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Hospitals and Healthcare Initiative

Market Progress Evaluation Report 7

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1 Executive Summary

This report is the seventh Market Progress Evaluation Report (MPER) of the Northwest Energy Efficiency Alliance's (NEEA's) Hospitals and Healthcare (H&H) Initiative. This report presents evaluation findings based on a regional phone survey with hospitals facilities managers, in-depth telephone interviews with Northwest design and construction firms and secondary research on the hospitals energy management trends. The report also includes an analysis of 2013 energy savings.

The H&H Initiative has targeted hospitals and hospital systems that have their headquarters in the Pacific Northwest (Idaho, Montana, Oregon and Washington). Historically, the primary goal of the Initiative was to have these organizations adopt Strategic Energy Management Plans (SEMPs), which can guide long-term changes in business practices and lead to reduced energy consumption. Strategic Energy Management (SEM), which includes the development of SEMP documents, is a broad organizational commitment to energy management that uses a comprehensive set of business tools and practices that enable hospitals to reduce energy consumption, maximize resource efficiency and lower costs. NEEA's Initiative has also assisted regional hospitals by providing technical resources, comprehensive website materials and a regional energy benchmarking challenge.

NEEA is completing its transition out of the hospitals market and **a key objective for this evaluation** was to take a snapshot of current market transformation and complete a longitudinal analysis compared with the BetterBricks 2010 MPER.

NEEA's Initiative has made noteworthy market transformation progress in the past four years. In particular, overall adoption of SEM practices, as measured in the phone survey, has increased significantly since the 2010 MPER hospitals survey. Adoption of SEM practices in the medium and large market segment increased from around 40% to 55% and adoption at participating facilities increased from approximately 50% to 76%. SEM practices have been adopted by 41% of the market among small and non-participant facilities and close to 50% of the total market in the Northwest. *NEEA has a formal goal that hospitals representing 25% or more of regional beds will be committed to and practicing SEM elements, and NEEA continues to exceed this goal.*

Notably, adoption of energy efficiency practices increased among non-participating hospitals from 20% in 2010 to 41% in 2014. This result suggests diffusion of NEEA's Initiative principles from participants to the wider market.

Following are some additional key findings from this evaluation:

1. **Increases in Overall SEM Penetration scores were driven by growth in the following Market Progress Indicators (MPI): Capital Improvements, Contracts with Suppliers, Mobilizing the Organization, and Strategic Leadership.** Among participant facilities the

increase in these MPIs ranged from 15% (Capital Improvements) to 55% (Strategic Leadership).

2. **SEMPs are in place at half the hospitals in the total market (small, medium and large).** Fifty percent of the total hospital beds in the market are covered by an energy plan. Sixty-six percent of participating hospital beds are covered by an energy plan.
3. **Eighty-seven percent of hospitals have seen an improvement in the energy performance of their buildings in the last 3 years.** Ninety six percent of participating hospitals and 71% of non-participating hospitals reported improvements in energy performance.
4. **Life Cycle Cost Analysis (LCCA) is common practice among participant hospitals.** Sixty five percent of participant hospitals report having made investment decisions based on LCCA and the remaining 35% plan to do so in the future.
5. **Hospitals are changing their delivery approaches to provide more efficient, higher quality, integrated clinical care at lower overall cost.** Medical practices are trending toward shorter hospital stays and more outpatient care. This could lead to lower net energy usage across the healthcare sector. Under the value based model hospitals executives may be more open to exploring energy efficient design, (lower cost) capital projects and technologies, including Energy Management Information Systems, at the facilities level. Twelve of the fourteen design and energy management professionals we interviewed believe that energy management in the Northwest will increase over the next five years.
6. **Continuing barriers to SEM include:**
    - Decreasing hospital revenue streams and limited capital availability
    - Lack of executive level commitment at some hospitals
    - High levels of risk aversion and perceptions that energy efficient changes can introduce risks to patient outcomes and operational reliability
    - Perceived high opportunity costs – i.e., funds could be better spent on revenue generating equipment that could have a greater impact on bottom line profits

Recommendations:

NEEA's ongoing involvement will be limited to monitoring and tracking activities to assess the progress of SEM and energy efficiency practices. To support these monitoring and tracking activities we recommend the following:

1. Conduct targeted research on overcoming specific barriers identified in this MPER to mitigate the impact of these barriers on future SEM adoption and diffusion.
2. Conduct periodic focused phone surveys with hospital staff similar to the survey conducted for this MPER to monitor Market Performance Indicators over time.
3. Conduct periodic interviews with utility staff to monitor the progress of utility SEM programs.
4. Continue to work with participating hospitals to gather energy savings data to track long-term energy impacts of SEM.

2 Introduction

2.1 Initiative Overview

This report is the seventh Market Progress Evaluation Report (MPER) of the Northwest Energy Efficiency Alliance's (NEEA's) Hospitals and Healthcare Initiative. NEEA is supported by and works in collaboration with the Bonneville Power Administration (BPA), the Energy Trust of Oregon and more than 100 Northwest utilities on behalf of more than 12 million energy consumers. NEEA uses the market power of the region to accelerate the innovation and adoption of energy-efficient products, services and practices.

Strategic Energy Management (SEM) is an organizational commitment to energy management that uses a comprehensive set of business tools and practices that enable hospitals to reduce energy consumption, maximize resource efficiency and lower costs. The Initiative began in 2002 with a focus on working with a select number of hospital systems in the region. Market Specialists in each state, supported by a team of technical specialists, identified target hospital accounts and worked with them to develop, adopt, and implement Strategic Energy Management Plans (SEMP) for improved energy management. The definition of SEM evolved since the Initiative began and was codified in 2011 by the release of ISO 50001:2011 Energy Management System standard. For the purposes of conducting longitudinal evaluation studies NEEA has continued to use the Hospitals and Healthcare Initiative definition of SEM and the related SEMP. NEEA considers hospitals to have an adopted SEMP if the hospitals meet four of the following six requirements:

1. There is a written SEMP to reduce building energy use[1]
2. The plan includes numeric goals for energy savings or use
3. The plan includes a timeline
4. The plan includes a budget
5. The plan is authorized by senior management
6. Senior management receives updates on plan achievements.

In addition to directly helping hospitals to develop SEMPs, NEEA's BetterBricks website has included technical tools for SEM planning and implementation, case studies, published articles by SEM experts and recordings of regional Peer Technical Forums. NEEA also collaborated with the American Society for Healthcare Engineering (ASHE) Region 10 to recruit and support hospitals across the region in adopting energy accounting and benchmarking practices (i.e., the E2C Energy Efficiency Challenge). Moreover, NEEA has co-funded Resource

[1] The terms "SEMP" and "SEM" appear throughout this document. SEMP refers to planning documents created by healthcare institutions that provide goals and guidance to achieve improved energy management practices. SEM is an organizational commitment and set of actions undertaken by those institutions to improve and sustain energy management best practices. Having a SEMP is just one component of broader SEM practices.

Conservation Managers (RCM's) at participant hospitals to implement SEMPs and champion energy efficiency projects, and co-funded consultant studies at some hospitals for project development, prioritization and savings estimating. The sixth MPER for this Initiative, available on NEEA's website, provides additional details about these interventions and informational tools.

The logic model that has historically guided NEEA's activities for the Initiative is presented in Figure 1, and reflects the short and long-term goals from various activity-outcome linkages.[2] Notably, NEEA is completing its transition out of the hospitals SEM market, since significant market transformation has been documented in past MPERs for the Initiative. Some of the things that NEEA has done to facilitate the transition include:

- Created a group of Northwest utility advocates to act as SEM resources after NEEA's market exit;
- Supported ASHE's Sustainability Roadmap for Hospitals website and Energy to Care Campaign;
- Authored a comprehensive page white paper documenting the Initiative's legacy of market interventions;
- Developed utility-specific account briefs documenting hospital customers' SEM accomplishments (to build upon going forward);
- Developed Memorandums of Understanding (MOUs) with key regional hospitals to maintain relationships for new NEEA initiatives and obtain information about future SEM projects; and
- Updated the BetterBricks website with SEM tools and materials.

With this context, some of the key objectives for this evaluation were to:

1. Document the current status of market transformation in the Northwest, as NEEA transitions to monitoring and tracking;

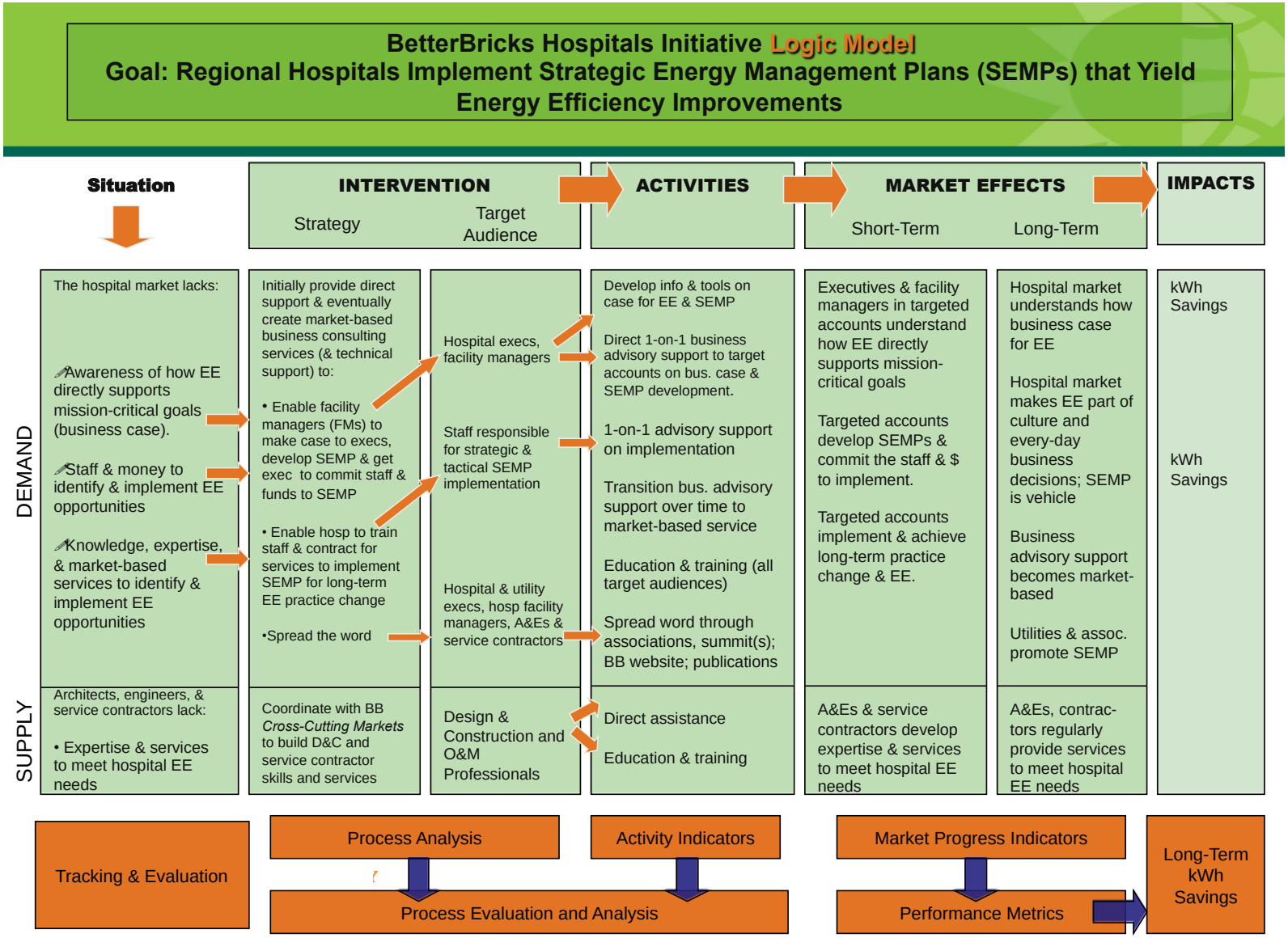
2. Document the services that leading design and construction and energy management firms are providing to their regional hospitals clients;

3. Document specific SEM activities that hospital are doing; and

4. Document current SEM implementation trends and challenges in the region, including how changing business models are likely to impact future energy consumption.

[2] For past results on these goals, refer to the 2010 BetterBricks Market Progress Evaluation Report (December 22, 2010) completed by the Research Into Action evaluation team.

Figure 1: Hospitals and Healthcare Initiative Logic Model



3 Evaluation Tasks

3.1 Market Characterization

For this task, we researched secondary data sources and publications to document trends in hospitals Energy Management and Information Systems, hospitals energy consumption by end use and emerging hospitals business model changes, which could affect energy consumption.

3.2 In-depth Interviews

Evergreen Economics conducted fourteen in-depth interviews with design and construction, and energy management professionals. The interviews focused on multiple topics, including: services offered to implement energy management and energy efficient design/construction, client perceptions of energy efficiency and SEM, market barriers to SEM adoption and persistence, perceived best energy management practices, and qualitative forecasts of future SEM adoption. Appendix A includes the interview guide used in this evaluation.

3.3 Northwest Hospitals Phone Survey

The Evergreen team completed 32 comprehensive phone surveys with facilities staff responsible for managing 54 hospitals, including several of the region's largest hospitals and hospital systems. A key goal of the survey was to benchmark progress against several Market Performance Indicators (MPIs) last measured in the 2010 MPER, including practices related to: building operations, capital improvements, life cycle costs analysis, design practices, strategic leadership, staff training and contracting with suppliers. Evergreen incorporated the questions from the 2010 MPER survey instrument that provided information for these metrics and replicated the question-weighting scheme. We also included additional questions to explore issues and topics illuminated during the aforementioned in-depth interviews. Appendix C includes the survey instrument used in the evaluation.

3.4 2013 Savings Validation

Our team reviewed project documentation provided by NEEA, the utilities and staff at participating hospitals to verify that methods used to derive savings claims were reasonable and that savings and rebate amounts were consistent between NEEA and project data providers.

4 Market Characterization

For MPER6 Evergreen used multiple data sources to characterize the Northwest H&H market, focusing on the number of facilities/beds in the market, construction and consolidation trends, and demand for SEM at the national level. For MPER7 we focused on the following three topics:

- Energy Management and Information Systems use among hospitals
- Hospitals energy consumption by end use
- Emerging hospitals business model changes that may affect energy consumption

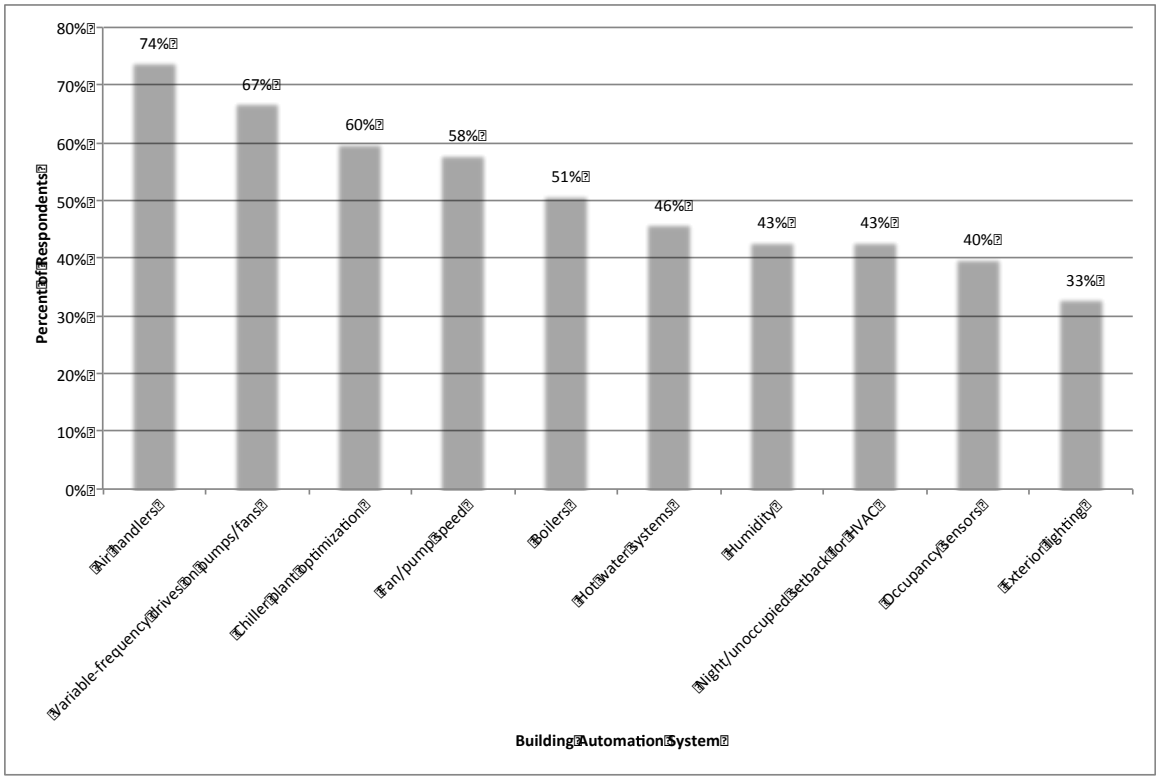
4.1 Energy Management and Information Systems

Energy Management Information Systems (EMIS) are software applications that acquire, store, analyze and display building energy use and system data. EMIS are distinct from, but can be integrated with, Building Automation Systems (BAS), which control energy using technologies in a facility. While BAS are commonplace in many facilities, fewer hospitals have EMIS.

Figure 2 below presents results from the 2011 Hospitals Energy Management Survey by Health Facilities Management, the American Society for Healthcare Engineering and the American Hospital Association about the prevalence of BAS.[3] More than half of all respondents reported having at least one of five building automation systems, for air handlers, variable-frequency drives on pumps/fans, chiller plant optimization, fan/pump speed and boilers. According to the 2011 Hospitals Energy Management survey, all BAS have increased since the 2006 survey.

[3]http://www.hfmmagazine.com/hfmmagazine/jsp/articledisplay.jsp?dcrpath=HFMMAGAZINE/Article/data/07JUL2011/0711HFM_FEA_CoverStory&domain=HFMMAGAZINE

Figure 2: Building Automation Systems Used in U.S. Healthcare Facilities



Source: 2011 Hospitals Energy Management Survey by Health Facilities Management, the American Society for Healthcare Engineering and the American Hospital Association

The 2011 Energy Efficiency Indicator (EEI) Healthcare Survey, administered by the Johnson Controls Institute for Building Efficiency (with others) found the following with regards to data collection and the presence of EMIS: [4]

- 82% of hospitals reported *measuring and recording* energy consumption data on at least a monthly basis.
- 48% of hospitals reported *reviewing and analyzing* energy consumption data on at least a monthly basis.
- 16% of respondents had adopted smart grid or smart building technology.
- When given a list of 12 on-site technologies, 33% of respondents indicated that they thought smart building technology such as EMIS would see the greatest level of adoption over the next decade. Only two technologies ranked higher among hospital

[4] http://www.institutebe.com/Energy-Efficiency-Indicator/Energy-Efficiency-Indicator-2011-EEI-Healthcare.aspx

respondents - lighting technologies and advanced building materials.

The results above indicate that while healthcare facilities have not adopted EMIS at the same frequency as BAS, there is a trend toward greater adoption of EMIS. The results also indicate that while healthcare facilities are commonly collecting energy consumption data, they are not always following through with analysis of this information, suggesting that where data is being collected, either through EMIS or other means, it is being underutilized.

These results are partly supported by information we heard during our interviews with NEEA staff and contractors, and participating hospitals in MPER6. One NEEA staff member noted that most facilities will have BAS but EMIS is not as common. Another noted that while there has been an increase in the use of EPA Portfolio Manager for energy use benchmarking, there has not been significant growth in adoption of EMIS such as Energy Expert in the Northwest. One last staff member noted that where EMIS are installed hospitals are unsure how to integrate them with their energy management practices.

In MPER 6 Evergreen asked facility managers at six participating hospitals what energy management systems they had in place. Of the six hospitals, four had a formal EMIS.

