Designing Energy Behavior – Leading Change
Carolinas HealthCare System

Kady Cowan, Carolinas HealthCare System

ABSTRACT

Carolinas HealthCare System (CHS), one of the nation's leading and most innovative healthcare organizations, provides a full spectrum of healthcare and wellness programs throughout North and South Carolina. Hospitals are among the most resource-intensive commercial buildings. They have strict requirements for temperature, humidity and air quality, meaning they need sophisticated HVAC systems, and they include nonclinical functions that have high energy demands, such as food services and information technology.

The CHS Office for a Healthy Environment designed and implemented a new Energy Behavior program in 2015 specifically for healthcare. Our design approach, grounded in putting humans at the center of the energy system incorporates insights from organizational strategy, behavior, operations, technology and investment. Our work is based on research from social marketing, collective impact, cognitive science, behavioral economics and ethnography. Our tactics include actors from diverse disciplines and departments coming together to co-create the most appropriate solutions for specific energy efficiency and conservation problems. Our methodology has been field tested in various socio-technical hospital environments, with diverse target audiences and target behaviors.

We will showcase how moving energy to the center of organization-wide planning and decision making can be barrowed across healthcare enterprises and commercial sectors. Our ability to iterate quickly by collecting energy and behavioral data shows successful long-term change and many co-benefits of energy efficiency and conservation interventions. Some of the biggest wins from the Energy Behavior program come directly from making facility managers more comfortable with adopting energy efficient solutions. We will present a summary of the specific energy issues that impact energy management in healthcare and the unique design approach we use to collect and document change and organizational commitment.

Introduction

Healthcare sector in the United States is the second largest commercial user of energy (Practice GreenHealth 2015). In 2013 there were 5,686 hospitals nationwide with 914,513 licensed beds. U.S. hospitals use more than 8% of the nation's energy (Healthier Hospitals Initiative 2012). The last comprehensive international inquiry into hospital energy intensity was completed over a decade ago reports the approximate annual energy consumption of American hospitals at 269 kBtu/ft^2. The portion of electrical energy consumption being 240 kWh/M^2 (75 kBtu/ft$^{2)}$ and the portion of thermal consumption being 610 kWh/M^2 (194 kBtu/ft$^{2)}$ (Umwelt *no date*).

As a sector healthcare facilities and hospitals in particular have a wide range of operating profiles with respect to energy consumption. This fact is generally attributed to the variability in number of beds and full-time staff per square foot, service intensity (patient days), quantity of imaging equipment, number of operating rooms, and finally, energy efficiency and adoption of energy management practices (ENERGY STAR 2015).

Over the last decade hospital administrators, hospital engineers and frontline staff have realized that moving attention for energy management from the realm of unknown to central operating practice has important savings potential through cost avoidance. Hospital CFO's rule of thumb is every $1 not spent; for example, on utilities, eliminates the need to earn $20 in revenue (ENERGY STAR no date). Dr. Herbert Pardes, President and CEO, New York Presbyterian Hospital simplifies this idea by saying; "Every dollar saved on energy costs is a dollar that is devoted to improving medical care for our patients."

Hospitals across the country have implemented energy management to varying degrees with guidance, assistance and recognition from groups such as ENERGY STAR, Practice GeenHealth, Healthier Hospitals Initiative, and ASHE (American Society for Healthcare Engineering). In general, hospitals tackle technical changes alone without consideration for process or behavioral changes because the expertise for implementing and tracking energy behavior change is limited or non-existent.

Two hospital systems have approached energy management differently. University Health Network (UHN) in Toronto, Canada and Carolinas HealthCare System (CHS) in Charlotte, United States. Both systems have accounted for human behavior early on and have integrated process change to compliment and improve the energy savings achieved with technical changes such as retro-commissioning and retrofits. This paper will outline how an environmental sustainability practitioner employed by the hospital used design and culture to influence these large complex organizations to prioritize energy management resulting in multi-million-dollar annual utility savings.

Relevance of Institutional Actors

For many hospitals and healthcare institutions energy management is a relatively new program area. Staffed with small teams, and required to communicate with senior leadership and financial decision makers new to the field of energy finance; energy managers traditionally select technical projects that can be easily measured, meet the demands for high ongoing annual savings and quick payback. Lack of familiarity with social and system science prevent many organizations from embracing the powerful low-cost approach of behavior change.

