Energy Efficiency in Health Care

January 31, 2012
3pm Eastern

**Moderators:**
Joel Rogers, Center on Wisconsin Strategy (COWS)
James Irwin, Center on Wisconsin Strategy (COWS)
Agenda

• Welcome (5 min)
• Presenters (55 min)
  • Kristen Taddonio, Program Manager, US DOE Commercial Real Estate Energy Alliance
  • Jeff Rich, Executive Director - Major Projects & Efficiency Improvement, Gundersen Lutheran Health System
  • John D'Angelo, Senior Director for Facilities, Cleveland Clinic
• Questions and discussion (30 min)
• Close
Energy Efficiency in Hospitals
Overview for ECN

January 31, 2012
Kristen Taddonio
Efficiency Specialist
Healthcare: A Significant Piece of the Economic and Energy Pie

- Americans spend roughly 15% of U.S. gross domestic product on healthcare.
- Hospitals and healthcare facilities account for just under a tenth of the energy used in U.S. commercial buildings.
- The healthcare industry is energy intensive, spending about $8 billion on energy annually!
  - In 2003, the average U.S. hospital spent ~$675,000, and the average outpatient clinic spent over $20,000 on energy.
- Despite those large expenditures, on average, utility bills are under 2% of a hospital’s operating revenues.

**Did you know?**
A typical hospital uses almost double the energy per square foot as an office building.
Industry Profile: Diverse

• Includes hospitals, doctors’ offices, clinics, and nursing homes.
• Over half of U.S. hospitals belong to a corporation that also owns or manages other healthcare facilities, but
• No dominant organizations: the 50 largest organizations in the U.S. account for only ~15% of revenues.
• Doctors offices: generally private, for-profit.
• Hospitals: generally nonprofits, with for-profit and government-run hospitals (such as the Veterans Health Administration) making up the remaining 30%.
• The role of insurance:
  – Healthcare revenue is largely controlled through reimbursement rates set by insurance companies and the government, a marked difference from other industries.
  – Rising energy costs are a risk, since they cannot be easily offset by simply charging higher prices.

• The impact of budget cuts:
  – Hospital budget cuts often lead to “deferred maintenance.”
  – Greater demands have been placed on facility managers’ time as staff levels have been reduced.
Major Trends

- Healthcare organizations are increasingly focused on their environmental impact.
- Improvements in this area can lower energy costs and improve patient experience, and are seen as closely related to the organizations’ mission of improving health and quality of life.
- Construction is likely to continue, albeit at a slower pace, creating opportunities to make the healthcare sector even more energy efficient.
Energy Facts

- Space heating is the largest end use, accounting for over 35% percent of healthcare sector energy consumption in the U.S.
  - Northeast and Midwest U.S. regions have relatively higher annual natural gas intensities than other regions, consistent with larger heating loads.
  - In contrast, the South has relatively higher electric intensities, suggestive of the larger role of cooling.
- Lighting accounts for nearly 20% percent of energy consumption and is the second largest end use.
- 35% to 45% of hospitals installed energy-saving measures between 2008 and 2010; the most common motivation was to lower energy costs.
- Retrocommissioning is a good investment for many hospitals because many use old equipment that has never undergone performance testing.
• Buy-in typically required from two key individuals: the facility energy manager and the CFO. Energy management may even include the COO or CIO.

• Discuss projects in terms of how they will help improve patient care and the hospital’s bottom line.

• The following slides provide strategies to consider when planning your programs.
Strategy 1: Provide Real-World Examples from Other Hospitals

• Provide real-world examples of how specific measures have worked out in similar hospitals to help build the business case:
  – Cost, payback, rate of return
  – Positive impacts on patient care, health
  – Additional benefits (improved comfort, reduced noise, lower maintenance costs, back-up power, etc.)
### Example: Air Handling System Retrofits Implemented in Existing Hospitals

