Energy Information and Resources

for Hospitals in Massachusetts

December 17, 2014

Health Care Without Harm

Healthier Hospitals INITIATIVE

Prepared by

Vermont Energy Investment Corporation

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In order to best assist hospitals and facility staff in their effort to improve energy efficiency and reduce carbon emissions and overall costs, Health Care Without Harm and the Healthier Hospitals Initiative have released a comprehensive tool – Energy Information and Resources for Hospitals in Massachusetts. This paper, which was made possible by funding from the John Merck Fund, lays out numerous options for rebates, loans, and other financial assistance and endeavors that can help hospitals meet their goals for lean energy.

EXECUTIVE SUMMARY

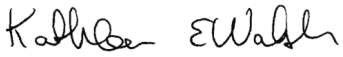
Across Massachusetts, hospitals are striving to improve health care and best meet patients' needs while keeping costs down and operating as efficiently as possible. Each department of the hospital is asked to do more with less while still offering excellent care and improving patient health. Facility departments have the unique opportunity to save money on operations while also advancing population health through the reduction of greenhouse gas emissions. Working toward energy efficiency is a chance for hospitals in Massachusetts and across the nation to save significantly. ENERGY STAR estimates that nationally every $1 savings in annual energy costs is equivalent to an increase of $20 in annual revenue (based on a five percent net operating margin). When a hospital has a net margin of 1.5%, every $1 energy savings is worth $67 in increased revenue. In Massachusetts, our hospital community has been a leader in energy efficiency efforts. Boston Medical Center, Baystate Health, Berkshire Medical Center, and Beth Israel Deaconess Medical Center have all utilized incentives from Mass Save to implement efficiency improvements. These improvements yielded payback in as little as 1.5 years with as much as $1,000,000 of savings per year. Saving energy is one of the most cost effective ways to increase hospital operating margin and, unlike other revenue streams, is entirely under the hospital's control.

While the incentive for hospitals to undertake lean energy project is large, not every hospital has yet to take action. In some cases, pertinent resources required for the initial investment are unavailable or scarified for more pressing facility projects. What's more, inadequate understanding about the potential rewards of lean energy also impedes its implementation. And, as is often the case, a lack of manpower and time prevents hospitals from focusing on these initiatives.

Health Care Without Harm and the Healthier Hospitals Initiative, through generous funding from the John Merck Fund, seek to assist hospitals in eliminating these barriers. This paper was written to provide clear guidance to facilities directors on (1) opportunities for funding energy efficiency projects and (2) making the case and securing support from hospital senior leadership. By outlining available tools and resources in a single source, this document is intended to make it quicker and easier to pursue energy efficiency projects. At the end of each section there is a comprehensive list of projects, programs, companies, and municipalities offering assistance to hospitals. Multiple case studies are included to provide best practices for other institutions.

Money spent on energy is typically 1 to 3 % of a hospital's total operating costs and is equal to about 15% of a hospital's profit. Energy efficiency presents a unique opportunity for hospitals to not only generate high savings, but also to further their mission of improving patient and community health. Health Care Without Harm and the Healthier Hospitals Initiative are dedicated to supporting hospitals in reaching both these goals.

Sincerely,



Kate Walsh, President and CEO

Boston Medical Center

INTRODUCTION

The purpose of this document is to provide relevant and useful information to hospital administrators, engineers, and facility personnel to allow them to improve energy performance at their facility. There are many ways to improve energy performance, and it is not possible to cover every scenario or opportunity, but this paper intends to provide a framework for setting goals, and then for meeting those goals by identifying potential projects, energy saving actions, and financing options. This paper is intended to compliment two documents: the Leaner Energy **How to Guide** and **Health Care & Climate Change: An Opportunity for Transformative Leadership**. The former paper illustrates a step-by-step approach toward reducing energy in hospitals and is available to enrollees of the Healthier Hospitals Initiative under the "How To" section. The latter document focuses on broad criterion for investment choices and case studies illustrating implementation in hospitals nationwide.

Hospitals are recognized as energy intensive facilities. In order to serve their customers, they are in use 24 hours per day and 365 days per year. Climate control through heating, cooling, and ventilation requires significant energy, as does lighting, laundry services, commercial cooking, medical procedures, and sterilization. Hospitals are among the most energy intensive of commercial spaces with usages of about 2.5 times the amount of energy as a commercial office on a square foot basis.

Figure 1 below illustrates the end uses of energy consumed by large hospitals.

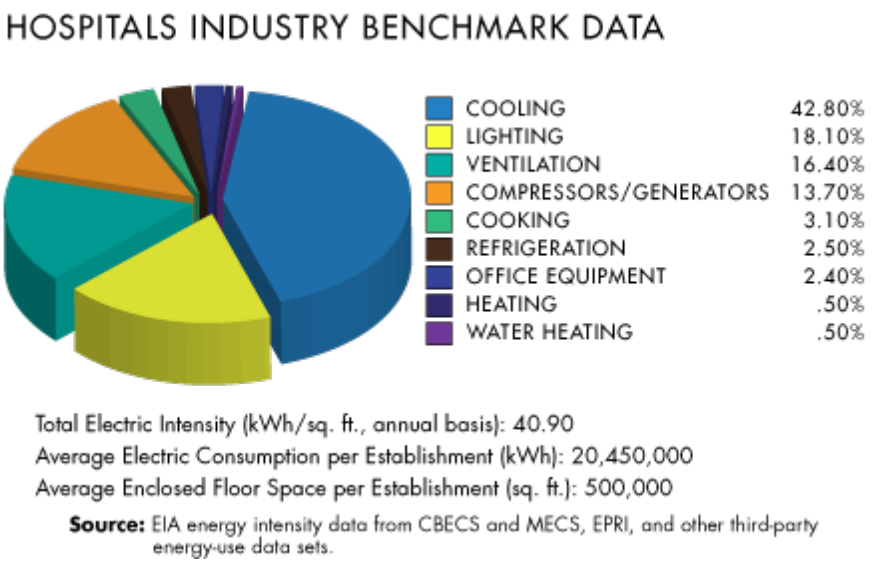


Figure 1: Energy End Use in Hospitals[1]

Money spent on energy is typically 1 to 3% of a hospital's total operating costs and is equal to about 15% of a hospital's profit.[2] Reducing energy use is a direct way to increase profit. Energy costs for hospitals on a square foot

1 Salt River Project. (2014). Health Care: Energy Costs. Retrieved from http://www.srpnet.com/energy/powerwise/business/savewithsrpbiz/healthcare.aspx?TabName=Water

2 Department of Energy. (2009). *Department of Energy Announces the Launch of the Hospital Energy Alliance to Increase Energy Efficiency in the Healthcare Sector*. Retrieved from http://energy.gov/articles/department-energy-announces-launch-hospital-energy-alliance-increase-energy-efficiency

basis vary widely around the country.[3] If a hospital is on the higher end of the range with respect to costs per square foot, then it is likely there are good opportunities for savings, and energy efficiency projects can be a great way to achieve those savings.

Renewable energy is increasingly cost competitive with utility energy and produces less or no carbon emissions. There are various financing options, including third party financing in the form of a lease or a power purchase agreement that typically lock in rates at or below current electricity prices for up to 20 years. This can be an effective way to manage energy costs and avoid rate volatility. A financially lucrative type of renewable energy is a solar photovoltaic (PV) system. Solar PV systems provide peak energy during the highest demand hours of the grid system when power is most expensive, on hot summer afternoons. A photovoltaic system is a potential way to reduce peak demand and peak demand charges in addition to reducing purchased energy.

If a hospital is ready to move beyond a project based approach and take more control over the energy use in their facility, then implementing an Energy Management System is the best way to go. Energy Management provides a comprehensive framework to address energy use through conservation actions, efficiency projects, and operational and maintenance practices.

Equally important to identifying a project is the ability to move forward with the project to a successful conclusion. This requires presenting a project in a way that will effectively illustrate the business case in order to receive approval from management. It may involve obtaining financing, incentives and grants, and should ensure that the project is installed, completed, and commissioned as designed. In order to establish new policies to encourage energy saving actions or changes in behavior by building occupants, it is necessary to provide education and feedback about the benefits from such changes.

3 Carpenter, D. Advancing Efficiency. (2011, July). *HFM Magazine*. 16.

DEFINITIONS

ENERGY PERFORMANCE

Measurable results related to energy use, energy efficiency, and energy consumption. Improvement of energy performance can be achieved through conservation, efficiency, renewable energy, and energy management.

ENERGY USE

The application of energy to complete a task, such as electricity used for ventilation or natural gas used for heat.

CONSERVATION

Conservation is defined as not using energy when it is not required. This sort of action (e.g., turning equipment off when not in use) is also frequently referred to as a behavioral action.

ENERGY EFFICIENCY

Energy efficiency is commonly defined as using less energy to achieve a required result. This can take the form of a fluorescent or LED light replacing an incandescent light, while producing an equal amount of lumens, or it can apply to more complex equipment.

RENEWABLE ENERGY

Under correct management practices, a renewable resource can be regenerated indefinitely. Renewable energy is most commonly seen in applications such as heating or electricity produced by the sun, wind, or biomass. The renewable energy device can be on site at the facility or off site as part of a central plant feeding a campus or a whole city. This paper will focus on on-site installations.

ENERGY MANAGEMENT SYSTEM

The implementation of an Energy Management System (EnMS) involves establishing an energy policy and energy goals, along with processes and procedures to achieve those objectives.

Energy Management Systems normally use the Deming Cycle of Plan, Do, Check, Act to ensure a recurring cycle of continuous improvement.

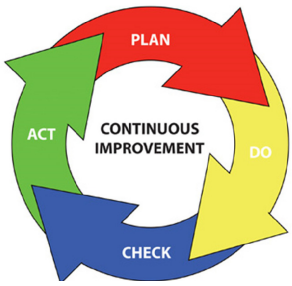


Figure 2: The Deming Cycle[4]

4 Kappler, C. (2013). *Softwaretools zur Analyse der Energieeffizienz von Hardware*. [PowerPoint Slides].

CONSERVATION

OVERVIEW

Conservation is the practice of reducing use of a resource when it is prudent to do so. The classic example is shutting off the lights when leaving a room. In a hospital, in addition to opportunities to shut down lights when not in use, there may be opportunities to achieve significant savings by shutting down standby boilers or operating suites if they are not in use. In a hospital setting, health and safety is clearly paramount so care must be taken to identify the appropriate time and circumstances under which it is acceptable to shut equipment off. In order to best manage and change behavior, an energy saving behavior or conservation program can be established to inform, educate, and inspire hospital employees to take action.