University Health Network (UHN) first embraced energy management in 1999, and as a result is home to a mature and robust energy management strategy where the investment of time and innovation to simultaneously integrate human behavior into process and technical energy management projects had resulted in persistent, transferable, scalable, self-sustaining, and fun energy management models.

Carolinas HealthCare System (CHS) on the other hand is just beginning on the energy management journey. CHS has the advantage of implementing advanced practice, including the use of tools and techniques grounded in social and system science. CHS is targeting three specific behavioral and cultural factors that compliment and reinforce more conventional building commissioning and technical retrofits.

- Raise the profile of energy for staff in their day-to-day work lives.
- Help facility managers and building operators be more comfortable recognizing, adopting and eventually suggesting energy efficient solutions.
- Demonstrating the role of senior leadership in energy conservation.

Why Are Hospitals Different?

Healthcare landscape. Hospital culture and healthcare workforce are tasked with ensuring accurate patient outcomes and experiences. Hospitals function in a highly regulated and scrutinized landscape bridging complex medical treatments with complex human needs. Hospitals have adapted over the decades to exist in almost constant change. This is only compounded by characteristics such as infinite competing priorities, fluctuating fiscal environments and an extremely risk averse default culture. These boundaries have shaped the time-poor, reactive, and treatment focused mindset that hospitals use and at which they have become expert. In contrast, energy behavior program design imposes a prevention mindset that may seem uncomfortable in this landscape.

Energy behavior research focuses on residential sector. Although the institutional and commercial sectors have significant energy savings potential, the majority of research focuses on residential consumers (Mourik and Rotmann 2013). This requires energy behavior practitioners working in the institutional sector to translate insights from the research to fit the workplace context. One individual at work may have different perceptions, attitudes and possibly even values compared to the same individual at home. The required actions at work are different from those common at home. Using a combination of research including residential focused energy behavior, pro-conservation behavior at work (Hargreaves, 2008) and environmental psychology (McKenzie-Mohr 1999) helps to bridge this gap.

Feedback. In many workplace settings the feedback mechanisms are unclear because the relationship to monthly bills is eliminated. Only in unique circumstances are institutions or commercial building equipped with sufficient sub meters to be able to view who is responsible for which energy impact. To deliver the much sought after feedback participants' request, workplace energy behavior programs rely on labor intensive audits, observations and calculations to discover relationships between actions and impacts. Co-benefits such as employee engagement, participating in something good, living values at work and sense of pride also play an important role in feedback, helping to demonstrate the value of collective impact[1].

Hospitals have unique operating profiles. Insights generated from personal interviews and focus groups exploring the meaning of energy use and management in hospitals conducted at University Health Network in Toronto in 2015 and Carolinas HealthCare System in Charlotte in 2016 with energy engineers and frontline facilities staff are summarized in Table 1. These insights expose some of the complexity of the operating landscape in healthcare.

[1] Collective Impact is a framework to tackle deeply entrenched and complex social problems. It is an innovative and structured approach to making collaboration work across silos to achieve lasting social change. *Source: accessed on May.5.2016 http://www.collaborationforimpact.com/collective-impact/*

Table 1. Energy Insights about Hospitals

Theme	Examples
Extreme operational demands	- Operations are 24/7 with limited to no downtime. - A massive base load must run all year round in healthcare.
Decision making and financial silos	- Healthcare operations and capital budgets are allocated and can be controlled by different entities making it difficult to justify operational savings to groups responsible for capital costs. - There is financial incentive for equipment to be replaced on 'like' for 'like' basis which can result in overlooking important energy savings. - Conflicting requirements coupled with poorly understood impacts of policies can result in energy waste based on untested assumptions (i.e. Infection prevention control vs energy vs comfort). - Procurement requirements can increase complexity and confusion which results in higher costs.
Standards not consistent nor consistently implemented	- Hospitals often use vague building codes and not the highest level design standards such as ASHRAE 189.1. - Many different space types in one building requiring great variation in ventilation, capacity and redundancy. - There are regular changes in form and function of spaces (i.e. clinics convert to office) which may have different requirements for energy services that are not included in the re-design.
Risk aversion	- Over engineering or oversizing equipment to accommodate multiple safety factors is common. - Slow uptake of new technology results in legacy technologies staying in use longer than required.
Frontline staff not engaged in energy actions or decision making	-There is a lack of access to energy training for operators with no incentive for operators to take training or to use it. - A common energy language is missing which makes providing meaningful feedback about energy consumption and energy services difficult or impossible.
Getting the right information to the right people at the right time	- Standard metrics are lacking for building operators and management to be able to understand and react to energy information. -It is difficult to communicate all the system requirements to consultants responsible for completing projects on site which results in a lack of consistency across the organization.
Documenting information	-Poor information and systems for maintaining or tracking information.

