Energy Information and Resources

for Hospitals in New Hampshire

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Prepared by

Vermont Energy Investment Corporation

Health Care Without Harm

Healthier Hospitals Initiative

Practice Greenhealth

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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 New Hampshire. 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

As hospitals, we strive every day to ensure the health and wellbeing of our patients and communities. With a broadening focus on health, not just health care, more and more hospitals recognize that human and environmental health are fundamentally connected, and have committed to various environmental initiatives. At Dartmouth-Hitchcock Health (D-HH), we see environmental stewardship as an essential piece of our goal to create a sustainable health system, one that improves the lives of the patients and communities we serve, for generations to come. Many New Hampshire hospitals, including ours, have joined hospitals across the country in the Healthier Hospitals Initiative (HHI), working to reduce energy and waste, use safer and less toxic products, and to purchase and serve healthier food.

In the area of energy use, there is a tremendous opportunity to reduce greenhouse gas emissions as well as save on energy costs. 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 percent, every $1 energy savings is worth $67 in increased revenue. In New Hampshire, many hospitals including Androscoggin Valley Hospital, Concord Hospital, and New Hampshire Hospital have taken steps to decrease energy usage and cost through energy conservation, energy efficiency, and renewable energy initiatives. As you will read about in the included case studies, implementing these measures has saved hospitals as much as $400,000 a year and reduced greenhouse gas emissions up to 85 percent.

While many options exist to reduce energy use and its environmental impact, hospitals must often overcome barriers to instituting projects such as financial resources, senior leadership approval, and competing priorities. Health Care Without Harm, Practice Greenhealth, and the Healthier Hospitals Initiative, through the generous support of the John Merck Fund, have compiled this paper to aid hospitals in overcoming these obstacles. It provides information on New Hampshire rebates, grants, and loans that assist with financing; recommendations on how to gain internal support for projects; and examples from various New Hampshire hospitals.

A commitment to use less and cleaner energy presents an excellent opportunity to both improve health and reduce costs. It is our hope that you will utilize this paper as a guide to move your sustainability work forward, leading our communities and our state to a healthier future.

Dr. James N. Weinstein
CEO and President
Dartmouth-Hitchcock Health

Robin F. Kilfeather-Mackey, CPA, MBA, MHCDS
Chief Financial Officer
Chair, Environmental Sustainability Council
Dartmouth-Hitchcock Health

INTRODUCTION

This paper's purpose is to provide information to hospital administrators, engineers, and facility personnel allowing them to improve the energy performance of their facility. There are many ways to improve energy performance, and it is not possible to cover every scenario or opportunity, but this paper provides 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 a broad discussion of clean energy investment in hospitals and includes case studies illustrating implementation nationwide. Most recently, New Hampshire put forth a 10-Year State Energy Strategy that can serve as an added reference.[1]

Hospitals are 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, food preparation, medical procedures, and sterilization. As a result, hospitals are among the most energy intensive commercial spaces with usages of about 2.5 times the amount of energy used in a commercial office on a square foot basis.

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

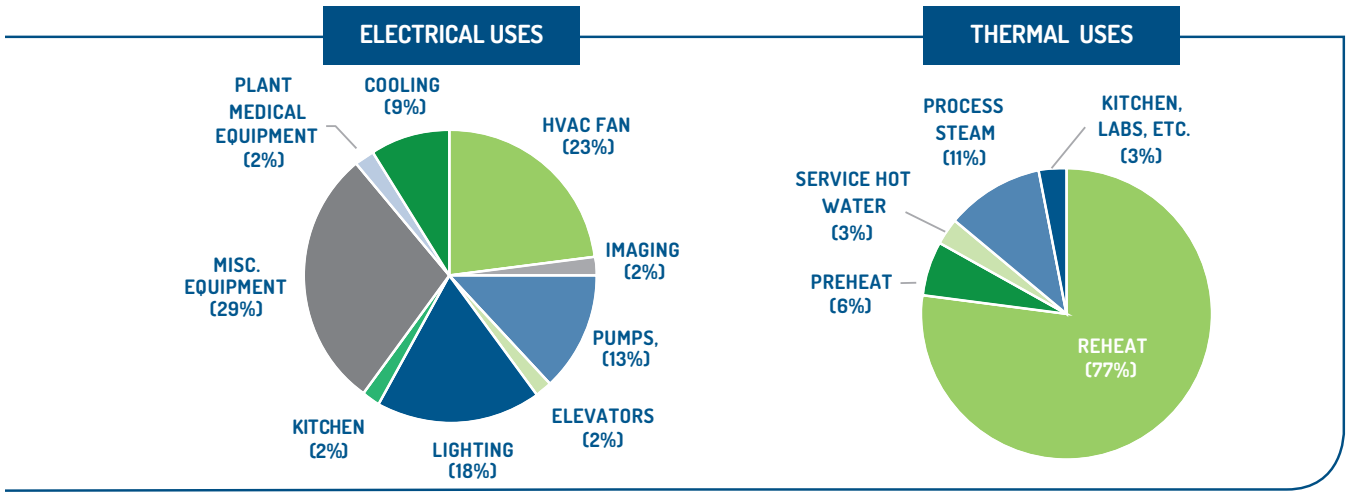

Figure 1: Energy End Use in Large Hospitals[2]

Hospitals spend typically 1 to 3 percent of their total operating costs, roughly 15 percent of their total profit, on energy.[3] Reducing energy use is a direct way to increase profit. Energy costs for hospitals on a square foot basis vary

1 To see full explanation of the state's planning process visit:http://www.nh.gov/oep/energy/programs/SB191.htm

2 Burpee H. et al. (2013, May). *Targeting 101: Advanced Energy Efficient Building Technologies for High Performance Hospitals*. University of Washington Integrated Design Lab.

3 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

widely around the country, depending largely on the age of the facility.[4] 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. Energy efficiency and renewable energy projects can be a great way to achieve those savings.

