Energy Action Plan for School Administrative Unit 41, Hollis & Brookline, NH

NRPC

Prepared by the
Nashua Regional Planning Commission, Jan. 2010

SAU 41 Profile

School Administrative Unit (SAU) 41 is located in the south central portion of the Nashua Region and includes the towns of Hollis and Brookline. According to 2007 Census estimates, Hollis is home to 7,738 residents, which places it 39th among NH's incorporated cities and towns. Brookline is home to 4,825 residents, which ranks it 73rd among NH's incorporated cities and towns based on these same estimates.

SAU 41 is comprised of the Hollis Elementary School District, the Brookline Elementary School District, and a Cooperative Secondary School District serving both Hollis and Brookline. Each district is governed by its own elected school board. The Brookline Elementary School District includes the Richard Maghakian Memorial School (RMMS) and Captain Samuel Douglass Academy (CSDA). RMMS houses 370 students from Pre-K through 3rd grade and CSDA is home to 302 students in grades 4 through 6. The Hollis Elementary School District is comprised of the Hollis Primary School, which houses Pre-K through 3rd grade, housing roughly 393 students [1] and Hollis Upper Elementary School, which includes grades 4 through 6, and houses roughly 399 students [2]. The Cooperative School district includes Hollis-Brookline Middle School and Hollis-Brookline High School. Hollis-Brookline Middle School houses roughly 426 students in grades 7 and 8 and Hollis-Brookline High School houses 929 students in grades 9 through 12.

Energy Inventory Background

Energy inventories help communities to assess their current energy use and track their energy reduction progress. By examining each building and comparing energy use across buildings, school districts, municipalities, and property managers can see how well each building is performing and where improvements can be made. The results are also beneficial in helping to prioritize potential energy reduction projects. The SAU 41 energy inventory was conducted using the Environmental Protection Agency's (EPA) Portfolio Manager. Portfolio Manager is an online, interactive energy management tool that allows users to track and assess energy consumption across a portfolio of buildings.

SAU 41 staff provided energy use data for each municipal building for the period beginning May 1, 2007 through April 30, 2009. The data was given to members of Project PROGRESS, a non-profit working to eliminate fossil fuel usage in SAU 41, who entered it into Portfolio Manager (Nashua Regional Planning Commission staff provided training on how to use the tool). The Hollis Energy Committee was also involved with this effort. After the inventory was complete, Nashua Regional Planning Commission staff analyzed the results and wrote this report.

The following buildings were included in the SAU 41 Energy Inventory:

Table 1.

Building Name	Size (ft^2)	Year Built	Portfolio Manager Category	Student Enrollment	Fuel Types
Captain Samuel Douglass Academy	49,421	1990	K-12 School	302	Electricity, Fuel Oil (No. 2)
Richard Maghakian Memorial School	57,264	1995	K-12 School	370	Electricity, Fuel Oil (No. 2)
Hollis Primary School	46,918	1975	K-12 School	393	Electricity, Fuel Oil (No. 2)
Hollis Upper Elementary	96,258	1980	K-12 School	399	Electricity, Fuel Oil (No. 2)
Hollis-Brookline Middle School	96,025	1975	K-12 School	426	Electricity, Fuel Oil (No. 2)
Hollis-Brookline High School	153,429	1997	K-12 School	929	Electricity, Fuel Oil (No. 2)
SAU 41 Administration	8,096	1960	Office	N/A	Electricity, Fuel Oil (No. 2)

Energy Inventory Results

The table below provides an overall summary of the SAU 41 Energy Inventory results. A more detailed analysis by measurement type follows.

Table 2.

Building Name	Total Energy Use (kBtu)	Current Site Energy Intensity ($kBtu/ft^2$)	Current Source Energy Intensity ($kBtu/ft^2$)	Annual Energy Cost	Energy Cost/ft^2	Total Greenhouse Gas Emissions ($MtCO_2e$)
Captain Samuel Douglass Academy	2,682,084	54.3	100.7	$84,399	$1.71	246.7
Richard Maghakian Memorial School	3,449,230	60.2	104.4	$102,843	$1.80	308.0
Hollis Primary School	3,717,847	79.2	132.7	$140,957	$3.00	327.3
Hollis Upper Elementary	5,079,055	52.8	102,0	$162,472	$1.69	475.7
Hollis-Brookline Middle School	4,674,487	48.7	90.5	$136,528	$1.42	430.4
Hollis-Brookline High School	8,654,366	56.4	107.6	$269,958	$1.76	805.8
SAU 41 Administration	315,212	38.9	64.2	$9,204	$1.14	27.6