<table>
<thead>
<tr>
<th></th>
<th>Fanny Allen Hospital, Colchester, VT</th>
<th>General American Life Insurance Co., St. Louis, MO</th>
<th>St. Louis Children’s Hospital, St. Louis, MO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building size (ft²)</td>
<td>114,000</td>
<td>450,000</td>
<td>560,000</td>
</tr>
<tr>
<td>Nominal fan power (hp)</td>
<td>85</td>
<td>750</td>
<td>1,470</td>
</tr>
<tr>
<td>Peak flow (cfm)</td>
<td>58,800</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>VAV retrofit cost ($)</td>
<td>810,838</td>
<td>1,013,000</td>
<td>405,000</td>
</tr>
<tr>
<td>Utility rebate ($)</td>
<td>552,666</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Net cost ($)</td>
<td>258,172</td>
<td>1,013,000</td>
<td>405,000</td>
</tr>
<tr>
<td>Cost per square foot ($/ft²)</td>
<td>7.10</td>
<td>2.30</td>
<td>0.70</td>
</tr>
<tr>
<td>Cost per nominal fan hp ($/hp)</td>
<td>9,539</td>
<td>1,350</td>
<td>275</td>
</tr>
<tr>
<td>Cost per peak cfm ($/cfm)</td>
<td>13.80</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Fan energy savings (kWh/year)</td>
<td>1,336,592</td>
<td>7,146,974</td>
<td>2,416,160</td>
</tr>
<tr>
<td>Fan power savings (kW peak)</td>
<td>255</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Energy savings ($/year)</td>
<td>129,086</td>
<td>248,000</td>
<td>138,000</td>
</tr>
<tr>
<td>Payback with rebate (years)</td>
<td>2.0</td>
<td>4.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Payback without rebate (years)</td>
<td>6.3</td>
<td>4.1</td>
<td>2.9</td>
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</table>
Strategy 2: Utilize Free Resources

• Many useful resources can help hospitals build the business case for specific efficiency measures.
• Consider how you can team up with these offerings to make your efficiency pitch even more attractive. Examples:
  – **Clean Energy Application Centers** – Hospitals can qualify for free CHP site assessments and evaluations! [www1.eere.energy.gov/industry/distributedenergy/racs.html](www1.eere.energy.gov/industry/distributedenergy/racs.html)
  – **ENERGY STAR for Hospitals** – Resources to help benchmark and build the business case for efficiency. [www.energystar.gov/healthcare](www.energystar.gov/healthcare)
  – **Hospital Energy Alliance** – Information, training, and resources for improving efficiency in hospitals. [www.commercialbuildings.energy.gov/alliances](www.commercialbuildings.energy.gov/alliances)
Example: Resources to Help Hospitals Build the Business Case for Efficiency

DOE Clean Energy Application Centers: Locations, Contacts, and Web Sites

NORTHWEST
www.northwestcleanenergy.org
Drew Spading
Washington State University
Tel: 360-956-2004
jspading@energy.wsu.edu

PACIFIC
www.pacificcleanenergy.org
Tim Lipman
University of California, Berkeley
Tel: 510-642-4501
mlipman@berkeley.edu
Vince McDonel
University of California, Irvine
Tel: 949-824-7302 x 121
mcdonel@ippep.uc Irvine

INTERNATIONAL DISTRICT
ENERGY ASSOCIATION
www.districtenergy.org
Rob Thornton
President
Tel: 503-366-9339
robert@districtenergy.org

INTERMOUNTAIN
www.intermountaincleanenergy.org
Patti Case
etc Group
Tel: 303-378/9137 x 3
PLITG@etcgp.com
Thomas Broderick
Southwest Energy Efficiency Project
Tel: 928-527-8036
thbroderick@swenergy.org

GULF COAST
www.gulfcoastcleanenergy.org
Dan Bullock
Houston Advanced Research Center
Tel: 281-364-6087
dbullock@harc.org

MIDWEST
www.midwestcleanenergy.org
John Cuttica
University of Illinois at Chicago
Tel: 312-996-4302
cuttica@uic.edu
Cliff Haefie
University of Illinois at Chicago
Tel: 312-355-3476
tchefk1@uic.edu

MID-ATLANTIC
www.maceac.psu.edu
Jim Freihaunt
Pennsylvania State University
Tel: 814-863-0083
jfreihaunt@engr.psu.edu