Renewable energy projects are increasingly cost competitive with utility energy and produce lower to no carbon emissions. Both energy efficiency and renewable energy projects hold the potential to reduce peak demand and the associated utility peak demand charges – often an important contributor to the financial picture of proposed clean energy projects. Solar photovoltaic (PV) systems provide peak energy during the highest demand hours of the grid system when power is most expensive, on hot summer afternoons. This can be an effective way to manage energy costs and avoid rate volatility. In general, on-site renewable systems or power purchased from a local renewable energy supplier can be a very effective way to reduce energy costs. With the various financing options, including third-party financing in the form of a lease or a power purchase agreement, renewable energy rates can be locked in at or below current electricity prices for up to 20 years.

Equally important to identifying a project is the ability to bring 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 derived from such changes.

If a hospital is ready to move beyond a project-based approach and take more control over the energy use in their facility, deploying an Energy Management Program should be a core component of the work. Energy management provides a comprehensive framework to address energy use through conservation actions, efficiency projects, and operational and maintenance practices.

4 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.

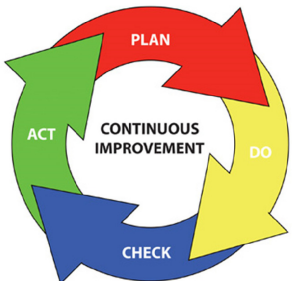

Figure 2: The Deming Cycle[5]

5 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 are often opportunities to achieve significant savings by shutting down pieces of equipment or specific facilities (e.g., operating suites, test suites) at certain times of day, typically overnight. In a hospital setting, health and safety is clearly paramount so care must be taken to identify the appropriate times and circumstances under which it is acceptable to shut off equipment. A conservation or energy saving behavior program can be established to inform and educate hospital employees to follow the requested actions. Such programs create advocates of its techniques by managing and changing conservation behavior within a hospital.

Conservation programs can achieve real results. University Health Network, composed 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 percent the first year and 4.2 percent in the second year.[6] Likewise, through use of behavior changes, Ridgeview Medical Center in Minnesota reduced energy use by six percent over a 15-month period netting $75,000 in savings.[7]

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 idea should 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-use impact, 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.[8]

6 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.

7 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

8 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.

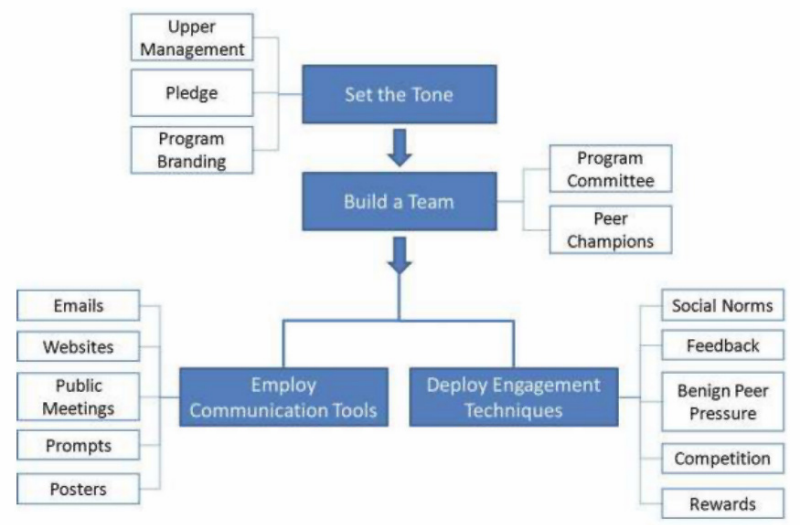

Figure 3: Behavior Program Strategies

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. 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 spawn from great teamwork. Programs require stakeholders in multiple departments for coordination and development. Those stakeholders then communicate with the rest of the organization, serving the dual role of peer champion for the program, either voluntary or appointed. This role model behavior helps 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, project websites, e-mails, and the various forms of social media such as Twitter, Facebook, and Instagram.

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 or specialized medical equipment. It may be necessary for some equipment that takes time to warm up to be left on at all times. However, every piece of equipment should be considered—ranging from the major energy consuming systems and to less energy intensive possibilities. Walking through the facility during off hours is one approach to noting what equipment 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 automatic occupancy and/or time-of-day controls for lighting, heating, ventilation, and air conditioning equipment. Sometimes equipment is turned on before it is needed or left on well after its required use. Some hospitals may have more surgical suites energized than necessary overnight or on weekends. Schedules should match the actual hours of use, especially for office spaces that are just used during the day.

Maintenance practices can also have a very significant 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.

Many utility energy efficiency programs support commissioning and retro-commissioning through the use of incentives to help pay for commissioning professionals.[9] 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 often go through multiple expansions and retrofit phases, it is possible that the heating, ventilation, and air conditioning systems have not been modified or expanded with efficiency as the primary goal. 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 four percent and 75 percent.
- 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.

9 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

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 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.[10] 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).[11] Comparatively, the average price for commercially billed electricity in New Hampshire as of October 2014 was $0.138 per kWh.[12] Energy efficiency is frequently the most cost-effective solution to reduce energy costs and mitigates the causes of global warming and climate change. In New Hampshire, Cheshire Medical Center/Dartmouth-Hitchcock Keene began using natural gas as opposed to burning fuel oil in their boilers saving the hospital $400,000 a year and reducing energy usage by 30 percent.

IDENTIFYING OPPORTUNITIES

New Hampshire currently charges a "system benefit charge" of $0.0018 per kilowatt-hour for all customers to fund energy efficiency program(s).[13] Recently, additional funding has become available through the Regional Greenhouse Gas Initiative (RGGI). These funds are generated by the proceeds from the sale of greenhouse gas allowances and are used to supplement the state's efficiency programs.[14] Links to the available programs (e.g., primarily the NHSaves program) are explained in further detail in the "Links, Resources, and Information" section.

The first step toward taking advantage of deep savings and energy efficiency is to reach out to the utility or program administrator. Under the umbrella of the NHSaves Program, New Hampshire utilities provide financial assistance with energy audits. Those hospitals working with municipal electric utilities are also eligible for rebates and incentives through Eversource Energy ("Eversource")[15] or New Hampshire Electric Co-Op (NHEC). A professional engineer or auditor can 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 of the facility (a level 1 audit) to identify obvious opportunities. Further investigation may just involve calculations or may require metering to verify operation (level 2 and 3 audits). More complex 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.