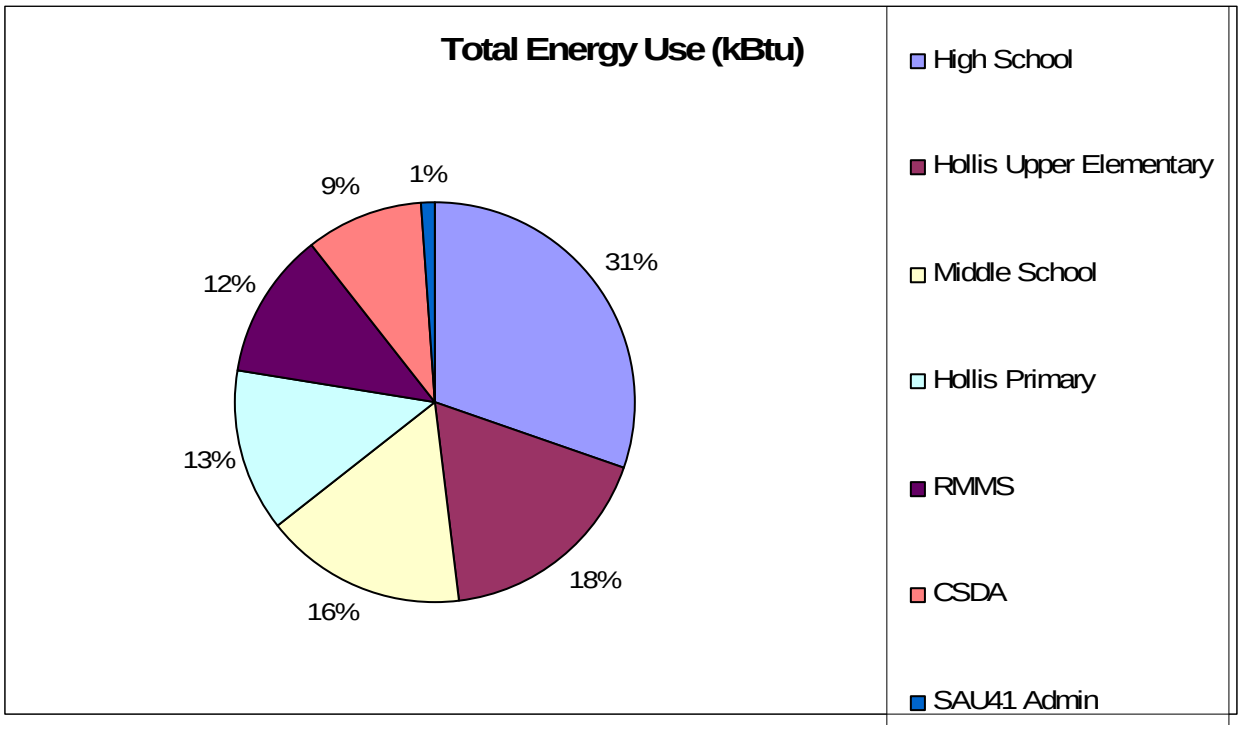
Energy Inventory Measurement Definitions:

- Site Energy Intensity—amount of energy expended per ft^2 on site to heat, cool, and electrify the area. This measurement fluctuates directly with actions such as how much lighting is being use and how the thermostats are set.
- Source Energy Intensity—amount of energy expended per ft^2 based on the type of fuel and the efficiency of that fuel type.
- $MtCO_2e$—metric ton carbon dioxide equivalent, allows emissions of greenhouse gases of different strengths to be added together.

Energy Use by Building

The Portfolio Manager Energy Inventory clearly demonstrates that energy use is not evenly distributed across SAU 41 buildings. For example, the Hollis-Brookline High School is consuming 31% of the total energy used across the entire portfolio of buildings. These results are illustrated in Graph 1 below.