4.2 Hospital Energy Consumption by End Use

There is limited aggregate energy end use information available for the healthcare industry, making it difficult to assess longitudinal trends in end use energy consumption. At the national level, energy use information is available through the Commercial Building Energy Consumption Survey (CBECS).[5] The most recent CBECS end use data for the healthcare industry comes from 2003. Table 1 below presents the proportion of energy used by nine end uses across hospitals in the United States.

[5] 2003 Commercial Building Energy Consumption Survey (CBECS). http://www.eia.gov/consumption/commercial/data/2003/

Table 1: Proportion of Energy Consumption by End Use

End Use	% of Total	% of Electricity	% of Gas
Space Heating	37%	2%	50%
Water Heating	19%	1%	35%
Lighting	16%	42%	0%
Ventilation	8%	21%	0%
Cooling	7%	14%	0%
Other	7%	12%	10%
Cooking	2%	1%	4%
Office Equipment	2%	5%	0%
Refrigeration	1%	2%	0%

Source: 2003 CBECS

The three highest energy consumers in hospitals are space heating (37%), water heating (19%) and lighting (16%). The three highest electricity-consuming end uses are lighting (42%), ventilation (21%) and cooling (14%). Half of the natural gas consumption in hospitals is accounted for by space heating, with water heating being the next highest gas consuming end use. The 2003 CBECS reports that overall fuel use is split between 45% electricity and 55% fossil fuels, mainly natural gas.

At the regional level, the 2010 Targeting 100! Report produced by the Integrated Design Labs at the University of Washington used a database of 11 hospitals developed by NEEA to assess hospital end use consumption.[6] This report documents similar results to the 2003 CBECS:

- The fuel use split in Northwest hospitals tends to be 40% electricity and 60% fossil fuel.
- Space heating accounts for 40% of energy use, domestic hot water accounts for 15% of energy use, and building fans and pumps account for 16% of energy use.

While lack of available data makes it difficult to assess longitudinal trends in end use energy consumption, a benchmarking study conducted by the National Renewable Energy Laboratory suggests that a 50% reduction in energy consumption by large hospitals is achievable by focusing on energy design measures including: [7]

- Reduced lighting power densities.

[6] Targeting 100! Envisioning the High Performance Hospital: Implications for a New, Low Energy, High Performance Prototype. 2010. University of Washington's Integrated Design Lab. http://idlseattle.com/t100/TOL_DWN.php

[7] Large Hospital 50% Energy Savings: Technical Support Document. 2010. National Renewable Energy Laboratory. http://www.nrel.gov/docs/fy10osti/47867.pdf.

- Daylight sensors in applicable perimeter zones.
- Occupancy sensors in applicable zones.
- A multi-zone variable air volume dedicated outdoor air system with zone-level water-to-air heat pumps. The heat pumps share a common condenser loop whose temperature is maintained though the use of a chiller and boiler.
- High-efficiency chillers, boilers, and water heaters.
- Demand controlled ventilation.
- More efficient pumps.
- Integration of subsystems to achieve whole-building performance.

4.3 Hospitals Business Model Changes and Energy Consumption

The healthcare industry currently faces many economic, demographic, regulatory and technological changes leading to calls for new management strategies to address these challenges. A 2012 study conducted by KPMG suggested that these changes will require healthcare organizations to "do better with less, to improve quality and to manage margins on less revenue."[8] A common theme arising in strategic business model discussions is a transition from volume-based models to value based healthcare delivery models. That is, a transition from more traditional fee for service revenue models to revenue models based on better quality outcomes and affordable prices. KPMG highlights as a key conclusion from their study that "the critical task facing the healthcare system is to transform care delivery in support of higher performance at lower cost. This will require improved clinical integration with next-generation information technology and the sophisticated redesign of care."

How a transition from volume to value based strategies in healthcare will affect energy consumption is not explicitly discussed in the management strategy studies available, however we can speculate on what these changes may mean for energy consumption. A shift from a volume based model to a value based model where the emphasis is on providing quality care with fewer resources represents a philosophical shift that is likely to be more aligned with ideas of efficiency and sustainability. Under the value based model hospitals are going to be focused on developing leaner processes and finding ways to reduce costs, meaning that executive staff may be more open to exploring energy efficiency opportunities at the facilities level. Lastly, the value-based model emphasizes the need for integrated information technology systems, which may lead to a greater acceptance and understanding of BAS and EMIS at the facilities level.

[8] Transforming Healthcare: From Volume to Value. 2012. KPMG Healthcare & Pharmaceuticals. http://www.kpmg.com/th/en/issuesandinsights/articlespublications/pages/transforming-healthcare-from-volume-to-value.aspx

5 Market Actor Interviews

Evergreen Economics conducted fourteen in-depth interviews with design and construction, and energy management professionals. The interviews took place during April and May 2014. The key objectives of these interviews were to:

- Identify services offered to promote and implement energy management and energy efficient design and construction practices
- Assess hospital client perceptions of energy efficiency and SEM
- Identify market barriers to energy management adoption and persistence
- Detail perceived competition to SEM – e.g., LEED, ENERGY STAR buildings
- Inventory perceived best energy management practices
- Develop forecasts of future SEM adoption
- Understand interactions with NEEA and utilities
- Identify desires for additional tools and information from NEEA
- Identify potential areas of inquiry for the hospital staff phone survey task

Key Findings:

- All of the interviewed firms consider energy efficient design and energy management to be important client services.
- Facilities and operations staffs typically consider energy efficiency to be a high priority, but energy efficiency is a lower priority at the executive level. Energy efficiency is a higher priority at facilities where there is an identifiable "energy champion."
- Energy efficiency is a higher priority at facilities where the C-suite views energy efficiency as a cost effective way to reduce their overall operating expenses.
- Eight of the nine interviewed design and construction professionals are aware of and promote the ASHRAE guideline reducing required outside air in non-surgical areas.
- All interviewed design and construction professionals link improved patient outcomes with improved daylighting and natural ventilation in their promotion of energy efficient design and energy management. However there was some skepticism about the validity of these claims among the interviewees.
- The majority of interviewees are seeing more consideration and implementation of EMIS, although there are still barriers to EMIS adoption and optimal use including high costs and lack of expertise.
- Several interviewees have successfully used life cycle cost analysis in bidding on hospitals projects, however in general hospitals are still primarily focused on initial costs.
- All design and construction professionals were aware of Integrated Design for High Performance[9], and most had participated in an Integrated Design project for new

[9] Evergreen defined Integrated Design for High Performance as an iterative whole-building process that takes into account the interactive effects of two or more building systems (e.g., lighting, heating, cooling, envelope, etc.) to maximize energy efficiency.

construction. Several mentioned that Integrated Design was an important part of all their projects.

Some of the most frequently mentioned barriers to energy management adoption include:

- Limited capital availability
- Lack of understanding of savings potential
- Lack of executive level commitment
- Perception that energy costs are sunk costs
- High level of risk aversion within hospitals and perception that energy efficient changes introduce risks to patient outcomes and operational reliability
- Low priority on efficient building programs and certifications, since most hospitals are unclear on how they add value to their organization
- Cost control trends may lead to reduced capital projects and increased hospitals construction by developers rather than hospitals, with lower attention to energy efficiency. (Cost control trends may also increase interest in no-cost improvements and operations and maintenance opportunities.)

5.1 Interviewee Role and Firm Details

Evergreen interviewed fourteen design and construction, and energy management professionals including architects, engineers, and energy management consultants. All interviewees held senior level positions in their organizations, and most were company Principals. The architects and engineers worked for firms with significant experience in the healthcare industry (30% – 60% of their client base), and several interviewees specialized in healthcare services. Energy management consultants we spoke with had less exposure to the healthcare industry and in some cases had not worked with hospitals specifically, but had strong knowledge of energy management practices in general. We also conducted one interview with a health design specialist with broad experience in energy efficient design of healthcare facilities. Table 1 below details the number of interviewees by profession.

Table 2: Count of Interviewees by Profession

Category	Desired Number of Completes	Number of Interviewees
Architecture	5	5
Engineering	5	4
Energy Management	4	4
Other	1	1

Table 3 presents the number of individual hospitals and hospital systems served by the interviewees in the past two years across the four-state Northwest region. Where hospital systems are noted, multiple campuses were served. Several firms we spoke with work with hospitals in other U.S. regions and internationally.

Table 3: Hospitals Served by Interviewed Firms by State in the Previous Two Years

State	Number of Hospitals / Hospital Systems Served
Idaho	1 Hospital 2 Hospital Systems
Oregon	4 Hospitals 4 Hospital Systems
Montana	1 Hospital
Washington	9 Hospitals 4 Hospital Systems

In addition to hospitals, the interviewees' firms also serve clients in other sectors and industries including: government, education, manufacturing, science and technology, corporate offices, sport, hotels and restaurants.

5.2 Promotion of Energy Efficiency and Energy Management

Energy efficient design and energy management were important to all of the firms we interviewed. All interviewees stated that they actively promote energy efficient building design and energy management to their clients. Evergreen asked the interviewees what specific energy efficiency or energy management services or assistance they provide to their clients. A summary of the services provided by each group follows:

Architect Firms

- Energy efficient design for new construction
- Energy efficient design for renovations and expansions
- Master planning, including energy master plan development
- Design and construction administration, including equipment and materials procurement
- Identification and coordination of utility rebate and incentive programs and certifications

Engineering Firms

- Mechanical and electrical engineering services
- Energy efficient building and systems design
- Building commissioning and retro-commissioning
- Energy master plan development

- Energy management assistance including
    - Energy audits
    - Pre and post occupancy energy use modeling
    - Identification and prioritization of energy savings opportunities
    - Identification and coordination of utility rebate and incentive programs and certifications

Energy Management Consultants

- Strategic Energy Management services
    - Engaging with staff to gauge commitment
    - Organizational and technical assessment and energy audit services
    - Energy management planning services including performance metric, action plan and internal energy policy development
    - Implementation assistance
    - Evaluation services
- Energy data analysis and performance tracking
- Internal and external marketing assistance
- Training and technical assistance
- Identification and coordination of utility rebate and incentive programs and certifications

Architects and engineers noted that there is not a lot of variation in the general services they provide, although there are differences in the specific design elements and services across hospitals as each facility is unique. One energy management consulting firm offers both "one-on-one" SEM services as well as services through a "cohort" model of SEM service delivery.

5.3 Hospital Perceptions of Energy Efficiency

Reported perceptions of energy efficiency in hospitals varied somewhat across the interviewees from one architect who reported that for his clients, energy efficiency was taken very seriously, to two interviewees who reported that energy efficiency has "fallen off the radar." In general, interviewees reported that hospitals are aware of energy efficiency but the level of awareness and the priority of energy efficiency vary between hospitals and within hospitals. Common themes and key findings across the interviewees were:

- Facilities and operations staffs are often very aware of energy efficiency and recognize it as a high priority, but energy efficiency is a lower priority at the executive level.
- In some cases facilities staff are less receptive to energy efficiency because it places an additional burden on them, they are wary of complex systems and get blamed for failures, while the credit for savings is attributed to management.

- Energy efficiency is lower on the list of hospital priorities behind patient care, comfort and satisfaction, modernization of medical facilities, functionality, operational efficiency, staffing and cost containment.
- Energy efficiency is a higher priority in facilities where there is an identifiable "energy champion" among the staff.
- Energy efficiency is a higher priority at facilities where the C-suite view energy efficiency as a cost effective way to reduce their overall operating expenses.
- Energy efficiency garners attention in the planning and design phases of a project, but is a lower priority when it comes to committing capital to energy efficiency in the construction and commissioning phases.
- Some hospitals believe that energy efficiency comes with financial or operational risk. Some hospitals perceive high opportunity costs, for example, funds could be better spent on revenue generating devices that could have a greater impact on the bottom line. Operational risks include infection control and broader patient outcome concerns.
- Concerns about revenue reduction mean that many hospitals are trying to find areas to save money and are turning to energy efficiency as a way to reduce costs.
- One interviewee reported that a certain level of energy efficiency has become ingrained in hospital culture, but there is little perceived need or desire to exceed this level of efficiency.

As a follow up question, we asked interviewees to compare perceptions of energy efficiency among their healthcare clients to perception in other client sectors. Of the nine respondents to this question, three believed that energy efficiency was a higher priority for hospitals, while four stated energy efficiency was a lower priority for hospitals. Two interviewees stated that hospitals fell somewhere in the middle of the spectrum.

Reasons provided for lower priority in hospitals included:

- Uncertainty in the healthcare industry about revenue streams
- Concerns about patient care and reliability
- Healthcare as an industry is often slower to adopt new technologies due to greater bureaucracy and code restrictions

Reasons provided for higher priority in hospitals included:

- Hospitals are very high energy users so there is greater incremental benefit to energy efficiency
- Hospital staffs are more aware of energy efficient design concepts and therefore more willing to adopt
- Hospitals have more opportunities to implement energy efficiency than other sectors, particularly with regard to building envelope and air comfort delivery.

5.4 Energy Efficient Design and Management Practices

ASHRAE Guideline Reducing Required Outside Air in Non-surgical Areas

Four of the five architects were aware of the new guideline and were actively discussing the guideline with their clients although only one mentioned that they were implementing the guideline. One architect mentioned that they need support in working with infection control officers to develop more research on the appropriateness of the guideline. All four of the engineers we spoke with were aware of the guideline and were implementing it with their clients. Only one of the four energy management consultants was aware of the new guideline.

Improved Daylighting and Natural Ventilation

We asked if the interviewees' firms linked improved patient outcomes with improved daylighting and natural ventilation in their promotion of energy efficient design and energy management. Aside from two energy management consultants who had limited exposure to the healthcare industry, all respondents were aware of these benefits and promoted them to varying degrees. The respondents also raised the following points about this issue:

- Several respondents were not completely confident in the claims of improved patient outcomes attributable to these designs and noted that some physicians were skeptical of the studies. They felt that more research was needed.
- Many hospitals are averse to natural ventilation as it has the potential to introduce contaminants from outside air, which can be problematic for some patients and there is not complete control over airflow between areas of hospitals.
- Some respondents stated that natural ventilation is only feasible now for public areas of facilities and not in patient areas. Reasons for this are health department codes, staff reluctance to implement new systems, and concerns about patient outcomes.

Prevalence of Energy Management Information Systems (EMIS)

Most interviewees stated that they are seeing more consideration and implementation of EMIS. Many interviewees noted that hospitals are doing a good job benchmarking energy usage using tools like ENERGY STAR Portfolio Manager and either have or are considering implementing an EMIS. However, interviewees listed a number of barriers to EMIS adoption:

- The high cost of many EMIS limits the ability of smaller facilities to install them.
- Reluctance to invest in what is seen as a non-revenue generating system with returns that are hard to quantify (i.e., the business case is difficult to make).
- Lack of expertise, willingness and time to optimally implement EMIS.
- One interviewee noted that the 2011 EPA change in the ENERGY STAR Portfolio Manager hospitals comparison group led to reduced scores and frustration at some hospitals, and in some cases cancelation of benchmarking.

Adoption of Life Cycle Cost Analysis

We asked interviewees if, when they are bidding on hospital projects, they estimate initial costs only or calculate life cycles. Eight interviewees engage in formal bidding processes. Of these, six stated that they engage in some form of life cycle cost analysis in the bidding process but that their clients were usually focused on initial costs. Two interviewees stated that all

their bids are on an initial cost basis. All interviewees reported that they tried to engage their clients in discussions of life cycle costs but it was difficult in many cases to do this.

Familiarity with Integrated Design for High Performance
All five architects were familiar with Integrated Design for High Performance, with three having been involved in an Integrated Design project in the past. All three of these architects engage with mechanical engineers and energy modelers early in the Integrated Design process. All four engineers we spoke with are aware of Integrated Design and have been involved in Integrated Design projects in the past. Each of these engineers mentioned that the Integrated Design approach was important to their firm. In every case, they explained that they had been involved early in the project timeline.

The interviewees identified the following best practices among their clients:

- Use of EMIS to monitor systems and identify problems early. However, this interviewee noted that there are problems with persistence of EMIS use and staff turnover with this practice.
- Tracking energy consumption data normalized by a patient day variable as well as heating and cooling degree-days.
- Signing on to the Architecture 2030 Challenge[10].
- Setting up a retro-commissioning team to proactively test equipment and develop ongoing lists of energy savings opportunities.
- Installation of heat recovery chillers, exterior solar shading, chilled beams, and ground source heat pumps.
- Operating room turndown of air changes in unoccupied surgery areas.
- Benchmarking energy consumption with ENERGY STAR Portfolio Manager.

5.5 Energy Management Barriers

The interviewees noted the following barriers to energy efficient design and energy management adoption within hospitals.

Financial Barriers:

- Limited capital availability for energy efficiency improvements and new construction due to:
    - Decreasing revenue streams.
    - Uncertainty surrounding impacts of the Affordable Care Act.
    - Required investment in expensive electronic medical records systems.

[10] The Architecture 2030 Challenge asks the global architectural community to adopt energy consumption and emissions targets to achieve a carbon neutrality goal by 2030. More information is available at http://www.architecture2030.org/2030_challenge/the_2030_challenge

- Lack of knowledge among financial decision makers about the savings potential of energy efficiency.
- Perception that energy costs are sunk costs meaning there is often no imperative at the executive level to minimize these costs.
- Savings from operations and maintenance (O&M) changes are often not returned to O&M budgets creating a disincentive and lack of resources for energy efficiency adoption at the operations level.

Organizational Barriers:

- Lack of executive commitment to energy efficiency and general resistance to change.
- Hospitals are very risk averse and often perceive energy efficient system changes as having the potential to introduce risks to patient outcomes and operational reliability.
- Difficulty communicating energy management goals across all layers of the organization. Hospitals have a diverse array of occupants and stakeholders with differing priorities and needs, which are often higher priority or at odds with energy efficiency. For example, surgeons often want low temperatures in operating rooms, and doctors are concerned about the impact of outside air on patient health.
- Lack of time to give to energy planning in existing facilities. Facilities staff are generally in a reactive "fire-fighting" mode and often cannot find time to step back and strategize.
- Reluctance of facilities and operations staff to promote complex energy efficient systems. There is a disincentive for facilities staff to promote these systems because if there are problems with the system they carry the burden of blame, whereas if there are savings, the credit is attributed to management.
- Potential for complacency at efficient facilities. One interviewee noted that some hospitals might have made progress to the point where the marginal benefits of further investment in energy efficiency seem small.

Operational Barriers:

- Building codes in the healthcare sector will continue to pose a challenge for energy efficiency.
- Facilities staffs have limited time to devote to energy efficiency.
- Requirements for operational up time make planning for energy retrofits challenging.

5.6 Energy Management Trends

Efficient Building Programs and Certifications

The majority of architects and engineers indicated that efficient building certifications are not a high priority for their hospital clients. While hospitals would often like to know how their facilities compare with programs such as LEED and ENERGY STAR, they are generally not willing to pay the cost for certification, and they are unclear on how certifications add value to their business. Several interviewees mentioned that their clients participated in ENERGY STAR, but also mentioned that many are disgruntled about the program after recent changes to the scoring system.

We also asked interviewees if they felt that building certification programs such as LEED and ENERGY STAR complement or compete with SEM. Generally, interviewees felt that the building certification and SEM were complementary, stating that building certifications were beneficial in that they keep awareness of energy efficiency in the fore, help initiate a conversation about energy efficiency, provide a way for hospitals to compare themselves against the market and provide valuable education and training. However, interviewees also noted that in some ways these approaches could be at odds with one another. One consultant noted that in some ways LEED is more comprehensive than SEM in that it encompasses water and waste management and could therefore be seen more far-reaching than SEM. Another noted that there can be a tendency for building owners to see certification as the completion of their energy efficiency requirement and therefore be disinclined to take any further action. Compounding this are building codes in Washington and Oregon that are already more stringent in some cases than the certification programs, making certifications more of a formality and again contributing to the impression that the energy efficiency job is done.

Impact of Cost Control Trends and Medical Practice Changes

We asked the interviewees how emerging cost control trends and changes in medical practices might affect hospital design and opportunities for energy efficiency. Interviewees noted that cost control trends could:

- Lead to reduced investment in capital projects and new construction.
- Contribute to a trend of developers constructing new hospitals rather than hospital systems, which could lead to less investment in energy efficient design and energy efficient technologies.
- Increase interest in no-cost improvements and operations and maintenance opportunities.
- Increase the number of joint venture projects, as in the collaboration between Kaiser Permanente and Legacy at the Salmon Creek Medical Center.