Conservation programs can achieve real results – such as reducing carbon emissions by 74% as in the US Government's "Green the Capitol" program. University Health Network, comprised of three teaching hospitals in Toronto Canada, implemented a comprehensive energy management program including a behavior called Thermostats, Lights and Controls (TLC) – Care to Conserve. The TLC-Care to Conserve program reduced energy use by 3.9% the first year and increased to 4.2% in the second year.[5] Likewise, through use of behavior changes, Ridgeview Medical Center in Minnesota was able to reduce energy use by 6% over a 15-month period, which netted $75,000 in savings.[6]

It has been said that anyone with the ability to turn on a light switch – or any other "on" switch – has energy purchasing authority. This fact must be impressed upon all employees of the hospital to make them aware that their cumulative individual actions have a large impact. If everyone is conscious of their energy purchasing actions, and knows what they can do to help, then significant changes can be made. Conservation programs are also known as Behavior programs. The American Council for an Energy Efficient Economy (ACEEE) has studied successful programs implemented in the United States and Canada and found that effective programs share four common strategies. The four strategies are:

- Set the Tone
- Build a Team
- Employ Communication Tools
- Deploy Engagement Techniques

Visually, these four strategies and their component parts can be displayed as in Figure 3[7].

5 American Council for an Energy-Efficient Economy. (2012, Jan.). *Greening Work Styles: An Analysis of Energy Behavior Programs in the Workplace* (Report No. B121). Washington, D.C.: Bin, S.

6 Class 5 Energy, Inc. (2013). *Achieving Energy and Cost savings in a Healthcare Organization with a Behavioral-Based Energy Efficiency Program*. Retrieved from http://mn.gov/commerce/energy/images/AchievingEnergyandCostSavings.pdf

7 American Council for an Energy-Efficient Economy. (2012, Jan.). *Greening Work Styles: An Analysis of Energy Behavior Programs in the Workplace* (Report No. B121). Washington, D.C.: Bin, S.

Figure 3: Behavior Program Strategies

SET THE TONE

As with most any initiative or goal in a business, regardless of profit or non-profit status, top management must be supportive of the end result or goal and set a positive, inclusive tone. Section 7 will discuss methods to present initiatives and projects to top management to secure their support. Without management support, it is extremely difficult to change behavior. Once management is convinced of the merits of saving energy at low or no cost to the hospital, then management should set a goal and make a public pledge to show commitment. Making the goal public helps to hold everyone accountable. Some people have found that branding the effort can help to build buy-in and create momentum. A brand, logo, or slogan such as “Everyone has the power to save” that inspires or creates an emotional response works best. It also helps if the brand builds on the identity of the hospital.

BUILD A TEAM

Successful behavior and conservation programs are often the result of great teamwork. Programs typically bring together key stakeholders from various departments, empowering them to develop and coordinate the program, and then communicate with the rest of the organization. Peer champions, either volunteers or appointees, act as role models and help communicate and reinforce the desired behaviors in their departments.

EMPLOY COMMUNICATION TOOLS

Communication of the program’s aims and methods to all employees is critical. Fortunately, there are many ways to communicate through public meetings, notices, posters, websites, e-mails, and the various forms of social media such as Tweets, text messages, and Instagram Photos.

DEPLOY ENGAGEMENT TECHNIQUES

Establishing Social Norms that emphasize wise energy use is important. Just as any business typically wants to establish a culture of safety, respect for peers, and/or hard work, making energy use a conscious part of work life is necessary to create change. There are many ways to create opportunities for change, including competition, feedback, and providing rewards. Establishing a competition between floors or departments can be a fun and constructive way to

motivate people. If the winner gets a prize such as a pizza party, that can provide added incentive. Feedback through praise or by peer pressure helps to reinforce the message.

IDENTIFYING OPPORTUNITIES

When looking for conservation opportunities, one must look for opportunities to turn things off when they are not immediately required. Opportunities may take the form of lighting, computers and other office equipment, or specialized medical equipment. It may be necessary for some equipment that takes time to warm up to be left on at all times to maintain effectiveness, especially if it is required to save lives, but every piece of equipment should be considered fair game for reduced hours of use. One approach is to walk through the facility during off hours to take note of what is left on. Soliciting employee suggestions encourages engagement and increases the likelihood of finding good opportunities.

In addition to equipment with on/off switches, there may be significant opportunities to reduce energy use through reprogramming of lighting, heating, ventilation, and air conditioning equipment. Sometimes equipment is turned on before it is needed, and off well after it is no longer required. Schedules should be matched to actual hours of use, especially for office space that is just used during the day. Some hospitals may have more surgical suites energized than necessary or at times when they are not needed.

Maintenance practices can also have an impact on energy use. Dirty filters can decrease performance of air supply systems, increasing energy use over time. It is common for economizers in packaged rooftop units to fail in an open position, so that they bring in more outside air than necessary or at inappropriate times. This surplus of outside air may increase the amount of heating, cooling, or dehumidification required thus using more energy.

Building commissioning is the practice of verifying that building systems are operating as designed and that its personnel understand how to operate these systems. Retro-Commissioning is commissioning an existing building. This process verifies that systems and equipment are still operating as originally intended. Because many hospitals are made up of buildings that have been expanded multiple times, it is very possible that the heating, ventilation, and air conditioning systems have not been modified or expanded with efficiency as the primary goal. Many utility energy efficiency programs support commissioning and retro-commissioning through the use of incentives to help pay for commissioning professionals.[8] A professional approach may employ meters and equipment to track energy use, temperatures, occupancy, and carbon dioxide levels versus scheduled hours of use.

LINKS, RESOURCES, AND INFORMATION

- Greening Work Styles: An Analysis of Energy Behavior Programs in the Workplace – This research report highlights five initiatives across the country aimed at reducing energy usage through behavior change. Savings ranged between as low as 4% to as high as 75%.
- Mass Save Retro Commissioning application form – Utilities participating in Mass Save programs offer rebates for retro-commissioning. Retro-Commissioning is the process of commissioning an existing building. Building commissioning is the practice of verifying that building systems are operating as designed and that the personnel responsible for its operation know what to do.

8 Mass Save. (2014). *Commissioning and Testing Services: Ensuring the Performance of Your Energy-Efficient Technologies.* Retrieved from http://www.masssave.com/business/services-financing/commissioning-testing

- **Operating Room HVAC Setback Strategies** – This monograph published by the American Society of Healthcare Engineering (ASHE) illustrates the high level of potential savings available to hospitals through operating room HVAC setback. The document explains a general overview of setback approaches as well as variables that must be assessed before completing this type of project such as code requirements, usage profiles, climate, and user needs.
- **US Department of Energy Existing Hospital Commissioning overview** – This document focuses on Existing Building Commissioning (EBCx) for hospitals. It describes a cyclical process to follow when completing EBCx and gives two specific case studies as examples. Both case study hospitals achieved significant, timely paybacks on EBCx projects.

ENERGY EFFICIENCY

OVERVIEW

Energy efficiency is commonly defined as using less energy to achieve a required result. This can take the form of a fluorescent or LED light replacing an incandescent light, while producing an equal amount of lumens, or it can apply to more complex equipment or building envelope improvements. When compared against conventional costs (i.e., fuel and electricity) and renewable energy investments, energy efficiency is recognized as being the most cost effective and stable way to save energy and money as well as combat climate change.[9] For example, a study by ACEEE that examined energy efficiency programs in 20 states from 2009-2012 determined the average cost for electrical energy efficiency measures was $0.028 per kilowatt hour (kWh).[10] Comparatively, the average price for commercially billed electricity in Massachusetts as of April 2014 was $0.139 per kWh.[11] Energy efficiency is frequently the most cost effective solution to reduce energy costs and mitigates the causes of global warming and climate change.

IDENTIFYING OPPORTUNITIES

Massachusetts currently charges "2.5 mills ($0.0025) per kilowatt-hour for all consumers (except those served by a municipal lighting plant) to fund energy efficiency program[s]."[12] As most ratepayers are paying this efficiency charge, it is prudent to take advantage of the resources this charge makes available. Different energy efficiency incentive opportunities may be available for commercial municipality ratepayers. Links to these utilities and available programs through entities such as Mass Save are explained in further detail in the links section.

The first step toward taking advantage of deep savings and energy efficiency is to reach out to the utility or program administrator (see Figure 4 and 5 below). Many Massachusetts utilities and some municipal lighting plants offer free or cost shared energy audits. A professional engineer or auditor should be able to identify opportunities for savings. Your utility should be able to recommend people to do this work. Often times the process starts with a walk through the facility to see what obvious opportunities there are, such as with lighting. This walk through audit will probably turn up additional opportunities that should be further investigated in order to quantify the potential savings. This further investigation may just involve calculations or may require metering to verify operation. Promising opportunities should be fully analyzed to include cost estimates or quotes, estimated savings and the value of those savings, available incentives, and other benefits such as comfort, better light quality, or reduced maintenance.

Identified projects can be evaluated in a number of ways, and then ranked in order of priority depending what is important to the hospital. The time for a return on investment may be reduced significantly with rebate opportunities, so

9 American Council for an Energy-Efficient Economy. (2009). *Energy Efficiency Holds Steady At 2.5 Cents Per Kilowatt-Hour Even As Costs of New Power Generation Rise*. Retrieved from http://www.aceee.org/press/2009/09/energy-efficiency-holds-steady-25-cents-kilowatt-hour-ev

10 American Council for an Energy-Efficient Economy. (2014). *New Report Finds Energy Efficiency is America's Cheapest Energy Resource*. Retrieved from http://www.aceee.org/press/2014/03/new-report-finds-energy-efficiency-a

11 U.S. Energy Information Administration. (2014). *Electric Power Monthly*. Retrieved from http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a

12 Funding for energy efficiency programs; mandatory charge per kilowatt-hour; other funding; gas energy efficiency programs; allocation of funds. Ch. 25 M.G.L. § 19 (2014). Retrieved from https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter25/Section19

it is important to involve the efficiency program early and to make sure that any specified retrofit equipment meets the program's requirements.

