - **Establish Baseline criteria for Design**
    - **Using local code requirements, standards set by your agency or others**
  - **Establish an Industry accepted energy Modeling program**
    - **Generally something comparable with DOE2 or the like**
  - **Collect actual consumption from owner/user for comparison**
    - **Fuel, electrical and water is our goal at this time**
  - **Summarize the data in graph form as well as an executive summary**
    - **This can be complicated simple or very elementary depending on the audience and message needed**

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- **Data Sources and Methods**
  - **Conditional square footage of the buildings to be provide by the building owner or taken from original modeling files**
  - **Energy Use Intensity (EUI) refers to kBtu (1000 British thermal units)/square foot/year**
  - **Actual energy and water usage comes from at least 12 months of utility billing records**
  - **Initial modeling results of projected energy and water usage come from the building's LEED®, or other energy model used, submitted for energy optimization (EA-1) and indoor water use reduction (WE-3)**
  - **Savings estimates are made by comparing actual results to these modeled usage levels**
  - **Incremental initial building costs for the water and energy efficiency features**

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- **Energy Efficiency Results Developed**
  - **Actual Compared to Design**
  - **Actual Compared to Baseline**
  - **Actual Compared to the Energy Star Median**

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- **Energy Cost Savings**

  –Estimates of Savings come from the savings calculated from above three items

  –Using Actual and Baseline use intensities to the median you have two alternative calculations of EUI savings in actual costs, you can project these savings over 25 years *, assuming that energy usage remains constant and the utility rates change only at the rate of inflation. NOTE: utility rates have actually increased faster than general inflation, most expect that to continue. Higher rate increase would result in even higher savings from efficiency.

*** A present value represents the value today of payments to be received in the future. The present values in this report assumes a real discount rate of 3%/year. This is equivalent to assuming in the absence of inflation that receiving $1 one year from now would have the same value as having $.97 today.**

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- **Water Efficiency Results**
  - **–Actual water use compared to Design**
    - **•A straight comparison of the design model to actual usage is the clear defining methodology. Occupant behavior probably will be the defining item in its usage, the design will take into account reasonable fixture counts and performance enhancements. The other factor that would explain any differences would be the actual use of the space being different from the original concept or number of users.**
    - **•It has been determined in many studies that this aspect of the design is usually the most disappointing item that does not meet expectations. It is one area that users tend to not conserve.**
    - **•Cleaver use of rainwater collection can be used for sanitary waste, these waste are then collected in a on-site septic system which in turn leaches onto landscape areas within the site and returned into the ground.**
  - **–Current water and sewer billing rates**
    - **•In most areas of the country, the dollar value of these water volume savings per square foot is minimal. However, because the incremental cost of low flow fixtures is also small, their use can still be a good financial decision.**

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- **Electrical Efficiency Results**
  - **Energy calculations are normally included in the primary overview**
    - **Most calculations have taken this source of energy into account in heat gain calculations**
    - **High efficiency lighting have actually been able to provide excellent performance to provide enough information to track on its own**
    - **Most institutions should be looking at performance under _kw/sf/year**
    - **This can be achieved by using high efficiency lighting, task lighting and various power shaving and saving devices**
  - **Helpful Hints in achieving savings**
    - **Look at where lighting is really required, provide that light to perform for its needed task as well as providing other needed levels as a side benefit**
    - **All lighting needs to be of high performance, new programs available to help off-set these costs, most major area lighting schemes if re-lamped or new high efficiency lighting replaced will pay itself back within 2 years.**
    - **Find the areas or functions that are causing your peak loading, which controls the size of your service and see where it can be shaved.**