NORTHEAST
www.northeastcleanenergy.org
Tom Bourgeois
 Pace University
Tel: 914-432-4013
bourgeois@pace.edu
Bela Kosanovic
University of Massachusetts Amherst
Tel: 413-545-0684
kosanovic@ecs.umass.edu

SOUTHEAST
www.southeastcleanenergy.org
Icass Panzarella
North Carolina State University
Tel: 919-515-0334
ipanzarella@ncsu.edu
Pedro Mingo
Mississippi State University
Tel: 662-325-3602
mingo@msstate.edu
Strategy 3: Leverage Incentive Programs

- Consult resources like DSIREusa.org to identify incentives that could help reduce first costs of efficiency projects. With competing demands for capital, it can help you get approval if you demonstrate how a proposal leverages incentives that will be available for a limited time.
Launched in 2009, HEA has grown from 31 charter members to 51 members – accounting for 27% of the healthcare industry square footage.

With its continuing growth, HEA has increasing influence on the healthcare industry’s energy efficiency.
Selected HEA Accomplishments

• Four lighting specifications completed – already saving over 34 million kilowatt hours per year.

• RTU Challenge has already attracted two entrants; RTU decision-support tool now available.

• Host of tools developed:
  – Best practices for integrating CHP into critical hospital systems
  – Healthcare energy metering guidance
  – Scoping study for medical equipment and plug loads
  – Collaboration on Advanced Energy Design Guides.

• HEA members Cleveland Clinic and Ascension Health recognized by President Obama and former President Clinton.
Thank You

- Kristen Taddonio
- U.S. Department of Energy - EERE
- Commercial Building Energy Alliances
- Kristen.Taddonio@ee.doe.gov
# Hospital Energy Alliance Membership

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<td>Advocate Trinity Hospital</td>
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<td>Cleveland Clinic*</td>
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<td>9.</td>
<td>Dartmouth-Hitchcock Medical Center</td>
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<td>10.</td>
<td>Dignity Health</td>
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<td>11.</td>
<td>Geisinger Health System</td>
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<td>12.</td>
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<td>Legacy Health System</td>
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<td>23.</td>
<td>Mayo Clinic</td>
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<td>24.</td>
<td>Metro Health Hospital</td>
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<td>25.</td>
<td>New York-Presbyterian Hospital*</td>
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<td>26.</td>
<td>Palomar Pomerado Health</td>
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<td>27.</td>
<td>Partners HealthCare</td>
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<td>28.</td>
<td>PeaceHealth</td>
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<td>29.</td>
<td>Practice Greenhealth</td>
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<td>Providence Health &amp; Services*</td>
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<td>Texas Medical Center (TECO)*</td>
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<td>38.</td>
<td>TRICARE Management Activity (TMA)*</td>
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<td>39.</td>
<td>University of Maryland Medical Center</td>
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<td>40.</td>
<td>University of Pittsburgh Medical Center*</td>
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<td>41.</td>
<td>University of South Alabama Medical Center</td>
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<td>42.</td>
<td>U.S. Department of Veterans Affairs*</td>
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<td>43.</td>
<td>U.S. General Services Administration</td>
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<td>44.</td>
<td>Veterans Health Administration</td>
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<td>45.</td>
<td>West Chester Medical Center</td>
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<td>46.</td>
<td>Yale-New Haven Hospital</td>
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<td>47.</td>
<td>American Society for Healthcare Engineering (ASHE)</td>
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<td>48.</td>
<td>American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)**</td>
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<tr>
<td>49.</td>
<td>Illuminating Engineering Society of North America (IES)**</td>
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<td>50.</td>
<td>International Facility Management Association (IFMA)</td>
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<td>51.</td>
<td>VHA (formerly Voluntary Hospitals of America)</td>
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</tbody>
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* Steering Committee Member
** Ex Officio Steering Committee Member
Who We Are

- Physician-led Integrated Delivery System
  - Headquartered in La Crosse, WI
  - Approximately 6,500 total employees
    - 475 employed physicians
    - 300 employed mid-level
    - 325-bed tertiary medical center
    - Level II trauma center
    - 41 clinic locations

- Medical Foundation
  - Residency and medical education programs
  - Clinical research program