Collecting insights such as the ones listed in Table 1 from the individuals closest to the work can quickly reveal barriers and priorities for an energy behavior program. Accounting for the context of energy use in hospitals leads to the appropriate selection of target audience, target behaviors and indicators of success.

Energy Behavior Program Design

This section will outline the genesis of the lead author's energy behavior program design methodology for hospitals as well as describe how this methodology is being used in a fresh hospital setting with specific attention on scaling-up energy behavior programs through intentional design, implementation and impact analysis.

At the helm of internal organizational energy behavior programs is either an energy behavior practitioner or a certified energy manager. The role of these leaders is to make an appropriate determination regarding where an energy behavior program should intervene in the energy ecosystem[2] landscape. Their roles are different but complementary.

An energy behavior practitioner is unique in the field and rare in any sector. Practitioners are equal parts researcher, coach, presenter, storyteller, evaluator, and futurist. Familiar with the context and culture of their organization allows a nimble response to change. As practitioners, the aim is to answer the perplexing question of how humans fit into the energy system and how to design for human behavior. Practitioners are successful when energy program gain acceptance and energy impacts persist over the long term.

On the other side, certified energy managers more commonly lead organizational energy management programs with a particular focus on engineering, building science and technology. However, for the first time since publication, the Association of Energy Engineers text book *Guide to Energy Management* (eds. Capehart, Turner, Kennedy 2015) have included a new chapter called "Human Behavior and Facility Energy Management". This is a dominant signal in the energy field that human behavior is integral to the energy system and certified energy managers can learn to integrate this powerful force into energy management plans.

Both the practitioner and the manager are interested in targeting action that will impact consumption of energy in the organization. They can do this by working with the target audience to design appropriate and meaningful interventions.

Behavioral Interventions

The range of interventions possible is almost endless. Popular schemes in the energy behavior space include; benchmarking, social norms, pledges, competitions, policy changes, mentorship and incentives. No matter which intervention is ultimately selected, at a minimum the intervention must have a **baseline**, appropriate **goals** that are meaningful to participants and a **feedback** mechanism so participants know how they are doing, how those around them are doing and how they are contributing to the overall organization target. Interventions vary, but one tool that seems to translate across groups is **commitment**. Participants who make a public commitment to their peers that they will take action helps them see them self as "the kind of person that would save energy" and therefore more likely to actually do it. This also puts their

[2] Energy Ecosystem is the interaction of all processes, actors and technical parts of the energy landscape. It acknowledges and accounts for the variability and unpredictability that is unique to each context specific socio-technical environment.

integrity at stake; to do what they said they would do. The last minimum program requirement is **celebration** and recognition. Acknowledging that individuals and teams are making progress and working toward their goals helps to keep momentum going and reinforces that they are not alone.