Graph 1

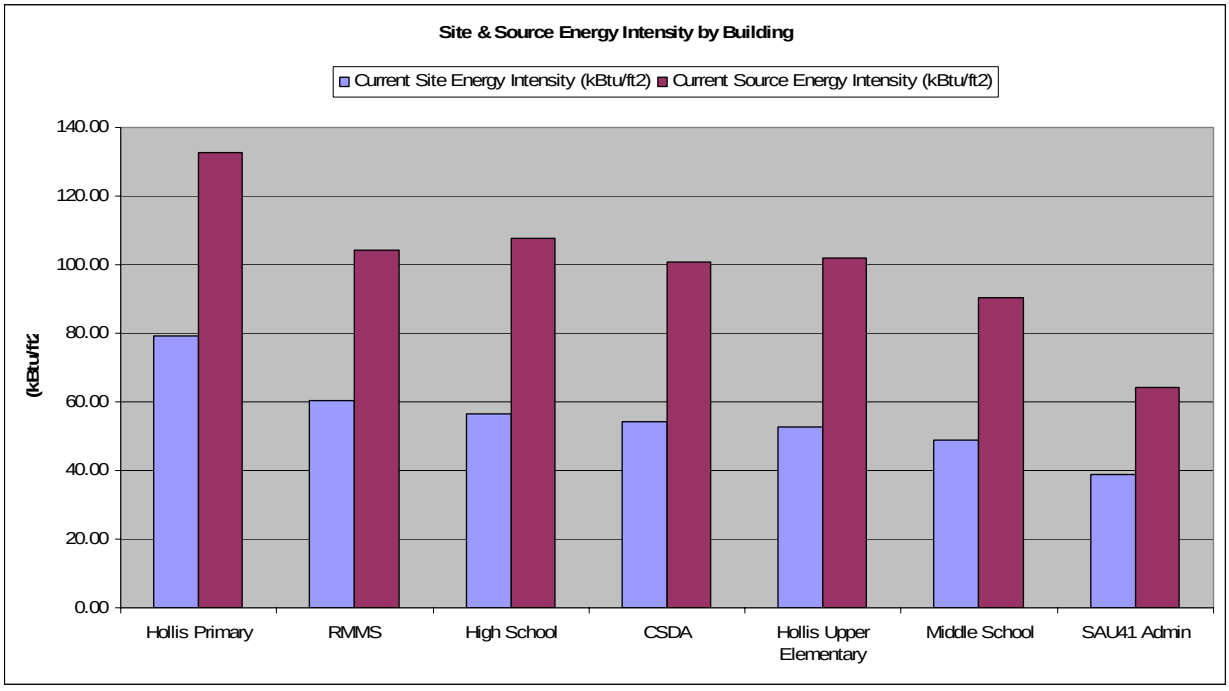


In addition to Total Energy Use, it is important to examine Energy Intensity, which provides a measure of the relative energy efficiency of a particular building. As mentioned above, site energy intensity is the amount of energy expended per square foot on site to heat, cool, and electrify the area. This measurement fluctuates directly with actions such as how much lighting is being use and how the thermostats are set. Thus, reductions in site energy intensity can be addressed through changes in behavior (ex. shutting computers off at night, turning down the thermostat) and through energy conserving technologies (ex. motion sensor lighting). Source Energy Intensity refers to the amount of energy expended per square foot based on the type of fuel used and the efficiency of that fuel type. Measures to reduce source energy intensity would involve changing the type of fuel being used to heat or cool the space.

The Hollis Primary School (46,918 ft^2) has the highest site energy intensity at 79.2 kBtu/ft^2 and the highest source energy intensity at 132.7 kBtu/ft^2. The Hollis-Brookline High School (153,429 ft^2) has the third highest site energy intensity and second highest source energy intensity at 56.4 and 107.6 kBtu/ft^2

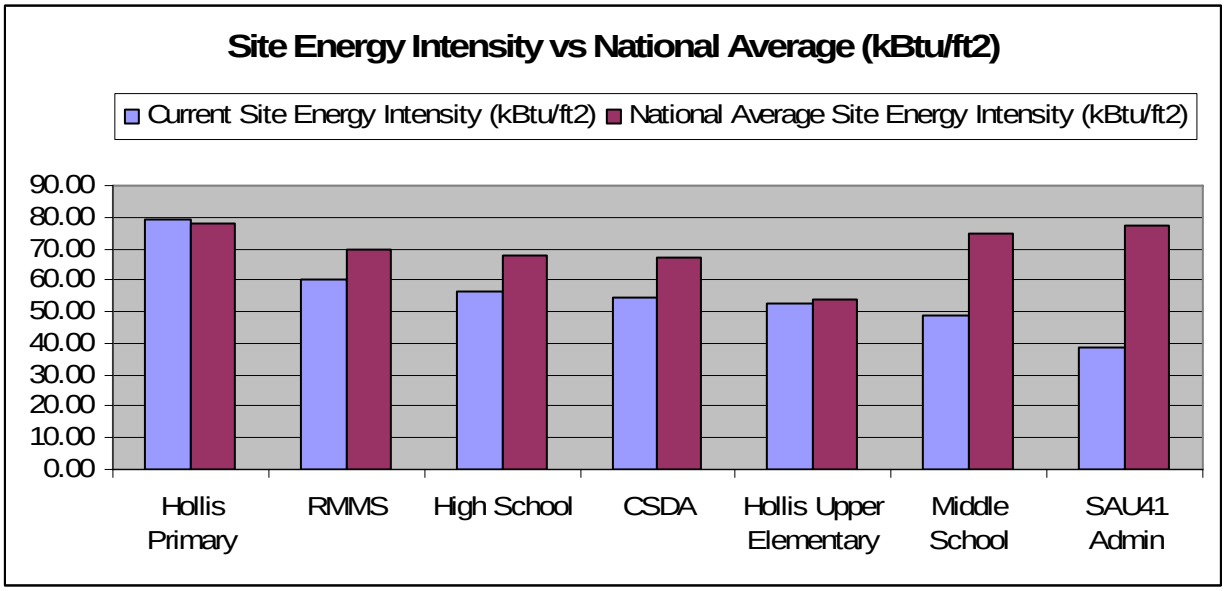
respectively. RMMS (57,264 ft^2) has the second highest site energy intensity and third highest source energy intensity at 60.2 and 104.4 kBtu/ft^2 respectively. Although site energy intensity is consistently lower than source energy intensity across the SAU 41 portfolio of buildings, it is recommended that steps are taken to focus on behavioral changes and simple energy conserving technologies first, as these are often the least costly and most easily implemented actions. These measures can be enacted across all buildings, with a particular focus on the Hollis Primary School and RMMS. A comparison of site and source energy intensities across buildings appears in Graph 2.