10 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

11 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

12 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

13 U.S. Department of Energy. (2014). *Programs*. Retrieved from http://programs.dsireusa.org/system/program?state=NH

14 American Council for an Energy-Efficient Economy. (2013). *State Energy Efficiency Policy Database.* Retrieved from http://www.aceee.org/sector/state-policy/new-hampshire.

15 Formerly known as Public Service of New Hampshire (PSNH).

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 it is important to involve the local utility as early as possible to make sure that any specified retrofit equipment meets the program's requirements and that the funds will be available when needed.

In New Hampshire, Concord Hospital, Dartmouth-Hitchcock Nashua, and Upper Connecticut Valley Hospital have utilized incentives from NHSaves to implement efficiency improvements.[16] These improvements yielded payback as high as a month's worth of electricity every year to over $245,000.[17] These savings on operating expenses yield an even higher operating margin.[18] The connection to operating margin is discussed in more detail later in this report. The next section outlines links and descriptions of available efficiency programs and case studies of hospitals that utilized these resources.

LINKS, RESOURCES, AND INFORMATION

The following headers and links were selectively sourced from the New Hampshire 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.

STATEWIDE PROGRAMS

- **Business Energy Conservation Revolving Loan Fund** – This source of funding is tailored to nonprofit and for-profit businesses in New Hampshire who have had difficulty financing energy efficiency improvements. A business must undergo an initial energy audit, the minimum loan amount is $100,000, and the payback period is 5 years maximum. The interest rate is determined by ensuring the project yields net positive cash flow after the calculated energy savings.
- **Enterprise Energy Fund Loan** – This source of funding provides a "low-interest, revolving loan fund available to businesses and nonprofit organizations to help finance energy improvements and renewable energy projects in their buildings."[20] Loan sizes range between $50,000-500,000.
- **Pay for Performance Program** – This program is operated under the jurisdiction of the New Hampshire Public Utilities Commission and consists of a network of industry partners. It is a three-step program that involves benchmarking, installation and implementation, and evaluation, measurement, and verification. Hospitals are specifically designated as potential participants in this program. Eligible businesses must have a demand greater than or equal to 100 kW and/or an annual fuel consumption of greater than or equal to 1,000 MMBTU. These designed projects must yield a total energy savings greater than 15 percent and a combined minimum internal rate of return (IRR) of 10 percent or higher.

Before pursuing financing options, project teams should first investigate the NHSaves incentives program (administered through the utilities, as described below). These rebates can significantly lower the amount of project capital needed.

16 NHSAVES. (2015). *Savings Profiles.* Retried from http://www.nhsaves.com/save-work/work-savings-profiles/

17 NHSAVES. (2015). *Darmouth-Hitchcock Nashua.* (2015). Retrieved from http://www.nhsaves.com/save-work/work-savings-profiles/dartmouth-hitchcock/

18 NHSAVES. (2015). *Concord Hospital.* Retrieved from http://www.nhsaves.com/save-work/work-savings-profiles/concord-hospital/

19 U.S. Department of Energy. (2015). *Programs.* Retrieved from http://programs.dsireusa.org/system/program?state=NH

20 Community Development Finance Authority. *Enterprise Energy Fund Overview.* Retrieved from http://www.nhcdfa.org/energy-efficiency/for-businesses-overview/

NHSaves funds are allocated to the utilities annually, so it is beneficial to discuss potential projects with utility experts early in the project development process.

PACE FINANCING (MUNICIPAL LEVEL)

- Commercial-PACE Financing Moves Forward in New Hampshire – This article describes an overview of a financing structure that is gaining ground in New Hampshire. Property Assessed Clean Energy (PACE) financing is implemented by municipalities, which designate PACE districts and approve or deny PACE projects. The financing ties a loan to the property through a lien, and is therefore not attached to the building owner if the property is sold. The loan period is determined to ensure the project is net positive after assessing potential energy savings. Underlying legislation signed into law in 2014, included raising the cap for commercial PACE financing to 35 percent of equity or $1,000,000, whichever is greater.[21] The PACE program has yet to receive funding, but it is anticipated that start-up funding will be developed in 2015.

UTILITY GRANT PROGRAMS

- Eversource - Energy Rewards Program – This energy-efficiency program is unique to Eversource (but similar to programs administered by other utilities for their large commercial and industrial customers). The program provides support for comprehensive retrofit projects undertaken by customers with a demand greater than or equal to 350 kW. Minimum savings for a project is 100,000 kWh per year and the minimum project cost is $150,000. This program excludes new construction, power-producing projects (e.g. combined heat and power), fuel switching, and repair or maintenance.

UTILITY LOAN PROGRAMS

- Liberty Utilities (Electric) – Financing – Financing is available to businesses that do not have an immediate outlay of cash to pay for efficiency improvements. If a project qualifies for a Liberty Utilities incentive, this may be combined with financing up to $50,000 per project at a zero percent interest rate. The loan payback mechanism occurs through the utility bills with a total annual maximum of $150,000 per year.
- New Hampshire Electric Co-Op - SmartSTART Energy Efficiency Loan Program – This funding mechanism is a zero-money-down financing structure for businesses served by NH Electric Co-Op. Eligible projects include weatherization, lighting and lighting controls, and other verifiable efficiency installations. The loan is paid by adding ¾ of the realized savings back onto the monthly electric bill.