The consensus among the interviewees was that the major trend in healthcare is toward conducting medical procedures in outpatient facilities and reducing inpatient time. This trend is manifesting in increased construction of medical offices and outpatient clinics. These facilities typically have much less intense energy usage. While traditional hospitals will have higher levels of energy consumption for each individual patient served, because hospitalized patients will tend to be sicker, the net effect is likely to be a reduction in energy consumption across the healthcare sector.

Another trend noted by one interviewee was a move toward integrated care teams. Under this model private offices are removed, and replaced with staff common areas that are situated close to patient rooms. The goal is to reduce the distance between staff and patients and minimize the amount of time spent by staff circulating. The impact on energy consumption of this trend is not yet known. There may be opportunities for efficiency gains due to shared

workspaces but there are also indications that there could be negative impacts on efficiency due to increased air circulation.

We also asked interviewees if their hospital clients were outsourcing their energy management operations or if they were trending toward in-house energy management. The majority of interviewees noted that their clients typically managed their energy operations in-house with very little outsourcing observed. One interviewee noted that he has seen some outsourcing to energy service companies among smaller community hospitals.

All but one interviewee believed that energy management at hospitals in the Northwest would increase over the next five years. Reasons given for increasing energy management included:

- Energy efficiency is becoming more "mainstream"
- Research based evidence that energy efficiency and green building have significant non-energy benefits in the healthcare environment
- Legislation and codes will require hospitals to be more efficient
- Programs like E2C[11] and the 2030 Challenge[12] will drive hospitals to energy efficiency
- Hospitals need to find cost savings and energy efficiency is going to evolve as a "natural place" to find savings

5.7 Interactions with NEEA and Utilities

Four of the fourteen interviewees had worked directly with NEEA through the BetterBricks or the Hospitals and Healthcare Initiative. In one case, NEEA provided assistance in the early design phase of some new construction projects.[13] The individual felt that it was beneficial to have NEEA (in the form of IDL representative or other consultants) represented in the room to lend credibility to the design plans. In another case, NEEA had provided funding for research into daylighting, ventilation and shading, and collaborated with the firm in developing case studies. The remaining interviewees who had worked with NEEA could not recall the specific services provided.

All of the interviewees had coordinated with electric or gas utilities in some way to promote energy efficiency. Most of these interactions have been based around securing rebates and incentives for energy efficiency. In some cases, utilities have been involved in projects to provide assistance with savings calculations. Two consultants are also working with utilities outside of the Northwest, and expect more SEM uptake by utilities in general. As traditional

[11] The ASHE Energy Efficiency Challenge (E2C) encourages hospitals across the nation to reduce their energy consumption by 10% or more over a 12-month period.

[12] The 2030 Challenge encourages the architecture and building communities to adopt targets to achieve carbon neutral new buildings by 2030.

[13] While individual interviewees may not recall NEEA involvement, NEEA worked closed with 5 projects in the early design phase with hospital systems associated with the interviewed firms.

incentive programs begin to approach maximum savings utilities will be looking for new ways to extract savings from their client base and SEM "will be a part of this conversation."

In general, interviewees stated that their firms have sufficient tools and resources to support their energy efficiency services. Areas where the interviewees thought that NEEA could provide additional assistance include:

- NEEA could restore recently reduced funding for the Integrated Design Labs (IDL), as the IDL provides critical services to help hospitals reach their energy savings targets.
- NEEA could help develop methods for measuring behavioral savings and work with the Regional Technical Forum (RTF) to adopt these methods.[14]
- NEEA could develop more case studies, which are a valuable tool for making the business case for energy efficiency and management to hospitals executives.
- Several interviewees would like NEEA's assistance in directly promoting energy management to hospital executives.

[14] NEEA is currently working with the RTF to develop savings estimation methods for SEM.

6 Northwest Hospitals Phone Survey

This chapter provides findings from a regional phone survey with hospitals facility managers. CIC Research conducted the survey between July 15, 2014 and September 1, 2014. The goal of the survey was to gain insights into regional SEM market penetration, trends and opportunities and allow comparisons with the 2010 BetterBricks MPER phone survey results.

6.1 Survey Population

The survey population was the population of small, medium and large hospitals in the four Northwest states tabulated in MPER6. Consistent with the 2010 MPER we defined large hospitals as hospitals with 300 beds or more. Medium hospitals are defined as hospitals with 150 to 299 beds in Oregon and Washington and with 100 to 299 beds in Idaho and Montana. In addition, we included a small hospitals segment to gain insight into the development of SEM practices among smaller hospitals and increase the pool of potential survey participants. We defined small hospitals as hospitals with 50 to 149 beds in Oregon and Washington and between 50 and 99 beds in Idaho and Montana. The resulting population contained 133 small, medium and large hospitals, which operate approximately 26,500 beds. Table 4 presents the hospital population by participation in NEEA's Initiative and size.

Table 4: Hospital Population by Participation Status and Size

Status / Size	# Facilities	# Beds
Participating		
Large	11	5,264
Medium	11	1,978
Small	8	855
Sub-Total	**30**	**8,097**
Non-Participating		
Large	18	7,209
Medium	36	7,164
Small	49	4,015
Sub-Total	**103**	**18,391**
Total	**133**	**26,488**

6.2 Survey Disposition

Overall, the survey recruitment process was very challenging owing to the busy schedules of the targeted facilities managers. CIC contacted each facility contact at least 10 times prior to eliminating them from the sample frame. CIC completed 32 interviews with staff responsible for managing 54 hospitals. This represents 41% of small, medium and large hospitals in the Northwest and 48% of hospital beds. Table 5 shows the distribution of completed phone surveys.

Table 5: Hospital Survey Disposition by Participant Status and Size

Status / Size	Interviews Completed (Facilities)	Interviews Completed (Beds)	Population (Facilities)	Population (Beds)	% of Facilities Interviewed	% of Beds Represented in Interviews
Participating						
Large	10	4,700	11	5,264	91%	89%
Medium	6	1,029	11	1,978	55%	52%
Small	6	631	8	855	75%	74%
Sub-Total	**22**	**6,360**	**30**	**8,097**	**73%**	**79%**
Non-Participating						
Large	7	2,690	18	7,209	39%	37%
Medium	12	2,311	36	7,164	33%	32%
Small	13	1,280	49	4,015	27%	32%
Sub-Total	**32**	**6,281**	**103**	**18,391**	**31%**	**34%**
Total	**54**	**12,641**	**133**	**26,488**	**41%**	**48%**

6.3 Survey Results

The 2010 MPER developed MPI scores, based on the BetterBricks logic model to measure the progress in the market of Initiative best practices. Table 6 presents the proportion of each market segment, in terms of beds managed, that has adopted practices associated with the Initiative MPIs, compared to the same MPI proportion from the 2010 MPER. [15] It is important to note the following about these results:

- The 2010 MPER surveyed medium and large hospitals only, whereas, Evergreen also surveyed small hospitals. Therefore, readers should compare column 1 "2010 Total Market (Medium & Large)" with column 2 "2014 Medium & Large Facilities", rather than comparing with the 2014 Total Market in column 7.
- The 2010 MPER includes two categories for non-participant hospitals, "non-participant" and "Light Touch".[16] For the current MPER we did not make these distinctions. As a result we cannot make comparisons across non-participant hospitals sub-groups.
- The 2010 MPER did not achieve an adequate number of completes to achieve the goal of 90/10 confidence/precision, therefore the proportions reported are suggestive rather than precise.
- The 2010 MPER rounded the MPI results to the nearest 5% for ease of interpretation, whereas the 2014 results are unrounded.

[15] See Appendix C for the question weighting scheme used for this evaluation.

[16] Light Touch hospitals were defined in the 2010 MPER as hospitals with exposure to BetterBricks through the website, training events and other outreach but that had not worked closely with BetterBricks.

Table 6: Proportion of Market Segment Evidencing MPIs

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Building Operations	**70%**	**58%**	**51%**	**95%**	**85%**	**46%**	**55%**
Benchmarking	45%	32%	20%	80%	76%	12%	27%
Tracking and Reporting	60%	51%	49%	95%	100%	35%	50%
Energy Performance Targets	70%	61%	52%	85%	66%	55%	58%
EE Plan	75%	51%	52%	70%	66%	47%	51%
EE Study	65%	66%	62%	80%	100%	53%	64%
EE Tune-Up	85%	85%	68%	100%	100%	71%	78%
Life Cycle Cost Analysis	**70%**	**70%**	**62%**	**80%**	**90%**	**59%**	**67%**
Capital Improvements	**80%**	**96%**	**81%**	**85%**	**100%**	**87%**	**90%**
Design Practices	**60%**	**63%**	**46%**	**65%**	**77%**	**50%**	**56%**
ID Awareness	60%	55%	36%	70%	83%	37%	48%
ID Modeling	50%	55%	42%	80%	83%	40%	50%
ID Activities	75%	70%	46%	70%	59%	62%	61%
ID Features	75%	70%	62%	95%	83%	62%	67%
Strategic Leadership	**50%**	**53%**	**39%**	**35%**	**91%**	**34%**	**48%**
Executive Commitment	70%	58%	36%	60%	100%	34%	50%
Vision	50%	48%	42%	35%	83%	34%	46%
Mobilize the Organization	**15%**	**48%**	**31%**	**15%**	**59%**	**36%**	**42%**
Communicating Expectations	15%	29%	27%	25%	59%	18%	28%
Training	20%	59%	33%	15%	59%	46%	49%
Contracts with Suppliers	**40%**	**40%**	**20%**	**35%**	**59%**	**24%**	**32%**
Overall Penetration	**40%**	**55%**	**41%**	**50%**	**76%**	**41%**	**50%**

In the following sections we highlight key comparisons between MPIs between the 2010 and 2014 surveys. In addition, we present the results of additional questions that were added to the survey to provide more detail on trends and opportunities going forward.

Overall Penetration

The Overall (SEM) Penetration MPI is a weighted score derived from the 7 primary MPIs.[17] Overall penetration of SEM elements appears to have increased since the 2010 MPER survey. Penetration of SEM elements in the medium and large market segment increased from around 40% to 55% and penetration at participating facilities increased from approximately 50% to around 75%. SEM elements have penetrated approximately 40% of the market among small and non-participant facilities and close to 50% of the total market in the Northwest. *NEEA has a formal goal that hospitals representing 25% or more of regional beds will be committed to and practicing SEM elements, and NEEA continues to exceed this goal.*

The 2010 MPER found for the first time that participant facilities had adopted BetterBricks best practices in greater proportions (50%) than non-participants (20%).[18] The 2014 survey continues this trend, with a greater proportion of participants (76%) adopting these practices than non-participants (41%). As both segments have increased overall adoption of SEM practices, we surmise that:

1. Participation in NEEA's Initiative increases the likelihood of adoption of energy efficient practices.
2. Adoption of energy efficiency practices has increased in the general population due to diffusion of NEEA's Initiative principles from participants to the wider market.

As we note in further detail below, the increase in overall penetration of best practices was due to increases in best practices related to:

- Contracts with Suppliers
- Mobilizing the Organization through training and communication of expectations
- Strategic Leadership
- Design Practices and Capital Improvements

Increases in these areas offset apparent decreases in best practices related to Building Operations.

Building Operations

[17] To calculate Overall Penetration of SEM the 7 MPIs are weighted as follows: Building Operations (0.18), LCCA (0.05), Capital Improvements (0.05), Design Practices (0.18), Strategic Leadership (0.18), Mobilize the Organization (0.18), Contracts with Suppliers (0.18).

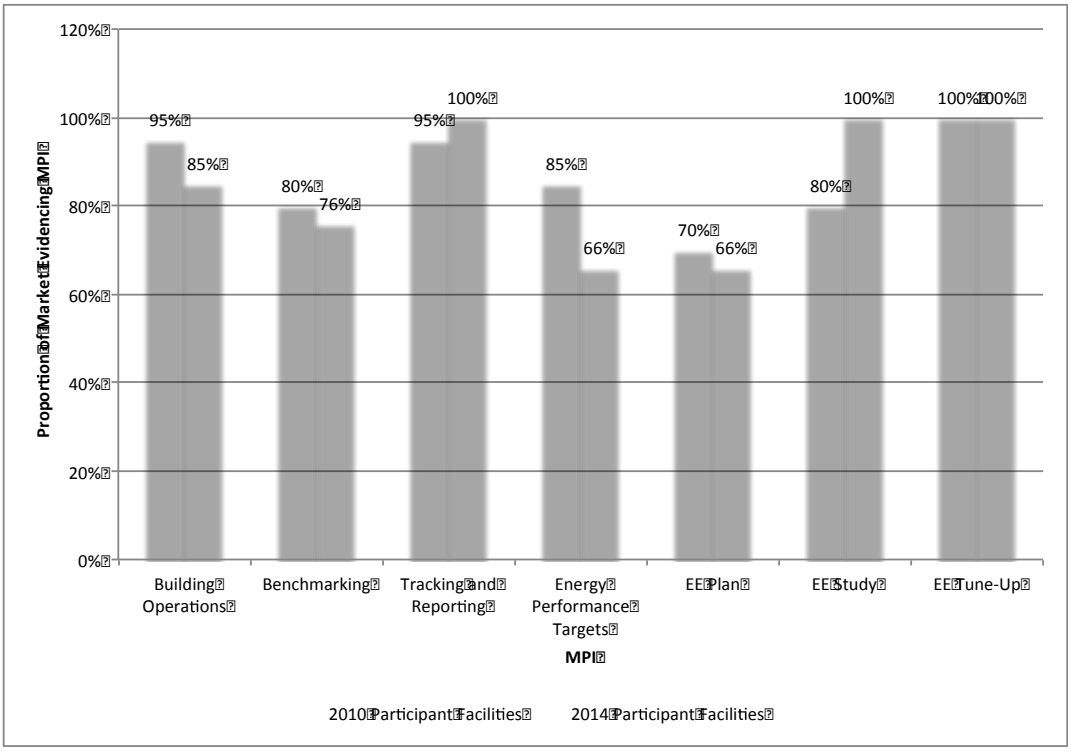
[18] The Hospitals & Healthcare Initiative was previously part of the BetterBricks Initiative evaluated in the 2010 BetterBricks MPER. The BetterBricks best practices defined in the 2010 MPER are also applicable to the Hospitals & Healthcare Initiative.

The Building Operations MPI is a combined score derived from 6 sub-metrics: Benchmarking, Tracking & Reporting, Energy Performance Target Setting, Energy Efficiency Planning, Energy Efficiency Studies and Energy Efficiency Tune Up.[19]

The results suggest that there has been an overall drop-off around 10% in the proportion of the medium and large hospitals market engaged in Building Operations best practices since the previous study, with all sub-metrics with the exception of EE Study and EE Tune-Up, which saw no noticeable change, seeing a decrease in the large and medium hospital market. As noted previously, given the small sample size of the MPER 2010 results this should be interpreted with caution.

Participating hospitals also show an apparent decline in the adoption of building operations best practices with a difference of approximately 10% as seen in Figure 1 below.

Figure 3: Prevalence of Building Operations MPIs among Participating Hospitals: 2010 and 2014



Differences in the elements that comprise the Building Operations MPI shed light on current trends in building operations practices in the market among participating hospitals. While there were some small declines in the prevalence of benchmarking and energy efficient plans

[19] To calculate the Building Operations MPI a weight of 0.167 is applied to each sub-metric score.

among participating hospitals, these are unlikely to be significantly different. However, there appears to have been a significant decline in setting energy performance targets among participating hospitals from 85% to 66%. Meanwhile, the prevalence of EE studies increased among participating hospitals from 80% to 100%. These findings suggest that participating hospitals have taken advantage of initial "low hanging" opportunities with predictable energy savings and are currently searching for new, innovative opportunities with less predictable energy savings.

Despite some apparent declines in building operations best practices, overall, their prevalence remains high among both participating hospitals and the total hospital market in the Northwest including small hospitals. Over half the hospital market in the Northwest has specific energy reduction targets, is involved in tracking and reporting energy usage and has an actionable energy plan.

We also asked interviewees additional questions to better understand their building operations practices, success and barriers. We asked the 2014 interviewees if they had seen an improvement in the energy performance of their buildings over the past three years. Table 7 shows that 87% of the respondents have seen improved energy performance in at least one of their buildings. All of the surveyed medium and large facilities have seen an improvement along with 96% of participant facilities.

Table 7: Have you seen an improvement in the energy performance of any of your buildings?

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
Yes	83%	100%	71%	96%	87%
No	1%	0%	29%	4%	13%

We then asked respondents what changes they had made that were the most likely to have led to improved energy performance. Table 8 reports some of the most common responses to this question. As can be seen, lighting upgrades, HVAC upgrades and O&M adjustments were the most mentioned causes of improved energy performance.

Table 8: Reported Changes Leading to Improved Energy Performance

Energy Efficiency Activity	% of Respondents (n=47)
Lighting Upgrades	56%
Upgrade Replace HVAC	40%
O&M Adjustments	36%
Upgrade or Install Controls	36%
New or Upgraded AHU	28%
Equipment Upgrades / Repairs	16%
Drives and Motors	8%
Energy Management Plan	4%

We followed this question by asking how they were measuring the improved energy performance they had seen. Table 7 shows that most common measurement activity was internal pre-post billing analysis.

Table 9: Energy Performance Measurement Activities

Measurement Activities	% of Respondents (n=45)
Billing Analysis	52%
Monitoring EUI	16%
Sub-metering	16%
Independent Audit	16%
Internal Audits	8%
ES Portfolio Manager	8%
Utility Rebates	4%

Approximately 60% of respondents reported that they had set an energy performance goal or target for at least one of their buildings. Interestingly, no participant facilities claimed to have met their goals and only 13% of the total market had met its goals.

Table 10: Success in Meeting Energy Performance Goals

	2014 Small Facilities (n=9)	2014 Medium & Large Facilities (n=23)	2014 Non-Participant Facilities (n=15)	2014 Participant Facilities (n=17)	2014 Total Market (n=32)
Yes	0%	18%	20%	0%	13%
No	100%	82%	80%	100%	87%

Table 11 presents a list of the primary barriers to meeting energy performance goals that respondents mentioned. The most commonly mentioned barrier was the financial capacity of the organization, followed by staff capacity and lack of time.

Table 11: Primary Barriers to Meeting Energy Performance Goals

Barrier	% of Respondents (n=29)
Financial Capacity	62%
Staff Capacity	21%
Available Time	10%
Executive Commitment	10%
Lack of Plan/Goals	10%
Competing Priorities	7%
Lack of Knowledge	7%
Opportunity Identification	3%
Low Incentives	3%

Energy Management Information Systems (EMIS)

Table 10 shows the prevalence of EMIS usage among the survey respondents. The use of EMIS is dramatically higher among hospitals that participated in the H&H Initiative (83%) than among the general market (24%). Medium and large facilities tend to implement these systems somewhat more often than smaller facilities. This finding is not surprising as most Initiative participants are system hospitals with more resources to implement an EMIS.

Table 12: Does your facility use an Energy Management Information System?

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=33)	2014 Non-Participant Facilities (n=30)	2014 Participant Facilities (n=22)	2014 Total Market (n=52)
Yes	17%	28%	3%	83%	24%
No	83%	72%	97%	17%	76%

We asked those hospitals with EMIS if they were encountering any challenges in using the EMIS to its full potential. One interviewee noted that there were challenges with the reliability of the (unspecified) system they were using. A second interviewee listed staff knowledge of the system, the ability to devote time to learning the system and the ability of staff to keep the system updated with data in a timely manner were significant challenges.

For those hospitals that had not yet adopted an EMIS, we asked if their organization was considering doing so. Table 13 shows that consideration of EMIS is relatively high among the hospitals we interviewed. Fifty percent of the total market that have not adopted EMIS is considering this option including both the remaining participating hospitals.

Table 13: Has your organization been considering using an Energy Management Information System?

	2014 Small Facilities (n=13)	2014 Medium & Large Facilities (n=19)	2014 Non-Participant Facilities (n=30)	2014 Participant Facilities (n=2)	2014 Total Market (n=32)
Yes	46%	56%	50%	100%	50%
No	54%	45%	50%	0%	50%

We then asked the interviewees from hospitals that had not adopted EMIS what the primary barriers to adoption were. A list of the main barriers appears in Table 14. The main barriers are lack of available funds to invest in EMIS, lack of knowledge of the EMIS or how to use them, and the perception that EMIS is a low priority.