Graph 2

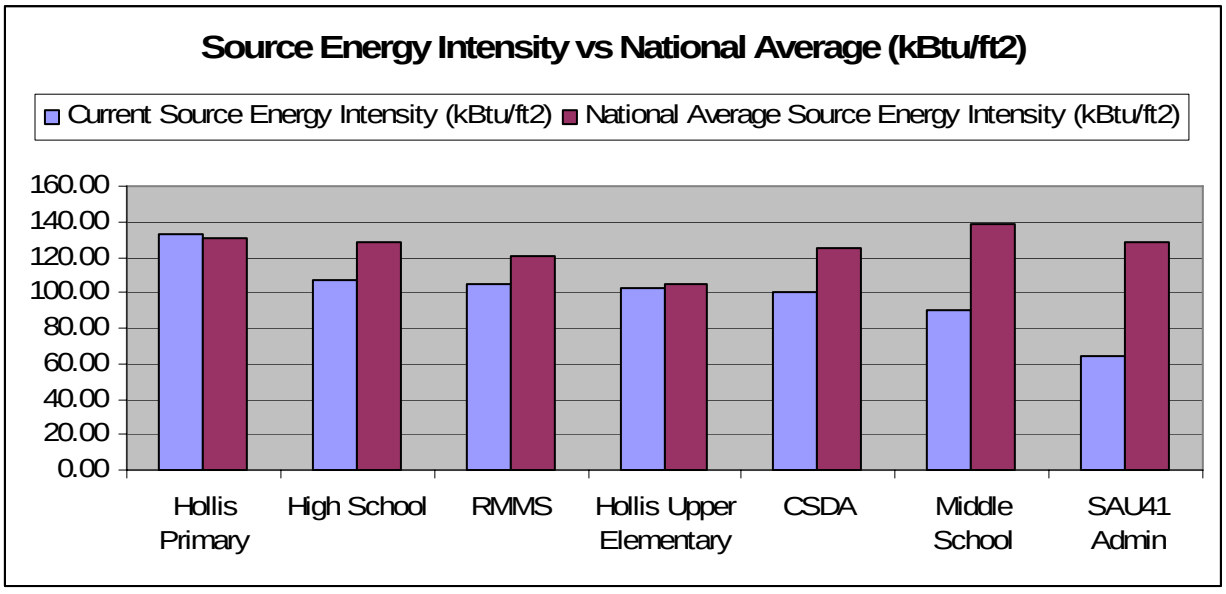


In addition to comparing site and source energy intensities across buildings in the SAU, Portfolio Manager also allows users to compare their buildings' site and source energy intensity to national averages for that building type. Graphs 3 and 4 illustrate these comparisons. Every building in the SAU 41 portfolio had a lower site and source intensity than the national average, with the exception of the Hollis Primary School. This provides further justification for the need to examine this building carefully.

Graph 3.