UTILITY REBATE PROGRAMS

- Liberty Utilities (Electric) – Large Business Program – This program is applicable to Liberty Utilities customers with an average demand greater than 200 kW. Incentives are available for new construction and retrofitting existing equipment. The incentives typically cover up to 35 percent of the project cost for existing equipment. If an outside engineering firm is used to evaluate savings potential on equipment, Liberty Utilities will usually fund half the cost. For new equipment and construction, Liberty Utilities will cover up to 75 percent of the incremental cost for the most efficient option.
- Liberty Utilities (Gas) - Commercial Energy Efficiency Programs – This utility offers a range of rebate opportunities

21 Sanders, Bob. (2014). *Businesses seemed please with 2014 legislature.* Retrieved from http://www.nhbr.com/April-18-2014/Businesses-seem-pleased-with-2014-Legislature/

for gas-related energy efficiency improvements. These range from space and water heating, to weatherization and custom projects. A free on-site energy audit is provided to Liberty Utility gas customers. As a follow up to an audit, engineering studies are incentivized at a rate of 50 percent up to $10,000.

- New Hampshire Electric Co-Op - Large Business Energy Solutions – NHEC offers incentives to businesses with a monthly demand greater than 100 kW. Rebates are not offered to projects with a simple payback of one year or less. A variety of equipment options are eligible for rebates such as lighting, variable frequency drives, and custom projects such as HVAC. Financing may be available from NHEC. NHEC also offers a variety of rebates for new construction, major renovation and replacing failed equipment.

- Eversource – Efficiency Programs – Eversource offers a range of incentives to upgrade systems to be more efficient. Rebates are offered for heating, cooling and water heating, retrofitting existing equipment, and new construction and end-of-life equipment replacements.

- Unitil (Electric) - Commercial and Industrial Energy Efficiency Programs – Unitil provides a range of incentives for hospitals. The Large Business Retrofit Program covers businesses with a demand greater than 200 kW. These incentivized options include energy audits and rebates for the purchase of efficient equipment. In addition, the C&I New Equipment & Construction Program may be used to replace failed equipment, for major renovations or for new construction projects.

- Unitil (Gas) - Commercial and Industrial Energy Efficiency Programs – Unitil offers incentives for small and large commercial customers up to 50 percent of the installed cost of an energy efficient upgrade up to $50,000 per master meter. Similar to the new construction program above, Unitil offers incentives for replacing failed equipment, for major renovations or for new construction projects. The incentives can cover up to 75 percent of the incremental cost of the efficiency measure.

CASE STUDIES

Concord Hospital – Through a mix of several energy efficiency projects – most notably the replacement of interior lighting fixtures as well as lighting retrofits to the exterior parking lot, garages, and walk ways – Concord Hospital expects to save 1,098,552 KWH per year. Financially, these improvements will be equal to saving approximately one month's worth of electricity each year. The project was made possible through Unitil incentive program, which provided more than $200,000 in incentives.

Upper Connecticut Valley Hospital – Upper Connecticut Valley Hospital in Colebrook saved on costs and energy by installing three new high-efficiency hot water boilers. The incentive program through Eversource Commercial, Heating, Cooling, and Water Heating Equipment program enabled the hospital to save more than $23,000 on installation costs.

Covenant Health - St. Joseph's Hospital – St. Joseph's Hospital was the first hospital in New Hampshire to achieve an ENERGY STAR score of 75 or higher earning them the ENERGY STAR certification. This was accomplished through a number of energy-efficiency initiatives over the years such as surveying and repairing all steam traps and installing new windows with energy-efficient glass as well as energy-efficient lighting in corridors and meeting rooms.

Cheshire Medical Center/Dartmouth-Hitchcock Keene - In 2010, Cheshire Medical Center/Dartmouth-Hitchcock Keene began an endeavor to decrease energy consumption by thoroughly looking at its overall system including examining each component. This led to a three-year project, which encompassed changing of piping and air handlers, among other actions. Between 2010-2013, the medical center decreased its kWh and MMBTU by 14 percent each. This first

phase allowed for the right-sizing of potential new services saving on initial investments. In 2014, the medical center began using natural gas as opposed to burning fuel oil in their boilers. This switch was part of a larger endeavor to reduce energy use. This change saves the medical center $400,000 a year and reduced energy usage by 30 percent. Additionally, it reduces the medical center's carbon dioxide emission by 20 percent.

REFERENCES

- Healthcare: An Overview of Energy Use and Energy Efficiency Opportunities – ENERGY STAR illustrates a broad overview of strategies for hospitals to save money. This paper highlights low-cost 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 the impact of cost saving and resiliency on the bottom line.
- System Benefits Charge – This page illustrates the relationship between utilities and the mandatory surcharges on electric bills that support efficiency and low-income energy assistance programs. The New Hampshire Public Utilities Commission oversees these programs and provides oversight, while the programs and allocated funds are managed within each respective utility.

RENEWABLE ENERGY

OVERVIEW

Renewable energy is most commonly associated with the generation of electricity from hydroelectric, solar, wind, or biomass systems. 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 discussion below will focus on on-site installations. Examples of the implementation of renewable energy systems may be found in the "Links, Resources, and Information" section below. These include examples of solar and biomass installations at New Hampshire Hospital, Littleton Regional Hospital, Memorial Hospital, and Androscoggin Valley Hospital.[22]

Renewable energy has declined in price such that it often produces energy at the same or less cost than energy purchased from the grid in many states. The map below shows that New Hampshire is one of those states where electricity produced by rooftop photovoltaic systems is equal or less than the cost of grid power before incentives.[23]