Table 14: Barriers to Adopting EMIS

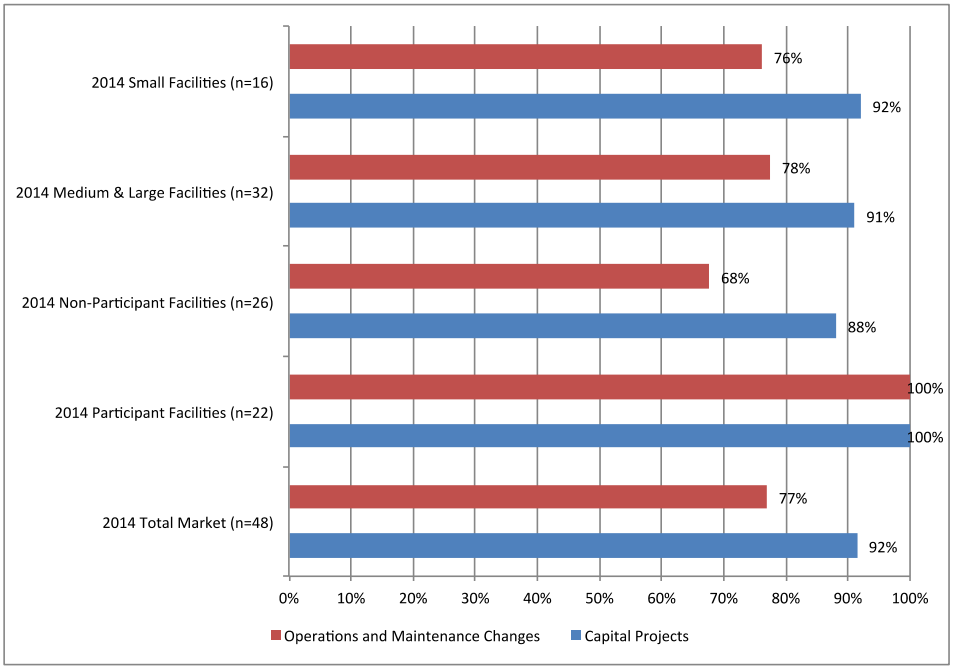
Barrier to EMIS	% of Respondents (n=29)
Funding	44%
Lack of Knowledge	28%
Low Priority	24%
Not Suitable	8%
Time Constraint	8%
Loss of Knowledge	4%
Lack of Awareness	0%

Energy Efficiency Studies

The survey analysis shows that Energy Efficiency studies are an area were hospitals, particularly those that participate in the H&H Initiative, are investing. We asked additional questions to better understand the type of studies hospitals were doing and what actions may be resulting from the studies. We asked the facilities staff if they had conducted any studies in the past 3 years and if so, whether the studies were looking for operations and maintenance (O&M) changes or capital projects that might lower energy costs. Figure 4 below presents the findings from these questions. All of the participating hospitals that conducted studies looked for both capital projects and O&M changes to enhance energy efficiency. The broader market

tends to focus more on capital projects (approximately 90%) than O&M (approximately 70%) opportunities.

Figure 4: Focus of Energy Efficiency Studies: O&M changes or Capital Projects

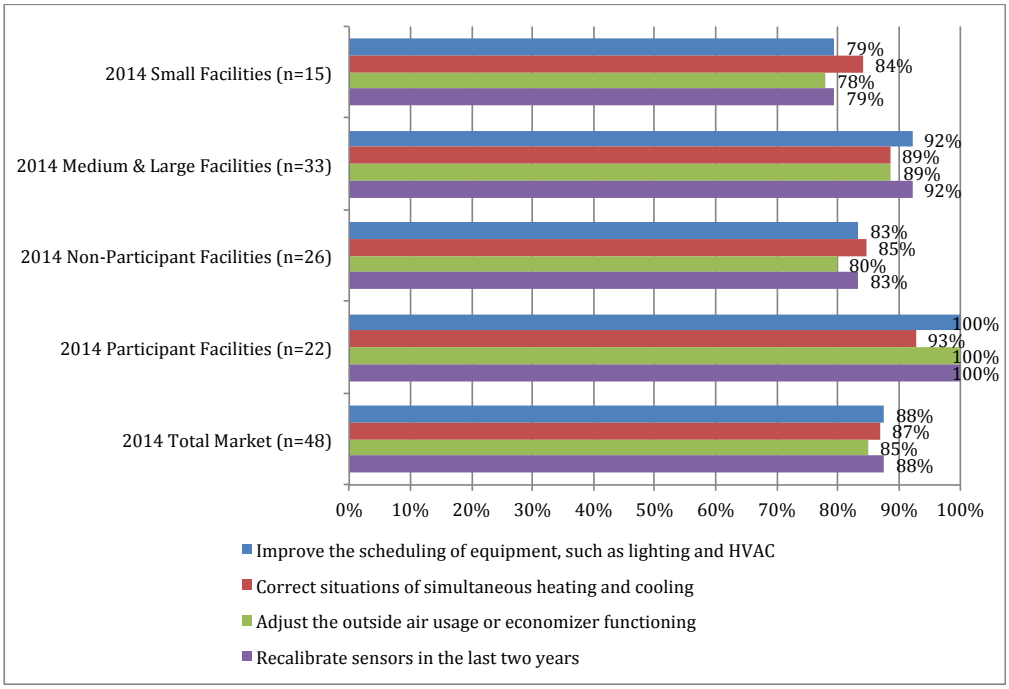


To investigate the types of O&M changes that hospitals are investigating, we asked if in the last two years hospitals had done or identified the need to do any of the following:

- Improving scheduling of HVAC or Lighting equipment
- Correcting situations of simultaneous heating and cooling
- Adjusting outside air usage or economizer functioning
- Recalibrating sensors

Figure 5 presents the results of the responses. Again, participant facilities engage in these practices more than non-participant hospitals, although every segment has a high rate of adoption of these practices, in excess of 75%.

Figure 5: Select O&M Changes Adopted by Hospitals



Lastly, we asked respondents what strategies they employed to ensure that the O&M activities they implement remain in place and will be long-lasting.

Table 15: Strategies to Ensure O&M Longevity

Strategies	% of Respondents (n=44)
Monitoring	36%
Standardizing / Preventive Maintenance	36%
Energy Plan	18%
Meetings / Institutional Review	14%
Dedicated Staff	9%
Continuous Commissioning	9%
Educating Staff	5%

Life Cycle Cost Analysis (LCCA)

Between 2010 and 2014 LCCA increased from 80% to 90% among participant hospitals, although adoption among all medium and large hospitals remained level at 70%.

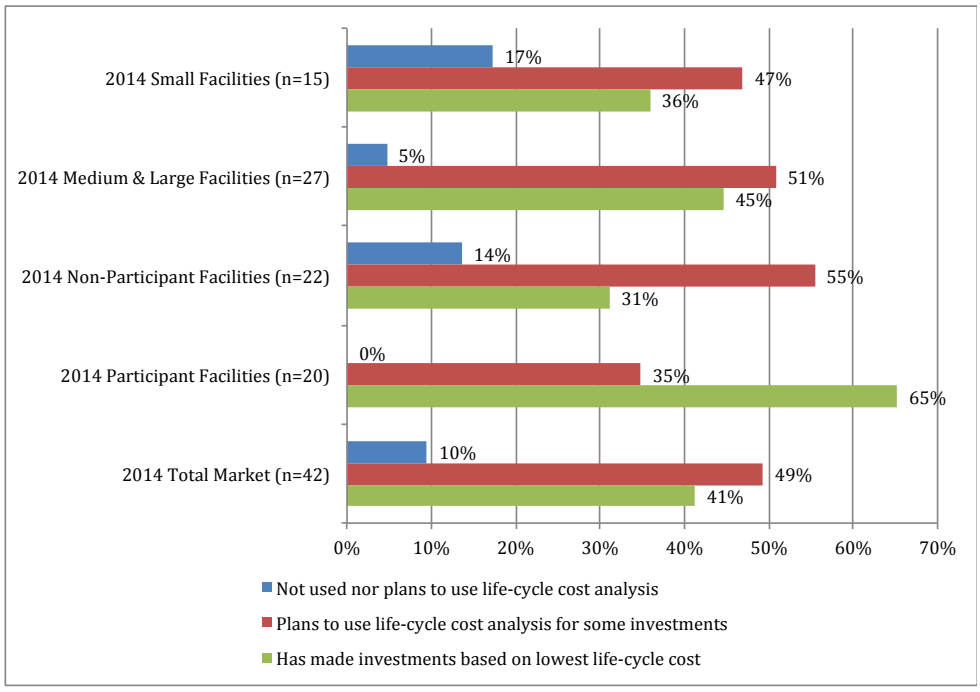
Table 16: Proportion of Market Evidencing LCCA MPI

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Life Cycle Cost Analysis	70%	70%	62%	80%	90%	59%	67%

Note 1: Excerpt from Table 6 included for easy reference.

We asked interviewees to describe their organization's investment decision making with respect to LCCA to try to gain further insight into the use of LCCA. As shown in Figure 4, participant facilities are much more likely to have used LCCA in an investment decision. Those participant facilities that have not already used LCCA plan to do so in the future for some investments. Non-participating facilities are less likely to have used LCCA in the past but more than 50% plan to do so in the future. Medium and large facilities are more likely to have engaged or plan to engage in LCCA than small facilities.

Figure 6: Organizational Investment Decision Making with Respect to LCCA



Integrated Design Practices

The Design Practice MPIs between the 2010 MPER and this evaluation saw no significant change for the total medium and large hospitals market. The proportion of participant

hospitals exhibiting design practice MPIs increased by approximately 10%, largely influenced by increase in Integrated Design awareness and modeling.

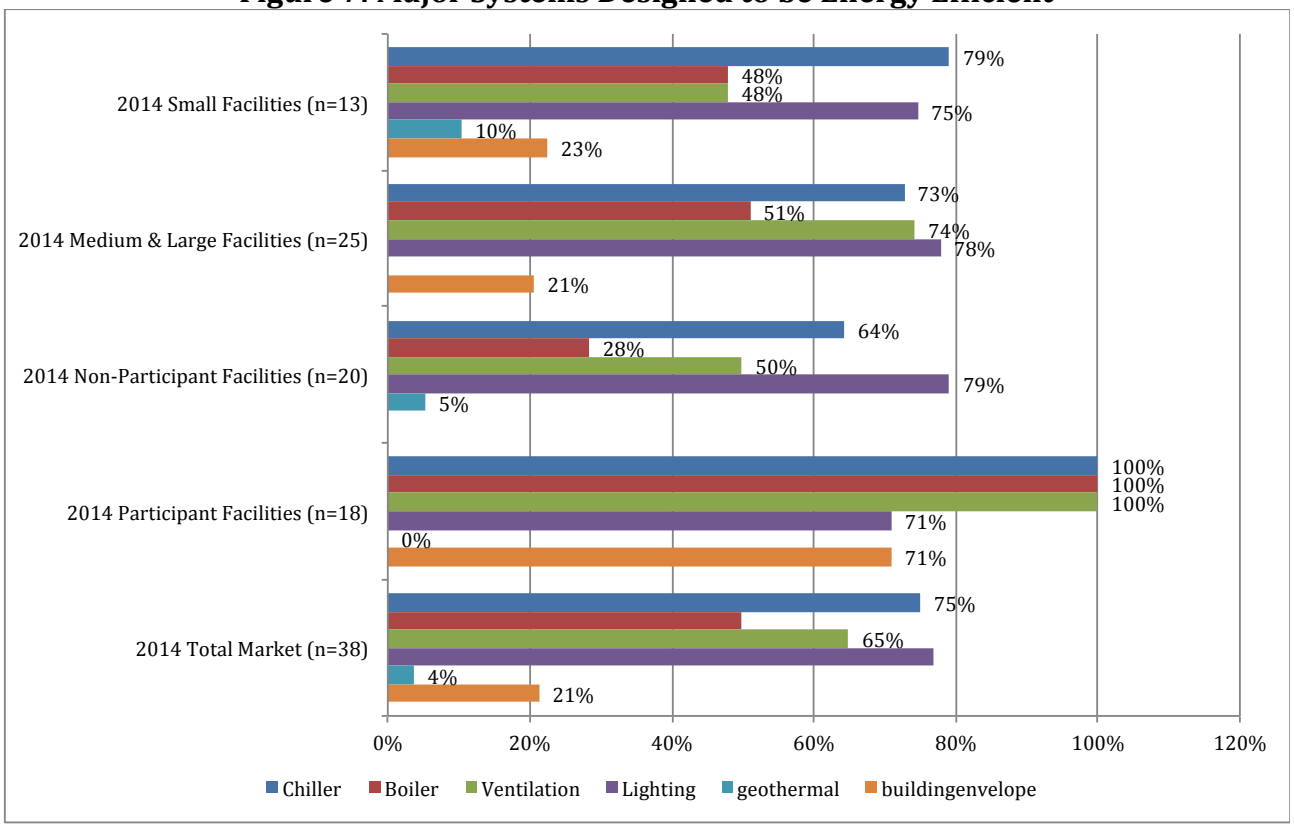
Table 17: Proportion of Market Evidencing Design Practices MPI

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Design Practices	**60%**	**63%**	**46%**	**65%**	**77%**	**50%**	**56%**
ID Awareness	60%	55%	36%	70%	83%	37%	48%
ID Modeling	50%	55%	42%	80%	83%	40%	50%
ID Activities	75%	70%	46%	70%	59%	62%	61%
ID Features	75%	70%	62%	95%	83%	62%	67%

Note 2: Excerpt from Table 6 included for easy reference.

To further investigate what applications may have involved integrated design practices we asked interviewees who had been involved in the design of a new construction, renovation or addition project an additional question. We asked if any major systems, such as chillers, boilers, ventilation, lighting systems or other systems were designed to use significantly less energy that in comparable facilities or less energy than required by code.

Figure 7: Major Systems Designed to be Energy Efficient



As can be seen in Figure 7, 100% of participant facilities where the respondent was involved in the design process, designed chillers, boilers and ventilation systems to be energy efficient, as well as some lighting and building envelope projects. Non-participant facilities showed less inclination to design energy efficient systems although 50% or more reported that they designed some lighting systems, chillers and ventilation systems to be energy efficient.

Strategic Leadership

Strategic leadership is very strong at participating hospitals (91%) with 100% of this market segment evidencing best practices related to executive commitment and 83% exhibiting best practices related to having an energy efficient vision for the organization. This is an increase of approximately 55% over the strategic leadership MPI from the 2010 MPER and 55% higher than 2014 non-participant facilities.

Table 18: Proportion of Market Evidencing Strategic Leadership MPI

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Strategic Leadership	**50%**	**53%**	**39%**	**35%**	**91%**	**34%**	**48%**
Executive Commitment	70%	58%	36%	60%	100%	34%	50%
Vision	50%	48%	42%	35%	83%	34%	46%

Note 3: Excerpt from Table 6 included for easy reference.

To investigate the extent of executive commitment we asked interviewees additional questions regarding the perceived level of executive commitment and motivation behind this commitment. We asked interviewees to rank the priority of energy efficiency from the perspective of senior management at their facility on a scale of 1 (very low) to 10 (very high). Not surprisingly, the lowest rankings are among the non-participating facilities with small differences between the small and medium/large facilities. Considering the number of other priorities facing senior management in the hospital industry these results suggest that energy efficiency is a relatively high priority. Notably, there is a possibility of bias in these results as we primarily surveyed facilities managers, for whom energy efficiency may be a high priority.

Table 19: Priority of Energy Efficiency from the Perspective of Senior Management

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
1	0%	0%	0%	0%	0%
2	5%	3%	6%	0%	4%
3	16%	20%	16%	23%	19%
4	5%	3%	6%	0%	4%
5	11%	23%	25%	9%	19%
6	11%	3%	9%	0%	6%
7	16%	11%	16%	9%	13%
8	37%	29%	13%	59%	32%
9	0%	3%	3%	0%	2%
10	0%	6%	6%	0%	4%
Average	6.0	6.0	5.7	6.5	6.0
Median	7	6	5	8	7

We next asked interviewees if senior management at their organization believed a commitment to sustainability or energy efficient facilities provides a strategic advantage in

their marketplace. Table 20 presents the results of this question. Over 75% of respondents in each segment answered positively. Interestingly, and somewhat counter to the previous question, participant facilities responded that senior management was less likely to believe a commitment to sustainability provides a strategic advantage (77%) than non-participant facilities (84%).

Table 20: Does senior management believe a commitment to sustainability or energy efficient facilities provides a strategic advantage?

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
Yes	84%	80%	84%	77%	82%
No	16%	20%	16%	23%	19%

The main reason interviewees gave for commitment to energy efficiency and/or sustainability is financial - that energy efficiency is an avenue to save money that can be used to provide better services to their customers and community. Other reasons given include awareness of environmental issues and alignment with the organizations mission.

Table 21: Main Reasons for Senior Management Interest in Energy Efficiency or Sustainability

Reasons	% of Respondents (n=44)
Financial	88%
Awareness of Environmental Issues	27%
Aligns with Mission	15%
Right thing to do	8%
Serves Community	4%
Aligns with Culture	4%

Lastly, we asked facilities staff about the importance of building or facility certifications such as LEED, ENERGY STAR and Practice Green Health. We asked them to rank their importance on a scale of 1 (not at all important) to 5 (extremely important). Table 22 presents the results of this question. Each segment gave an average score of 3 (Somewhat Important) or lower.

Table 22: Importance of Building or Facility Certifications to the Organization (e.g.: LEED, ENERGY STAR)

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
Not at all important	11%	20%	13%	23%	17%
Not very important	16%	23%	22%	18%	20%
Somewhat important	58%	31%	28%	59%	41%
Very important	16%	17%	28%	0%	17%
Extremely important	0%	9%	9%	0%	6%
Average Score	2.79	2.71	3	2.36	2.74

Mobilizing the Organization

This MPI and subsumed MPIs represent another area where progress has been made in the hospitals market. The metric for this MPI increased from 15% to 48% for the medium and large hospitals segment and from 15% to 59% for the participant segment. Looking at the underlying MPIs it appears that the increase in the MPI is a result of increased commitment to staff training as well as improved communications of expectations.

Table 23: Proportion of Market Segment Evidencing MPI

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Mobilize the Organization	**15%**	**48%**	**31%**	**15%**	**59%**	**36%**	**42%**
Communicating Expectations	15%	29%	27%	25%	59%	18%	28%
Training	20%	59%	33%	15%	59%	46%	49%

We asked some additional questions focused on understanding the level of organizational commitment to training facilities staff in energy efficient practices and identifying the common types of training and certification that staff are taking part in. We first asked if over the past two years operations staff have received more training in energy efficiency than in previous years. We then asked if any of the interviewees or their staff had received certifications related to energy efficiency. As shown in Table 24, approximately 70% of all respondents answered positively, with participant hospitals reporting more training (82%) than non-participant hospitals (58%). Table 25 reports that over 60% of all respondents

across the total market have received some form of energy efficiency certification, with 100% of participants responding positively. Table 21 reports the proportion of respondents that stated their organization devotes time or financial resources to staff to obtain training and certifications.

Table 24: Over the last two years operations staff have received more training in energy efficiency than in previous years?

	2014 Small Facilities (n=18)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=31)	2014 Participant Facilities (n=22)	2014 Total Market (n=53)
Yes	56%	74%	58%	82%	68%
No	44%	26%	42%	18%	32%

Table 25: Have you or any of your staff received certifications relating to energy efficiency?