In Massachusetts, Baystate Health/Baystate Medical, Berkshire Medical Center, and Beth Israel Deaconess Medical Center have utilized incentives from Mass Save to implement efficiency improvements. These improvements yielded payback periods as short as 1.5 years with as much as $200,000 of savings per year.[13,14,15] These savings on operating expenses yield an even higher operating margin. This type of financing rationale is further discussed in the implementation section. Lastly, some hospitals may be able to negotiate for a higher rate of incentives or increased services with their utility, which can occur when the hospital is willing to enter into a Memorandum of Understanding (MOU) with the utility. The utility gets a commitment from the hospital through the MOU, and the hospital typically gets enhanced benefits. For example, Southcoast Health signed an MOU with its utility, which awarded higher than standard incentives for its efficiency work.[16] The next section outlines links and descriptions of available efficiency programs and case studies of hospitals that utilized these resources.

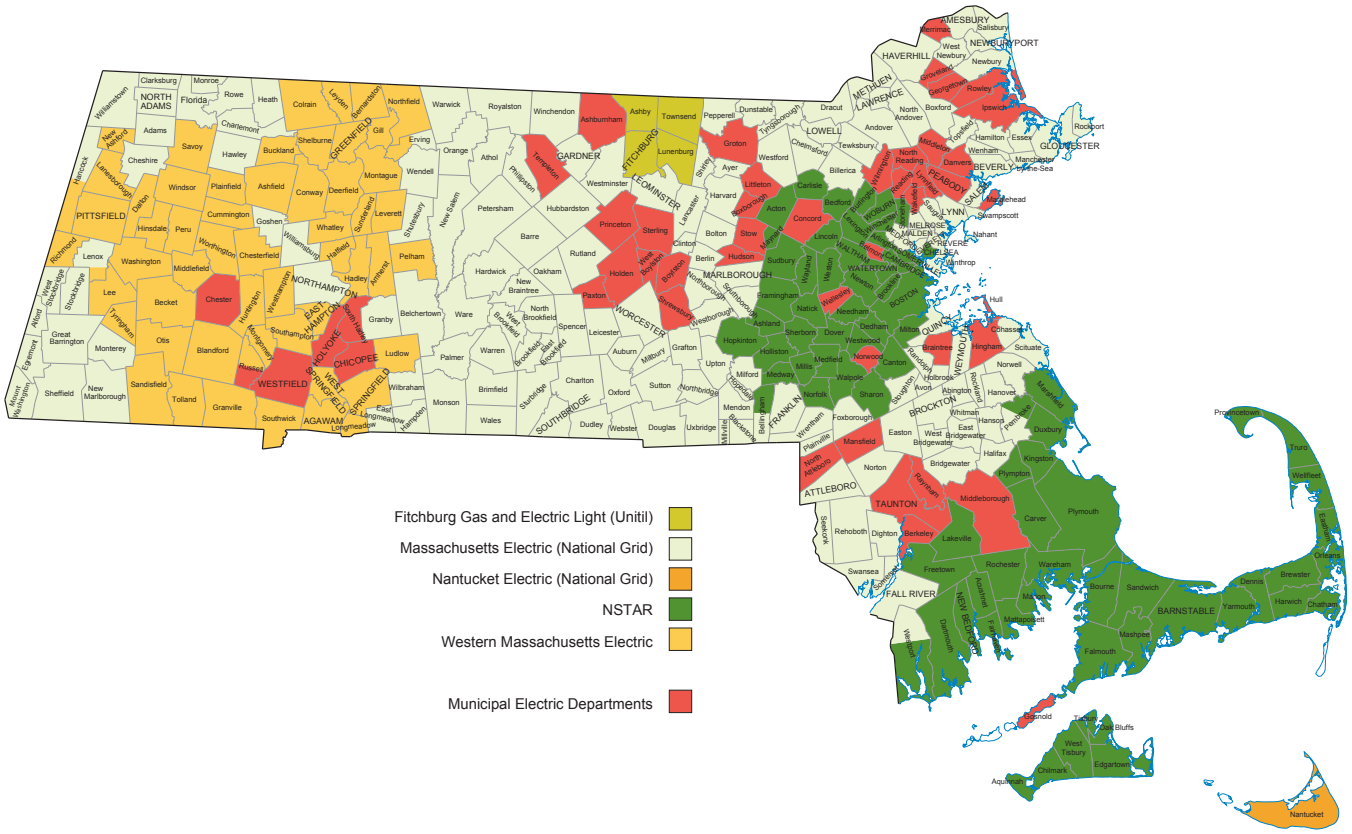


Figure 4: Map of Electric Providers in Massachusetts[17]

13 Mass Save. *Baystate Health/Baystate Medical.* (n.d.) Retrieved from http://www.masssave.com/~/media/Files/Business/Case-Study/Baystate-Health-Case-Study.pdf

14 Mass Save. *Berkshire Medical Center*. Retrieved from http://www.masssave.com/~/media/Files/Business/Case-Study/NP_I0011_CI_CaseStudies_BerkshireMed.pdf

15 Mass Save. *Beth Israel Deaconess Medical Center*. (n.d.) Retrieved from http://www.masssave.com/~/media/Files/Business/Case-Study/NP_I0011_CI_CaseStudies_BIDMC.pdf

16 Healthier Hospitals Initiative. (2014). *Southcoast Health: A Multi-Prong Approach to Energy Efficiency*. Retrieved from http://healthierhospitals.org/get-inspired/case-studies/southcoast-health-multi-prong-approach-energy-efficiency

17 Massachusetts Clean Energy Center. [*Map of Electric Providers in Massachusetts*] [map]. <http://images.masscec.com.s3.amazonaws.com/uploads/attachments/ElectricUtilityMap.pdf> (11 Dec. 2014).

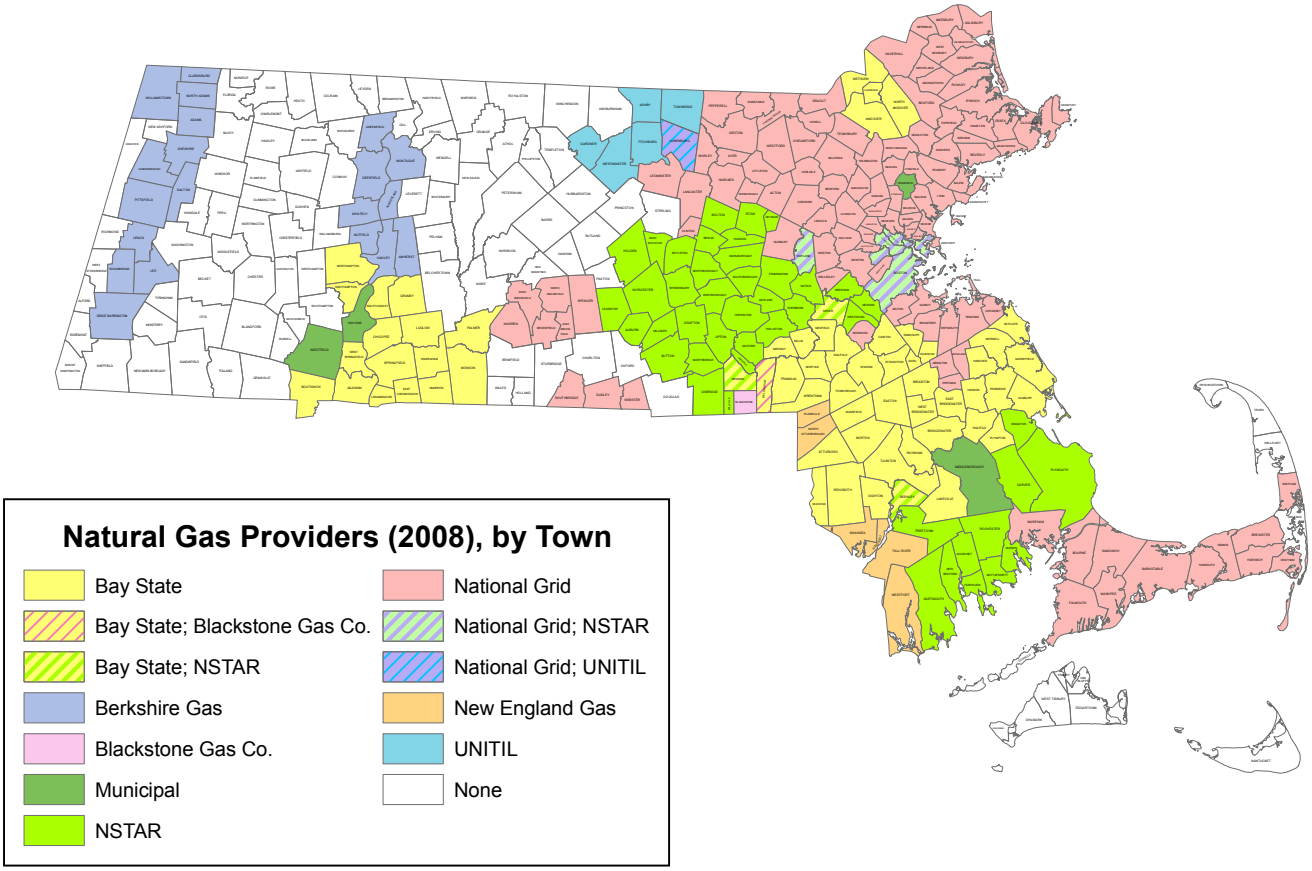


Figure 5: Map of Natural Gas Territories[18]

18 The Commonwealth of Massachusetts. [*Map of Natural Gas Territories*] [map]. 2008. Scale not given. "MassGIS Data – Public Utility Service Providers." 2009. < http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/pubutil.html> (11 Dec. 2014).

LINKS, RESOURCES, AND INFORMATION

The following headers and links were selectively sourced from the Massachusetts page on the **Database for State Incentives for Renewables and Efficiency** (DSIRE).[19] Some of these links and headers were restructured for the scope of this document. The database is scheduled to be reformatted by the end of December 2014, and will then contain up-to-date information on the resources below.

- Statewide Rebate and Loan Programs – Mass Save offers many of the efficiency program options available in Massachusetts. Mass Save "is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers." Typically, the Mass Save programs are available to all 8 Program Administrators in Massachusetts, which are listed below. Mass Save programs do not include municipal light districts. Programs Administrators are investor owned utilities such as National Grid and NSTAR. However, each incentive program may not be offered to all eight Program Administrators. Each incentive program lists the participating Program Administrators on the incentive page. The eight Program Administrators and links to their websites are listed in the next bulleted section.