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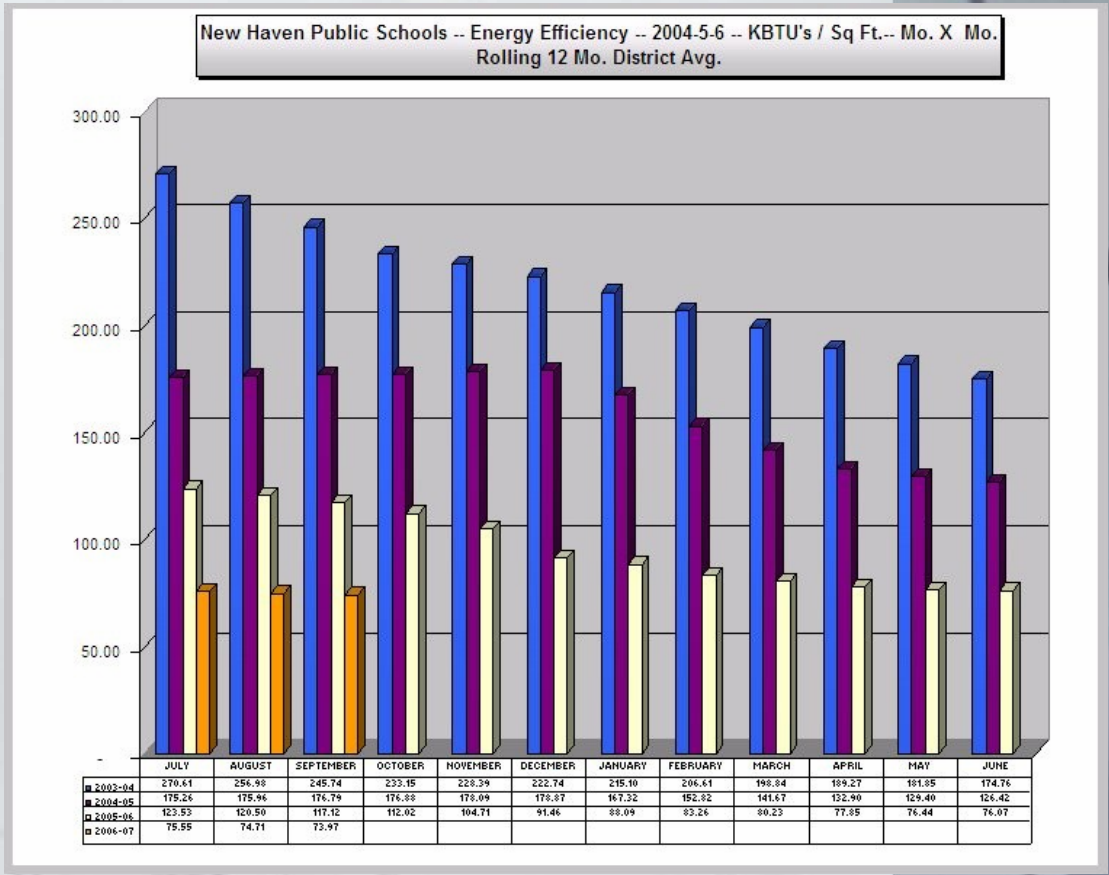
- **Building Performance Recap**
  - **Our expectation is that most buildings being studied should experienced real energy savings**
  - **Most buildings are anticipated to perform well in relation to general expectations using median EUI**
    - **$2/sf is the median average for 25 year present value is based on an EUI of 50 kBtu/sf for a typical office building as an example**
  - **However there can be a large variation in estimated savings depending on the calculation method used, the simple data requested is not adequate to precisely calculate savings for any specific building**
  - **We should be able to show some savings for indoor water usage in relation to original baseline modeling.**
    - **The American Waterworks Association has developed a standard of care for various building types that will provide a median baseline**

Post Occupancy Evaluations for Public Buildings with sustainable design

- **New Haven Public Schools**
  - **High Performance School Standards established**
  - **Chart used to provide overview of total energy savings**
  - **Legend**
    - **Orange 2007**
    - **Yellow 2006**
    - **Red 2005**
    - **Blue 2004**



	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
2003-04	270.61	256.98	245.74	233.15	228.39	222.74	215.10	206.61	198.84	189.27	181.85	174.76
2004-05	175.26	175.96	176.79	176.88	178.09	178.87	167.32	152.82	141.67	132.90	129.40	126.42
2005-06	123.53	120.50	117.12	112.02	104.71	91.46	88.09	83.26	80.23	77.85	76.44	76.07
2006-07	75.55	74.71	73.97									