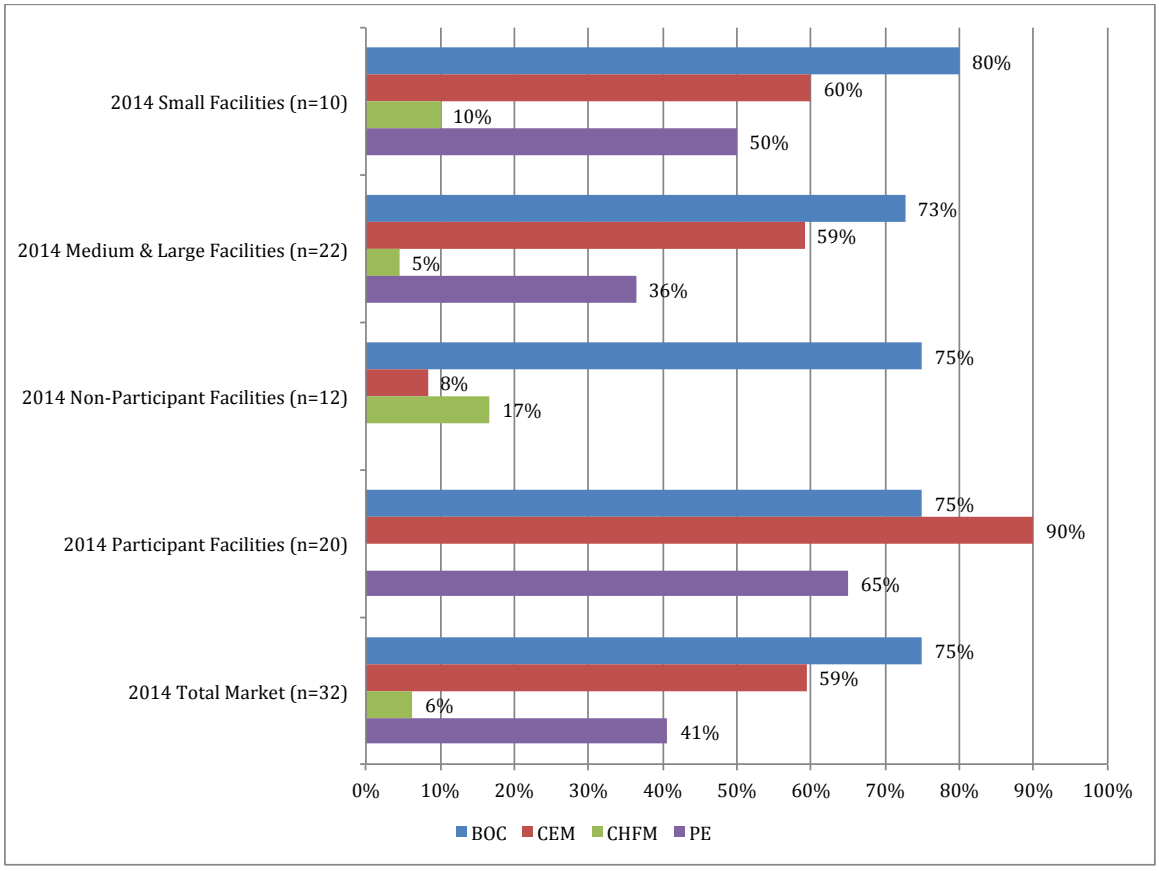
	2014 Small Facilities (n=18)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=31)	2014 Participant Facilities (n=22)	2014 Total Market (n=53)
Yes	56%	69%	40%	100%	64%
No	44%	31%	60%	0%	36%

Table 26: Does your organization allocate resources for staff to obtain training?

	2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
Org. Allocates Time	58%	57%	56%	59%	57%
Org. Allocates Funds	58%	63%	63%	59%	61%

Interviewees reported four certifications that staff received at all facilities interviewed: Building Operator Certification (BOC), Certified Energy Manager (CEM), Certified Healthcare Facilities Manager (CHFM), and Professional Engineer (PE). Figure 8 below presents the distribution of these certifications across the analyzed market segments.

Figure 8: Certifications Held By Facilities Staff



Our last battery of questions focused on the extent to which organizations provide tools that support a strategic approach to energy efficiency and energy management, namely, financial or budgeting tools, implementation tools, communication tools, and evaluation and monitoring tools (i.e., mobilizing the organization). We asked interviewees to provide a score indicating how well their organization does in providing them with four general toolsets, from 1 (not at all well) to 10 (extremely well). The mean and median of the scores for each toolset and each segment are provided in Table 27.

Table 27: Effectiveness Ratings for Organizations' Energy Efficiency Tools

		2014 Small Facilities (n=19)	2014 Medium & Large Facilities (n=35)	2014 Non-Participant Facilities (n=32)	2014 Participant Facilities (n=22)	2014 Total Market (n=54)
Financial or budgeting tools	Mean	5	5	5	6	5
	Median	5	5	5	7	5
Implementation tools	Mean	5	5	5	5	5
	Median	5	6	5	7	5
Communication tools	Mean	5	6	5	8	6
	Median	5	7	5	8	7
Evaluation and monitoring tools	Mean	4	5	5	4	5
	Median	4	4	5	4	4

Contracts with Suppliers

This MPI reflects the extent to which energy efficiency is considered when developing contracts with suppliers of goods and services to the hospital market. *NEEA has a formal goal that hospitals representing 25% of beds require (e.g., through RFPs and contracts) trade allies to support SEM practices, and the survey shows that NEEA has exceeded this goal in 2014 (32%).*

Table 28: Proportion of Market Segment Evidencing MPI

MPI	2010 Total Market (Medium & Large)	2014 Medium & Large Facilities	2014 Small Facilities	2010 Participant Facilities	2014 Participant Facilities	2014 Non-Participant Facilities	2014 Total Market
	n=35	n=35	n=19	n=22	n=22	n=32	n=54
Contracts with Suppliers	**40%**	**40%**	**20%**	**35%**	**59%**	**24%**	**32%**

Table 29: Equipment Specifications that Include Energy Efficiency Requirements

Equipment Type	% of Respondents (n=38)
Lighting	53%
HVAC	33%
AHU	33%
Chillers/Boilers	27%
Other	27%
Appliances	13%
All	13%
Building Envelope	7%

7 2013 Energy Savings Validation Summary

SBW validated the electrical energy savings from the Initiative for the year 2013, and Table 30 shows the summarized results for the nine facilities for which savings information was provided by NEEA. Detailed findings regarding the implemented projects and validation methodologies are included in the report Appendix.

SBW's validation consisted of inspection and review of the documentation provided by NEEA, the utilities, and the facilities. Where a utility has incentivized a measure, SBW verified that the amount claimed by NEEA matched the amount reported by the utility. Where more detailed information was available, SBW verified that the means used to arrive at the savings claim were reasonable, and that the results were within the range of expected savings for the measures. Overall, NEEA's participant hospitals saved over 3.7 million kWh in 2013.

Table 30: Validated Electrical Energy Savings for 2013

Hospital Group / Facility	2013 Validated kWh (aMW)	Electric Utility
2013-1	165,929 (0.019)	Flathead Electric Cooperative
2013-2	192,173 (0.022)	Flathead Electric Cooperative
2013-3	626,265 (0.072)	Idaho Power
2013-4*	609,587 (0.070)	Cowlitz PUD
2013-5	520,000 (0.059)	Puget Sound Energy
2013-6	140,150 (0.016)	Clark County PUD
2013-7	1,109,481 (0.127)	Energy Trust of Oregon
2013-8	234,916 (0.027)	Energy Trust of Oregon
2013-9	106,864 (0.012)	Seattle City Light
Total	**3,705,365 (0.422)**	

* Savings were reduced by 6,358 kWh based on evaluation findings.

8 Key Findings and Recommendations

NEEA's Initiative has made noteworthy market transformation progress in the past four years. In particular, overall adoption of SEM practices has increased significantly since the 2010 MPER hospitals survey. Adoption of SEM practices in the medium and large market segment increased from around 40% to 55% and penetration at participating facilities increased from approximately 50% to 76%. SEM practices have been adopted by 41% of the market among small and non-participant facilities and close to 50% of the total market in the Northwest. *NEEA has a formal goal that hospitals representing 25% or more of regional beds will be committed to and practicing SEM elements, and NEEA continues to exceed this goal.*

Notably, adoption of energy efficiency practices increased among non-participating hospitals from 20% in 2010 to 41% in 2014. This result suggests diffusion of NEEA's Initiative principles from participants to the wider market.

Additional Key Findings:

1. **Increases in Overall SEM Penetration scores were driven by growth in the following MPIs: Capital Improvements, Contracts with Suppliers, Mobilizing the Organization, and Strategic Leadership.** Among participant facilities the increase in the MPIs ranged from 15% (Capital Improvements) to 55% (Strategic Leadership).
2. **A decrease in the Building Operations MPI somewhat offset the increases in other MPIs.** The Building Operations MPI decreased by approximately 10% for both participating hospitals and the medium and large hospital market.
3. **SEMPs are in place at half the hospitals in the total market (small, medium and large).** Fifty percent of the total hospital beds in the market are covered by an energy plan. Sixty-six percent of participating hospital beds are covered by an energy plan.
4. **Eighty-seven percent of respondents have seen an improvement in the energy performance of their buildings in the last 3 years.** Ninety six percent of participating hospitals and 71% of non-participating hospitals reported improvements in energy performance.
5. **Energy Management Information Systems are in place in 83% of hospitals participating in the H&H Initiative**, but only in 3% of non-participating hospitals. Barriers to adopting EMIS include lack of funding, lack of expertise and competing priorities.
6. **Participant hospitals focus on both O&M and capital projects when looking for energy efficiency opportunities**, whereas non-participant hospitals focus more on capital projects than O&M opportunities
7. **Participant hospitals saved over 3.7 million kWh in 2013 from capital projects.**
8. **Life Cycle Cost Analysis is common practice among participant hospitals.** Sixty five percent of participant hospitals report having made investment decisions based on LCCA and the remaining 35% plan to do so in the future.
9. **Hospital investment in training of facilities staff has increased significantly.** The Training MPI increased from 20% to 59% for the total medium and large market, and from

15% to 59% among participating hospital organizations. Sixty eight percent of the total market (small medium and large) report staff receiving more training in the past two years than in previous years. Certifications mentioned are BOC, CEM, CHFM and PE.

10. **Continuing barriers to SEM include:**
    - Decreasing hospital revenue streams and limited capital availability
    - Lack of executive level commitment at some hospitals
    - High levels of risk aversion and perceptions that energy efficient changes can introduce risks to patient outcomes and operational reliability
    - Perceived high opportunity costs, for example, funds could be better spent on revenue generating equipment that could have a greater impact on bottom line profits
11. **Hospitals are changing their delivery approaches to provide more efficient, higher quality, integrated clinical care at lower overall cost.** Currently, medical practices are trending toward shorter hospital stays and more outpatient care. This could lead to lower net energy usage across the healthcare sector. Under the value based model hospitals executives may be more open to exploring energy efficient design, (lower cost) capital projects and technologies (including EMIS) at the facilities level. Twelve of the fourteen design and energy management professionals we interviewed believe that energy management in the Northwest will increase over the next five years.
12. **All of the interviewed design and construction firms consider energy efficient design and energy management to be important client services.** All of these firms were aware of Integrated Design for High Performance, and most had participated in an Integrated Design new construction project.
13. **All of the interviewed design and construction professionals link improved patient outcomes with improved daylighting and natural ventilation in their promotion of energy efficiency.** However there is still some skepticism about the validity of these claims in the hospitals design community.
14. **The energy management consultants we interviewed believe that the Northwest utilities will increasingly integrate them in SEM services going forward.**

Recommendations:

NEEA is transitioning out of the Hospitals and Healthcare market and will no longer be engaged in implementation activities aimed at impacting the market such as initiative service delivery or recruitment. NEEA's ongoing involvement will be limited to monitoring and tracking activities to assess the progress of SEM and energy efficiency practices. To support these monitoring and tracking activities we recommend the following:

1. **Conduct targeted research on overcoming specific barriers identified in this MPER to mitigate the impact of these barriers on future SEM adoption and diffusion.** Specifically, D&C interviews and hospital facilities staff identified lack of capital for energy efficient improvements, lack of executive level understanding of energy savings potential, lack facility staff time to and lack of facility staff knowledge of energy efficiency measures.

2. **Conduct periodic focused phone surveys with hospital staff similar to the survey conducted for this MPER to monitor Market Performance Indicators over time.**
3. **Conduct periodic interviews with utility staff to monitor the progress of utility SEM programs.**
4. **Continue to work with participating hospitals to gather energy savings data to track long-term energy impacts of SEM.**

Appendix A: Market Actors In-Depth Interview Guide

Market Actors In-Depth Interview Guide

Key Objectives:

- Identify services and activities to promote and implement energy management
- Assess client perceptions of energy efficiency and SEM
- Understand interactions with NEEA and utilities
- Identify market barriers to energy management adoption and persistence
- Detail perceived competition to SEM – e.g., LEED, ENERGY STAR buildings
- Inventory perceived best energy management practices
- Develop forecasts of future SEM adoption
- Identify desires for additional tools and information from NEEA

Target Audience: Up to 15 interviews with a mix of design and construction (D&C) firms, energy management consultants, and Integrated Design Labs staff identified by NEEA.

Hi, this is _____ with Evergreen Economics, an energy program evaluation firm in Portland, Oregon. My company is researching energy efficient design and energy management practices among Hospitals and Healthcare facilities for the Northwest Energy Efficiency Alliance (NEEA) and BetterBricks initiative, which promotes Strategic Energy Management or "SEM" in the Pacific Northwest. Key elements of SEM include:

- Written plans, with timelines and budgets, to reduce building energy use;
- Numeric goals for energy savings or use;
- New construction, equipment upgrades and operations management projects to save energy; and
- Tracking and reporting of energy consumption and savings.

As part of our research we'd like to learn how your [ORGANIZATION/COMPANY] provides energy management services to hospitals, and also commercial and industrial clients. We would also like to get your perspective on recent energy management trends, best practices and market barriers.

Can we schedule a time to talk about these topics for about about 30 minutes? In return for your time and feedback, we will send you a gift card worth $50 after the interview is completed.

[IF NEEDED] Your answers will be kept confidential and will be grouped with other respondents for reporting in aggregate form only. Neither your name nor organization will be mentioned in any reports or documents.

Role and Firm Details
I'd like to start with some general information about you and your company.

1) What is your title?

2) Which hospitals have you worked with over the past two years? In which states are these hospitals located?

3) Besides hospitals, do you work with other large commercial and industrial clients? What industries are these clients in?

4) What percentage of your client base do hospitals make up, in terms of revenues or client counts?

Promotion of Energy Efficiency and Energy Management
Now I would like to ask you some questions about the role of energy management in your firm's and your client's activities.

5) (FOR SEM CONSULTANTS ONLY) What energy management planning or projects assistance has your company provided to its Northwest hospital clients? This could include SEM plan development, project development and prioritization, energy savings estimating, contractor referrals, or other services.
   a) Does your scope of services vary depending on the type of hospital you are working with?

6) (FOR D&C/ARCHITECTS ONLY) What energy efficiency or energy management project assistance has your company provided to its Northwest hospital clients? This could include new construction, renovations, energy management plan development, project development and prioritization, energy savings estimating, contractor referrals, or other services.
   a) How does your scope of services vary depending on the type of hospital you are working with?

7) What is your personal role in the services you have just described?

8) Compared to other client needs, how much attention does energy management receive?
   a) Is it a higher or lower priority for hospitals than other commercial or industrial clients?
   b) Why is this?

9) How are energy efficiency and energy management perceived by your hospital clients? How does this differ from other commercial or industrial clients?

10) (FOR D&C/ARCHITECTS ONLY) Does your firm actively promote energy efficient building design to clients or is this primarily driven by client requests?

11) Have you observed any energy management best practices among your hospitals clients?
    a) If YES: Get details.

12) How about Energy Management Information Systems, or EMIS. These typically differ from Building Automation Systems (BAS) in that they facilitate analysis of energy usage by internal staff and sometimes utilities. Are you seeing more implementation or consideration of EMIS?

13) Are you aware of the new ASHRAE guideline that reduces required outside air in non-surgery areas? Is this something you are implementing with your clients?

14) Does your firm link improved patient outcomes to improved daylighting and natural ventilation in your promotion of energy management?

15) When/If you are bidding on a hospitals project do you bid on an initial cost basis or a life cycle cost basis?

16) (FOR D&C/ARCHITECTS ONLY) Are you familiar with the architectural design process called integrated design for high performance?

    [IF NEEDED] Integrated Design is an iterative whole-building process that takes into account the interactive effects of two or more building systems (e.g., lighting, heating, cooling, envelope, etc.) to maximize energy efficiency.

    If Yes:
    a) (ENGINEERS) To what extent are you involved in the integrated design process from the outset of the project? Are you being engaged as a co-leader of energy efficiency projects?
    b) (ARCHITECTS) To what extent do you engage a mechanical engineering firm at the beginning of a project? Are you engaging an engineering firm to co-lead a project?

Energy Management Barriers and Trends

Now I would like to ask you some questions about energy management barriers and trends.

17) What are the main barriers to energy management adoption and persistence within hospitals? How about within the commercial and industrial sectors?

18) Are there any efficient building programs or certifications, such as LEED or ENERGY STAR that your clients are focused on?

a) If YES: Do you think these programs/certifications help to reinforce comprehensive strategic energy management, or compete with comprehensive SEM? (GET DETAILS)

19) How are new cost control trends and medical practice changes, such as higher numbers of outpatients, affecting hospital design and opportunities for energy efficiency?
   a) What designs will predominate 10 to 20 years in the future?

20) In the past, many hospitals operations were outsourced, particularly with regards to energy management. Is this changing? Are hospitals reverting to in-house energy management operations?

21) Do you think that energy management at hospitals in the Northwest is likely to increase, decrease or remain the same over the next 5 years?
   a) Why?

Interactions with NEEA and Utilities

Now I would like to ask you some questions about your interactions with NEEA's BetterBricks initiatives and local utilities that service your hospital clients, and then we'll be done.

22) Has your company coordinated with NEEA's BetterBricks or Hospitals and Healthcare Initiative in the past to implement energy management?
   a) If Yes: What assistance did NEEA provide? Was NEEA's involvement influential on the projects you have been involved in?
   b) If No: Why hasn't this happened?

23) Does your company coordinate or partner with electric or gas utilities to promote or implement energy management?
   a) If Yes: How does this occur?
   b) If No: Why hasn't this happened?

24) How might your company's work with local utilities change in the future?

25) Are there specific challenges or barriers to working with utilities on energy management projects?

26) How do see your company's energy management services growing or declining in the Northwest in the next 5 years?

27) Does your firm have the tools you need to support SEM? What additional information or tools do you need?

28) Is there any information NEEA could give your company, so that you are better positioned to promote or implement SEM in the longer-term?

Those are all the questions I have right now. Thank you very much for your time and good information!

We would like to send you or someone else you designate a gift card to Amazon, Home Depot, iTunes, Starbucks or PetSmart.

Which card should we send, and whom should we direct it to? (RECORD NAME AND EMAILING ADDRESS)

Appendix B: Hospitals Survey Instrument Development and Weighting

Survey Guide Development

The Evergreen team worked with NEEA staff to ensure the survey instrument and question weighting retained a high level of consistency with the previous phone survey implemented for the 2010 MPER. Specifically, the survey instrument includes all questions from the 2010 MPER survey instrument used to develop scores for 7 market performance indicators (MPIs), Building Operations, Life Cycle Cost Analysis, Capital Improvements, Design Practices, Strategic Leadership, Mobilizing the Organization and Contracts with Suppliers, as well as an Overall Adoption metric. In addition, we included new questions identified through staff interviews and interviews with Design and Consulting professionals aimed at identifying trends and opportunities that exist in the Hospitals & Healthcare marketplace. To identify new questions we include a subscript (N) after the questions number in the survey instrument.

One challenge faced by the evaluation team was how to accommodate individual hospitals that were part of a larger hospital system. In some cases, hospitals systems that participated in the initiative explicitly requested that one representative be contact for all hospitals in their system. Other hospital systems employ staff who oversee all operations across system facilities. The 2010 MPER overcame this challenge by conducting one interview for a hospital system and weighting the responses to the number of hospitals in that system, effectively applying the interviewee's answers to all the hospitals that they were responsible for. Evergreen and NEEA staff agreed to adopt a similar approach. We designed the survey introduction to ask interviewees from hospital systems if they could speak in detail about the specific hospitals in their hospital systems. At the outset of the interview, the interviewer asked if the interviewee could speak for all hospitals in their hospital system and where necessary read a list of the hospitals. If the interviewee stated they could speak for all hospitals, that interviewee's answers were recorded for each hospital in their system. If they could not speak for all hospitals in their system, the interviewer applied their answers only to the hospitals they could speak for. The interviewer then asked the interviewee for a contact name and telephone number for someone who could speak for the remaining hospitals in the system.

