Energy Conservation Measures Can Yield Big Savings

Iona Canada, Trane
Jeff Rich, Gundersen Lutheran
Learning Objectives

• Learn how to benchmark current energy use

• Gain a process for evaluating and selecting energy conservation measures for your facility

• Learn how to select an energy conservation company with which to align your energy reduction efforts

• Learn how to build stakeholder support for energy reduction efforts
## FutureScan Top Issues

<table>
<thead>
<tr>
<th>ISSUE</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
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<tbody>
<tr>
<td>Financial challenges</td>
<td>70%</td>
<td>77%</td>
<td>76%</td>
<td>77%</td>
</tr>
<tr>
<td>Healthcare reform implications</td>
<td>-</td>
<td>-</td>
<td>53%</td>
<td>53%</td>
</tr>
<tr>
<td>Governmental mandates</td>
<td>22%</td>
<td>26%</td>
<td>30%</td>
<td>32%</td>
</tr>
<tr>
<td>Patient safety and quality</td>
<td>33%</td>
<td>43%</td>
<td>32%</td>
<td>31%</td>
</tr>
<tr>
<td>Physician/hospital relations</td>
<td>35%</td>
<td>35%</td>
<td>25%</td>
<td>30%</td>
</tr>
<tr>
<td>Care for the uninsured</td>
<td>38%</td>
<td>41%</td>
<td>37%</td>
<td>28%</td>
</tr>
<tr>
<td>Patient satisfaction</td>
<td>17%</td>
<td>22%</td>
<td>15%</td>
<td>16%</td>
</tr>
<tr>
<td>Personnel shortages</td>
<td>30%</td>
<td>30%</td>
<td>13%</td>
<td>11%</td>
</tr>
</tbody>
</table>

## Financial Challenges

<table>
<thead>
<tr>
<th>Issue</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid reimbursement</td>
<td>88%</td>
</tr>
<tr>
<td>Medicare reimbursement</td>
<td>78%</td>
</tr>
<tr>
<td>Bad debts</td>
<td>70%</td>
</tr>
<tr>
<td>Increasing costs for staff, supplies, etc.</td>
<td>70%</td>
</tr>
<tr>
<td>Inadequate funding for capital improvements</td>
<td>63%</td>
</tr>
<tr>
<td>Managed care payments</td>
<td>51%</td>
</tr>
<tr>
<td>Other commercial insurance reimbursement</td>
<td>42%</td>
</tr>
<tr>
<td>Revenue cycle management (converting charges to cash)</td>
<td>37%</td>
</tr>
<tr>
<td>Emergency department</td>
<td>30%</td>
</tr>
<tr>
<td>Competition from specialty hospitals</td>
<td>20%</td>
</tr>
</tbody>
</table>

Healthcare Executives and the Physical Environment

Health professionals must be accountable for the physical environment and its impact...

Source: Trane 2008 – 2011 research with healthcare executives
Creating an Environment for a Better Patient Experience

How important is the overall hospital environment to the patient experience?

• 93 percent believe the physical environment is important or very important to the patient experience

Source: Trane 2008 – 2011 research with healthcare executives
Healthcare Challenges

• Up to one-third of hospital infections can be airborne (Kowalski, 2007)

• Physical environment ranked second most important, (behind clinical care) in a 2008 patient experience study (Harris Interactive)

• 90 percent compliance on 23 of 31 quality measures (TJC, 2010)

• CEOs surveyed say green and LEED practices correlate with:
  – Reduced length of stay (Health Hospital Initiative)
  – Increased productivity and job satisfaction (USGBC)
Energy Conservation as an Important Part of an Improved Physical Environment

U.S. Department of Energy conclusions:

– 8 percent of the nation’s greenhouse gas emissions are directly related to fossil fuel energy consumed by health system facilities

– Hospitals consume 2.5 times more energy than other commercial buildings

– U.S. hospitals spend $5 billion annually on energy for facilities
What footprint will we leave behind?
• 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
  • Gundersen Lutheran Medical Foundation
    • Residency and medical education programs
    • Clinical research program
• Gundersen Lutheran 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 Service Area
Environmental Recognition

- Practice Greenhealth’s Environmental Leadership Circle
  - Fifth consecutive year
- Mississippi Valley Conservancy Green Corporation of the Year
- La Crosse Chamber of Commerce Regional Progress Award
Our Envision® Program

• Energy Management
  – Energy Efficiency
    • 25 percent improvement vs. 2007 baseline in first 2 years
  – Renewable Energy
    • Plan for 100 percent energy independence with renewable production by 2014
• Waste Management and Control
• Recycling
Why Do Buildings Perform Poorly?