    - Massachusetts Municipal Commercial Industrial Incentive Program – In addition to being available to Program Administrators, this program is sponsored by the Massachusetts Municipal Wholesale Electric Company (MMWEC) and is available to the following municipal departments: Chicopee Electric Light Department, Holden Municipal Light Department, Ipswich Municipal Light Department, and Westfield Gas and Electric Department. The incentives depend on the municipal department and range in options from retrofit opportunities to heating and lighting upgrades.

    - Mass Save - Financing for Business Program – This financing opportunity offers interest free loans up to $500,000 in cooperation with lending institutions. Projects require pre-approval from Program Administrators and may connect with additional incentives.

    - Mass Save - Commercial New Construction/Major Renovation and Failed Equipment Replacement Program – This program offers a list of incentives for equipment ranging from air compressors to custom measures. Each incentive opportunity may only be available to certain Program Administrators. All 8 Program Administrators offer custom measures.

    - Mass Save - Large Retrofit Program – A variety of incentives are available for energy efficient equipment upgrades. Some examples include new heating equipment, variable speed drives, and lighting controls. These listings link to a variety of programs within Mass Save and some are only available to a restricted list of Program Administrators.

    - Mass Save and GasNetworks - Commercial Natural Gas Rebate Programs – These opportunities are available for natural gas utilities in the Mass Save or GasNetworks territories. A variety of rebates are offered for equipment such as boilers, heaters, water heaters, and combined units.

- Program Administrators of Rebate and Loan Programs – Mass Save offers incentive programs sponsored by 8 different investor owned utilities statewide. Program Administrators may differ in regards to the types of incentives offered for different measures. In addition, specific measures need to be preapproved by a Program

19 North Carolina State University. (2014). *Massachusetts Incentives/Policies for Renewables & Efficiency*. Retrieved from http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=MA

Administrator before a project takes place. The following bullets are a list of the 8 different Massachusetts Program Administrators:

- Berkshire Gas – This utility is also a member of GasNetworks and offers 4 main types of rebates: high efficiency heating, high efficiency water heating, controls equipment, and kitchen equipment.
- Cape Light Compact – Cape Light Compact serves businesses with a demand up to 300 kW. This utility offers a free energy assessment and will pay up to 80% of cost of approved projects up to $150,000. To initiate participation, a ratepayer must call Cape Light Compact.
- Columbia Gas of Massachusetts - Commercial Energy Efficiency Program – Columbia Gas offers a no-cost walk through of a facility to determine potential improvements. If the customer deems additional scoping necessary, Columbia Gas will pay 50% of the fee for a professional engineer (P.E.) up to $7,500. Efficiency projects are covered by Columbia Gas at a rate of 50% up to $100,000. The first step for participation in one of these programs is to reach out to the Energy Efficiency Call Center.
- National Grid – This utility offers a wide range of services and incentives for large businesses such as hospitals. These offerings include opportunities for financing options, commissioning, third-party technical assistance, and equipment upgrades.
- Liberty Utilities – This utility offers a variety of incentives through Mass Save and GasNetworks. To determine the most effective choices, a similar offer is available as Columbia Gas, above: after the initial visit, if additional scoping is deemed necessary by the customer, Liberty Utilities will pay 50% of the fee for a professional engineer up to $7,500. Efficiency projects are covered by Liberty Utilities at a rate of 50% up to $100,000.
- NSTAR (Electric and Gas) – Energy Efficiency Programs – NStar lists a variety of choices for energy efficiency. Gas and electric program options are available. In addition, engineering services are available to NStar customers. The engineering services costs are typically equally shared by the customer and the utility. Engineering services may help determine the most cost effective improvements to implement.
- Unitil – This utility offers business gas efficiency and business electric efficiency programs, rebates, and assistance. Full listings of these programs are not directly available through the company's website; it is best to reach out via the online contact form or by phone.
- Western Massachusetts Electric - Commercial Energy Efficiency Rebates – Retrofit incentives and new construction/failed equipment incentives are offered through Western Massachusetts Electric. These include options for hospitals such as Retro-Commissioning (RCx), Chillers, and HVAC systems.

- Municipal Lighting Plant Rebates and Incentives

  - Chicopee Electric Light - Commercial Energy Efficiency Rebate Program – Chicopee Electric Light offers three types of programs applicable to hospitals: custom retrofits, express lighting, and new construction/major renovation.
  - Concord Municipal Light Plant – This department offers audits at a discounted rate as well as a High Efficiency Lighting Program.
  - Hudson Power and Light – Energy audits are partially reimbursable for commercial customers.

- Reading Municipal Light Department (RMLD) – RMLD offers a commercial lighting retrofit program and commercial energy initiative rebate program. The latter program encompasses upgrades that may pertain to a hospital such as HVAC upgrades and is capped at $50,000 per customer.
- South Hadley Electric Light Department (SHELD) – SHELD offers three types of audits to their customers: lighting, all electric, and all fuels. The price of the audit is based on the square footage of the facility.
- Sterling Municipal Light Department (SMLD) – SMLD does not offer a prescriptive efficiency program, but will offer audits if reached out to directly.
- Taunton Municipal Lighting Plant (TMLP) – TMLP offers an initial walk-through audit free of charge. If the customer complies with initial recommendations, TMLP will cover up to 50% of the cost of a supplemental audit by a professional engineer.
- Westfield Gas & Electric – This department offers a range of incentive opportunities from lighting upgrades, retrofits, and renovation projects. These opportunities may be tailored to a hospital's needs and so hospitals are encouraged to reach out directly.

- Additional Financing and Reference Information
  - Case Studies
    - Baystate Health/Baystate Medical – This hospital utilized Mass Save incentives to arrange a comprehensive energy audit of the facility. The results of the audit yielded findings that promoted the replacement of the HVAC system, instituting controls, and a major lighting upgrade. These changes are yielding an estimated savings of around $200,000 per year.
    - Berkshire Medical Center – This case study focuses on an LED lighting upgrade in Berkshire Medical Center's parking garage. The combination of incentives and cost savings from reduced consumption yield an estimated payback in 8 years.
    - Beth Israel Deaconess Medical Center – This Mass Save incentivized project involved an upgrade to the demand ventilation system for this medical center's laboratories. The payback period was less than 1.5 years.
    - Boston Medical Center – This teaching hospital signed a Memorandum of Agreement with its utility, NSTAR, to reduce energy usage. The result of this collaboration yielded the highest incentive payment the utility has issued, $988,745. These funds were reinvested towards additional energy projects that yielded nearly 2/3 of the initial incentive payment.
    - Southcoast Health – This hospital system used a Memorandum of Understanding with its utility to leverage above-average incentives for energy improvements. It took on a sizeable construction load, and so to help manage these changes, hired extra staff to direct this process. The hospital system is currently investigating a co-generation (combined heat and power) system and solar (further details in the Additional Links and Information section below).

- Property Assessed Clean Energy (PACE) Financing – PACE is a means to fund renewable and energy efficiency improvements to a home or business. The financing structure involves a loan from a local government and is repaid through the utility.[20] Commercial PACE financing is growing across the country and could provide hospitals financing options in coming years.[21]
  - **Status of legislative process** – PACE Financing is currently under deliberation by the Massachusetts legislature. As of July 14, 2014, the financing option passed the Senate and awaits in the House Committee on Ways and Means. The status of **this senate bill** (S.2255) may be investigated through the website for the General Court of the Commonwealth of Massachusetts.[22]
- **Mass.Gov – Energy Efficiency for Businesses and Institutions** – This page offers a large array of resources pertaining to hospitals interested in conservation, renewable energy, and energy efficiency. A variety of financing options are offered at the utility, state, and federal level. In addition, the page highlights supplemental tools such as resources to evaluate energy efficient improvements.
- **Healthcare: An Overview of Energy Use and Energy Efficiency Opportunities** – ENERGY STAR illustrates a broad overview of strategies for hospitals in regards to saving money on facilities budgets and preserving jobs. This paper highlights low measures (e.g., changing lighting systems) and other net positive investments (e.g., moving to a more efficient HVAC system). ENERGY STAR highlights the importance of tailoring a conversation with a CFO in terms of resiliency and cost savings on the bottom line.

20 North Carolina State University. (2014). *PACE FINANCING*. Retrieved from http://www.dsireusa.org/solar/solarpolicyguide/?id=26

21 Property Assessed Clean Energy. (n.d.) Retrieved from http://www.pacenow.org/c-pace-case-studies/

22 An Act fueling job creation through energy efficiency of 2014, S.B. 2255, 188th Gen. Ct. (2014). Retrieved from https://malegislature.gov/Bills/188/Senate/S2255/History

RENEWABLE ENERGY

OVERVIEW

Renewable energy is generated from an energy source that can be regenerated indefinitely under proper management practices. Renewable energy is most commonly seen in applications such as heating or electricity produced by the sun, wind, or biomass. The renewable energy system can be on site at the facility or off site as part of a central plant feeding a campus or a whole city. The content below will focus on on-site installations. Examples of the implementation of renewable energy systems may be found in the links section below. These pertain to effective savings opportunities through solar and biomass installations for **Cape Cod Healthcare** and **Cooley Dickinson Hospital** respectively.

IDENTIFYING OPPORTUNITIES

REBATE AND INCENTIVE PROGRAMS

A wide variety of renewable energy opportunities are available within Massachusetts. The Massachusetts Clean Energy Center (MCEC) offers many incentives for renewable energy investment from biomass boilers to geothermal heating and cooling. All investor-owned utilities have a built in fee that goes into a public benefit fund. Some municipal lighting plants have opted into the benefit including Ashburnham, Holden, Holyoke, Russell, and Templeton.[23] This benefit charge provides funding to the Renewable Energy Trust Fund, which MCEC manages. These resources are discussed in further detail in the next section.

Similar to the benefits of an energy audit, mentioned in the energy efficiency section, it will save time to reach out to a professional to help identify and quantify potential opportunities that may be available for a facility. For example, the **Massachusetts Clean Energy Center** has a webpage for general inquiries and program specific inquiries such as questions solely about solar photovoltaic (PV) panels. If an energy consultant performs an onsite energy audit, this individual may point out potential best suited sectors for renewable energy investment at a facility.