Survey Question Weighting

We followed the 2010 MPER approach to estimate penetration of SEM MPIs. Approximately 60 questions provided the information required to calculate the MPIs. There are three levels of MPI, with each level of MPI providing information to the next level. Each survey question provided information for the Level 1 MPIs. These questions took 2 forms, categorical questions and binary (Yes, No) questions. We coded each categorical question with a score from 0 to 1 depending on the number of potential response categories. For example, questions with response categories, "seldom or never, less than half, about half, more than half, and virtually all the time" we coded as 0, 0.25, 0.5, 0.75, and 1, respectively. We coded binary

questions with a score of 0 if the answer was no and 1 if the answer was yes. We then assigned a weight to each question and computed a weighted score for each Level 1 MPI. If a facility scored 0.63 or greater in a Level 1 MPI this facility met the MPI and was counted in the proportion of the market meeting the MPI. To calculate the penetration of the Level 2 MPIs we followed a similar process. Each Level 1 MPI was assigned a weight and a weighted score was developed for the Level 2 MPI. If a facility scored greater than 0.63 for the Level 2 MPI, this facility met the MPI and was counted in the proportion of the market meeting the MPI. To calculate the Level 3 Overall Penetration MPI we followed the same process.

Table 31 below presents the detailed weighting scheme we followed.

Table 31: Hospital Survey Question Weighting Scheme

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
Building Operations Metrics								
6	Calculated the energy use per square foot (EUI=1)	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.125	**Benchmarking**	0.167	**Building Operations**	0.18	**Overall Penetration**
8	Obtained an ENERGY STAR score	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.125					
24_1	Comparing across buildings you are responsible for?	0,1	0.125					
24_2	Comparing across buildings in the region?	0,1	0.125					
24_3	Comparing performance of the same building over time?	0,1	0.125					
24_4	Comparing building performance to energy use goals?	0,1	0.125					
27	Have you trained any of your staff in using ENERGY STAR Portfolio Manager?	0,1	0.125					
26_1	Used results to help in establishing an energy use or savings target?	0,1	0.125					
26_2	Reported results to building owners decision makers	0,1	0.5	**Tracking and Reporting**	0.167	Building Operations		

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
			Building Operations Metrics (Cont.)					
7	Kept the estimate of energy use per square foot current by regularly updating the energy consumption and facilities size information	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.25					
9	Kept the ENERGY STAR score current by regularly updating the energy consumption and benchmarking information	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.25					
10	Set a goal or target for energy use or energy use reductio	1=0, 2=.25, 3=.5, 4=.75, 5=1	1	**Energy Performance Targets**	0.167	Building Operations		
37	Plan is actually written, not just generally understood	0,1	0.125	**EE Plan**	0.167	Building Operations		
38	Plan includes numeric goals for energy savings or use	0,1	0.125					
39	Plan includes specific action items	0,1	0.125					
40	Plan includes a timeline	0,1	0.125					
41	Plan identifies the responsible parties	0,1	0.125					
42	Plan includes a budget	0,1	0.125					
43	Plan is authorized by senior management	0,1	0.125					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
			Building Operations Metrics (Cont.)					
44	Senior management receives updates on plan achievements	0,1	0.125					
11	Conducted a study or audit to identify ways to reduce building energy use [Study=1] AND, if response "less than half" or "about half", then [Study_Potential=1] [Study_Potential=0 for responses "none," "more than half", "and virtually all"]	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.4	**EE Study**	0.167	Building Operations		
32	[If Study_Potential=1] You mentioned you have conducted a study to identify ways to reduce building energy use, but have not done so for all of your buildings. Do you currently have plans to study most of the remaining buildings over the next two years?	0,1	0.25					
33	[If Study=0] Within the next two years, do you have plans to conduct a study or audit to identify opportunities to reduce building energy use?	0,1	0.25					
34	[If Study=1] Who conducted the study (if interviewee identified entity who conducted study response = 1, else response = 0)	0,1	0.2					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
			Building Operations Metrics (Cont.)					
35	[If Study=1] Did the study look for operations and maintenance changes that might lower energy costs?	0,1	0.4					
14	Taken steps to reduce building energy use [Actions=1]	1=0, 2=.25, 3=.5, 4=.75, 5=1	0.1425	**EE Tune Up**	0.167	Building Operations		
15	[If Actions=1] Have you seen an improvement in the energy performance of any of your buildings?	0,1	0.1425					
53	For any building you are responsible for, have you made any no-cost or low-cost changes in operations or maintenance to reduce energy costs in the last three years?	0,1	0.1425					
54_1	Improved the scheduling of equipment, such as lighting and HVAC?	0,1	0.1425					
54_2	Corrected situations of simultaneous heating and cooling?	0,1	0.1425					
54_3	Adjusted the outside air usage or economizer functioning?	0,1	0.1425					
54_4	Recalibrated sensors in the last two years?	0,1	0.1425					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
				LCCA Metrics				
21	Are you familiar with life-cycle cost analysis, also called total cost of ownership analysis? [LCCA=1]	0,1	0.5	**LCCA**	1	**LCCA**	0.05	**Overall Penetration**
22	[IF LCCA=1] Which of these 3 statements best describes your organization's investment decision-making with respect to life cycle cost analysis? Would you say: 1. Your organization has not used nor plan to use life-cycle cost analysis 2. Your organization has plans to use life-cycle cost analysis for some investments 3. Your organization has made investments based on lowest life-cycle cost	1-.0, 2=.5, 3 = 1,	0.5					
				Capital Improvement Metrics				
52	For any building you are responsible for, have you replaced existing equipment with high-efficiency equipment in the last three years?	0,1	1	**Capital Improvements**	1	**Capital Improvements**	0.05	**Overall Penetration**
				Integrated Design Metrics				
59	How familiar are you with the architectural design process called Integrated Design?	1-.0, 2=.5, 3 = 1,	0.33	**ID Awareness**	0.25	**Design Practices**	0.18	**Overall Penetration**

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
			Integrated Design Metrics (Cont.)					
60	[If 59= 2 or 3] Has your organization used integrated design for any of its new construction, addition or renovation design projects in the last three years?	0,1	0.66					
61	Other than for code compliance, did you use energy modeling to determine the design?	0,1	1	ID Modeling	0.25	Design Practices		
62	Was a design charrette (shar-et) held, where the architect meets with the owner, building operator, and consulting engineers to collaboratively create the building design?	0,1	1	ID Activities	0.25	Design Practices		
63	Was any major system--such as the chiller, boiler, ventilation, or lighting system--designed to use less significantly less energy than in comparable facilities or required by code?	0,1	1	ID Features	0.25	Design Practices		

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
				Strategic Leadership Metrics				
72	Does your organization consider sustainability or energy efficiency to be part of its market identity?	0,1	1	Vision	0.5	**Strategic Leadership**	0.18	**Overall Penetration**
69	Does the senior management of your organization believe a commitment to sustainability or energy efficient facilities will provide the organization with a strategic advantage?	0,1	0.33	**Executive Commitment**	0.5	Strategic Leadership		
71	Have energy efficiency and sustainability goals been formally adopted through a mission statement or policy and procedures statements?	0,1	0.33					
74	Has your firm established a specific individual, team or committee responsible for energy use reduction and/ or sustainability?	0,1	0.33					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
Mobilizing the Organization Metrics								
79	Have you trained any of your building engineers and operators in how to conduct studies to identify energy savings opportunities?	0,1	0.125	**Training**	0.66	**Mobilizing the Organization**	0.18	Overall Penetration
81	Have you or any of the O&M staff participated in any seminars or training related to energy efficiency?	0,1	0.125					
82	[If 81 = Y] About what proportion of the O&M staff have received training related to energy efficiency?	1=.33, 2=.66, 3=1	0.125					
83	[If 81 = Y] What organizations sponsored the presentation or training? (If respondent identifies training response = 1 else response = 0)	0,1	0.125					
84	[If 81 = Y] Have you or any of your staff received certifications relating to energy efficiency?	0,1	0.125					
88	Does your organization allocate time for your operations staff to improve capability in energy efficiency?	0,1	0.125					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
Mobilizing the Organization Metrics (Cont.)								
90	Is energy efficiency included in your professional development planning for any staff?	0,1	0.125					
91	Would you say that over the last two years operations staff have received more training in energy efficiency than in previous years?	0,1	0.125					
92	Does your organization consider demonstrated competence in energy efficiency as a factor in promotion decisions?	0,1	0.33	**Communicating Expectations**	0.34	Mobilizing the Organization		Overall Penetration
93	Is energy efficiency included in job descriptions of operational staff positions?	0,1	0.33					
94	Does your organization recognize its energy efficiency or sustainability achievements in staff meetings and credit key individuals and teams?	0,1	0.33					

Q. Number	Question Text	Possible Scores	MPI 1 Weight	MPI Level 1	MPI 2 Weight	MPI Level 2	MPI 3 Weight	MPI Level 3
				Contracts Metrics				
80	Have you identified contractors with demonstrated capability to conduct studies to identify energy savings opportunities?	0,1	0.25	**Contracts with Suppliers**	1	Contracts with Suppliers	0.18	Overall Penetration
66	Do any of your contracts with equipment service providers include energy efficiency requirements?	0,1	0.25					
67	Has your organization included energy efficiency requirements in any of its specs for equipment purchases?	0,1	0.25					
65	For future new construction projects, does your organization plan to request that your A&E team be experienced in or willing to learn Integrated Design?	0,1	0.25					

Appendix C: Northwest Hospitals Phone Survey Instrument

MPER7 Hospitals and Healthcare Market Phone Survey

July 17, 2014

Key Objectives:

1. Enable longitudinal comparison against Healthcare findings from the 2010 BetterBricks MPER, specifically in terms of:
   - 1.1. **Benchmarking:** Understand hospitals' practices regarding energy intensity calculations and ENERGY STAR scores
   - 1.2. **Energy Efficiency Study, Plan and Performance Targets:** Inventory hospitals' practices regarding energy usage studies, plans for reductions and goals establishment
   - 1.3. **Energy Efficiency Tune-up and Capital Improvements:** Identify actions hospitals have taken to reduce energy usage (e.g., install high-efficiency equipment)
   - 1.4. **Integrated Design Awareness:** Understand hospitals' practices regarding integrated design
   - 1.5. **Contracts with Suppliers:** Understand hospitals' contracting processes with respect to energy efficiency
   - 1.6. **Executive Commitment**: Assess senior management commitment to SEM
   - 1.7. **Training:** Inventory staff training received for energy management
2. Allow measurement of the initiative's progress along key metrics
3. Identify trends and opportunities

Target Audience: 70 hospital facility directors or energy managers at hospitals and healthcare facilities.

IF CONTACT NAME KNOWN: Hi, may I speak with (NAME), please.

IF CONTACT UNKNOWN: I would like to speak with the Director of Facilities or the manager responsible for facility operations. Who would that be? (RECORD NAME, THEN ASK TO SPEAK TO THAT PERSON. ARRANGE CB IF NECESSARY.)

WHEN CORRECT PERSON ON PHONE:
Hi, my name is _____ calling on behalf of the Northwest Energy Efficiency Alliance, or NEEA. We are not selling anything. We are surveying hospital facility directors on current practices in facility operations in the Northwest. Your participation in this study is very important. Information from this survey will help NEEA to plan future training opportunities for hospital staff. The results of the full study will be published on NEEA's website in 2015, and NEEA will email you the link to that report when it is published. To thank you for your help and this valuable feedback, we will send you a $25 Amazon gift card ($50 FOR INTERVIEWEES FLAGGED AS SYSTEM REPRESENTATIVES) as a token of our appreciation. Your responses are completely confidential. The interview takes about 30 minutes. Is this a good time to talk or should we schedule another time?

.

If needed: Appointment date and time:_____

1

(IF NECESSARY) NEEA is a non-profit organization that works to accelerate the innovation and adoption of energy-efficient products, services and practices in the Northwest region. NEEA is supported by, and works in collaboration with, the Bonneville Power Administration and over 100 Northwest utilities on behalf of more than 12 million energy consumers.

(IF RESPONDENT SAYS THEY WERE INTERVIEWED LAST YEAR) Yes, Evergreen Economics did interview you a year ago, and NEEA really appreciates your participation in that interview. That interview was for the annual market progress evaluation report, and last year the focus was to inform NEEA on how NEEA can support the healthcare systems and hospitals as NEEA exits the market. This interview that we are conducting now is to help NEEA to determine the progress made by their healthcare initiative over the years, and your input is very important for this purpose.

(IF INTERVIEWEE IS FLAGGED AS A SYSTEM REPRESENTATIVE) I understand that you will be speaking on behalf of ___ (insert number of hospitals) that are within the (INSERT SYSTEM NAME). As you answer the questions, I would like you to think of whether you can speak for all ___ (insert number of hospitals) in your system, or whether you think I should also speak with someone else to get a more comprehensive picture. If you think that I should also speak with someone else, I would very much appreciate it if you would let me know whom I should speak with at the end of this interview.

SCREEN:

SC1. Just to confirm, are you responsible for decisions about facility operations and management for hospital facilities in the Pacific Northwest?

1. Yes (SKIP TO Q 1)
2. No

SC1a. Is there another senior person responsible for decisions about facility operations and management with whom we might speak?

1. Yes (GET CONTACT INFO)
2. No (THANK & TERMINATE)

NOTES:
Questions with the subscript (N) indicate new questions that did not appear in the RIA survey. All other non-subscripted questions are retained to maintain the weighting scheme used by RIA in the 2010 survey.

About the Contact

Q 1. First I have a few background questions. Would you please tell me your title?

Q 2. Do your responsibilities include directing new construction, major renovation or additions for your organization?

1. Yes
2. No

Q 3. How many beds are there in the facilities you are responsible for? Would you say

1. 1-49
2. 50-100
3. 100-150
4. 150-249
5. 250-349, or
6. 350 or more

[IF LESS THAN 50 BEDS] We are talking with Facility Directors at larger facilities, those with at least 50 beds. So, those are all my questions for you. Thank you very much. TERMINATE CALL.

About the Firm

Q 4. How many acute-care locations do you have responsibility for in the 4 states of the Pacific Northwest? [If necessary: Washington, Oregon, Idaho, and Montana]

Q 5. About how many staff work in operations and maintenance at these location? Would you say…

1. 1-4
2. 5-9
3. 10-24, or
4. 25 or more

EUI, ENERGY STAR, Goals, Studies, Plans

Now I have a few questions regarding your business practices.
You indicated that about [# IN Q 4] locations are currently under your responsibility or oversight.

[IF MULTIPLE LOCATIONS (Q4>1), SAY:] Please tell me what proportion of these locations you have done any of the following in the last 3 years. Please use the categories of None, Less than Half, About Half, More than Half, or Virtually All.

[IF 1 LOCATION (Q4=1), SAY:] Please tell me if you have done any of the following at this location in the last 3 years.

Q 6. Calculated the energy use per square foot (EUI=1) (if necessary: also known as energy intensity, energy utilization index, or EUI)

1. None/No (SKIP TO Q 8)
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 7 Kept the estimate of energy use per square foot current by regularly updating the energy consumption and facilities size information

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 8. Obtained an ENERGY STAR score

1. None/No (SKIP TO Q 10)
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 9 Kept the ENERGY STAR score current by regularly updating the energy consumption and benchmarking information

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 10. Set a goal or target for energy use or energy use reduction [NOTE: target can be for multiple buildings considered collectively and does not need to be for an individual building]

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 11. Conducted a study or audit to identify ways to reduce building energy use

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 12. (If Q 11=2-5) Was more than one building studied?

1. Yes
2. No.

Q 13. Created an action plan to reduce building energy use

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 14. Taken steps to reduce building energy use

1. None/No
2. Less than Half
3. About Half
4. More than Half
5. Virtually All/Yes

Q 15. Have you seen an improvement in the energy performance of any of your buildings?

1. Yes
2. No (SKIP TO Q 18)

Q 16. What changes did you make that likely led to the improved energy performance? (OPEN ENDED)

Q 17$_{(N)}$ How did you measure the improvement in energy performance? (OPEN ENDED)

Q 18$_{(N)}$ (IF Q 10 NOT 1) Have you met your energy goals or targets for energy use reduction?

3. Yes (SKIP TO Q 20)
4. No

Q 19$_{(N)}$ What has been the primary barrier to meeting your energy reduction goals or targets? (OPEN ENDED)

Q 20$_{(N)}$ (IF ALL Q 10, Q 11, Q 13, Q 14 = 1) Has your organization made plans to investigate ways to reduce energy use in your facilities in the future?

1. Yes → please specify
2. No

Q 21. Are you familiar with life cycle cost analysis, also called total cost of ownership analysis?

1. Yes
2. No (SKIP TO Q 23)

Q 22. Which of these 3 statements best describes your organization's investment decision-making with respect to life cycle cost analysis? Would you say:

1. Your organization has not used nor plan to use life-cycle cost analysis
2. Your organization has plans to use life-cycle cost analysis for some investments
3. Your organization has made investments based on lowest life-cycle cost

EUI and ENERGY STAR Details

Q 23. (If Q 8 = 1, D/K or Ref AND Q 6 = 2-5, ELSE SKIP TO Q 25) You indicated you've calculated the energy use per square foot. What tool did you use, if any? (MULTIPLE RESPONSE – DO NOT READ CHOICES)

1. ENERGY STAR Portfolio Manager
2. Energy Expert
3. Utility Manager Pro
4. Avista IQ
5. Microsoft Excel
6. Other (specify)_____

Q 24. What are you comparing the results to? Are you… (READ ITEMS)

	Yes	No	DK
(IF Q 6=2-5)			
1) Comparing across buildings you are responsible for?	1	2	9
2) Comparing across buildings in the region?	1	2	9
3) Comparing performance of the same building over time?	1	2	9

(IF Q 10=2-5)	1	2	9
4) Comparing building performance to energy use goals?	1	2	9

Q 25. (If Q 8=2-5) You indicated you've obtained an ENERGY STAR score. What are you comparing the results to? Are you… (READ ITEMS)

	Yes	No	DK
(IF Q 8=2-5)			
1) Comparing across buildings you are responsible for?	1	2	9
2) Comparing across buildings in the region?	1	2	9
3) Comparing performance of the same building over time?	1	2	9
(IF Q 10=2-5)	1	2	9
4) Comparing building performance to energy use goals?	1	2	9

Q 26. (If Q 6=2-5 OR Q 8=2-5) Have you done any of the following with the [Energy Use per Square Foot and/or ENERGY STAR score] results? Have you… (READ ITEMS)

	Yes	No	DK
1) Used results to help in establishing an energy use or savings target?	1	2	9
2) Reported results to building owners decision makers?	1	2	9
3) Applied for an ENERGY STAR rating	1	2	9

Q 27. (If Q 8=2-5) Have you trained any of your staff in using ENERGY STAR Portfolio Manager?

1. Yes
2. No

Q 28$_{(N)}$ An Energy Management Information System, or EMIS, typically differs from a Building Automation System, or BAS, in that an EMIS helps facilitate the analysis of energy usage by internal staff as well as use of utilities. Does your facility use an Energy Management Information System or EMIS (E-M-I-S)?

1. Yes
2. No (SKIP TO Q 30)

Q 29$_{(N)}$ (IF Q 28 = 1) What challenges does your organization have using the EMIS, if any? (OPEN ENDED) (SKIP TO Q 32)

Q 30$_{(N)}$ (IF Q 28 = 2) Has your organization been considering using an Energy Management Information System or EMIS?

1. Yes
2. No

Q 31$_{(N)}$ What barriers does your organization have to using the EMIS, if any? (OPEN ENDED)

Study Details

Let's talk a little more about studies and audits to reduce building energy use.

Q 32. (If Q 11=2-3) You mentioned you have conducted a study or audit to identify ways to reduce building energy use, but have not done so for all of your buildings. Do you currently have plans to study most of the remaining buildings over the next two years?

1. Yes
2. No

Q 33. (If Q 11=1) Within the next two years, do you have plans to conduct a study or audit to identify opportunities to reduce building energy use?