Graph 4

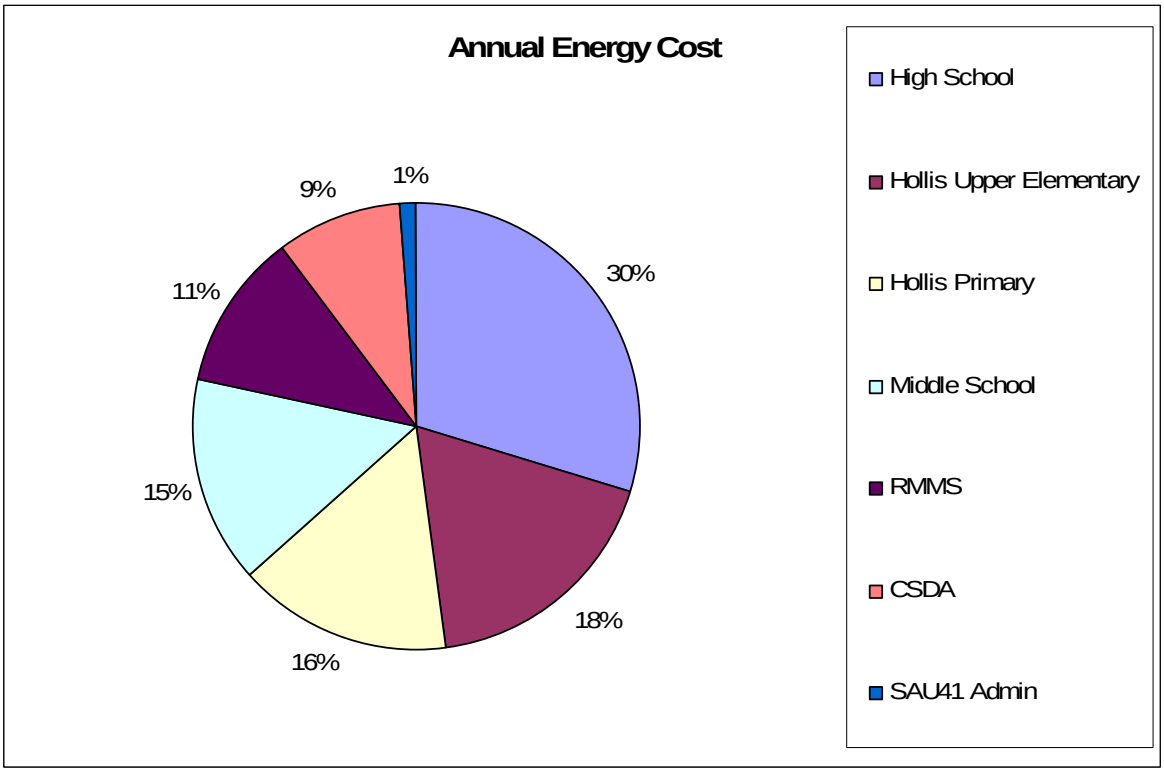


Costs by Building

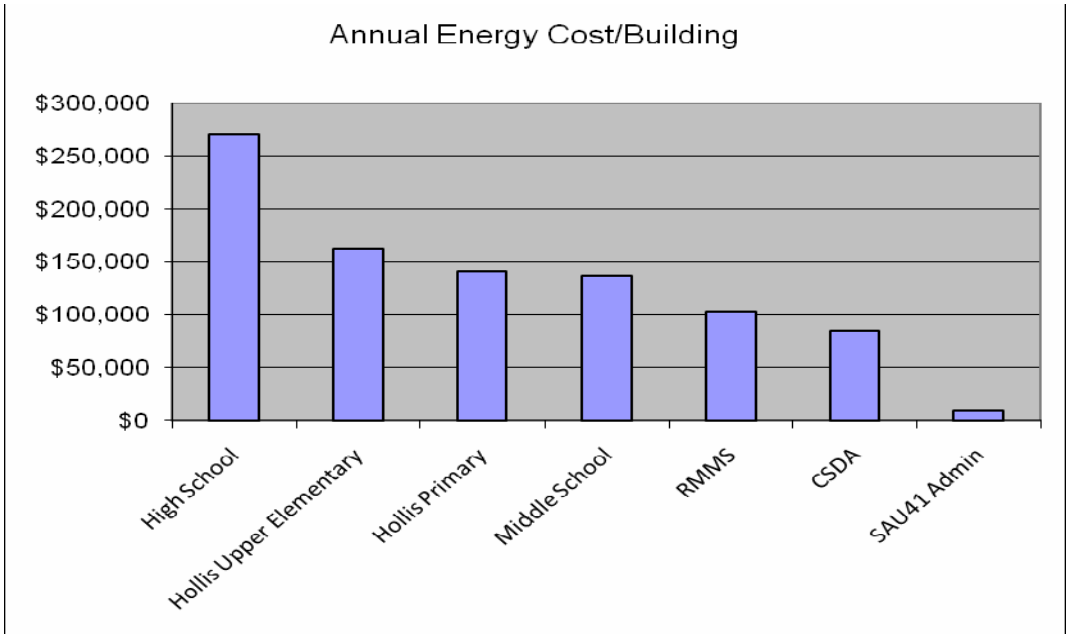
Another way to evaluate building performance is to examine overall energy costs and energy costs per ft^2. The cost of running school buildings is a major concern for most school districts and taxpayers. Therefore identifying ways to save on energy costs is often a priority when conducting energy inventories. The Hollis-Brookline High School accounts for 30% of total annual energy costs at $269,957.65. The Hollis Upper Elementary school has the second highest annual energy cost at $162,472.10 and the Hollis

Primary School has the third highest annual energy cost at $140,957.06. These results are illustrated in Graphs 5 and 6.