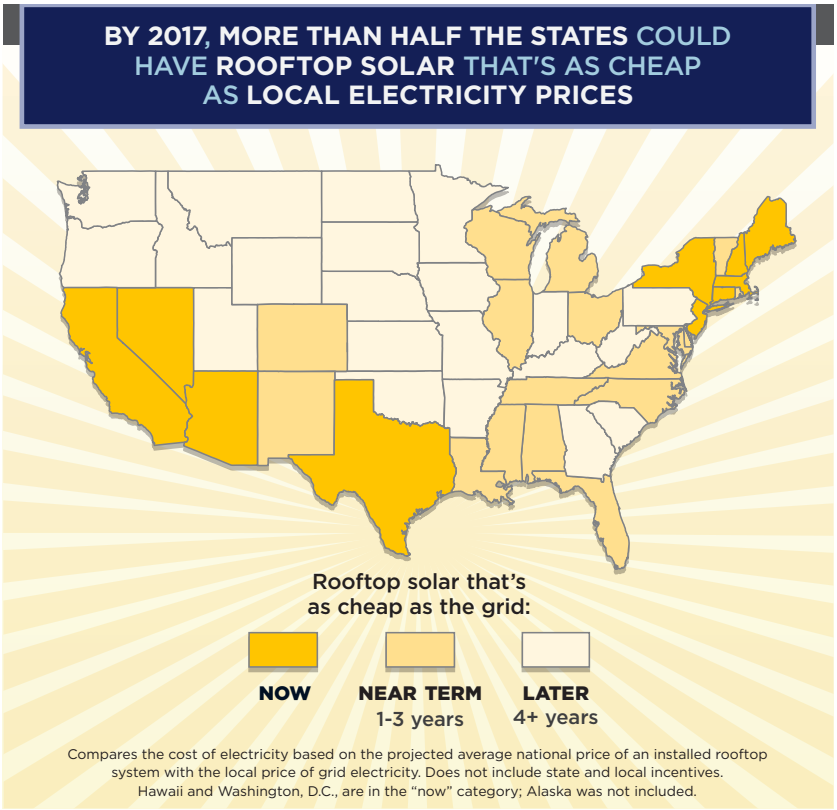

Figure 4[24]

22 To hear the Androscoggin Valley Hospital (AVH) case study, the link directs you to a page on sharing calls, scroll down until you see the sharing call for AVH.

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

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

IDENTIFYING OPPORTUNITIES

REBATE AND INCENTIVE PROGRAMS

A wide variety of renewable energy opportunities are available within New Hampshire. The Renewable Energy Fund, administered by the Public Utilities Commission, offers rebates for investments in biomass, solar electric, and solar thermal systems. New Hampshire's Renewable Portfolio Standard (RPS) law requires that 23.8 percent of the state's electricity come from renewable sources by 2025. Electric service providers comply by acquiring renewable energy certificates (RECs) tied to generated electricity from renewable sources. However, if service providers are not meeting sufficient levels of renewable energy in a year, they must make an alternative compliance payment. These payments provide the funding for the Renewable Energy Fund.[25]

THIRD-PARTY FINANCING

Third-party financing options can make solar installations more cost effective through two different methods: purchase power agreements (PPAs) and solar leases. PPAs involve 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 market 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]

Energy Service Companies (ESCOs) provide another form of energy project financing. After conducting an "investment grade" engineering audit of the facility, the ESCO proposes a set of measures that it will install and finance. Once installed, the financial savings created through lower energy bills are used to pay for the equipment and services provided by the ESCO, and the remainder is retained by the hospital. The contractual arrangements are somewhat complex, and rely on careful upfront negotiations around the measures installed and the on-going performance monitoring. In recent years, this has become a common approach to financing and executing energy-efficiency projects.

LINKS, RESOURCES, AND INFORMATION

- The following headers and links were sourced from the New Hampshire page on the Database for State Incentives for Renewables and Efficiency.[27] Some of these links and headers were restructured for the scope of this document.

STATEWIDE PROGRAMS

- Enterprise Energy Fund Loan – This source of funding provides a "low-interest, revolving loan fund available to businesses and nonprofit organizations to help finance energy improvements and renewable energy projects in their buildings." Businesses and nonprofits are encouraged to first utilize rebate and loan programs offered by entities such as the NH Office of Energy and Planning. Loan sizes range between $50,000 and $500,000.
- New Hampshire Public Utilities Commission - Commercial and Industrial Bulk-Fuel Fed Wood Pellet Central Heating Systems Rebate Program – This program offers a payment of 30 percent of the heating system and

25 New Hampshire. *Renewable Energy Fund.* Retrieved from http://www.puc.state.nh.us/Sustainable%20Energy/RenewableEnergyFund.html

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

27 U.S Department of Energy. (2014). *Database of State Incentives for Renewables & Efficiency: New Hampshire Incentives/Policies for Renewables & Efficiency.* Retrieved from http://programs.dsireusa.org/system/program?state=NH

installation costs up to $50,000. An additional rebate for thermal storage tanks is available at a rate of 30 percent of the costs up to $5,000.

- New Hampshire Public Utilities Commission – Commercial & Industrial Incentive Program – This program offers rebates for solar electric and thermal systems that are 100kW D/C (or equivalent) or smaller in size up to $50,000.
- New Hampshire Public Utilities Commission - Commercial & Industrial Renewable Energy Grants - Projects covered under this annual grant award include thermal and electric renewable systems. Projects eligible to apply for rebates under the C&I Solar Rebate Program or the C&I Bulk-Fuel Fed Wood Pellet Central Heating System program are ineligible under this funding source. The minimum application amount is $150,000 and there is no price ceiling.

PROPERTY TAX INCENTIVE

- Renewable Energy Property Tax Exemption – This tax exemption includes rules for solar, wind, and biomass systems. It is a net neutral tax program, which means that any increase in property value created by the renewable energy installation is tax exempt.

UTILITY PROGRAMS

- New Hampshire Electric Co-Op Renewable Energy Programs – NHEC offers incentives for solar hot water and solar photovoltaic installations. The incentive is up to 25 percent of installation costs up to $20,000. Accepting an incentive forfeits Renewable Energy Certificates (RECs), which could be sold to NHEC or another entity.
- Public Utilities Commission C&I Solar Rebate Program - This program offers rebates for solar electric and thermal systems that are 100 kW or smaller. The incentive levels for solar electric systems are $0.80 per Watt, up to $50,000, and for solar thermal systems the incentive level is $0.07 per thousand-Btu per year ($0.12 per thousand-Btu/year for systems of fifteen collectors or fewer in size), up to $50,000.
- Eversource – Renewable Energy Options – Eversource offers net metering as an option for customers that own or operate systems up to one megawatt (1 MW). Eversource offers information on wind, solar, and geothermal installations while emphasizing that it may be more cost effective to focus on efficiency and conservation improvements first.