THIRD PARTY FINANCING

Some municipalities may not participate in the public benefit fund mentioned above. This may present barriers to participation in some renewable energy installations as incentives and rebates can reduce the time for a return on investment. However, third party financing options may be available to break down these barriers. Third party financing is on an upward trend in states such as California, Arizona, Colorado, and Massachusetts. In Massachusetts, third party financing accounted for over half of new solar installations in 2012.[24] However, some municipal light districts, such as Chicopee Electric Light, do not allow third party financing.[25] Therefore, before initiating a third party financing discussion and renewable generation project, it is best to reach out to the facility's electric provider.

23 Massachusetts Clean Energy Center. (n.d.) *Municipal Lighting Plant Communities*. Retrieved from http://www.masscec.com/content/municipal-lighting-plant-communities

24 U.S. Department of Energy. (2014). *Third-Party Solar Financing: Third-Party Ownership of Distributed Solar Power Systems*. Retrieved from http://apps3.eere.energy.gov/greenpower/onsite/solar_financing.shtml

25 Chicopee Electric Light. (n.d.) *News & Events*. Retrieved from http://www.celd.com/index.php?page=solar-rebate-program

Third party financing options can make solar installations more cost effective through two different methods: purchase power agreements (PPAs) and solar leases. A PPA involves a developer installing a system at no up-front cost to the customer. The customer then buys power through the developer at a fixed rate, which is usually lower than the current price for electricity. When the contract expires, the customer may be able to purchase the system or extend the agreement. Under a solar lease, the customer pays no up-front costs for the system. Instead, the customer pays for the system over the course of years or decades similar to an automobile loan to purchase a vehicle.[26]

Cape Cod Healthcare (CCH) utilized third party financing to help investigate and provide assistance implementing an effective energy strategy for the hospital. Cape Cod Healthcare's facilities manager partnered with the hospital's energy provider, NSTAR, and a third party business called Early Bird Power. Early Bird Power helped Cape Cod Healthcare weigh renewable energy options such as wind and solar. These options were considered along with financial incentives offered through NSTAR. After determining that it wanted to pursue an offsite solar development project, CCH put out a Request for Proposals (RFP) for a third party to bid on the project. The RFP was specifically structured to mitigate financial risk for CCH. Southern Sky won the bid by offering a detailed, cost favorable solution to Cape Cod Healthcare. This hospital now has a method to offset some of its energy use after a thoughtful financing process.[27] This project resulted in $300,000 in annual savings.

LINKS, RESOURCES, AND INFORMATION

The following headers and links were sourced from the Massachusetts page on the Database for State Incentives for Renewables and Efficiency.[28] Some of these links and headers were restructured for the scope of this document.

- Financing
  - **Excise Tax Deduction for Solar or Wind-Powered Systems** – This tax deduction applies to the deduction of the cost of wind or solar installation expenses. These renewable energy systems must be installed in the Commonwealth.
  - **Case Study - Cape Cod Healthcare Solar Project** – This case study shows a successful partnership between a hospital, the hospital's electric utility, and a third party financing organization. The hospital is saving $300,000 annually through a successful RFP process and negotiation of the utilization of RECs through the hospital's electric accounts.
  - **Green Power Network** – This source is a clearinghouse for Massachusetts specific information regarding purchasing or selling green power. A variety of organizations are listed by category including utility programs, third party financing, and REC marketers.

26 Solar Energy Industries Association. (n.d.) *Third Party Solar Financing*. Retrieved from http://www.seia.org/policy/finance-tax/third-party-financing

27 Browne, E. (2013). *A Green Solution, Partnering with Energy Providers on Solar Power.* Retrieved from http://www.edwardmbrowne.com/green-solar-power/

28 North Carolina State University. (2014). *Massachusetts Incentives/Policies for Renewables & Efficiency*. Retrieved from http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=MA

- Statewide Grant and Rebate Programs
  - Massachusetts Clean Energy Center (MCEC) - Clean Energy for Business – MCEC programs are offered primarily to businesses operating through an investor owned utility (with municipal lighting plant exceptions listed in the next bullet). These programs include options for solar hot water, solar photovoltaic systems, geothermal, wind, and more. These grants and rebates are offered for both feasibility studies as well as installation costs.
  - Municipal Lighting Plants Eligible for Renewable Energy Trust - Some lighting plants (mentioned in the bullet above) have begun participating in the Renewable Energy Trust Fund, which contributes to incentive pools. These include Ashburnham, Holden, Holyoke, Russell, and Templeton. MCEC recommends obtaining written confirmation from the municipal lighting plant before entering into an installation agreement.
- Third-Party Financing
  - Solar Energy Industries Association – This page gives a general overview and additional insight related to the two main types of third party financing for solar systems: purchase power agreements (PPAs) and solar leases.
  - The Dawning of Power Purchase Agreements – This overview document published by the American Society of Healthcare Engineers (ASHE) outlines power purchase agreements (PPAs) and how they pertain to hospitals. The funding structure is explained along with emphasis on points such as bargaining for the ownership of green credits resulting from a renewable generation system.

- Municipal Lighting Plant Renewable Energy Incentives and/or Information
  - Ashburnham Municipal Light Department – Ashburnham is a participant in MCEC programs listed in the statewide programs above and offers a variety of the MCEC options on its website such as solar and wind installations.
  - Boylston Municipal Light Department – This department does not specifically offer any rebate or incentive programs but lists its regulations concerning terms and conditions surrounding solar installations and interconnection policy.
  - Chicopee Electric Light (CEL)– Solar Installation Information – This municipal light district offers commercial rebates for solar installations at a rate of $2.50 per Watt. CEL does not allow third party financing.
  - Concord Municipal Light Plant – Program offerings for solar installations and electric thermal storage heating systems are available.
  - Groton Electric Light Department – GELD offers net metering on solar installations with prior approval and offers zero percent interest on loans to install electric thermal storage systems.
  - Holyoke Gas & Electric Green Initiatives – Holyoke is a participant in MCEC programs listed above and offers solar and wind installation incentives through MCEC. Once renewable systems are installed, compensation rates are calculated at peak wholesale price.

- Hudson Light & Power (HLP) - Photovoltaic Incentive Program – HLP offers two different levels of solar incentives based on the orientation of the array. These are based on the need to reduce peak demand in the afternoon. These incentives cap at $10,000 and $12,000 for each range.
- Peabody Municipal Light Plant (PMLP) – This lighting plant does not offer renewable energy rebates or incentives. Instead, this link provides a detailed description of this light department's net metering policy that would apply toward wind and solar installations.
- Princeton Municipal Light Department – This department does not offer incentives for renewable energy. This link provides a description of interconnection and distributed generation policies for wind and solar installations.
- Taunton Municipal Lighting Plant Net Metering Information – Taunton provides net metering and rebates for solar installations at a rate of $2 per watt at a cap of $5,000. Commercial installations must not exceed 60 kW or a purchase power agreement must be signed.
- Wakefield Municipal Gas & Light Department (WMGLD) – This department offers net metering on systems up to 10 kW. Net metering is offered for the following generation systems: solar, wind, small hydro, fuel cells, and combined heat and power.
- West Boylston Municipal Light Plant – WBMLP caps net metering generation systems at 90% of a customer's historic peak demand or 60 kW. The light plant website provides policy guidelines surrounding interconnection and net metering.

- Reference Information
  - Alternative Energy Portfolio Standard (APS), Renewable Energy Credits (REC), and Renewable Portfolio Standard (RPS) – This page lists terms, definitions, and policy structures outlined by the Massachusetts Department of Energy Resources. Alternative Energy Portfolio Standards, Renewable Energy Credits, and Renewable Portfolio Standards are all clearly defined and delineated.
  - Biomass
    - Biomass – Energy and Environmental Affairs – This page, operated by the Executive Office of Energy and Environmental Affairs, outlines a variety of different resources for biomass information ranging from a basic overview to Renewable Portfolio Standards.
    - Biomass Energy Resource Center: Institution Case Studies – This page highlights four creative examples outlining the usage of biomass in health care facilities.
    - Case Study – Cooley Dickinson Hospital – This hospital installed its second wood fired boiler in 2006, which provides heat, electricity, and cooling through the use of absorption chillers to the hospital. These wood chip boilers displace the need for natural gas and oil fired boilers, which now only remain as backup sources.
  - Building Energy Codes – This page provides three main resources: energy efficiency specific aspects of the states' building codes, stretch codes (energy performance codes), and stretch code adoption by community.

- Massachusetts Department of Energy Resources - Net Metering and Interconnection Standards – This page outlines many frequently asked questions and detailed aspects of net metering and interconnection policy guidelines for solar and wind systems. One basic takeaway from this page is that all investor owned utilities are required to have uniform net metering and interconnection standards. These investor owned utilities are referenced as program administrators in the energy efficiency links section above. Municipalities may or may not participate in net metering or interconnection or have varying guidelines associated with these regulatory structures. These are highlighted in the section above.
- Net Metering Frequently Asked Questions – This page is operated by the Massachusetts Executive Office of Energy and Environmental Affairs and provides a general overview of terminology surrounding net metering.
- Solar Energy Industries Association (SEIA)
  - Massachusetts Solar Topics – This page highlights a variety of links generated from a Massachusetts specific search query within the SEIA website.
  - Massachusetts State Solar Policy – This page lists a variety of facts, links, and resources available for solar programs in MA.
- Wind Exchange – This source, hosted by the US Department of Energy, gives a variety of resources for wind energy such as maps and basic education. The website offers resources on distributed wind and highlights a wind installation at a community hospital in Greensburg, Kansas.

ENERGY MANAGEMENT SYSTEMS

OVERVIEW

An energy management system is a framework with the end goal to reduce energy consumption over time and incorporates all of the approaches discussed in this paper: conservation, behavioral based approaches, efficiency, and renewable energy. There are several options for guidance on how to implement an energy management system. The Leaner Energy **How to Guide** **lays out a step-by-step** process of how to put an energy management system into place. Other guides for energy management include the International Organization for Standardization (ISO) 50001[29] standard and the ENERGY STAR Energy Management program. The ISO energy management system process involves setting a policy as well as creating goals, methodological processes of documentation, and actions to achieve these goals.[30] This certification resembles an industry standard similar to quality management in manufacturing (ISO 9001), and is designed to promote uniform procedural quality in the energy reduction process. While ISO 50001 is designed for industrial processes, it can be applied to commercial and institutional facilities as well.