- Health Plan
  - Provider-owned and -operated health insurance company

- A variety of affiliate organizations including EMS ambulance service, rural hospitals, nursing homes, hospice, etc.
Our Envision® Program

- Energy Management
  - Energy Efficiency
  - Renewable Energy
- Waste Management and Control
- Recycling
- Sustainable Design of New Facilities

Gundersen’s Vision for Energy and Environmental Stewardship
Program Objectives

1. Energy Independence by 2014 - Produce more power than Gundersen consumes from fossil fuel sources

2. Make healthcare more affordable to our patients by neutralizing the future cost of energy through energy production

3. Distinguish Gundersen and our community as a national leader in energy conservation and the development of renewable energy sources.
Why Should a Healthcare System Consider Energy/Environment?

- Pollutants from the burning of fossil fuels cause:
  - Cancer, liver disease, kidney disease, reproductive issues
  - Cardiovascular deaths and stroke\(^1\)

- According to the Department of Energy, hospitals are 2.5 times more energy intensive than other commercial buildings\(^2\)
  - This is inconsistent with our mission… we are responsible for contributing to disease through our wasteful consumption.

- Energy costs continue to escalate, making it more difficult to provide affordable care

- Reducing waste results in an improved bottom line

\(^1\)Source: American Heart Association Scientific Statement: DALLAS, May 10, 2010
In 2008 Gundersen launched an aggressive energy conservation effort which examined heating and cooling systems, lighting systems and employee behavior to identify opportunities to reduce energy consumption. Dozens of Energy Conservation Measures (ECMs) were then implemented.

Gundersen Lutheran is saving $1.25M annually from reduced energy use!
Energy Intensity Baseline

Time Series Decomposition Plot for TotalBTU/Sqft
Additive Model

Variable
- Actual
- Fits
- Trend
- Forecasts

Accuracy Measures
- MAPE: 3
- MAD: 577
- MSD: 585468
Conservation Project Status

Actual vs. Predicted kBtu per sq. ft.
Monthly Electricity + Gas Baseline = 19,660 kBtu / sq. ft.

Started energy conservation program in spring of 2008

-5,000 kBtu/sq.ft./month = 25% Improvement

UCL=2093
X=0
LCL=-2093
Conservation

Pros

• Reduces waste
• Opportunities exist everywhere
• Best financial returns
• Easy to implement
• Quick success for momentum
• Can save 20%-30% of energy use
• Builds credibility of stewardship
• Lessens renewable energy investment

Cons

• Not sexy (boiler rooms, roofs)
• Can’t reduce ourselves to zero
Why Do Health Facilities Have Energy Savings Potential?

• Many buildings are never originally commissioned
  – Typically a 1% add to project cost
  – Life cycle costs of building not well understood by owners

• Architect / Engineering firms seek to limit project scope
  – Minimize complexity and maximize margin for engineering time
    • Meet customer’s capital budget and schedule
  – Conservative / redundant systems reduce engineer’s risk & liability
  – Typically there is no customer energy intensity goal to meet
  – Energy expense reduction is not stated as a requirement by owners

• Space use changes with time
Some of our newest buildings were the worst performers.
New Hospital Sustainable Design

433,000 Square Feet

Annual Energy Usage:
• 115 kbtu/sqft

Estimated Annual Savings:
• $660K at current energy rates
Clinic Case Studies

Gundersen Lutheran Energy Check-up
Decorah Clinic

Top opportunities identified:
- Retrofiting lights to more efficient high-bay ballast/fluorescent, allows for 1-2 bulbs rather than 3-4.
- Adding a design-build exhaust fan and isolating the design exhaust fan from those serving other areas allows fewer fans to run.
- Schuling exhaust fans and air handling unit only when necessary.
- Seasonally adjusting the heat operating; can be induced during summer months.
- Schuling/sequencing hot-water boilers to shut down on nights and weekends when not occupied by building

Using valves to isolate buildings for better efficiency.
- Insulating pipes, check valves and pumps.

The Decorah Clinic - Decorah Clinic in northeast Iowa is a busy ambulatory medical center that also includes ambulatory surgery and behavioral health services. The staff of nearly 100 includes general surgeons, physicians, physician assistants, nurse practitioners, radiation therapists, an optometrist, chiropractor and orthodontists. Specialty physicians from Gundersen Clinic La Crosse and Central Clinic also staff the Decorah Clinic to provide outreach care for patients.