CASE STUDIES

- Crotched Mountain Rehabilitation Center – This medical rehabilitation facility replaced its oil fired heating system with a woodchip boiler system. After oil prices nearly doubled in cost per gallon, the initial 7-year project payoff estimate was reduced to 5 years.
- Weeks Medical Center – This hospital installed a woodchip boiler system with thermal storage capacity in partnership with the North Country Resource Conservation and Development Council (NCRC&D) to yield an estimated project payback of 7.6 years. Yeaton Associates engineered the biomass system, which became operational in March 2011.
- Memorial Hospital – Memorial Hospital entered into a contract with Ensyn for the supply of RFO (a biofuel). Ensyn's RFO is produced from forest residues and will be used for heating fuel, replacing petroleum-based fuels. This project will reduce fuel costs from $450,000 to $213,000, and will reduce Memorial's greenhouse gas emissions by 85 percent.

REFERENCE INFORMATION

- Electric Renewable Portfolio Standard (RPS) – This page summarizes New Hampshire's goals around incorporating renewable energy into its source energy mix. It outlines four classes of renewables with percentages to be met each year in each class. Excluding municipalities, the responsibility for meeting these standards rests on utilities.
- Interconnection Standards – DSIRE provides an excellent summary for NH net metering policy: "New Hampshire requires all utilities selling electricity in the state to offer net metering to customers who own or operate systems up to one megawatt (1 MW) in capacity that generate electricity using solar, wind, geothermal, hydro, tidal, wave, biomass, landfill gas, bio-oil or biodiesel. CHP [combined heat and power] systems that use natural gas, wood pellets, hydrogen, propane or heating oil are also eligible." Combined heat and power systems are further described in the "Additional Links and Information" section below.
- Net Metering – This page, hosted by DSIRE, further describes net metering mentioned in the Interconnection Standards link above. A noteworthy difference is the description of REC ownership: the RECs associated with the excess power sold back to the utility can be claimed by the utility.
- New Hampshire Office of Energy and Planning – Renewable Energy Incentives – This website highlights financial incentives available at the local, state, and federal level for renewable energy. The subject matter includes net metering information, federal tax incentives, local tax incentives, and the statewide incentive program highlighted above.
- Small Wind Regulation – This document provides an overview of a bill signed into law in 2008 that prevents unnecessary regulation on wind development by municipalities. It provides certain guidelines for enforcement for municipalities and provides restriction on a municipality enacting a policy that exceeds established state, federal, or international codes.
- Solar Skyspace Easements – This New Hampshire statute outlines a building owner's opportunity to create an easement to preserve "sky space" that provides sunlight to an installed solar generation system.
- Wind Exchange – This source, hosted by the US Department of Energy, gives a variety of resources for wind energy such as maps, basic and advanced education.

THIRD-PARTY FINANCING

- Solar Energy Industries Association – This website provides 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.
- Model Documents for An Energy Savings Performance Contract Project – This United States Department of Energy website offers a number of model contract templates and associated documents.
- National Association of Energy Service Companies – The NAESCO site provides helpful background information on ESCOs and the ways in which these companies serve the market.

ENERGY MANAGEMENT SYSTEMS

OVERVIEW

Energy management programs are essentially frameworks designed to reduce energy consumption over time and incorporate all of the approaches discussed in this paper: conservation, efficiency improvements, and use of renewable energy systems. There are several resources that provide guidance to implementing a comprehensive energy management program The Healthier Hospital Initiative's Leaner Energy Challenge **How-to Guide** lays out a step-by-step process of how to put an energy management system into place. Other guides include the I*nternational Organization for Standardization (ISO) 50001*[28] standard and the *ENERGY STAR Energy Management program*. The ISO energy management process involves setting a policy as well as creating goals, methodological processes of documentation, and actions to achieve these goals.[29] 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.

An energy management program creates a multi-year plan that yields various benefits—financial and organizational. Providence Health and Services implemented energy management and saved millions in energy costs.[30] Providence's success can be attributed to several key factors. This hospital system has embraced the use of 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 scoring system that allows a hospital to compare their energy use to other facilities, and to set realistic goals.

The Leaner Energy Challenge 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 team lead. 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 Challenge 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 5, highlights seven distinct components: make a commitment, assess performance, set goals, create an action plan, implement the action plan, evaluate progress, and recognize achievements.[31]

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

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

30 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

31 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

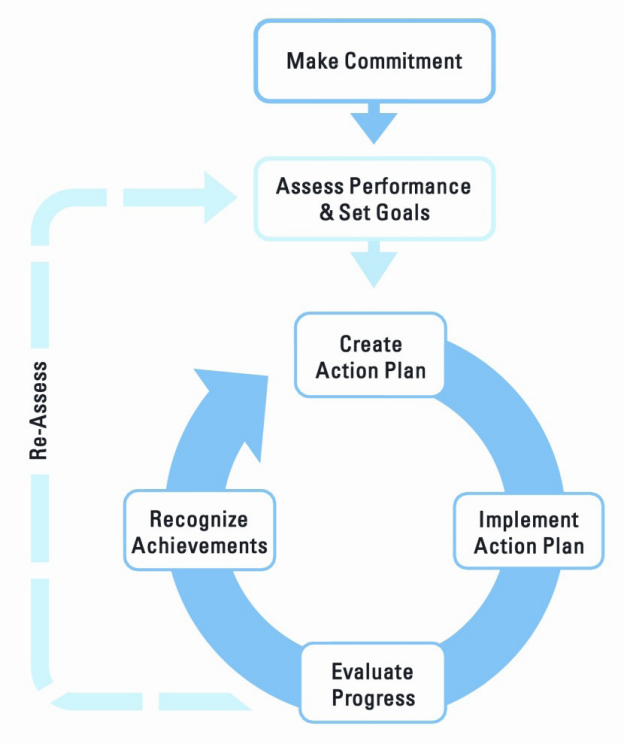

Figure 5: ENERGY STAR Energy Management

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 Figure 6. 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.