Graph 5

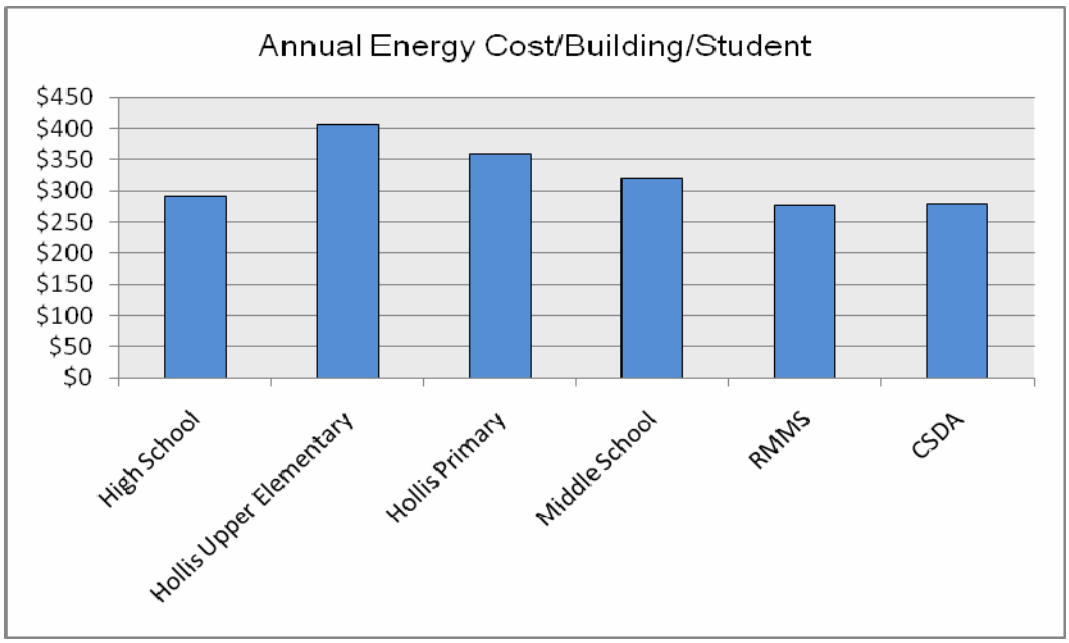


Graph 6



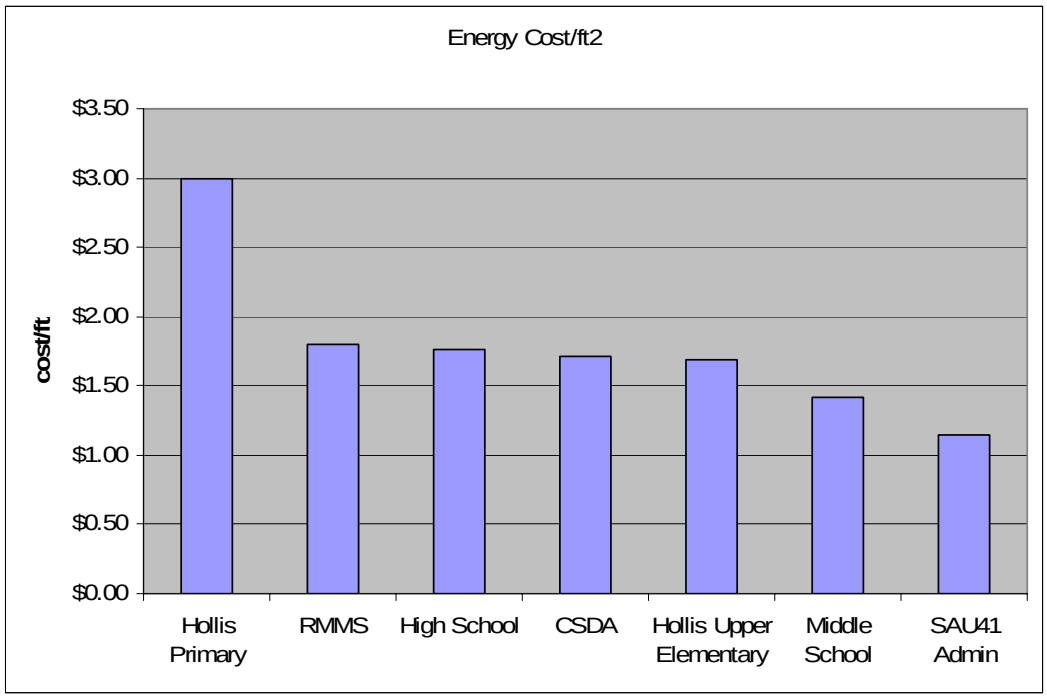
Related to Graph 6 above, the energy usage per building per student is also enlightening. Graph 7 shows that the Hollis Upper Elementary and the Hollis Primary schools have the largest energy cost per student.

Graph 7



When comparing energy costs per square foot, the Hollis Primary School stands out once again at $3.00/ft^2 and can be seen in Graph 8.