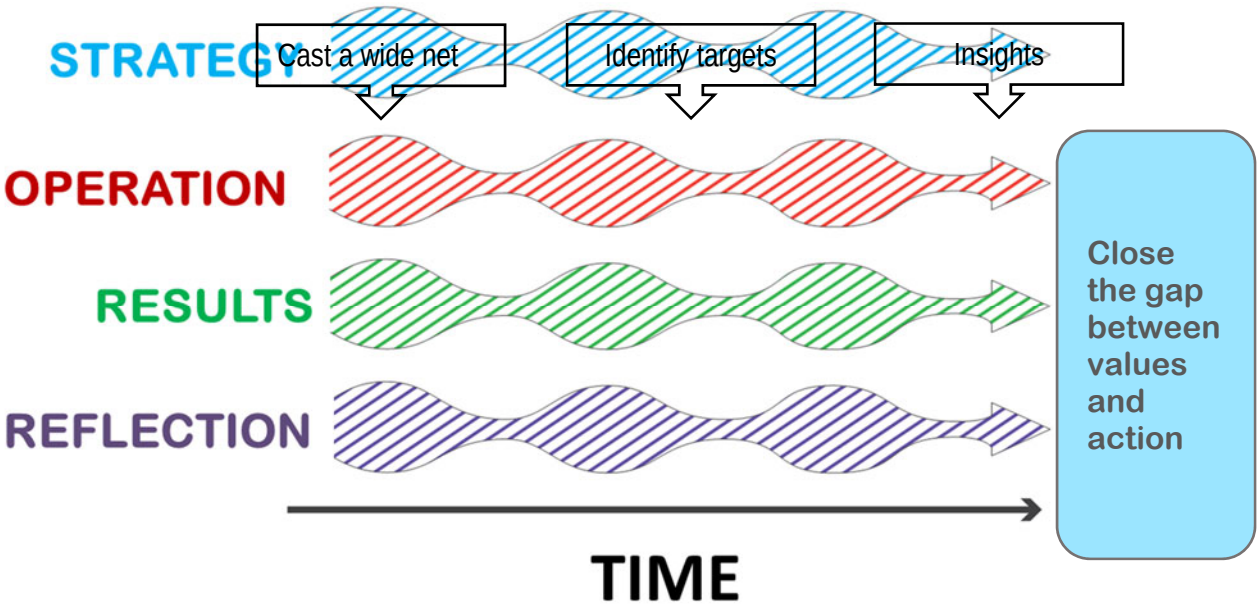

Figure 1. Energy Ecosystem Program Design Framework. *Source*: Cowan, K. 2014

An Energy Behavior Design Framework

To help interpret the stages of program design the Energy Ecosystem Program Design Framework (Figure 1) was developed based on the energy behavior program called Operation TLC in Toronto at the University Health Network. Program designers must balance movement between abstract and tangible in four program areas simultaneously. Thus, capturing and using the feedback from various design stages for continuous improvement and not one particular outcome. The Energy Ecosystem Program Design Framework is an iterative cycle that can be conceptualized as four waves. The process begins with the abstract and moves toward the tangible over time gaining insight along the way. This is done by collecting information, leveraging influence and understanding interactions in each program area: strategy, operation, results, and reflection. An example of how this model was used for energy behavior program design will be summarized in the next section.

Hospital with Mature Energy Management System

University Health Network (UHN) in Toronto, Canada spent over a decade embedding energy management into day-to-day operations and decision making. UHN has a robust energy behavior program called Operation TLC (Turn off Lights and Computers) that has influenced thousands of staff actions toward energy conservation by elevating the importance of little energy saving habits.

Being the program designer of Operation TLC between 2007 and 2015 was the catalyst for the development of the Energy Ecosystem Program Design Framework. Use and refinement of the model over time resulted in shifting the energy culture of the 4 large hospitals in the network from a "lights *on* kind of place" to a "lights *off* kind of place" realizing $3.5 million (CND) or 10% in annual utility savings. Other indicators of success and clear signals of culture change include:

- The CFO routinely asks for energy impact analysis on all capital projects
- 100 departments decreased their excess use of electricity between 30% to 100%
- Facilities staff accept and often suggest energy efficiency measures
- Of the total organization wide energy conservation goal of 10% between 1-3% can be attributed to the no cost energy behavior program Operation TLC
- Over 60% of the 14,000 staff were familiar with Operation TLC and over 25% worked directly with the program

Using the framework. By using the framework several things about program design became clear. People and technology were valued equally and behavior was seen not as an add-on but as a resource that could be managed. The framework helped to differentiate the need to develop a process to set the course for the future instead of creating a universal solution. This feature of the program acknowledged that solutions for specific energy problems would be discovered by participants themselves to fit their unique context.