1. Yes
2. No

Q 34. (If Q 11=2-5) Who conducted the study, was it: (READ, ALLOW MULTIPLES)

1. The utility
2. Staff working for your firm
3. Contractors, or
4. Someone else (specify)

Q 35 (If Q 11=2-5) Did the study look for operations and maintenance changes that might lower energy costs?

1. Yes
2. No

Q 36$_{(N)}$ (If Q 11=2-5) Did the study look for capital projects that might lower energy costs?

1. Yes
2. No

Plan Details (If Q 13=2-5, ELSE SKIP TO "GOAL DETAILS"(Intro before Q 45)

You indicated you have created a plan to reduce building energy use. Which of the following describe the plan? [If respondent has several plans with different characteristics, ask:] Do any of the plans include any of the following?

Q 37. Plan is actually written, not just generally understood

1. Yes
2. No

Q 38. Plan includes numeric goals for energy savings or use

1. Yes
2. No

Q 39. Plan includes specific action items

1. Yes
2. No

Q 40. Plan includes a timeline

1. Yes
2. No

Q 41. Plan identifies the responsible parties

1. Yes
2. No

Q 42. Plan includes a budget

1. Yes
2. No

Q 43. Plan is authorized by senior management

1. Yes
2. No

Q 44. Senior management receives updates on plan achievements

1. Yes
2. No

Goal Details in Absence of Plan (If Q 10=2-5 AND Q 13=1, ELSE SKIP TO "ACTION DETAILS" Q 52)

You indicated you have created a goal to reduce building energy use. Which of the following describe the goal? [If respondent indicates having several goals with different characteristics, ask if any of the goals include any of the following]

Q 45. Goal is actually written, not just generally understood

1. Yes
2. No

Q 46. Goal specifies numeric targets for energy savings or use

1. Yes
2. No

Q 47. Goal includes a completion date

1. Yes
2. No

Q 48. Goal identifies the responsible parties

1. Yes
2. No

Q 49. Goal includes a budget

1. Yes
2. No

Q 50. Goal is authorized by senior management

1. Yes
2. No

Q 51. Senior management receives updates on progress toward goal

1. Yes
2. No

Action Details (If Q 14=2-5, ELSE SKIP TO Q 57)

Q 52. For any building you are responsible for, have you replaced existing equipment with high-efficiency equipment in the last three years?

1. Yes
2. No

Q 53. For any building you are responsible for, have you made any no-cost or low-cost changes in operations or maintenance to reduce energy costs in the last three years?

1. Yes
2. No

Q 54. Please indicate whether in the last two years you have done any of the following or identified the need to do so….

	Yes	No	DK
1) Improved the scheduling of equipment, such as lighting and HVAC?	1	2	9
2) Corrected situations of simultaneous heating and cooling?	1	2	9
3) Adjusted the outside air usage or economizer functioning?	1	2	9
4) Recalibrated sensors in the last two years?	1	2	9

Q 55$_{(N)}$ (IF Q 53= YES) What strategies do you have in place to ensure that these O&M (Operations and Maintenance) changes will be long-lasting? (OPEN ENDED)

Q 56$_{(N)}$ What would you say are the top 3 most valuable actions you have taken to improve energy efficiency in your facilities for the long-term? (OPEN ENDED)

Integrated Design

Q 57. In the last 3 years, has your organization initiated any new construction, renovation, or addition project?

1. Yes
2. No (SKIP TO Q 66)

Q 58. Did you have any involvement in the design of that project?

1. Yes
2. No

Q 59. How familiar are you with the architectural design process called Integrated Design? Integrated Design is an iterative whole-building process that takes into account the interactive effects of 2 or more building systems – for example lighting, heating, cooling, or envelope - to maximize energy efficiency.

Would you say… (READ CHOICES)

1. Not at all familiar (SKIP TO Q 61)
2. Somewhat familiar, or
3. Very familiar

Q 60. Has your organization used integrated design for any of its new construction, addition or renovation design projects in the last 3 years?

1. Yes
2. No

Q 61. (If Q 58=1) Other than for code compliance, did you use energy modeling to determine the design? Energy modeling is a pre-construction, whole-building assessment of energy efficiency that uses computer programs for calculations.

1. Yes
2. No

Q 62. (If Q 58=1) Was a design charrette (shar-et) held, where the architect meets with the owner, building operator, and consulting engineers to collaboratively create the building design?

1. Yes
2. No

Q 63. (If Q 58=1) Was any major system--such as the chiller, boiler, ventilation, or lighting system--designed to use significantly less energy than in comparable facilities or less energy than required by code?

1. Yes
2. No (SKIP TO Q 65)

Q 64. What system? (OPEN-ENDED W PRE-CODES. DO NOT READ, MULTS OK)

1. Chiller
2. Boiler
3. Ventilation
4. Lighting
5. Other (specify)

Q 65. (If Q 59=2 or 3) For future new construction projects, does your organization plan to request that your A&E team be experienced in or willing to learn Integrated Design?

1. Yes
2. No

Contracts

Q 66. Do any of your contracts with equipment service providers include energy efficiency requirements?

1. Yes
2. No

Q 67. Has your organization included energy efficiency requirements in any of its specs for equipment purchases?

1. Yes
2. No (SKIP TO Q 69)

Q 68. Which equipment specs have included energy efficiency requirements? (OPEN ENDED)

Commitment

Q 69. Does the senior management of your organization believe a commitment to sustainability or energy efficient facilities will provide the organization with a strategic advantage?

1. Yes
2. No **(SKIP TO** Q 71**)**

Q 70$_{(N)}$ (IF Q 69 = YES) What would you say are the main reasons senior management is interested in sustainability and/or energy efficiency? (OPEN-ENDED)

Q 71. Have energy efficiency and sustainability goals been formally adopted through a mission statement or policy and procedures statements?

1. Yes
2. No

Q 72. Does your organization consider sustainability or energy efficiency to be part of its market identity?

1. Yes
2. No

Q 73$_{(N)}$ On a scale of 1 to 10 where 1 is "not at all a priority" and 10 is "a very high priority" and, where would you rank the priority of energy efficiency from the perspective of senior management at your facilities?

Not at all a priority									A very high priority
1	2	3	4	5	6	7	8	9	10

Organization

Q 74. Has your firm established a specific individual, team or committee responsible for energy use reduction and/ or sustainability?

1. Yes
2. No

EVERGREEN ECONOMICS

Q 75$_{(N)}$ How important are building or facility certifications to your organization, for example LEED, ENERGY STAR or Practice Green Health? Would you say they are: (READ LIST)

1. Not at all important
2. Not very important
3. Somewhat important
4. Very important
5. Extremely important

Q 76$_{(N)}$ How much has healthcare industry consolidation affected your organizations commitment to energy efficiency over the past 5 years,? Would you say: (READ LIST)

1. A lot
2. Somewhat
3. Not at all (SKIP TO Q 79)

Q 77$_{(N)}$ Has healthcare consolidation had a positive, negative or neutral impact on energy management at your facility?

1. Positive
2. Negative
3. Neutral (SKIP TO Q 79)

Q 78$_{(N)}$ Why is that? (OPEN ENDED) _____

Staff Training and Recognition

Q 79. Have you trained any of your building engineers and operators in how to conduct studies to identify energy savings opportunities?

1. Yes
2. No
3. Not Applicable - don't employ staff appropriate for this

Q 80. Have you identified contractors with demonstrated capability to conduct studies to identify energy savings opportunities?

1. Yes
2. No

Q 81. Have you or any of the O&M staff participated in any seminars or training related to energy efficiency?

1. Yes
2. No (SKIP TO Q 84)

EVERGREEN ECONOMICS

Q 82. About what proportion of the O&M staff has received training related to energy efficiency? Would you say it's… (READ CHOICES)

1. Less than Half
2. More than Half, or
3. Virtually All

Q 83. What organizations sponsored the presentation or training? (OPEN-ENDED WITH PRE-CODES; DO NOT READ, MULTIPLE RESPONSE, CONTINUE TO PROBE WITH "ANYTHING ELSE?")

1. BOC
3. CEM
4. IFMA
5. AIA
6. Cascadia Green Building Council
7. OSHE
8. WASHE
9. Society of Healthcare Engineers
10. Conferences
11. PGE
12. Utility
13. Seattle IDL (Integrated Design Lab)
14. Practice Greenhouse
15. University of Washington
16. Community colleges
17. Other (specify)

Q 84. Have you or any of your staff received certifications relating to energy efficiency?

1. Yes
2. No (SKIP TO Q 88)

Q 85. What certifications? (OPEN-ENDED WITH PRE-CODES, DO NOT READ):

1. BOC
2. CEM
3. Other (specify)

Q 86$_{(N)}$ Does your organization REQUIRE certifications for facilities staff?

1. Yes
2. No (SKIP TO Q 88)

Q 87$_{(N)}$ Which certifications does your organization require of staff? (OPEN-ENDED WITH PRE-CODES, DO NOT READ):

1. BOC
2. CEM
3. Other (specify)

Q 88. Does your organization allocate time for your operations staff to improve capability in energy efficiency?

1. Yes
2. No

Q 89$_{(N)}$ Does your organization allocate funds for your operations staff to improve their skills in energy efficiency?

1. Yes
2. No

Q 90. Is energy efficiency included in your professional development planning for any staff?

1. Yes
2. No

Q 91. Would you say that over the last two years operations staff have received more training in energy efficiency than in previous years?

1. Yes
2. No

Q 92. Does your organization consider demonstrated competence in energy efficiency as a factor in promotion decisions?

1. Yes
2. No

Q 93. Is energy efficiency included in job descriptions of operational staff positions?

1. Yes
2. No

Q 94. Does your organization recognize its energy efficiency or sustainability achievements in staff meetings and credit key individuals and teams?

1. Yes

2. No

Q 95$_{(N)}$ I'm going to read a list of toolsets. For each, please tell me how well your organization does at providing you with tools to support a strategic approach to energy efficiency and energy management.

	Not at all well	Not very well	Somewhat well	Very well	Extremely well
1) Financial or budgeting tools	1	2	3	4	5
2) Implementation tools	1	2	3	4	5
3) Communication tools	1	2	3	4	5
4) Evaluation and monitoring tools	1	2	3	4	5

Assistance Received

Q 96. Have you received project assistance or information from the Integrated Design Labs at state universities in Washington, Idaho, or Montana or from the Energy Studies in Buildings Lab at the University of Oregon?

1. Yes
2. No

Q 97. Before today, have you heard of an organization called the Northwest Energy Efficiency Alliance or NEEA?

1. Yes
2. No

Q 98. (If Q 96=1 or Q 97=1) How, if at all, did NEEA or Design Labs information, training, or assistance directly influence your firm's practices regarding energy efficiency? (OPEN ENDED)

(IF INTERVIEWEE IS FLAGGED AS A SYSTEM REPRESENTATIVE, READ. OTHERWISE SKIP TO CLOSING) **Now that you have answered all the questions in this survey, do you believe that your answers apply to all __ (insert number of hospitals) hospitals under your system, or should I speak with someone else to get a more comprehensive picture?**

1. my answers apply to all hospitals (SKIP TO CLOSING)
2. you need to speak to someone else about other hospitals (CONTINUE)

Can you give me the name and phone number of the person I should speak to?

Interviewer to record the following:
Contact person: ____
Telephone number: ___

Email address: ___
Name or location of Hospital about which this person will be providing answers: _____

(CLOSING) Those are all the questions I have for you. Thank you very much for your time and for sharing this information! What is the best email address to send your Amazon gift card to?
(RECORD EMAIL ADDRESS & READ BACK TO RESPONDENT FOR VERIFICATION.)

Email address _____

☐ Respondent declined gift card

Thanks again for your participation.

Appendix D: 2013 Savings Validation Details

sbw
ENERGY · WATER · EFFICIENCY

M e m o r a n d u m

FROM: SBW Consulting

TO: Rita Siong, Northwest Energy Efficiency Alliance

DATE: February 24, 2014

RE: Hospital & Healthcare Initiative 2013 Energy Savings Validation

CC: John Boroski, Evergreen Economics

SUMMARY

This memorandum describes SBW Consulting's (SBW's) validation of the electrical energy savings from the Northwest Energy Efficiency Alliance's (NEEA's) Hospital and Healthcare (H&H) Initiative for the year 2013. Table 1 summarizes the validated savings for the nine facilities included.

SBW's validation consisted of inspection and review of the documentation provided by NEEA, the utilities, and the facilities. Where a utility has incentivized a measure, SBW verified that the savings amount claimed by NEEA matched the amount reported by the utility. Where more detailed information was available, SBW verified that the means used to arrive at the savings claim were reasonable, and that the results were within the range of expected savings for the measures.

To protect the anonymity of Initiative participants, SBW used an anonymization scheme.

Table 1: H&H Initiative Validated Electrical Energy Savings for 2013

Hospital Group / Facility Identifer	2013 Validated kWh (aMW)	Electric Utility
2013-1	165,929 (0.019)	Flathead Electric Cooperative
2013-2	192,173 (0.022)	Flathead Electric Cooperative
2013-3	626,265 (0.072)	Idaho Power
2013-4[1]	609,587 (0.070)	Cowlitz PUD
2013-5	520,000 (0.059)	Puget Sound Energy
2013-6	140,150 (0.016)	Clark County PUD
2013-7	1,109,481 (0.127)	Energy Trust of Oregon
2013-8	234,916 (0.027)	Energy Trust of Oregon
2013-9	106,864 (0.012)	Seattle City Light
Total	**3,705,365** **(0.422)**	

[1]A savings adjustment of -6,358 kWh was made based on evaluation findings.

1. 2013-1

1.1. Methodology

The serving utility, Flathead Electric Cooperative, verified the savings for 2013-1 as part of their energy efficiency incentive program. SBW examined forms provided by the utility and verified that the savings were as reported.

1.2. Findings

Claimed savings derived from one HVAC measure and one lighting measure. The facility replaced block heaters serving the emergency generation system with more efficient heaters. The facility also completed various lighting upgrades across the campus. No detail was available for individual lighting upgrades. Table 2 shows savings for the two measures.

Table 2: 2013-1 Facility Lighting Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
More efficient block heaters for emergency generator	43,362	43,362
Lighting projects	122,567	122,567
Total	**165,929**	**165,929**

2. 2013-2

2.1. Methodology

The serving utility, Flathead Electric Cooperative, verified the savings for this facility as part of their energy efficiency incentive program. SBW examined ventilation night setback and block heater forms provided by the utility and verified that the savings were as reported.

2.2. Findings

Claimed savings derived from two HVAC measures:

1. The facility replaced block heaters serving the emergency generation system with more efficient heaters.
2. The facility programmed the HVAC system to reduce ventilation quantities during nighttime hours.

Table 3 shows the validated savings for each measure.

Table 3: 2013-2 Facility HVAC Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Efficient block heaters	7,884	7,884
Ventilation nighttime setback	184,289	184,289
Total	**192,173**	**192,173**

3. 2013-3

Savings at 2013-3 fell into two categories:

1. NEEA reported Energy Expert savings, which are cumulative for the year based on reductions tracked on the main utility meter due to various actions related to operations and maintenance. These savings were not incentivized by the utility.
2. Idaho Power approved a lighting upgrade on a different meter.

3.1. Main Meter Energy Expert Savings

Energy Expert is a utility billing meter monitoring package offered by Northwrite, Inc. The software captures and records pulses from the meter on 15-minute intervals. The program allows monitoring and comparison of energy usage.

3.1.1. Methodology

SBW reviewed the method used by Energy Expert to calculate savings, and compared the Energy Expert estimate with an itemized list of installed measures provided by the facility. These measures were not incentivized by the utility.

NEEA's Energy Expert consultant estimated savings with 2012 as the baseline year. Energy Expert compared meter use in 2013 with 2012 usage on a weather-normalized basis. Energy Expert normalizes for weather by associating each meter reading with the outside air temperature. The software also "bins" the meter readings into 5-degree temperature bins. The usage in these bins is compared from one year to the next, based on the assumption that energy usage is closely tied to outside air temperature. This process means that an improvement in late 2012 will have a small effect on the 2012 bins, and that some of these 2012 savings will actually accrue in 2013. Likewise, the 2013 reporting will not account for a project implemented in late 2013 in its entirety.

The Energy Expert consultant provided monthly and quarterly progress reports written by 2013-3 staff. Table 4 shows the list of 2012 and 2013 energy conservation measures (ECMs) implemented at 2013-3 as of December 2013. The list describes the conservation measures implemented, and gives an estimate of projected energy savings. These estimates were for planning purposes, and the consultant does not intend these to represent monitoring and verification (M&V) estimates.

Table 4: Energy Savings Measures Implemented at 2013-3

Project	Month Finished	Estimated Annual Savings (kWh)
Bad mixed air dampers on fan	Jul-12	92,653
LED upgrade	Jan-12	1,109
AHU hi/lo speed operation w/ VFD	Feb-12	336,200
Space lights	Mar-12	23,354
Parking lot pole light upgrade - 1000 W to 575 W	Sep-12	218,557
MR-16 LED upgrade	Sep-12	1,226
AHU DAT reset 54 to 58°F	Oct-12	138,361
AHU DAT reset 54 to 58°F	Oct-12	25,612
Chiller shutdown earlier in the night	Oct-12	300 (kWh/hr)[1]
AHU airflow night setback	Oct-12	62,903
AHU reset schedule	Oct-12	52,961
Cooling Tower sequencing	Oct-12	9,708
T-12 to T-8 upgrade	Oct-12	1,457
MR-16 LED upgrade	Oct-12	4,253
LED upgrade	Oct-12	1,533
Data center cooling	Nov-12	751,008
Parking garage LED lighting	Dec-12	50,449
MR-16 LED	Feb-13	5,599
Total[2]		**1,776,943**

Notes: Based on "ECM project list December 2013.xls," 2013-3, December 2013.

[1] The facility reported savings in kWh per hour of setback. The number of setback hours was not specified.

[2] Excludes savings reported in kWh per hour of setback for chiller shutdown measure.

3.1.2. Findings

As noted above, 2012 measures will have part of their impact in 2012 and part of their impact in 2013, and some of the 2013 savings will be deferred until 2014 Energy Expert accounting. For this reason, the facility estimate of 2013 energy savings shown above does not include any savings for measures implemented in the second half of 2013. This is a conservative methodology.

Additionally, according to the consultant, various operations and maintenance actions are taken on a regular basis that are not formally reported. While the impact of these actions cannot be quantified, they are captured in the Energy Expert accounting.

In conclusion, Energy Expert's estimate appears to be a reasonable estimate of savings for the list of measures reported. Table 5 shows the validated savings.

Table 5: 2013-3 Energy Expert Energy Savings

Project	Original Savings (kWh/year)	Validated Savings (kWh/year)
Multiple commissioning and capital measures	450,051	450,051

3.2. Lighting Upgrade

This project upgraded T12 lighting to T8 in three areas (referred to here as Areas A, B, C). Additionally, outdoor lighting in another building (referred to here as Building B) parking area was upgraded, and MR-16 exterior lighting at Building B was upgraded.

3.2.1. Methodolody

SBW examined the documentation provided by Idaho Power, consisting of an email from the project manager, forms from the utility, and measure descriptions.

3.2.2. Findings

Table 6 shows the validated savings for the lighting system upgrade.

Table 6: 2013-3 Lighting Upgrade Energy Savings

Project	Original Savings (kWh/year)	Validated Savings (kWh/year)
Area A T-12 to T-8 Upgrade	47,118	47,118
Area B T-12 to T-8 Upgrade	36,996	36,996
Area C T-12 to T-8 Upgrade	62,084	62,084
Building B Parking & Exterior Lighting Upgrades	30,016	30,016
Total	**176,214**	**176,214**

4. 2013-4

Savings for this facility fell into two categories.

1. The serving utility, Cowlitz PUD, verified the savings for three measures as part of their energy efficiency incentive program.
2. Savings for three additional measures not incentivized by the utility were estimated using engineering calculations.

SBW verified that the savings were as reported and that the engineering calculations were reasonable.

4.1. Utility Incentivized Measures

Cowlitz PUD incentivized three measures:

1. Operating room HVAC hours were reduced
2. Lighting was upgraded to T-8 and LED
3. Parking lot lighting was upgraded from metal halide to LED

4.1.1. Methodology

SBW examined the documentation provided by Cowlitz PUD, consisting of an email from the utility and measure descriptions.