The Decorah Clinic building was built in 2006, and is one of our health system's newest buildings. However, it was constructed before we had an environmental mindset, and the Clinic was not energy-efficient. Prior to the Energy Check-up, the Decorah Clinic spent nearly $10,000 a year on energy costs. Notice as much as the Gundersen Lutheran Environmental Leadership Team thought it should be spending. With some simple steps from the Clinic we expect to see a steady 50% reduction in energy use and over $40,000 in annual savings with payback of under one year.

For more information or to set up your energy check-up, call Gundersen Lutheran's Environmental Leadership team at (608) 775-2780.

Gundersen Lutheran Energy Check-up
Prairie du Chien Clinic

Top opportunities identified:
- Retrofiting lights to more efficient high-bay ballast/fluorescent, allows for 1-2 bulbs rather than 3-4.
- Using a building automation system (BAS) to reduce mechanical cooling costs during summer months.
- Adding a design-build exhaust fan and isolating the design exhaust fan from serving other areas allows fewer fans to run.
- Schuling/sequencing hot-water boilers to shut down during unoccupied hours.
- Schuling/sequencing hot-water boilers with a control unit to manage temperature during unoccupied hours.
- Incorporating scheduling changes for heating and cooling mechanical systems.
- Insulating pipes, check valves and pumps.

The Prairie du Chien Clinic - Prairie du Chien clinic is a busy ambulatory medical center with a staff of 76, including general surgeons and an orthopedic surgeon, family and internal medicine physicians, nurse practitioners and certified nurse midwives, physician assistants, diabetes educators, registered dietitians, and more.

The Prairie du Chien Clinic was built in 1994, and has since undergone many renovations and additions. It offered a number of opportunities for energy efficiency. Prior to the Energy Check-up, the Prairie du Chien Clinic spent nearly $75,000 a year on energy costs. With some simple steps, the Clinic expects to see a steady 35% reduction in energy use and over $23,000 in annual savings with payback of about 1.5 years.

For more information or to set up your energy check-up, call Gundersen Lutheran's Environmental Leadership team at (608) 775-2780.
Energy Efficiency for Community Health

January 31, 2012
John D’Angelo, PE, CMVP
Senior Director, Facilities
204 buildings at 24 million square feet in North America
Patients First

- Patient Experience
- Patient Safety
- Patient Outcomes
Energy Usage Index

kBTU/SF

Year

CC
Goal

2007 2008 2009 2010 2011
Patient Experience

- Patient controls of lighting & HVAC
- Natural light & quality artificial light
- Modern BAS and HVAC controls
- Quiet at night

“Although lighting should serve the demands of the medical staff, it should also permit patient/visitor comfort. Patients feel comfortable when they can control the lighting in the space and participate in defining their own level of personal privacy.”

ANSI/IESNA RP-29-06, Lighting for Hospitals and Health Care Facilities
On May 15, 1929, the main building of the Cleveland Clinic caught fire. The fire began when an exposed light bulb was too close to some nitro-cellulose x-ray film, igniting the film. In the end, 123 people lost their lives. Eighty of the dead were either patients or visitors at the clinic, and the rest were employees. One of the Cleveland Clinic's founders, Dr. John Phillips, was among the dead. Most of the victims died from inhaling poisonous gases produced by the burning x-ray film.
Patient Outcomes

- Circadian Rhythms
- Healthcare Associated Infections
- Consistent visual presentation
- Radiation vs. conduction in the OR
- Asthma from airborne particulates
- Carcinogens and toxic byproducts
CC Lab
• 135 ksf
190,000 sf
$100M
LPD = 0.61
## Hospital Energy Alliance Membership

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| | 51. VHA (formerly Voluntary Hospitals of America)

* Steering Committee Member
** Ex Officio Steering Committee Member
Cleveland Clinic

Every life deserves world class care.
Contact Information for ECN

Administrator - ecn@efficiencycities.org
Listserv - ecnmembers@efficiencycities.org
Website - www.efficiencycities.org