Iterative cycle. Moving from imprecise phases of hunch to proof along the waves of the framework grounds the process. An iterative cycle of casting a wide net and asking what is possible then analyzing the results to identify the most appropriate target moves the program from abstract to tangible over time. Useful tools to the program designer vary; at a minimum process flow, documentation, utility data, sub meters, sensors, audits, observations, interviews, surveys, and reports help the program designer separate signals from the noise to make more meaningful programming decisions as well as demonstrating program impact. The useful insights that keep Operation TLC moving have been generated this way and result in embedding energy more deeply into the fabric of the organization through every action, intention and decision.

Operational insights that have been most useful include; creating an organizational echo[3] so all participants feel they are part of something bigger than themselves and using existing networks, trusted individuals and social cohesion to make energy conservation matter. Operation

[3] Organizational echo is heard when many different individuals, units, divisions or departments across and up and down the silos do their unique part in the energy efficiency and conservation playbook. Each participant can "hear" their contributions echoed across the organization and be reassured that others are working toward the same goal, albeit in different ways. Organizational echo is both a motivational tool and feedback mechanism for program participants and is central in creating a culture of energy management.

TLC resulted in an energy behavior program that is simple and compelling enough that anyone in the organization is comfortable talking about it, which results in keeping it top of mind.

Formal evaluation of institutional energy behavior programs is difficult to obtain so the framework recommends that regular cycles of reflection are completed by the program design team. This encourages double-loop learning to ensure that assumptions and values are checked on a regular basis. Program designers must be ready and willing to release program elements that are in decline and observe trends that are emerging from the noise. In the case of Operation TLC a lighting audit that was too difficult for program champions to complete on their own was revised so it could be completed in groups or in buddies.

Energy co-benefits. Another large hospital system in London England called Barts Health NHS Trust has documented a long list of accomplishments since Operation TLC – UK began in 2013. They astutely collected metrics that are central to the hospital's core mission; patients. This illustrates the value of looking for co-benefits in addition to energy savings. Barts Health has reported the following successes;

- 38% fewer patients request to change room temperature
- Staff report feeling proud to improve patient care
- $600,000 USD financial savings per year, enough for 18 new nurses
- Patients report 30% fewer sleep disruptions (Global Action Plan 2016)

Energy successes that have merit to the organization overall are more likely to persist for the long-term compared to a program that does not find a way to fit in.

Hospital with Emerging Energy Management System

In 2012, Carolinas HealthCare System (CHS) adopted a goal to reduce energy use intensity (EUI) 20% from a baseline of 295 kBtu/ft^2. This goal applies across a selection of the owned acute care[4] hospital facilities and will be accomplished in 2017. Success will align CHS with other top energy performing hospitals in the United States who report EUI closer to 230 kBtu/ft^2 (Practice GreenHealth 2015).

Occupant energy behavior pilot at CHS. The return on investment for energy management is exciting. However once initial savings have been achieved and accounted for seeing them decline over time can be frustrating. Attention to this detail motivated Carolinas HealthCare System in 2015 to link human behavior to the capital projects underway at 6 acute hospitals. To estimate the savings opportunity from behavior a research project lead by Emilie Greene, then Program Manager for a Healthy Environment at Carolinas HealthCare assisted by Khiry Sutton, alumna of Wake Forest University's Sustainability Graduate Program tested the impact of prompts for healthcare staff at CHS Lincoln Hospital. The target behaviors, intended for unoccupied patient rooms are easy to do in under two minutes and include: 1) turn off lights 2)

[4] "Acute care is a branch of secondary health care where a patient receives active but short-term treatment for a severe injury or episode of illness, an urgent medical condition, or during recovery from surgery. In medical terms, care for acute health conditions is the opposite from chronic care, or longer term care." (wikipwedia)

turn off televisions 3) power down computer monitors 4) reset thermostats and 5) close window blinds (Sutton 2015).

In addition to visual prompts energy behavior programs targeting frontline workers; nurses, housekeeping and security were supported by ongoing education and endorsed by department specific leadership. If those factors are in place rooms with visual prompts had a 42% higher chance of being in compliance with the target behaviors than rooms with no prompt. (Sutton 2015).