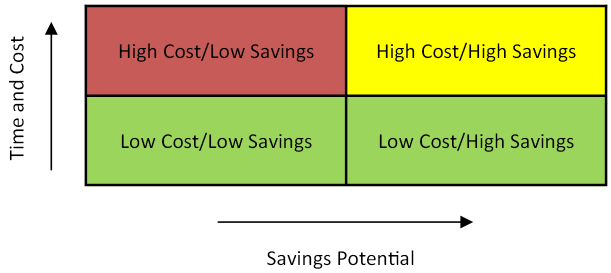

Figure 6: Opportunities Prioritization Matrix

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 a clean energy project has been identified, there will be a number of challenges in implementing it. 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 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. This section identifies some common barriers and suggests strategies for overcoming them.

IDENTIFYING PROJECT EVALUATION CRITERIA

Ask the Chief Financial Officer or finance team what criteria will be used for evaluating and funding proposed projects. The project proposal should be presented in a form that is consistent with the method used by the finance team and executives to evaluate any investment. Otherwise, confusion around the financial terminology and analysis can become a significant and unnecessary barrier. Methods include internal rate of return (IRR), return on investment (ROI), net present value (NPV), and simple payback.

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. In some cases, the underlying barriers are a combination of senior management skepticism or lack of support and the availability of money.

The financial strength of any institution is always a major concern. Based on national averages, every $1 a nonprofit hospital saves in energy is essentially equivalent to $20 in increased revenue. The ratio for many hospitals is even more dramatic, including many facilities in New England. For example, $1 energy savings is worth $67 in increased revenue when a hospital has a net margin of 1.5 percent. If the net margin at a hospital is four percent or less, then Figure 7 shows the impact of a $10,000 reduction in energy use in the form of equivalent revenue. In short, saving energy is a very effective method for the increasing operating margin.

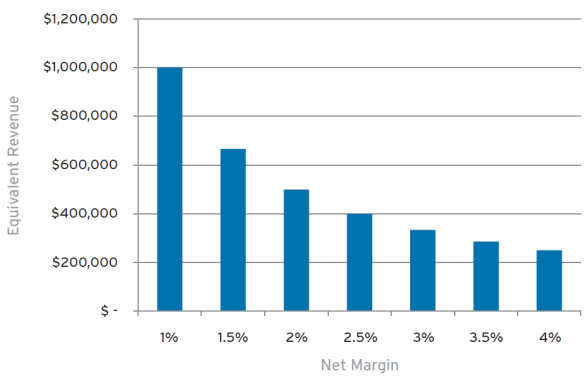

Figure 7: Revenue Equivalent to $10,000 in Energy Savings

PARTNER WITH YOUR UTILITY

Efficiency programs in New Hampshire have ambitious goals and are designed to use limited funds cost effectively. Don't hesitate to try negotiating with your utility for incentives. Establishing a relationship with your account manager and putting a strategic energy management Plan (SEMP) in place demonstrates the organization's commitment to energy projects. Talking to these individuals early in the project selection process will make it more likely that the funds will be available when the project is ready to go. Keep in mind that these programs are funded on a calendar year basis. Ask questions and engage with your account manager. The hospital is paying into the state program through the systems benefit charge, and therefore the facility should be benefiting from the program. This includes access to any available technical resources that can assist in developing the best solutions, including finding low-cost or no-cost energy improvements.

OVERCOMING PERCEPTION OF RISK

Taking steps to mitigate actual or perceived risks is a method for assuaging the fears of managers who will make the investment decision for energy projects. Gathering Case studies or other information from various hospital facility personnel can also be very helpful with respect to utilizing "lessons learned" by others. The New Hampshire Hospital Association or Health Care Without Harm can help provide connections with other facilities that have undertaken similar projects, and case studies on similar projects. Your utility may also be able to put you in touch with another hospital that has experience with the type of measures you are considering. If your hospital is willing to serve as the pilot for a new type of measure and become a case study or resource for information for other businesses, then that may provide a pathway to discuss higher incentives. 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. Remember that looking beyond simple payback to include the cost savings that accumulate after the project has paid itself back is an essential component of the complete financial picture of a project. Most efficiency measures pay back their cost long before their expected lifetime. Individual measures may be held to specific standards whereas a full composite project needs to simply have a positive net present value to be financially viable. 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 financial criteria being applied. It may be possible to wrap this measure in with other more attractive measures and receive funding for the whole project. It can also be helpful to bundle long and short payback measures together so that the short payback items help offset the long payback measures.

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 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 example, lighting projects that reduce energy use also typically radiate less heat into conditioned space. While this results in a net increase in energy required to heat the facility in the winter, the benefits seen in the warm months will often more than offset this effect. These types of benefits and interactions should be factored into the decision-making process.

Renewable energy projects can also provide benefits beyond just energy. Renewable energy reduces carbon emissions from central power plants. New Hampshire gets 21 percent of its electricity from natural gas, so reducing energy consumed from the grid reduces carbon emissions.[32] Renewable energy also displaces other harmful emissions from fossil-fuel-burning power plants.

SELLING THE PROJECT

Once you have determined the criteria for the financial approval test and addressed the risks associated with the project, demonstrate, through packaging, that the efficiency and renewable projects meet all the criteria outlined by management. Be prepared to demonstrate that the cost of doing nothing is higher than might be expected. An interesting paper entitled **Monetizing Energy Solutions** provides an example of this concept. The principles illuminated in the paper are applicable to commercial customers and hospitals. 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.

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. There are multiple potential sources of funds 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 are recognized as low-risk investments. In addition, some utility programs offer financing as noted above. Financing can be a good way to fund a project if a loan is structured such that the loan repayments are offset by the savings realized. This scenario can be particularly attractive when there is no available budget for capital costs, and the loan payments can essentially be incorporated into the operating budget.

IMPORTANT POINTS TO CONSIDER WHEN IMPLEMENTING A PROJECT

ENSURE EQUIPMENT MEETS REQUIREMENTS

Some efficiency programs may 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 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 meet the requirements of

32 U.S. Energy Information Administration. *New Hampshire State Energy Profile.* Retrieved from http://www.eia.gov/state/print.cfm?sid=NH

the utility overseeing the incentives. The worst case scenario is that equipment is installed that does not meet the requirements, and therefore no incentives are available. This 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 installed as specified and operating correctly.