Regardless of the brand, energy management creates a framework that yields multiple benefits, financial and organizational. Providence Health and Services implemented energy management and has saved millions in energy costs.[31] These savings translate directly toward Providence's goals of job security for its employees and charitable giving. Providence's success can be attributed to a multitude of factors. This hospital system has done a wonderful job of utilizing benchmarking tools such as ENERGY STAR Portfolio Manager. This tool has allowed Providence to set a baseline energy usage and annually track progress. The use of Portfolio Manager to help make energy use visible is an important step to managing energy. Portfolio Manager also provides context in the form of a 1 to 100 score that allows a hospital to see where they are on the spectrum of energy usage and to set realistic goals.

The Leaner Energy *How To Guide* lays out an 11-step process specific to hospitals that incorporate the principals outlined in both ISO 50001 and the ENERGY STAR energy management program. The steps include obtaining management approval, forming an energy team, and designating an energy lead person. The next steps are to set goals, assess where the organization currently stands through benchmarking, and identify opportunities through audits. **The final steps in the Leaner Energy program are to draft a Strategic Energy Management Plan (SEMP), implement projects, educate employees, and then report on progress.**

ENERGY STAR offers a simplified structure for energy management modeled after the Deming Cycle of Plan, Do, Check, Act. ENERGY STAR's framework for energy management is a cyclical process to reduce a facility's energy usage over time. ENERGY STAR's approach toward energy management, outlined in Figure 6, highlights seven distinct components: make a commitment, assess performance, set goals, create an action plan, implement the action plan, evaluate progress, and recognize achievements.[32]

29 International Organization for Standardization. (n.d.) *ISO 50001 – Energy management*. Retrieved from http://www.iso.org/iso/home/standards/management-standards/iso50001.htm

30 Project Committee ISO/PC 242. (2011). *Energy Management*. Retrieved from https://www.iso.org/obp/ui/#iso:std:iso:50001:ed-1:v1:en

31 The American Society for Healthcare engineering. (2006 Dec.). Building the Architecture of Energy Management at Providence Health and Services. *INSIDE ASHE*, 37-39. Retrieved from https://www.energystar.gov/ia/business/healthcare/ashe_nov_dec_2006.pdf

32 United States Environmental Protection Agency. *Guidelines for Energy Management*. Retrieved from http://www.energystar.gov/sites/default/files/buildings/tools/Guidelines%20for%20Energy%20Management%206_2013.pdf

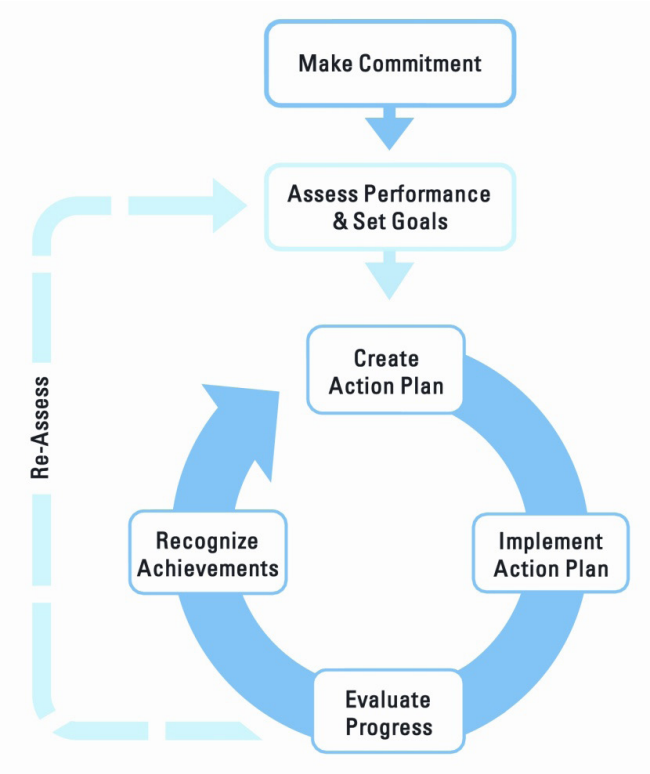


Figure 6: ENERGY STAR Energy Management

The EPA has a very useful self-assessment tool called the Energy Program Assessment Matrix. It outlines the various management elements required to effectively implement an energy management program. Hospital facility and administrative managers can use the matrix and see where they currently stand and where there are opportunities for improved energy management practices. It can also be used as a roadmap to implement an energy management program.

IDENTIFYING OPPORTUNITIES

The purpose of an energy management system is to provide a process to manage the purchase and use of energy as well as the purchase of devices that use energy. Therefore, there may be opportunities for improvement in procurement, operations, maintenance, and programming of controls. For example, having a procurement process to evaluate capital purchases with respect to both energy use and first cost, as opposed to just looking for lowest first cost, will save energy and money in the long term. Any and all procedures offer potential for improvement.

One way to help identify energy management opportunities is to hold a Kaizen event. Kaizen is a Japanese word meaning “improvement” or “good change.” In a Kaizen event, a group of people is brought together to look at equipment or a process/system and brainstorm ways of making improvements. The group should include not only those who normally work with or are responsible for the equipment, process or system, but people from other departments as well. The desired result of a Kaizen event is to identify opportunities, both behavioral/operations and capital projects, which can be sorted into various categories as in the Figure 7 below. Low Cost opportunities with both Low and High potential for savings can be implemented quickly to start with quick wins and build momentum. High Cost (in terms of dollars or time) opportunities can be further evaluated for implementation or discarded.

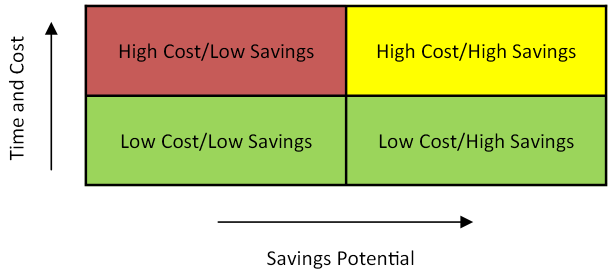


Figure 7: Opportunities Prioritization Matrix

LINKS, RESOURCES, AND INFORMATION

- American Society of Healthcare Engineering
  - Energy Management at Providence Health and Services – This brief document consists of an interview discussing how Providence Health and Services, a network of 26 hospitals in the Pacific Northwest, institutes energy management within its network. Providence realized the potential cost savings of energy management using operating margin as a metric, which is discussed in the next section.
  - Navigating the ENERGY STAR Website – This document provides a guide for health care organizations to navigate options offered through the ENERGY STAR website.
  - Help for Hospitals Striving to Achieve Sustainability – This document is a joint venture between three health care associations. It highlights three main steps for hospitals: establish a baseline, retro-commission HVAC controls, and change thermostat settings to balance between comfort and savings.
- ENERGY STAR
  - Guidelines for Energy Management – This PDF illustrates a seven-step approach toward implementing energy management for a facility.
  - Energy Program Assessment Matrix – This excel document is a complimentary tool to accompany ENERGY STAR's Guidelines for Energy Management above. It provides a resource to track progress for a facility to implement energy reduction.
- Health Facilities Management - 2011 Hospital Energy Management Survey – This survey's most significant findings point to evidence indicating a large number of facilities who have not instituted basic recommendations surrounding energy management. This source points to areas of needed improvement such as better auditing procedures.
- International Organization for Standardization - Energy Management Systems – ISO is known for other reputable certifications such as quality control, and now offers a standardized certification for energy management.
- Targeting 100! – This project, hosted by the University of Washington, aims to reduce the Energy Use Intensity (EUI) of hospitals in six study cities. The study affirms the importance of Energy Management with its conclusion: "Deep energy reductions are made possible by an integrated design process including integrated team structuring and decision making with integrated technical strategies."

IMPLEMENTING THE PROJECT

Once an energy efficiency project has been identified, there may still be a number of barriers to implementing the project. Many times facility staff are focused on day-to-day operations and do not have the time and resources to take on additional project management or energy management work. Senior management may not see the value of focusing on energy or there may be concern about installing new, efficient but unproven equipment. Getting the funds to pay for equipment retrofits or renewable energy systems can be a challenge. This section will outline a number of strategies to try to overcome these barriers.

STRATEGIES FOR MOVING FORWARD

There are often many barriers that prevent an energy project from getting approved. It only takes one barrier to stop a project. This section identifies a number of common barriers and suggests strategies for overcoming them.

IDENTIFYING PROJECT EVALUATION CRITERIA

Ask the Chief Financial Officer what the criteria are for evaluating and funding projects. It may be an Internal Rate of Return (IRR), Return on Investment (ROI), a positive Net Present Value, cash flow, or simple payback. If simple payback is given as the criteria for deciding to move forward on an energy project, ask if all projects are evaluated in this way. Sometimes energy projects are held to a different standard than other projects. If there is a different standard for energy projects, ask why. The answer may uncover additional barriers that will need to be overcome.

IMPROVING OPERATING MARGIN

Energy efficiency, sustainability, and renewable energy may seem like worthy causes in the abstract, but are stymied by real problems when it comes to implementing projects. Many times the underlying barriers are a combination of senior management skepticism or lack of support and the availability of money. Both of these are significant, but can often be addressed together. The financial strength of any institution is always a major concern, regardless of profit or nonprofit status. Any project or action that reduces costs and increases Operating Margin should be of interest to senior management. Because reducing energy use directly reduces Operating Expenses, it has a greater impact on Operating Margin than increasing Revenue does. Increasing Revenue impacts both the numerator and denominator in the formula below, thus limiting its impact on Operating Margin.

$$\text{Operating Margin} = \left(\frac{\text{Revenue - Operating Expenses}}{\text{Revenue}} \right)$$

Based on national averages, every $1 a nonprofit hospital saves in energy is equal to $20 in increased revenue for a hospital. The ratio for many hospitals is even more dramatic. A ratio of $1 energy savings is worth $67 in increased revenue when a hospital has a net margin of 1.5%. If the Net Margin at your hospital is 4% or less, which is true of many hospitals in New England, then Figure 8 shows the impact of a $10,000 reduction in energy use in the form of equivalent Revenue. In short, saving energy is the most cost effective way to increase Operating Margin, and is entirely under the hospital's control, whereas increasing Revenue is not entirely under the hospitals control.