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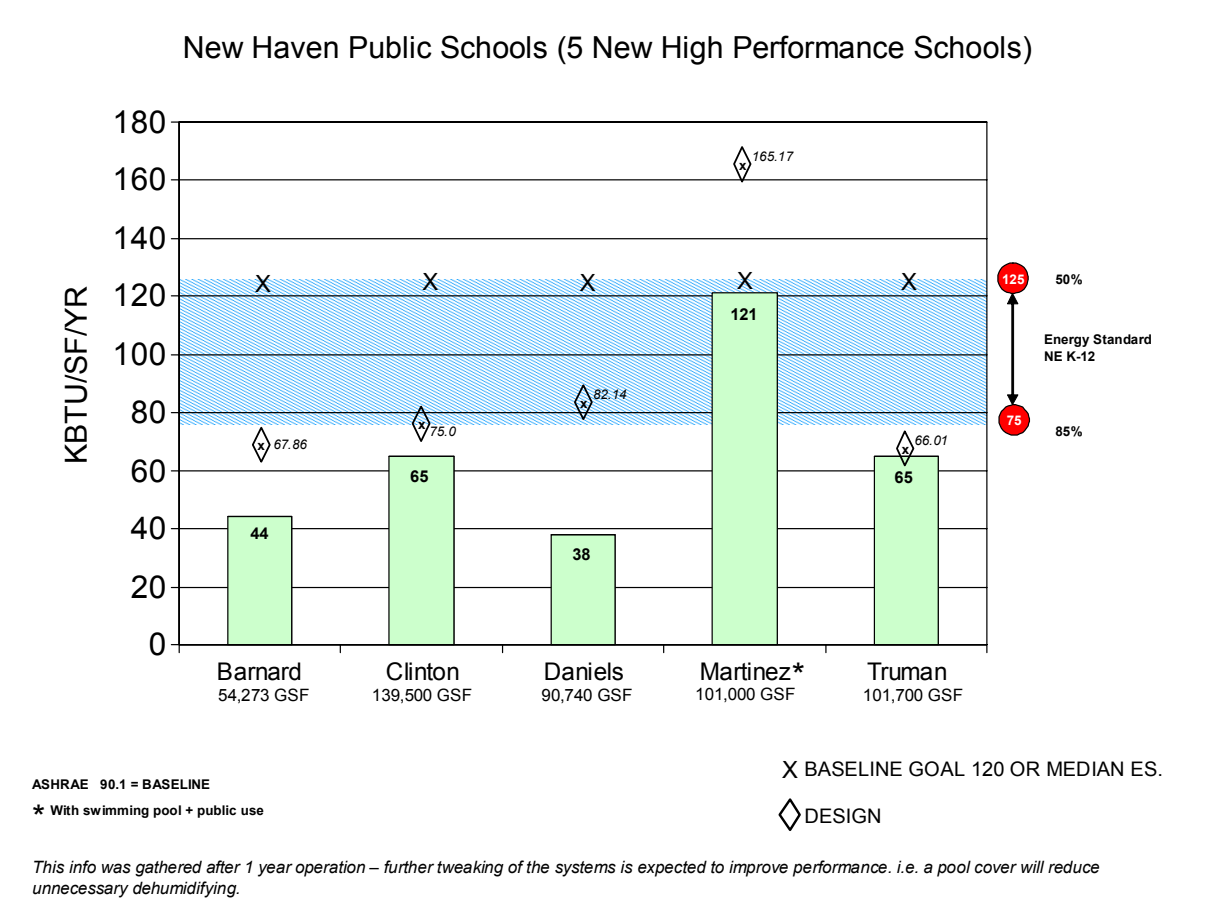
- **New Haven Public Schools New Construction Projects**
  - **Barnard, 54,273 gsf**
  - **Clinton, 139,500 gsf**
  - **Daniels, 90,740 gsf**
  - **Martinez, 101,000 gsf**
  - **Truman, 101,700, gsf**



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- **Univ. of New Hampshire Dormitory Projects**