- Many buildings are never originally commissioned
  - Typically a 1 percent 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
    - Meet customer’s capital budget and schedule
  - Conservative/redundant systems reduce engineer’s risk and liability
  - Typically there is no customer energy intensity goal to meet
  - Energy expense reduction not stated as a requirement by owners

- Space use changes over time
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
The Cost of Energy

$5,000,000+ Energy Bill in 2007
>$350,000 Increase Annually for Gundersen Lutheran

The need for affordable healthcare compels us to address this trend
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
- \(-5,000 \text{ kBtu/sq.ft./month} = 25\% \text{ Improvement}\)
Energy Status

Gundersen Lutheran's "Road to Renewable Energy"

- Wind Site 3
- Biomass Boiler
- Dairy Gas Site
- La Crosse County Landfill
- Wind - Lewiston
- Wind - Cashton
- CHP - City Brewery
- Conservation Measures Phase 3
- Conservation Measures Phase 2
- Conservation Measures Phase 1
- Start

Estimated Implementation Date

May-08, Dec-08, Sep-09, Dec-09, Dec-10, Aug-11, Sep-11, Oct-11, Sep-12, Nov-12, Oct-13

Cumulative %
Finding Your Opportunity
Possible Benchmarking Resources

• Energy Star “Target Finder”
  – Climate and sector adjusted benchmarking tool
  – Multiple units (kWh, therms, kBtu, $, etc.)
  – Energy intensity standard is (Total kBtu per square foot/yr)

• Grumman Butkus Associates Survey
  – Voluntary survey of Upper Midwest hospitals

• University of Washington, NEEA, U.S.DOE, et.al.
  – Study of Pacific Northwest hospital energy intensity vs. Scandinavia
  – Targeting 100 kBtu / sq. ft. by 2030

• Wisconsin Focus on Energy
  – Building energy intensity calculators with comparisons to federal indices
The Value of Commissioning

Several of our newest buildings were our worst performers

- Hospital
- East / Founders
- LaCrosse Clinic
- Support Services
- Onalaska Clinic

Legend:
- Red: 2009 Energy Intensity (kBtu / Sq. Ft.)
- Green: Grumman Butkus WI Hospital Average
- Purple: Energy Star Climate Adjusted Hospital Top 5%
- Cyan: Critical Care Hospital Design Target
To Manage You Must First Measure

Model for Total BTU / Sq. Ft.
Additive Model

Accuracy Measures
MAPE 3
MAD 577
MSD 575272
Establishing a Baseline

Time Series Decomposition Plot for therm/Sqft
Additive Model

Accuracy Measures
- MAPE 5.07794
- MAD 0.00573
- MSD 0.00005
Control Charts Validate Improvement

Residual Plot (Actual vs. Forecast) (therms/ft^2)

- UCL = 0.01684
- \( \bar{X} = -0.00283 \)
- LCL = -0.02250
Energy Conservation

- Identifies best resources to leverage
  - Many conservation measures have paybacks < 2 years
- Focuses on immediate benefits to gain momentum
- Reduces the amount spent for renewable energy supply
- Gains credibility with stakeholders
- Provides opportunities to create unique partnerships with others

20-30 percent energy reduction can be achieved through conservation measures
Retrocommissioning

• Retrocommissioning examines heating and cooling systems, lighting systems and employee behavior to identify opportunities to reduce energy demand.

• Low-cost or no-cost energy conservation measures (ECMs) are then implemented to improve efficiency.

Use only the energy you need, when you need it, where you need it… no more.
Find The Energy Waste “In Lean Terms”

• Overproduction
  – Lights on and nobody’s home
  – Compressors running at night

• Inventory
  – Redundant equipment

• Transportation
  – Ventilation air moving after hours

• Motion
  – Fans moving air unnecessarily
  – Circulating pumps moving hot water on weekends

• Defects
  – Thermostat placed next to a heat source
  – Failed steam traps
  – Compressed air leaks

• Waiting
  – Loss of pressure/temperature

• Processing Waste
  – Boiler blowdown
  – Stack exhaust
  – Conditioned air exhaust
# Energy Conservation Measures Project Lists

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Priority Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Projects listed]</td>
<td>[Details listed]</td>
</tr>
</tbody>
</table>

## Energy Conservation Project Priority Matrix

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Project Description</th>
<th>Priority</th>
<th>Cost Impact</th>
<th>Time Impact</th>
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</thead>
<tbody>
<tr>
<td>[Projects listed]</td>
<td>[Details listed]</td>
<td>[Priority values]</td>
<td>[Cost Impact values]</td>
<td>[Time Impact values]</td>
</tr>
</tbody>
</table>