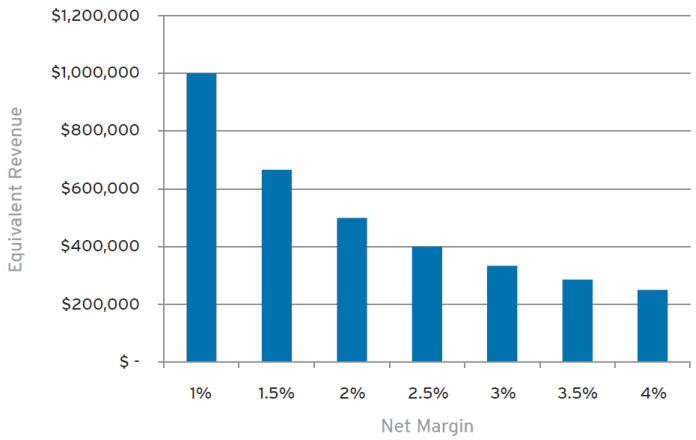


Figure 8: Revenue Equivalent to $10,000 in Energy Savings

PARTNER WITH YOUR UTILITY

Efficiency programs in Massachusetts have ambitious goals and are looking for cost effective savings everywhere they can find them. Don't hesitate to try negotiating with your utility for incentives. However, technical resources are often more valuable than monetary incentives. For example, sometimes changing policies or practices/settings, which may not be eligible for incentives, can save appreciable amounts of money. Establishing a relationship with your account manager and putting a Strategic Energy Management Plan in place demonstrates commitment to energy efficiency that may entitle you to extra help or benefits. Ask questions and engage with your account manager. If your facility is paying a systems benefit charge, then your account manager is being funded in part by your hospital. Use them as a resource to help you!

OVERCOMING PERCEPTION OF RISK

If energy projects are perceived as being risky, in that the promised savings may not materialize, or that the equipment may fail, then it may be necessary to gather information and take steps to reduce both the actual and perceived risk in order to move forward. Case studies or information gained from other hospital facility personnel may be helpful with respect to utilizing "lessons learned" to reduce risk. The Massachusetts Hospital Association or Health Care Without Harm may be good organizations to use to connect with other facility people who have already done the project you are considering. Tapping into their experience can be beneficial. Your utility may also be able to put you in touch with another hospital that has already done a particular project. Some utilities may be willing to reduce the risk for unproven efficiency measures by providing a higher than normal incentive. For example, there are now cost effective LED linear T8 replacement lamps available on the market, but not many people have installed them. If your hospital is willing to serve as the pilot for a new type of measure and a case study or resource for information for other hospitals, then that may be worth something to the utility. Ask your utility program account manager what they can do to help.

PRESENTATION OF PROJECT FINANCIAL INFORMATION

Some efficiency programs can help to present the financial aspects of a project by means of life cycle or cash flow analysis. Sometimes it helps to look beyond simple payback to see the cost savings accumulate after the project has paid itself back. Most efficiency measures pay back their cost long before their expected lifetime. If they didn't, then efficiency programs would not be able to incentivize them. Efficiency programs are typically held to strict standards whereas a project must have a positive net present value in order to be eligible for an incentive. Sometimes a particular

measure may not be cost effective on its own, in that its payback is too long and therefore does not meet the efficiency program's criteria for cost effectiveness. It may be possible to wrap this measure in with other cost effective measures thus receive funding for the whole project. It can also be a good strategy to bundle long and short payback projects together so that the short payback project can help make the long payback project look more attractive as part of one package. The risk of doing all the short payback projects first is that it may become increasingly more difficult to get internal funding for projects as the payback increases.

ACCOUNTING FOR OTHER BENEFITS

Efficiency projects often have benefits beyond energy savings that can help to sell a project to management. For example, retrofitting lighting can improve the quality and amount of the light while still saving energy. Improved light quality improves productivity and safety. New LED lighting lasts longer than fluorescent lighting, increasing the amount of time between lamp replacements, which reduces maintenance. Heating and ventilation projects may improve worker and patient comfort and reduce maintenance. Improved lighting and comfort has been shown to improve employee morale and increase productivity. There are also interactive effects that should be considered for their benefits. For example, lighting projects that reduce energy use also typically throw less heat into conditioned space. While this results in a net increase in energy use to heat the facility in the winter that increase in fuel use is typically more than offset by a decrease in cooling energy. Because cooling energy is normally a big cost for hospitals, the added benefit of reduced cooling (minus the increased cost for heating) should be accounted for in the calculation when presenting the project. All these other benefits should be factored into the decision making process when evaluating an energy efficiency project.

Renewable energy projects can also provide benefits beyond just energy. Renewable energy reduces carbon emissions from central power plants. Massachusetts gets most of its electricity from natural gas and coal fired power plants[33], so reducing energy consumed from the grid reduces carbon emissions by .9354 lbs. per kWh[34], which is the highest in New England. Renewable energy also displaces other harmful emissions from fossil fuel burning power plants.

SELLING THE PROJECT

Once you have determined the criteria for passing the financing approval test and addressed the risks associated with change, then package efficiency and renewable projects to demonstrate that they meet the criteria outlined by management. It is normal to have to sell the project to management. If management is still not convinced, it may be possible to demonstrate that the cost of doing nothing is greater than the cost of doing a project. An interesting paper entitled **Monetizing Energy Solutions** provides an example of this concept. While the paper uses an industrial customer in its example, the principles illuminated in the paper are applicable to commercial customers and hospitals. The paper provides perspective and a methodology that allows for a full and informed financial evaluation of a project. The paper's central point is as follows: the rational purpose of investing capital is to recover that capital plus additional monies. The measurement for potential increases in capital is typically the *rate of return on capital.* However, the rate of return can also be negative if capital is not invested in an energy efficiency or renewable energy project, and waste is allowed to accrue. Organizations that evaluate energy projects based on simple payback are putting themselves at a disadvantage because they may be missing out on projects with good rates of return.

33 Institute for Energy Research. (n.d.) *Massachusetts Energy Facts*. Retrieved from http://instituteforenergyresearch.org/media/state-regs/pdf/Massachusetts.pdf

34 MiloSlick Scientific. (n.d.) *State Electricity and Emissions Rates*. Retrieved from http://www.miloslick.com/EnergyLogger_files/State_Electricity_and_Emissions_Rates.pdf

FINANCING, INCENTIVES, GRANTS, TAX INCENTIVES, AND OTHER SOURCES OF MONEY

The links and descriptions in the energy efficiency and renewable energy sections provide information about incentives, grants, and financing options. Often times there can be multiple sources of money that are not mutually exclusive. Many banks are willing to lend money for efficiency and renewable energy projects because they are becoming better understood and accepted as good risks. In addition, some utility programs offer financing. Financing can be a good way to enable a project if it is structured such that the loan repayment can be paid in lieu of utility payments while potentially being cash positive or cash neutral. This scenario can be attractive when there is no available budget for capital costs, but there is an operating budget. As mentioned in the energy efficiency section, the Mass Save Financing for Business Program provides interest free loans up to $500,000 for pre-approved projects.

IMPORTANT POINTS TO CONSIDER WHEN IMPLEMENTING A PROJECT

ENSURE EQUIPMENT MEETS REQUIREMENTS

Most efficiency programs require a contract that reserves incentive money for the proposed project and outlines the requirements of the program. The contract should outline the estimated savings and incentive for the project, specify what equipment is eligible for incentives, and detail quantities. The contract may also state that meters may need to be installed or other data may need to be collected in order to verify savings. It is common for changes to happen during the project. If it is a change in quantities, then the savings and incentive will most likely be prorated to take the new amount into account.

If incentives are a critical part of the project, it is essential that the installed equipment meets the requirements of the efficiency program providing the incentives. The worst case scenario is that equipment is installed that does not meet the requirements, and therefore no incentives are available. This messy situation can be avoided by clearly understanding the requirements of the efficiency program, getting a commitment in writing for the incentives and what they are contingent upon, and ensuring that the correct, qualifying equipment is actually installed.

COMMISSIONING AND PROGRAMMING

Once new equipment is installed, it is important that it is commissioned, programmed, and used as intended to realize the energy savings. Some efficiency programs require commissioning for certain measures to obtain the full offered incentive. Sensors and controls must actually sense and control something to be effective. Commissioning ensures that sensors and controls are installed, programmed, and calibrated correctly. Likewise, variable speed drives do not save energy unless they are told to slow down by some input. Facility personnel need to understand the sequence of operations in order to maintain the equipment. It is common for sensors and controls to be overridden to solve an immediate problem, and then the equipment stays in that state and energy savings are negated.

In order to avoid the overriding of controls, or to be able to reset the controls to the designed specifications, a Facility Operating Plan can be an effective tool. A Facility Operating Plan—that describes how equipment and systems are supposed to work, where to get service and spare parts, and what to do in case of problems—is a valuable way to preserve institutional knowledge and avoid the serious loss of information when people leave.

TRAINING

It is important for hospital facility managers to understand energy procurement and energy-using equipment in order to identify opportunities for improvement and to implement best management practices. There are two excellent training opportunities available for facility managers seeking a higher level of understanding of energy management and energy efficiency within a hospital system: Building Operator Certification and Certified Energy Manager. The attributes for these two opportunities are discussed below.