In order to estimate the amount of electricity produced by each room and the amount of savings possible with compliance researchers developed a unique energy behavior measurement equation "By applying the compliance rates and vacancy rates observed through the study, the electricity costs at CHS Lincoln Hospital could be reduced by as much as $50/day on peak, and $27/day off peak when 4 or more behaviors were performed. If the hospital can sustain its current energy efficiency behavior compliance rate, it can achieve an estimated monthly savings of approximately 15,896 kWh." (Sutton 2015).

The results of this study demonstrate that integrating occupant behavior change into capital energy efficiency investments offers potential to improve energy performance and generate ongoing savings at a relative low cost of implementation. When each actor in the energy ecosystem is aware of and can act in their own role to contribute to energy savings the spectrum of energy efficiency becomes visible and indicates a shift to a culture of conservation.

Operator energy behavior pilot at CHS. To test the transferability and scalability of the Energy Ecosystem Program Design Framework a comprehensive energy behavior program is being conceptualized at Carolinas HealthCare System to complement technical upgrades supported through capital investments. Capital projects at 12 hospital facilities have been allocated for retro-commissioning, conversion from pneumatic to digital (DDC) controls, chilled water system optimization, operating room ventilation schedule set-backs and BAS fault analytics. Customizing the energy behavior program for facilities staff, the target audience in tandem with capital investments will increase efficiency, reduce building scale complications and retain energy savings over the long term by building a culture of trust, engagement, pride and embedding energy management into the fabric of the organization.

This program is starting with energy management training for frontline facility staff. Using this pause from day-to-day tasks to learn about energy decisions that they can control will be the first formal introduction to energy management for this group at CHS. As well this training will be used to initiate a formal dialogue on how to spot energy opportunities and give the frontline the support and/or permission needed to resolve these issues. As the dialogue regarding energy matures the energy behavior program will begin to take shape in a collaborative design process targeting simple energy saving actions that frontline staff can take. The first energy behavior intervention with this target audience will be launched in Summer 2016 with the first cohort of trainees.

Design for Impact

Drawing a straight line between energy behavior and energy impact is time consuming and difficult. Most targeted interventions like the ones in hospitals are too small to impose a randomized controlled trial or quasi-experimental design. In the quest to know and ultimately predict what savings can be expected from behavioral interventions good pilot design is essential (Dunn, Dethman, Bean 2016).

Large utilities that do have the capacity to conduct experimental research to link interventions to savings have found anywhere from 1-3% of utility wide savings can be attributed to behavior. Utilities purposefully keep their estimates low because of the difficultly in attributing savings to energy behavior alone. However, in 2015 BC Hydro evaluated their popular and successful Workplace Conservation Awareness program to quantify the energy savings from this behavior based program and found results in the 1-2% range. Including retro-commissioning (RCx) as a behavior based approach increases savings by an additional 16% at the facility level (Mills 2009). Similar findings have been reported by Opower a customer engagement platform that represents a wide range of utilities in the U.S. (Opower 2013).

The energy behavior program at CHS will not only set a course toward a culture of conservation but will help to advance information that links interventions to energy savings through intentional program design. Attributing energy savings to behavior based programs is not only valuable to CHS but the energy behavior program planners.

Insights and Conclusion

The ultimate success in energy behavior programing is a shift in energy culture from negligent to mindful with interventions that encourage actions that are at first persistent then habitual. Although it seems possible that program designers will eventually have enough tools, feedback, and insight to be able to predict the outcome of an intervention given the context. For now, program designers must cycle through iterative phases to make sure the interventions and programs result in the intended outcome and the culture is moving in the direction of conservation.

Hospitals are among the most resource-intensive commercial buildings. They have strict requirements for temperature, humidity and air quality, meaning they need sophisticated HVAC systems, and they include nonclinical functions that have high energy demands, such as food services and information technology. Organizational structure is complex which can make finding access points to elevate energy conservation unclear. For large hospital systems, annual energy costs can reach into the tens of millions of dollars. Yet most health systems still don't make energy investments a priority.

Some of the biggest wins from the energy behavior program come directly from making facility managers and building operators more comfortable with recognizing, adopting and eventually suggesting energy efficient solutions. Targeting actions and actors who have the most control over energy decisions is the most rewarding part of energy behavior programming. With an energy conservation mind-set large scale energy projects can increase energy efficiency and conservation; reduce building scale complications; retain energy savings over the long-term; move faster and more smoothly and be more cost effective.