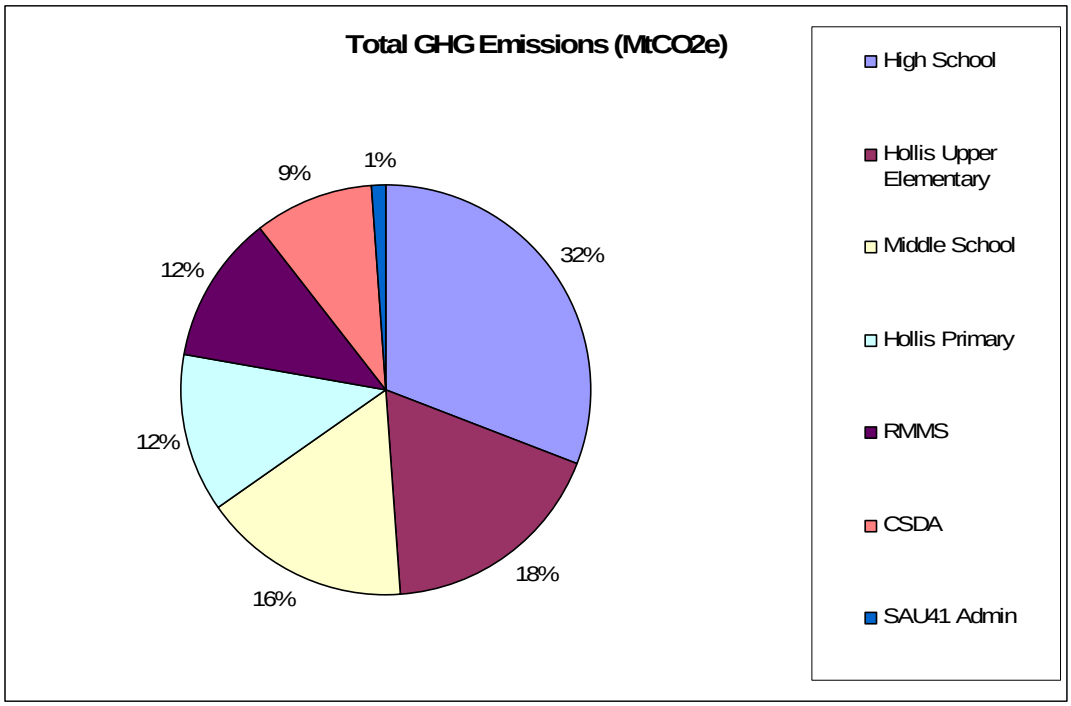
Graph 8



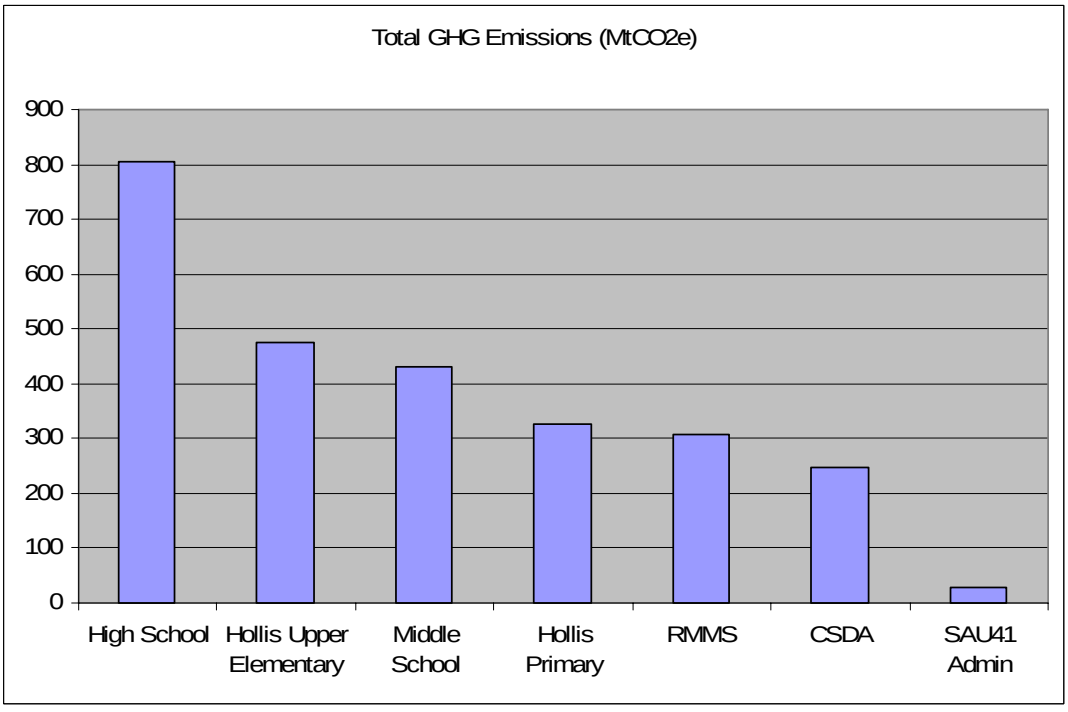
Greenhouse Gas Emissions

The final method for evaluating building performance is through greenhouse gas emissions. As mentioned above, Portfolio Manager measures greenhouse gas emissions in $MtCO_2e$, or metric ton carbon dioxide equivalent. This allows emissions of greenhouse gases of varying strengths to be added together. In SAU 41, three buildings—the Hollis-Brookline High School, Hollis Upper Elementary School, Hollis-Brookline Middle School—account for 66% of the total emissions coming from all 7 buildings in the portfolio. The High School alone produces 32% of the emissions at 805.82 $MtCO_2e$.