- Cost Impact: Low, Medium, High
- Time Impact: Low, Medium, High
Project Classification

1. Low Cost/No Cost
   - Projects that don’t require large capital
   - Offer truly quick paybacks (< 1 or 2 years)
   - An audit can uncover these small projects which will have substantial impact overall (i.e. scheduling of systems)
   - First year impact – 42 percent energy savings

2. Competitive Capital
   - Large ECMS requiring substantial capital
   - Justified against other projects in the capital budget (i.e. re-lamping, steam trap replacement, etc.)
   - First year impact – 43 percent energy savings
3. Opportunistic Infrastructure Replacement

- Infrastructure replacement projects completed for other reasons, such as building renovation or end-of-life equipment replacement
- Incremental payback must justify the additional investment
- Opportunities for significant energy efficiency benefits if improvements are made to systems or equipment including chiller, boiler, system controls, data centers, etc.
- First year impact – 15 percent of energy savings
## Prioritizing ECMs

### Energy Conservation Project

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Name</th>
<th>Annual Benefit</th>
<th>Speed to Implement</th>
<th>Payback</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Establish enforce new temp range guidelines to support energy eff.</td>
<td></td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>2. Shut down/reduce regional site signage and/or parking lot lights</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>3. Hot Water Scheduling: upgrades, design better than current</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>4. Eliminate hot water boiler-Founders, bring over from Domestic East Building</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>5. Decrease pressure in HP boilers</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>6. Heat recovery off of our boiler stacks ORC</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>7. Replace all windows in LaCrosse that have not been addressed (i.e., LaCrosse clinic, Foundation, GSB)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>8. Connect steam loop on LaCrosse Campus</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>9. Install motion sensors for lights on offices and conf. rooms (analyze appropriate)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>10. Lighting controls where needed (i.e., region too)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>11. Retrofit regional clinics and smaller buildings with retrofit lighting</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>12. Alternative heat source for regional clinics (solar heating, new furnace, gas, wood?)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>13. Replace existing HVAC with heat recovery wheel</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>14. With other regional clinics, audit insulation and supplement with additional insulation as needed</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>15. More HVAC’s rooms in existing buildings</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>16. Use emergency generators to supplement electrical load and turn over fuel</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>17. Natural gas standby generators (load shed)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>18. Elevator analytics</td>
<td></td>
<td>2</td>
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<td>1</td>
<td>4</td>
</tr>
<tr>
<td>19. Sweater day: turn down heat (non-patient care areas)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>20. Add biomass boiler</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>21. Sell the old Viroqua Clinic so we don’t have to heat it</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>22. Meters</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>23. Daylight harvesting (East Clinic, Hospital Lobby, SBB, Studios, Oral Clinic, new Regional clinics)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>24. Establish appliance policy/controls to limit personal appliance use (i.e., space heaters, fans, etc.)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>25. Occupied individual rooms HVAC during day when not occupied (GMF)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>26. Ceiling fans in high ceilings (distribution off, laundry, power plant, lobbies)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>27. Develop specs. for old stuff too! for motors and other equipment (i.e., Havorth lighting, etc.)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>28. LED lighting on outside signage regional sites</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>29. LED lighting for parking lots or reduce during certain hours</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
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<tr>
<td>30. Nightlight retrofit in the hospital (dimmer switch?)</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>31. Upgrade older/non-efficient kitchen equipment</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>32. Replace exhaust hood kitchen ventilation control</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>33. Install VO’s on hospital chilled water pumps</td>
<td></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