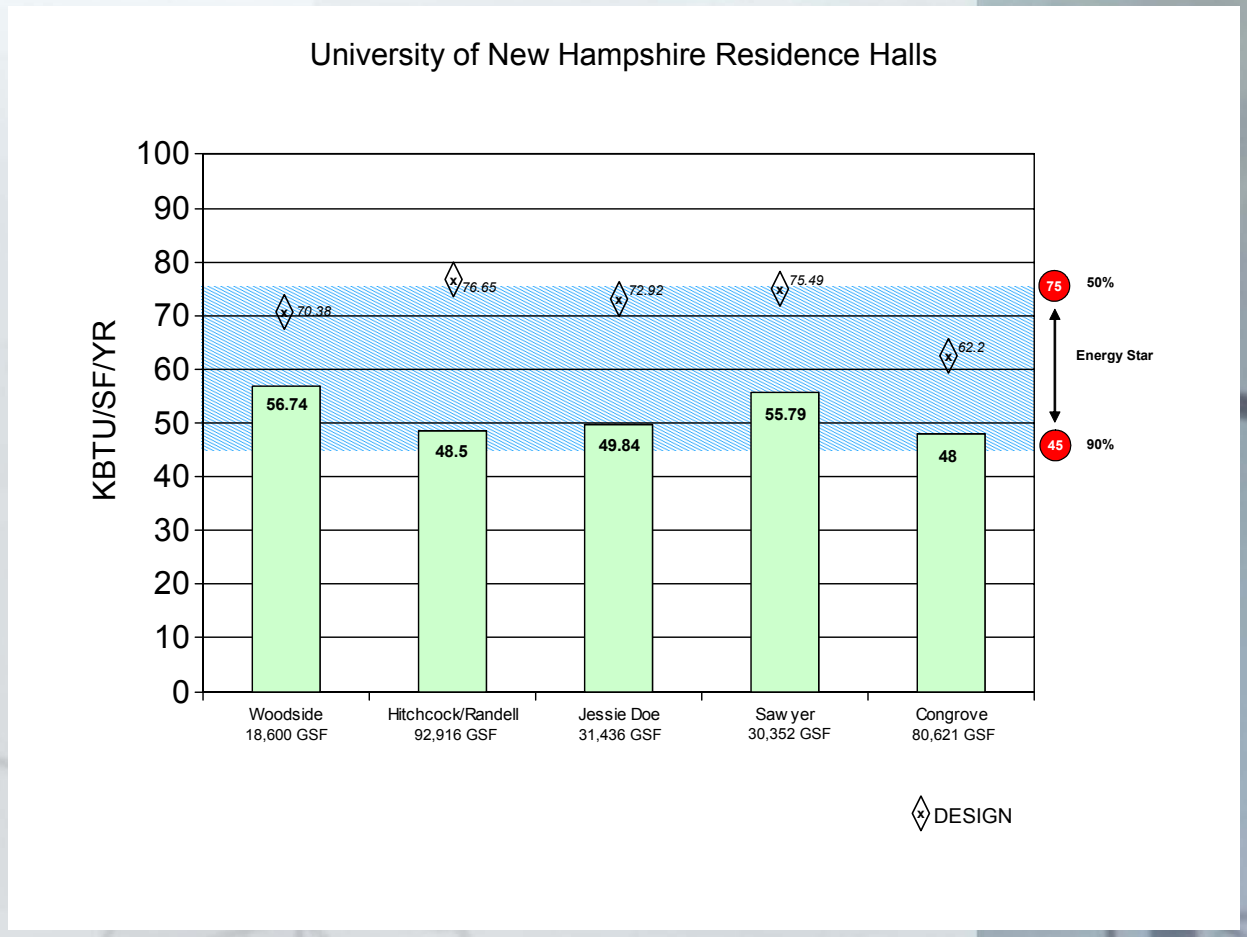
- **Woodside Hall**
  18,600sf

- **Hitchcock/Randall Hall**
  92,916sf

- **Jessie Doe Hall**
  31,436sf

- **Sawyer Hall**
  30,352sf

- **Congrove Hall**
  80,621sf



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- **Overview of Lessons Learned**
  1. **Most collected data is after one year, the following years should be better since no or very little tweaking has been done to adjust inefficiencies**
  2. **Although significant energy savings have been realized, it has not resulted in cost savings, the cost of fuel has increased much more rapidly than the efficiency, therefore little immediate cost benefit to savings, but significant savings over unbudgeted escalation. As mentioned before, over the past 16 years we in the NE have experienced an annual increase of 7.6%/Yr.**
  3. **Significant savings can be found in centralized monitoring, load shedding, Purchase of clean energy, dual fuel boilers, demand control ventilation base on CO2 monitors, and a general audit of energy use.**
  4. **Set up the basis for collecting information prior to operating the facilities**

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- **Questions – Answers**

- **Resources**
  - **USGBC - LEED® www.usgbc.org**
  - **Cascadia Region Green Building Council 1/30/06 Report www.cascadiagbc.org**
  - **www.energystar.gov**
  - **www.unh.edu**