4.1.2. Findings

Savings claimed by the utility were limited to one HVAC measure and two lighting measures for 2013. SBW checked that the amount claimed by NEEA matched the savings claimed by the utility. The value for the HVAC measure was valid, but values for the two lighting measures differed, with the utility claiming savings lower than what NEEA had reported for one measure, and claiming savings higher than reported by NEEA for the other. The net effect was to reduce savings by 6,358 kWh, or 1.6% of the total utility incentivized savings. Table 7 shows the utility incentivized savings for 2013-4.

Table 7: 2013-4 Utility Incentivized Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Reduce HVAC hours for operating rooms	349,660	349,660
Lighting upgrades to T-8 and LED	17,198	6,741
Parking lot lighting upgrade - metal halide to LED	35,636	39,735
Total	**402,494**	**396,136**

4.2. Non-Utility Measures

The facility implemented three measures for which they did not receive utility incentives:

1. Air handling unit economizer operation
2. VFD for boiler combustion air fan
3. Rebuilt air handler in another building (referred to here as Building B)

4.2.1. Methodology

SBW performed a review of the provided engineering calculations, which consisted of a spreadsheet weather bin model for each ECM.

ECM-5: Air Handler Unit Economizer Operation

This measure repaired the outside air economizer in the air handling unit serving Area A, resulting in cooling energy savings. The consultant calculated savings using a weather bin-based spreadsheet analysis. The analysis used spot measurements of AHU component volts and amperage to calculate kW's for the compressors, evaporator blower, condenser fans, and power exhaust (all components affected by the measure). The baseline assumed no economizer operation (The spreadsheet calculated mechanical cooling energy for all bin hours with a cooling load). The installed case assumed outside air economizer operation, resulting in no mechanical cooling energy during hours in which free cooling was available. In addition, the analysis calculated a penalty due to power exhaust operation, which occurs when outside air exceeded 50% of supply air.

ECM-6: VFD for Boiler Combustion Air Fan

This measure added a variable frequency drive (VFD) to the boiler room combustion air fan. In the baseline, the fan ran at full capacity and a damper bypassed unneeded airflow to the boiler. The VFD allowed for fan speed modulation, eliminating the need for a bypass damper and resulting in fan energy savings. Savings were calculated using readings taken from a kWh consumption counter at the VFD panel during the baseline and post-installation periods. The analysis calculated an average kWh per day for each case (110.4 kWh/day baseline, 62.0 kWh/day post-installation). The analysis assumed that the boiler operates an average of 354.6

days per year. The savings was calculated as (110.4 kWh/day - 62.0 kWh/day) x 354.6 days/yr = 17,166 kWh/yr.

ECM-21: Building B AHU Upgrade

Compressor efficiency was increased by rebuilding the existing compressors on the air handling unit. In addition, the measure repaired the outside air economizer and replaced unit controls. These actions resulted in cooling energy savings. The analysis calculated savings using a weather bin-based spreadsheet analysis. The analysis used spot measurements of AHU component volts and amperage to calculate kW's for the compressors, condenser fans, supply fans, and return fans (all components affected by the measure). The baseline assumed no economizer operation. The installed case assumed economizer operation and an assumed 25% reduction in kW for the rebuilt compressors.

4.2.2. Findings

SBW reviewed each calculation in depth and found them to be a reasonable estimate of savings. The evaluation did not uncover any errors. The model used actual measurements/readings taken on site, which further bolstered the credibility of the estimates. Table 8 shows savings for each of the non-incentivized measures.

Table 8: 2013-4 Non-Incentivized Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Area A air handler unit economizer operation	20,314	20,314
VFD for boiler combustion air fan	17,166	17,166
Building B AHU upgrade	175,971	175,971
Total	**213,451**	**213,451**

5. 2013-5

5.1. Methodology

The serving utility, Puget Sound Energy, verified the savings for this facility as part of their energy efficiency incentive program. SBW verified that the savings were as reported.

5.2. Findings

Claimed savings were due to one HVAC measure. SBW verified that the amount claimed by NEEA matched the savings claimed by the utility. Table 9 shows the savings for 2013-5.

Table 9: 2013-5 Facility HVAC Project

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Constant Volume AHUs Converted to Variable Volume	520,000	520,000

6. 2013-6

6.1. Methodology

Savings for one measure not incentivized by the utility were estimated using engineering calculations. SBW reviewed the savings calculation and verified that the savings were as reported.

Claimed savings were due to one HVAC measure. The analysis calculated savings using a weather bin-based spreadsheet analysis. The analysis used spot measurements of the building chiller compressor and chilled water pump volts and amperage to calculate a spot kW reading. A part load efficiency curve from eQUEST was used to calculate an adjustment factor for each outside air temperature bin, to be applied to the spot kW. For outside air temperatures below 44°F outside air temperature (the chilled water supply temperature setpoint), the compressor kW was set to its minimum value. The chilled water system kWh was calculated for each temperature bin as (adjusted compressor kW + pump kW) x operating hours. In the baseline, the chilled water system operated 24/7 year round (8,760 hours). After the installation, observations revealed that the chiller operated only between 53°F and 62°F outside air temperature, which equates to 2,362 annual operating hours. Below 53°F, cooling loads are satisfied by airside economizers at the air handling unit. Above 62°F, central plant chillers handle the entire cooling load and the building chiller is deactivated.

6.2. Findings

SBW reviewed the provided calculations in depth and found them to be a reasonable estimate of savings. The evaluation did not uncover any errors. The model used actual measurements/readings taken on site, which further bolstered the credibility of the estimate. Table 9 shows the savings claimed for 2013-6, which matches the savings value from the engineering calculation.

Table 10: 2013-6 Facility HVAC Project

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Reduce Building Chiller Runtime	140,150	140,150

7. 2013-7

7.1. Methodology

The serving utility, Energy Trust of Oregon, verified the savings as part of their strategic energy management (SEM) incentive program for multiple facilities within the 2013-7 health system. SBW verified that the savings were as reported.

7.2. Findings

SBW verified that the amount claimed by NEEA matched the savings claimed by the utility. No information was available on specific measure savings, or savings at specific facilities within the system. Table 11 shows the total savings for all facilities within the system.

Table 11: 2013-7 SEM Savings

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
SEM Year 2 Continuation	1,109,481	1,109,481

8. 2013-8

8.1. Methodology

The serving utility, Energy Trust of Oregon, verified the savings as part of their strategic energy management (SEM) incentive program for multiple facilities within the 2013-8 health system. SBW verified that the savings were as reported.

8.2. Findings

SBW verified that the amount claimed by NEEA matched the savings claimed by the utility. No information was available on specific measure savings, or savings at specific facilities within the system. Table 12 shows the total savings for all facilities within the system.

Table 12: 2013-8 SEM Savings

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
SEM Year 2 Standard	234,916	234,916

9. 2013-9

9.1. Methodology

The serving utility, Seattle City Light, verified the savings for a lighting measure at one facility. SBW verified that the savings were as reported.

9.2. Findings

SBW verified that the amount claimed by NEEA matched the savings claimed by the utility. Table 13 shows the total savings at the facility.

Table 13: 2013-8 SEM Savings

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
LED Lighting Upgrade	106,864	106,864

Appendix E: NEEA Response to MPER 6 Report

Memorandum

February 1, 2014

TO: Rita Siong

FROM: Kim Hughes

SUBJECT: Hospital & Healthcare Initiative MPER#6 Recommendations and Response

Here are my responses to the most recent MPER#6 on the Hospital & Healthcare Initiative.
If you have questions please let me know.

Best regards,
Kim Hughes, Senior Initiative Manager

9.0 KEY FINDINGS AND RECOMMENDATIONS

LONG TERM MONITORING & TRACKING (RECOMMENDATIONS 1 AND 7):

Conduct annual interviews with current Initiative participating hospitals to confirm they are still implementing the key elements of SEM. NEEA will need to utilize a combination of top-down/whole building and bottom-up approaches to conduct long-term monitor and tracking. Historically, the types of projects completed and the types and quality of savings data submitted by hospitals and utilities have varied significantly, and the quality and formats of future data are unknown. Where appropriate, collect detailed data in the form of utility meter data and lists of measure and actions, supplemented by interviews of key personnel to clarify the context for installations. The party responsible for this effort may also have to sample some sites and develop a quantification scheme based on available information.

Response:

The initiative Product Manager, who develops the Long Term Monitoring and Tracking (LTMT) plan, has access to both recommendations and will be a part of further strategic initiative discussions.

ACE MODEL (RECOMMENDATION 6):

Recommend NEEA make minor changes to the ACE model EUL assumptions. First, for HVAC equipment, adopt a more detailed categorization scheme with more distinct measure lives, as shown in Table 7: Recommended HVAC Equipment EULs; or use an overall average of 17 years. Second, include HVAC controls with other O&M measures and use an average life of 8 years.

Response:

Currently, the Hospital and Healthcare ACE model is not used to calculate energy savings associated with SEMP impacts. Rather, a project-by-project review and validation/verification process is in place. I recommend NEEA Planning adopt the suggested EULs when reporting savings.

Northwest Energy Efficiency Alliance
421 SW Sixth Avenue, Suite 600, Portland, OR 97204
503.688.5400 | Fax 503.688.5447
neea.org | info@neea.org

TRANSITION OF HEALTHCARE TOOLS AND MATERIALS (RECOMMENDATION 5):

Update website SEM content with case studies on new energy efficient hospitals. Several interviewees suggested adding case studies on the Swedish Medical Center in Issaquah, Washington and the Peace Health Hospital in Friday Harbor, Washington.

Response:

NEEA plans to complete two additional case studies in 2014. The Hospital & Healthcare Utility Work Group provided similar feedback.

OPERATIONS AND MAINTENANCE (O&M) SUPPORT (RECOMMENDATION 4):

Work with BPA to expand or replicate its Track and Tune program to serve the hospitals segment. According to interviewees, BPA's program to induce operational improvements in the industrial sector has been very successful, and NEEA (and the utilities) could collaborate with BPA to explore if and how they could expand the program to serve regional hospitals. This could be a valuable complement to existing utility rebate programs, which generally focus on capital projects.

Response:

NEEA is currently coordinating with the Hospital & Healthcare Utility Work Group on transition activities and will share this recommendation with BPA and the work group to see if there are any opportunities to collaborate on O&M.

EXECUTIVE COMMITMENT TO SEM (RECOMMENDATION 2):

Deliver periodic presentations to groups of regional hospitals executives to describe and promote SEM. This would help to ensure that changing management has the opportunity to consider SEM or is not inclined to eliminate existing, successful efforts. These presentations could replicate the recent presentation to a Montana hospitals alliance on the benefits derived at Kalispell Regional Medical Center. NEEA and participating utilities should launch these presentations after finalizing details regarding how NEEA's SEM tools and knowledge transfer to the utilities, so the utilities are prepared to respond to increasing inquiries about SEM.

Response:

NEEA is currently coordinating with the Hospital & Healthcare Utility Work Group on transition activities and will share this recommendation to see if there are any opportunities to address executive commitment. NEEA is also developing the concept for a commercial/industrial SEM infrastructure program. I will share this recommendation with the development team.

OUTSIDE ADVOCATE FOR SEM (RECOMMENDATION 3):

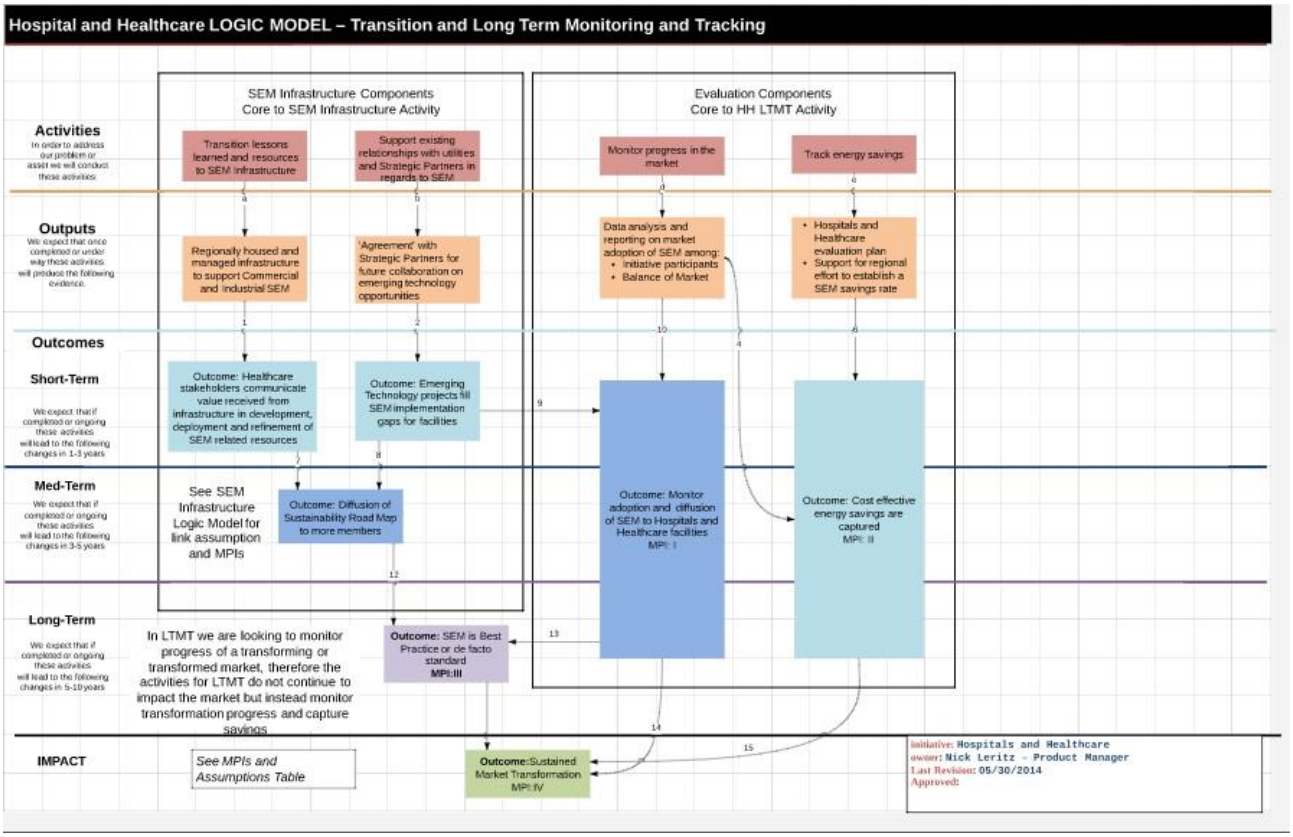
Conduct advocacy training with hospitals SEM staff and utility account managers before leaving the market. Providing RCMs, facilities managers and utility account representatives with advocacy tools and skills could help to maintain an executive focus on SEM.

Response:

NEEA is currently coordinating with the Hospital & Healthcare Utility Work Group on transition activities and will share this recommendation to see if there are any opportunities to address advocacy training. NEEA is also developing the concept for a commercial/industrial SEM infrastructure program. I will share this recommendation with the development team

CC: Sepideh Rezania, Christopher Frye

Appendix F: Hospitals & Healthcare Draft LTMT Logic Model



ENERGY + WATER + EFFICIENCY

M e m o r a n d u m

FROM: SBW Consulting

TO: Rita Siong, Northwest Energy Efficiency Alliance

DATE: March 9, 2015

RE: Hospital & Healthcare Initiative 2014 Energy Savings Validation

CC: John Boroski, Evergreen Economics

SUMMARY

This memorandum describes SBW Consulting's (SBW's) validation of the electrical energy savings from the Northwest Energy Efficiency Alliance's (NEEA's) Hospital and Healthcare (H&H) Initiative for the year 2014. Table 1 summarizes the validated savings for the three facilities included.

SBW's validation consisted of inspection and review of the documentation provided by NEEA, the utilities, and the facilities. Where a utility has incentivized a measure, SBW verified that the savings amount claimed by NEEA matched the amount reported by the utility. Where more detailed information was available, SBW verified that the means used to arrive at the savings claim were reasonable, and that the results were within the range of expected savings for the measures.

Table 1: H&H Initiative Validated Electrical Energy Savings for 2014

Hospital Group / Facility Identifer	2014 Validated kWh (aMW)
2014-1	2,313,639 (0.264)
2014-2	642,420 (0.073)
2014-3	620,493 (0.071)
Total	**3,576,552** **(0.408)**

1. 2014-1

1.1. Methodology

The serving utility verified the savings for 2014-1 as part of their energy efficiency incentive program. SBW examined forms provided by the utility and verified that the savings were as reported.

1.2. Findings

Claimed savings derived from four HVAC measures. The project added a ground water loop to the chilled water system, added magnetic bearings on chillers, and modified the control sequence on select air handling units to reduce fan speeds during off hours, thus reducing airflow. Table 2 shows savings for the four measures.

Table 2: 2014-1 Utility Incentivized HVAC Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Centrifugal Chiller Improvements: Ground Water Loop	861,809	861,809
Ventilation System Improvements: Operating Room Setback	525,021	525,021
Centrifugal Chiller Improvements: Chiller Magnetic Bearing	344,129	344,129
Ventilation System Improvements: AHU Fan Setback	582,680	582,680
Total	**2,313,639**	**2,313,639**

2. 2014-2

2.1. Methodology

NEEA claimed savings for one HVAC measure at this site. The utility did not incentivize the savings. The NEEA Technical Lead for the project used engineering calculations to estimate savings. SBW reviewed the calculations and verified that the savings were as reported.

The installed measure affected six air-handling units. Each unit has variable speed drive fans. A mix of direct expansion (DX) cooling and central chilled water-cooling provides cooling. A mix of electric heat and central gas-fired hot water boilers provides heating. The hospital originally operated the air handlers 24/7 year round with no setbacks. The installed measure adjusted the control sequence of the six units to set back the airflow during unoccupied hours. This resulted in electric savings to fan, heating, cooling, and pumping end use energies.

The Technical Lead estimated savings with a spreadsheet analysis that used fan logger data to calculate fan energy savings for the six affected air-handling units. The analysis applied the fan energy percent savings to calculated heating, cooling, and pumping energies to determine savings for the respective end uses. Inputs to the calculation were based in part on information provided by the site contact, and in part on assumptions made by the Technical Lead. SBW reviewed the inputs for accuracy and reasonableness. **Error! Reference source not found.** describes the primary assumptions made in the model, all of which SBW concluded to be reasonable.

Table 3: 2014-2 Savings Calculation Assumptions

Parameter	Value	Evaluation Notes
Cooling equivalent full load hours	1,250 hours/year	Checked against TMY3 weather data and found to be reasonable.
Cooling efficiency	0.65 kW/Ton	This value is typical for affected types of systems.
Heating equivalent full load hours	8,760 hours/year	Heating does not occur year-round (this is not a literal value). This value was used in conjunction with the average heating delta T to determine the average year-round heating energy.
Average heating delta T	7 °F	This is the average temperature difference seen by the heating coil. The value was checked against TMY3 weather data and found to be reasonable.
Heating efficiency	82%	This value is typical for the affected types of systems.

2.2. Findings

SBW reviewed the provided calculations in depth and found them to be a reasonable estimate of savings. The evaluation did not uncover any errors. The model used actual meter data taken on site, which further bolstered the credibility of the estimate. Table 4 shows the validated savings for the single measure.

Table 4: 2014-2 Facility HVAC Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Reduce ventilation of six air handlers	642,420	642,420
Total	**642,420**	**642,420**

3. 2014-3

3.1. Methodology

The serving program administrator verified the savings for multiple facilities within the 2014-3 health system. SBW verified that the savings were as reported.

3.2. Findings

The program administrator claimed savings at five separate buildings within the health system, but did not provide details of the actual measures installed. Table 4 shows the validated savings for each building.

Table 5: 2014-3 Program Administrator Incentivized Projects

Project Title	Original Savings (kWh/year)	Validated Savings (kWh/year)
Building A (Hospital)	429,126	429,126
Building B (Medical Office Bldg)	43,528	43,528
Building C (Medical Office Bldg)	40,847	40,847
Building D (Medical Office Bldg)	18,769	18,769
Building E (Hospital)	88,223	88,223
Total	**620,493**	**620,493**