### Weights

- Annual Benefit
- Speed to Implement
- Payback

### Weighting Categories

- Responsibility
- Correlation Scores

### Weights

- 10: High
- 6: Medium
- 4: Low
# Action Plan Support and Validation

## Energy Audit Post-Event Action Plan
Revised 6/15/2010

<table>
<thead>
<tr>
<th>Item</th>
<th>Major Milestone</th>
<th>Owner</th>
<th>Target</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Perform Energy Audit</td>
<td>Albert/Cliff</td>
<td>6/3 ▲</td>
</tr>
<tr>
<td>2</td>
<td>Set up bi-weekly conference calls - Jeff, Albert, Cliff</td>
<td>Albert</td>
<td>6/9 ▲</td>
</tr>
<tr>
<td>3</td>
<td>Send out Thank-you letter and event documents to participants</td>
<td>Albert</td>
<td>6/11 ▲</td>
</tr>
<tr>
<td>4</td>
<td>Discuss report-out with Dick Funk</td>
<td>Albert</td>
<td>6/14 ▲</td>
</tr>
<tr>
<td>5</td>
<td>Conference Call - Jeff &amp; Albert</td>
<td>Albert</td>
<td>6/15 ▲</td>
</tr>
<tr>
<td>6</td>
<td>Report Out at Friday Report-Out session</td>
<td>Albert/Cliff</td>
<td>6/19 ▲</td>
</tr>
<tr>
<td>7</td>
<td>Provide 2 gas bills and 1 electric bill for April &amp; May to Cliff</td>
<td>Cliff</td>
<td>6/23 ▲</td>
</tr>
<tr>
<td>8</td>
<td>Conference Call - Jeff, Cliff, Albert</td>
<td>Albert</td>
<td>7/7</td>
</tr>
<tr>
<td>9</td>
<td>Retro-commissioning plan w/Focus On Energy</td>
<td>Cliff</td>
<td>7/9</td>
</tr>
</tbody>
</table>

**B/ft² - Prairie du Chien**

![Graph of B/ft² vs Study month]
Clinic Case Studies

• Decorah Clinic
  – One-day audit
  – 50 percent improvement identified
  – $40,000 annual savings
  – On-year payback

• Prairie du Chien Clinic
  – One-day audit
  – 35 percent improvement identified
  – $30,000 annual savings
  – 18 month payback
Evidence-Based Design

- Private rooms improve patient safety
  - Improves indoor air quality & lowers infection rates
- Environments that promote healing lower stress and promote satisfaction
- Clean hands are key to preventing infection
- Reduced noise levels ease stress and improve communication
- Natural light and nature views can improve patient outcomes

Recommendations based on Ulrich and Zimring’s research
Patient Outcomes – Trane Example

Air Quality
Poor air quality and ventilation, combined with having two or more patients in the same room, are prime causes of nosocomial infections such as MSRA and pneumonia. Robert Wood Johnson Foundation

Noise Levels
High noise is connected to patient restlessness, staff distractions, communication errors, privacy issues

Lighting
“Increasing lighting in nurse areas decreases mistakes.” Ken Gomes, Emanuel Medical Center
Patient Outcomes – Lighting Example

By controlling the body’s circadian system, light impacts outcomes in healthcare settings

- Reducing depression among patients
- Improving sleep
- Easing pain
- Decreasing length of stay in hospitals
- Reduces label reading or skin color observation errors
- Improving adjustment to night-shift work among staff

Patient Outcomes

• Up to 2 million U.S. hospital patients contract dangerous infections during their hospital stays (1 in 20 of all those admitted)
  • Hospitals spend $5-10B treating the infections
  • HAIs contribute to more than 100,000+ deaths

• Up to one-third of all hospital spread infections are airborne
  • Airborne pathogens can be spread widely and over long distances by air currents.
  • Commonly spread airborne infections include influenza A, streptococcus, rubella virus, legionella and staphylococcus, among many others (Kowalski, 2007)
Financial Performance

• Hospital Acquired Infections
  – Cost: $35,000 to $337,000

• Medical Errors and CDC Estimates
  – 500,000 surgical site infections annually in the United States
  – 40 to 60 percent are preventable
  – Hospital could recognize a savings of $3,152 per patient
  – Reduce average length of stay by 7 days by reducing infections

• Indoor Air Quality for Staff
  – 176 million lost work days at a cost $70 billion annually (Berkeley National Laboratory)
Financial Performance

• Productivity in the Surgical Suite
  – Surgery is top revenue producer (up to 68 percent)
  – Length of surgery is the #1 factor in infection rates

• Length of Stay
  – Prototype hospital with operating costs of $28 million that reduces its average lengths of stay by one day realizes annual costs savings of $384,000
Financial Performance – Community Stewardship

Green Impacts Length of Stay
• 47 percent of hospital administrators find that patient recovery times fall when green construction practices are used (Turner Construction, 2007 study)

• Hospitals which have comprehensive environment programs and practice green initiatives have shown reduced length of stay by up to 2 percent (George Mills – The Joint Commission)

Green Could Impact Market Share
• Number two question from recent college grads when selecting employer is: What is your ‘Green’ strategy? (For-Profit COO)
Hospitals for a Healthy Environment (H2E)
http://www.h2e-online.org/

H2E now Practice Green Health

• Creating a national movement for environmental sustainability in health care – Green Guide for Healthcare (free copy online)

• Jointly founded by the American Hospital Association, the U.S. Environmental Protection Agency, Health Care Without Harm, and the American Nurses Association

• Providing a wealth of practical tools and resources to facilitate the industry’s movement toward environmental sustainability.

• New DOE initiative looks at EnergySmart Hospitals

• LEED NC AGH and LEED HC
Questions?

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