In addition to these successes energy behavior programs also attribute value to employee co-benefits such as engagement, job satisfaction, pride and respect, working to your highest skill set and camaraderie. For hospitals there are potential co-benefits for patients as well; quiet at night, improved patient experience through comfort and cohesive staff teams. The community benefits are even farther reaching; hospitals are seen as leaders in the community acting on community values. Most broadly the impact of increased energy literacy – that ability to understand and talk about energy creates meaning so impacts become clearer to a wider audience.

While CHS actively manages energy costs by implementing opportunities as they are identified, by acting more strategically, CHS can significantly improve its energy-related

performance. Internalizing energy management into every-day decision-making, and operating procedures helps assure substantial and long-lasting reductions in energy use throughout CHS.

References

BC Hydro. 2016. Workplace Conservation Awareness. PowerSmart. Accessed March 18, 2016 https://www.bchydro.com/powersmart/business/programs/workplace-conservation.html?WT.mc_id=rd_oldworkplaceconservationawareness

Capehart, Turner and Kennedy Eds. 2015. *Guide to Energy Management 8th Edition*. Fairmont Press.

Cowan, Kady. 2014. "Turn off the Lights or 1000 little steps." Behave Energy Conference. September 4, 2014. University of Oxford, UK. PowerPoint.

Dunn, A., Dethman, L., Bean, M. 2016. "Designing Insightful Pilots". SEE Action Webinar. March 22, 2016. Accessed May 16, 2016 https://www4.eere.energy.gov/seeaction/sites/default/files/pdfs/DesigningInsightfulBehaviorPilots.pdf

ENERGY STAR. 2015. "Energy Use in Hospitals: Data Trends." Accessed May 5, 2016. https://www.energystar.gov/sites/default/files/tools/DataTrends_Hospital_20150129.pdf

ENERGY STAR. no date. "Benchmarking to Save Energy." Accessed June 9, 2016. https://www.energystar.gov/ia/business/healthcare/Benchmarking_to_Save_Energy.pdf

Global Action Plan. 2016. "Barts Health NHS Trust: Operation TLC." Accessed May 16, 2016. https://www.globalactionplan.org.uk/barts-health-nhs-trust

Hargreaves, Tom. 2008. *Making Pro-Environmental Behaviour At Work*. Doctor of Philosophy Thesis. University of East Anglia, School of Environmental Science.

Healthier Hospitals Initiative. 2012. "Leaner Energy." Accessed May 5, 2016. http://healthierhospitals.org/hhi-challenges/leaner-energy

Mazzi, E., Cowan, K., Westervelt, E. 2015. "Chapter 21. Human Behavior and Facility Energy Management." *Guide to Energy Management 8th Edition*. Fairmont Press. 675-701.

McKenzie-Mohr, Doug. 1999. Fostering Sustainable Behavior: An introduction to Community-Based Social Marketing. New Society Publishers.

Mills, Evan. 2009. “Building Commissioning: A Golden Opportunity for Reducing Energy Costs and Greenhouse Gas Emissions.” California Energy Commission, Public Research Interest Group.

Mourik, Dr. R., Rotmann, Dr. S. 2013. “The Monster: Subtask 1 analysis of IEA DSM Task 24: Closing the Loop: Behaviour Change in DSM – From Theory to Practice. Accessed May 5, 2015. http://bit.ly/task24monster

Opower, 2013. “Unlocking the Potential of Behavior Based Energy Efficiency.” Accessed March 18, 2016. http://www2.opower.com/potential

Practice GreenHealth. 2015. “2015 Sustainability Benchmark Report.” www.practicegreenhealth.org.

Sutton, Khiry. 2015. “Hospital Finds Energy Savings Behaviors Contagious.” *FMJ Magazine*. International Facility Management Association (IFMA). November/December 2015: 25-28.

Umwelt, Wissenschaftszentrum. Environmental Science Center Ed. No Date. *Greener Hospitals: Improving Environmental Performance.* Bristol-Myers Squibb. University Augsburg, Germany.