BUILDING OPERATOR CERTIFICATION

This multilevel certification provides an opportunity for facility operators to gain a deeper understanding of aspects involved in energy efficiency measures for a hospital. The certification is recognized by a wide variety of organizations such as the Green Building Certification Institute as continuing education for LEED.[35] There are two levels of certification: Level I and Level II. Both courses consist of seven to eight one-day classes that are accompanied by trainings, assignments for practical application, and exams. Level I certification outlines foundational material such as energy efficient lighting, controls, benchmarking, indoor air quality, efficient HVAC, and common areas for facilities to immediately achieve energy and financial savings. Level II certification dives deeper into the subject matter with a focus on energy management, HVAC controls, diagnostic systems, and preventative maintenance and troubleshooting.[36] Depending on the facility's utility, the fee for registration may be eligible for one or more conditional rebates. The first rebate is offered upon completion of the Building Operator Certification and the second is offered upon receipt of an incentive application for an efficiency upgrade at the operator's facility.[37]

CERTIFIED ENERGY MANAGER

Becoming a Certified Energy Manager (CEM) is a mark of energy professionalism. The Association of Energy Engineers (AEE) hosts this certification process. AEE is a nonprofit professional society with a mission "to promote the scientific and educational interests of those engaged in the energy industry and to foster action for Sustainable Development."[38] CEM is recognized by a multitude of energy organizations and certification bodies such as the US Department of Energy (US DOE) and the American National Standards Institute (ANSI). This certification requires specific eligibility as a combination of education and/or experience.[39] Becoming certified can involve attending an initial preparatory seminar, which may vary in length depending on the seminar host, but is typically four days. The preparatory seminar is followed by a four hour open book exam. The exam covers a wide range of topics, similar to those covered in the section above. These topics and their level of weight are available in the CEM body of knowledge.[40]

35 Building Operator Certification. (2014). *Recognition & Accreditation*. Retrieved from http://www.theboc.info/w-recognition.html

36 Building Operator Certification. (2014). *2015 Course Schedule*. Retrieved from http://www.theboc.info/ne/ne-schedule.html

37 Building Operator Certification. (2014). *Northeast Training*. Retrieved from http://www.theboc.info/ne/ne-fees.html

38 Association of Energy Engineers. (n.d.) *About the Association of Energy Engineers (AEE).* Retrieved from http://www.aeecenter.org/i4a/pages/index.cfm?pageid=3280

39 Association of Energy Engineers. (n.d.) CEM – *Certified Energy Manager*. Retrieved from http://www.aeecenter.org/i4a/pages/index.cfm?pageID=3351

40 Association of Energy Engineers. (n.d.) *CEM Body of Knowledge*. Retrieved from http://www.aeecenter.org/i4a/pages/index.cfm?pageID=4349

ADDITIONAL LINKS AND INFORMATION

COMBINED HEAT AND POWER

The US Department of Energy (US DOE) released a report in 2011 that showcases the benefits of Combined Heat and Power systems (CHP). CHP consists of an electrical generator or a heat generation system that provides heat and power through heat recovery – also termed cogeneration.[41] CHP systems are typically much more efficient than systems operating independently to provide similar outputs. The EPA estimates a potential increase of efficiency by roughly 25% using a CHP system (Figure 9). Hospitals are unique facilities because energy must be in constant supply or life support systems may fail. Therefore, a hospital relying on electricity from a standard utility may require backup systems for power generation in the event of grid failure. An onsite CHP system can generate onsite power that runs parallel to energy purchased from the grid. This model can provide emergency support, reduce peak demand charges, and save a facility money on its bottom line. UMass Memorial Medical Center and UMass Memorial University Campus installed a CHP system in late 2011. This system, combined with incentives, is yielding a $6.2 million in annual savings with a payback period of less than three years.[42]

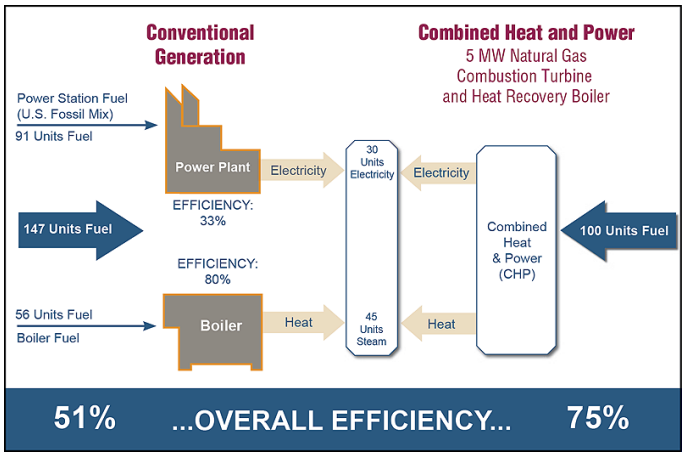


Figure 9[43]

CHP systems reduce the amount of total emissions and greenhouse gases emitted from a hospital, combating climate change and air pollution. Some hospitals may be suited to further reduce impacts on climate change by installing a combined heat and power biomass system. Under conditions of sustainable forestry management from supply sources and proper air pollution controls, biomass CHP systems may be viable resource for a hospital system to combat challenges mentioned above. Within limitations, biomass can be considered a carbon neutral source over a long time frame.[44] Biomass CHP systems take advantage of the efficiency gains from CHP and operate on a climate neutral fuel.

41 U.S. Department of Energy. (2011). *Hospitals Discover Advantages to Using CHP Systems*. Retrieved from http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/hea_chp_fs.pdf

42 Health Care Without Harm. (2013). *Powering the Future of Health Care Financial and Operational Resilience: A Combined Heat and Power Guide for Massachusetts Hospital Decision Makers*. Retrieved from http://www.greenribboncommission.org/downloads/CHP_Guide_091013.pdf

43 United States Environmental Protection Agency. (2013). *Combined Heat and Power Partnership*. Retrieved from http://www.epa.gov/chp/basic/efficiency.html

44 Sedjo, R. (2013). Comparative Live Cycle Assessments: Carbon Neutrality and Wood Biomass Energy. Retrieved from http://www.rff.org/RFF/Documents/RFF-DP-13-11.pdf

For example, Cooley Dickinson Hospital in Massachusetts uses a CHP biomass system to provide electricity, space heating in winter and cooling by means of absorption chillers during the warm summer months.[45]

LINKS TO ADDITIONAL RESOURCES

- American Public Health Association - Addressing the Urgent Threat of Global Climate Change to Public Health and the Environment – This policy statement by the American Public Health Association (APHA) focuses on the findings by the Intergovernmental Panel on Climate Change (IPCC) and the impacts climate change will have on human health. APHA advocates freedom from the impacts of climate changes as a basic human right and emphasizes hospital leaders and policymakers to take any action possible to combat additional contributions of anthropogenic CO2 into the atmosphere.
- Combined Heat and Power
  - An energy management system (EMS) strategy for combined heat and power (CHP) systems based on a hybrid optimization method employing fuzzy programming – This article published in Energy illustrates a model that optimizes a CHP system taking into account uncertainty in demand and fuel and electric prices.
  - Optimization criteria for cogeneration systems: Multi-objective approach and application in an hospital facility – This paper, published in Applied Energy, focuses on determining a profitable solution for a CHP system based on a model derived on multiple variables.
- Health Care Without Harm – Powering the Future of Healthcare – This paper provides a primer for facility managers and C-level hospital executives on CHP technologies, their application in the health care field, and the policy frameworks that currently support CHP in Massachusetts.
- Health Care & Climate Change: An Opportunity for Transformative Leadership – This document illustrates the significant role hospitals can take toward addressing climate change. The paper lays a general framework for hospitals nationwide. A specific focus is paid toward the importance of a Strategic Energy Management Plan (SEMP) and investment considerations. A diverse array of case studies is offered with one Massachusetts example focusing on Partners HealthCare SEMP.
- Health Care Without Harm - Climate and Health Resources – This page focuses on providing additional information in four categories: impacts of health care, policy, tools, and education.
- Healthier Hospitals Initiative - Case Studies – This page highlights a multitude of case studies showing how hospitals are leading the charge in energy reduction, leadership development, waste reduction, and the sourcing of food and beverages.
- National Grid - Managing Energy Costs in Hospitals – This overview document, published by one of Massachusetts's utilities, illustrates the basics surrounding demand charges, ways to immediately lower consumption, and longer term solutions such as commissioning and energy efficiency improvements.

45 U.S. Department of Energy Northeast Clean Energy Application Center. (n.d.) *Project Profile: Cooley Dickinson 500 KW BIOMASS CHP PLANT*. Retrieved from http://www.northeastchptap.org/Data/Sites/5/documents/profiles/CooleyDickinsonCaseStudy.pdf

CONCLUSION

This paper covers topics surrounding renewable energy and various forms of energy efficiency. Of these options, energy efficiency has been proven to be the most cost effective source of energy.[46] This paper has outlined a number of approaches to reduce energy use through behavior programs, projects that upgrade equipment, and better management of the processes that purchase and consume energy. Renewable energy has declined in price such that it produces energy at the same or less cost than energy purchased from the grid in many states. The map below shows that Massachusetts is one of those states where electricity produced by rooftop photovoltaic systems is equal or less than the cost of grid power before incentives.[47]

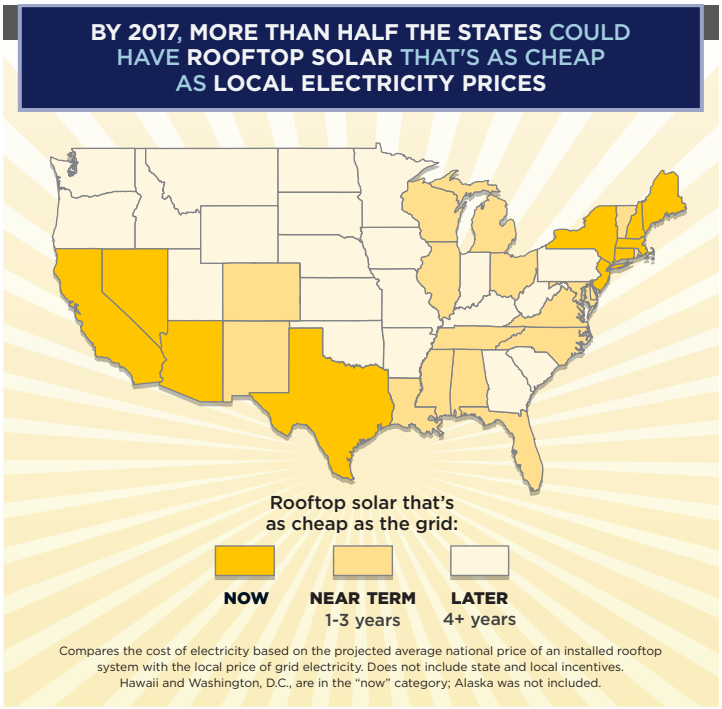


Figure 10[48]

This paper may be used as a resource to learn key concepts to save energy in a hospital facility or network and to find the incentives and assistance available. These resources are based on a facility's location and utility. Many of these changes will help to save money, reduce energy use, and improve the health of the environment.

46 American Council for an Energy-Efficient Economy. (2009). *Energy Efficiency Holds Steady At 2.5 Cents Per Kilowatt-Hour Even As Costs of New Power Generation Rise*. Retrieved from http://www.aceee.org/press/2009/09/energy-efficiency-holds-steady-25-cents-kilowatt-hour-ev

47 Union of Concerned Scientists. Retrieved from http://www.ucsusa.org/our-work/clean-energy/increase-renewable-energy/affordable-rooftop-solar-united-states#.VIsRSifuciF

48 Union of Concerned Scientists. Retrieved from http://www.ucsusa.org/our-work/clean-energy/increase-renewable-energy/affordable-rooftop-solar-united-states#.VIsRSifuciF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