Graph 9



Graph 10



Energy Inventory Analysis

When prioritizing which buildings to focus energy efficiency and conservation efforts on, it is important to look across the entire spectrum of performance measures, which include Site Energy Intensity (kBtu/ft^2), Source Energy Intensity (kBtu/ft^2), Energy Cost/ft^2, Total Energy Use (kBtu), Annual Energy Cost ($), and Greenhouse Gas Emissions ($MtCO_2e$).

The Hollis-Brookline High School was in the top three worst performing buildings in every category. It had in the highest Total Energy Use, Annual Energy Cost, and Greenhouse Gas Emissions; the second highest Source Energy Intensity; and the third highest Site Energy Intensity and Energy Cost/ft^2. The consistency with which the High School performed poorly in each of these categories indicates that further attention and priority should be given to this building.

The Hollis Primary School was the worst performing buildings in every category that considers square footage. It had the highest Site Energy Intensity, highest Source Energy Intensity, and highest Energy Cost/ft^2. It also had the third highest Annual Energy Cost.

The Hollis Upper Elementary School also performed poorly, with the second highest Total Energy Use, second highest Annual Energy Cost, and second highest Greenhouse Gas Emissions.

Finally, RMMS had the second highest Site Energy Intensity and Energy Cost/ft^2 and the third highest Source Energy Intensity.

Recommendations based on Energy Inventory Results

<u>Overall Goal</u>

A recommended goal is to reduce municipal energy consumption by 15% below 2008 levels by 2015. This is in line with the NH Climate Action Plan's goal to reduce NH's annual greenhouse gas emissions by 80% below 1990 levels by 2050. In 2008, the SAU 41 buildings consumed 28,572,281 kBtu of energy. A 15% reduction by 2015 would bring SAU 41's energy consumption level down to 24,286,438.85 kBtu.

<u>Building Recommendations</u>

- Use students, volunteers, and local energy committee members to conduct walk-through building audits to look for easily correctable changes in behavior or easily implemented energy efficiency measures. Continue to track building performance in Portfolio Manager after subsequent actions have been implemented to measure associated energy efficiency improvements. The following buildings should receive priority when conducting these audits:

1. Hollis-Brookline High School
2. Hollis Primary School
3. Hollis Upper Elementary School
4. Richard Maghakian Memorial School

- Use facility maintenance staff to recommission buildings that continue to perform poorly after walk-through audit recommendations have been implemented. Recommissioning examines the building's equipment systems operation and maintenance procedures and compares them to intended or design operations procedures. The primary focus of recommissioning is to identify operation and maintenance improvements that will result in energy cost savings and that are relatively fast and inexpensive to implement. Recommissioning does not necessarily involve the purchase or installation of new equipment or technology and in-house staff can typically implement many of the operation and maintenance improvements. Example recommissioning activities include calibrating building controls such as thermostats and occupancy sensors; adjusting operating schedules to ensure equipment is only on when necessary; checking for leaky or improperly functioning steam traps; and cleaning heat exchanger tubes in condensers, evaporators, and boilers to maintain optimal efficiency. Priority should be given to buildings that do not have an active preventative maintenance program.

- Conduct professional audits of buildings where no performance improvements are seen after implementing volunteer walk-through audit recommendations and recommissioning activities. Energy audits examine existing building systems for equipment replacement (retrofit) opportunities that will result in energy cost savings. Utility providers often offer free or low cost auditing services and should be utilized first.

- After energy efficiency measures have been successfully implemented, research the feasibility of installing green energy technologies (ex. small wind, solar, geothermal) in one of more school buildings. Priority should be given to buildings with high source energy intensity.

- Involve students to the greatest extent possible when conducting audits and making energy efficiency improvements. This will help to raise awareness of the SAU's efforts to improve energy efficiency and instill an environmental ethic in students and their parents.

- Take advantage of local agencies and resources to help plan and implement energy efficiency and conservation measures. The New Hampshire Local Energy Committee Working Group, www.carboncoalition.org, offers a number of tools designed to provide guidance and technical support to communities looking to reduce their energy use. The Nashua Regional Planning Commission

may also be able to offer additional services. Please contact Jill Longval at 603-424-2240 x27 or jilll@nashuarpc.org.

References

[1] Hollis Primary School enrollment estimate: http://www.schooldigger.com/go/NH/schools/0384000171/school.aspx

[2] Hollis Upper Elementary School enrollment estimate: http://www.schooldigger.com/go/NH/schools/0384000566/school.aspx