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 before incentives are paid out. 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.

In general, facility personnel need to be trained how to correctly operate and maintain the equipment. It is common for sensors and controls to be overridden to solve a temporary problem or to deal with an emergency, but then the equipment is left in that state and energy savings are negated. The installation of an Energy Management System (EMS) designed to monitor and control key building systems has become an increasingly common way to avoid such situations. EMS systems are used to set-up and maintain optimal system operation, and provide alarms and other indicators when equipment is not operating as intended.

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 also be an effective tool. A well-written facility operating plan describes how equipment and systems are supposed to work, where to get service and spare parts, and what to do in case of common problems. Having a written document or website is a valuable way to preserve institutional knowledge and avoid loss of information when facility staff leave the organization.

TRAINING

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 operations staff to gain a deeper understanding of energy efficiency measures within a hospital. The certification is recognized by a wide variety of organizations such as the Green Building Certification Institute as continuing education for LEED.[33] 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 other common measures used by facilities to quickly achieve energy and financial savings. Level II certification dives deeper into the subject matter with a focus on energy management, HVAC controls, diagnostic systems, preventative maintenance, and system troubleshooting.[34] 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.[35]

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."[36] 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 through a combination of education and/or experience.[37] 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.[38]

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

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

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

36 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

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

38 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 U.S. 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 and a heat generation system that provides heat and power through heat recovery (also referred to as a cogeneration system).[39] CHP systems are typically much more efficient than the more conventional arrangement of separate supplies for heat and power. The EPA estimates a potential increase of efficiency by roughly 25 percent using a CHP system (Figure 8). Hospitals are unique facilities because of the potential impact on patient health and safety when power goes out. Therefore, a hospital relying on electricity from a standard utility typically has backup systems for power generation in the event of grid failure. Some types of facilities (e.g., level 1 trauma centers) require multiple layers of back-up power. An onsite CHP system can generate onsite power that runs in parallel with energy purchased from the grid. This approach can provide emergency support, reduce peak demand charges, and save a facility money on its bottom line.

As an example in New Hampshire, the Veterans Affairs Medical Center in Manchester is currently completing installation of a 750 kWatt natural gas fired CHP system as part of the modernization of its facility energy plant. To begin this project the VA conducted a thorough technical analysis including plant availability, auxiliary power, heat rate, and energy generation. The analysis estimated that based on the facility's annual thermal and electric load profile, the average overall CHP efficiency will range from 60-65 percent with the capability of providing additional thermal loads. The system will produce base load power with no excess energy exported to the electric company. Supplemental and standby power will be purchased through the electric utility thus ensuring energy from either the CHP plant or utility at all times.

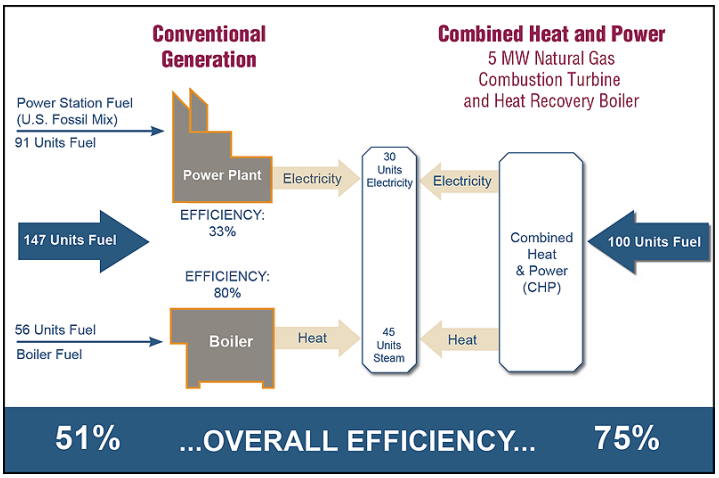

Figure 8[40]

As an inherent feature of their design, CHP systems reduce the amount of total emissions and greenhouse gases emitted from a facility's physical plant, combating climate change and air pollution. Some hospitals may be suited to further

39 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

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

reduce impacts on climate change by installing a biomass-fired CHP system. Under conditions of sustainable forestry management from supply sources and proper air pollution controls, biomass CHP systems may be a 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.[41] Biomass CHP systems take advantage of the efficiency gains from CHP and operate on a climate neutral fuel.

LINKS TO ADDITIONAL RESOURCES

- Health Care Without Harm – Powering the Future of Health Care – This paper provides a primer for facility managers and C-level hospital executives on CHP technologies, their application in health care, and the policy frameworks that currently support CHP in Massachusetts. While this document centers on Massachusetts, its generalized information can be helpful to those in New Hampshire.
- 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. Particular attention is paid to the multiple benefits of investment in energy efficiency and renewable energy projects in hospitals.
- Health Care Without Harm - Climate and Health Resources – This website 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 illustrates the basics surrounding demand charges, ways to immediately lower consumption, and longer-term solutions such as commissioning and energy efficiency improvements.
- 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 as well as and fuel and electric prices.
  - Optimization criteria for cogeneration systems: Multi-objective approach and application in a hospital facility - This paper focuses on determining a profitable solution for a CHP system based on a model derived on multiple variables.

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 change as a basic human right and emphasizes hospital leaders and policymakers take any action possible to combat additional contributions of anthropogenic CO2 into the atmosphere.

41 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

CONCLUSION

This paper discusses renewable energy and energy efficiency projects in health care facilities. Of these two options, energy efficiency is often the more cost effective strategy.[42] This report is intended to be a resource on key concepts, and identifies the incentives and assistance specifically available to New Hampshire hospitals. Investments in clean energy projects will save money, reduce energy use, and lower a health care facility's impact on the environment. This paper has outlined a number of approaches to save energy costs and reduce carbon footprint—including conservation programs, lighting and equipment upgrades, retro-commissioning, installation of control systems or on-site renewable generation, and the purchase of energy efficient office equipment or grid supplied renewable energy.

42 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

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