

Getting to 'Green'

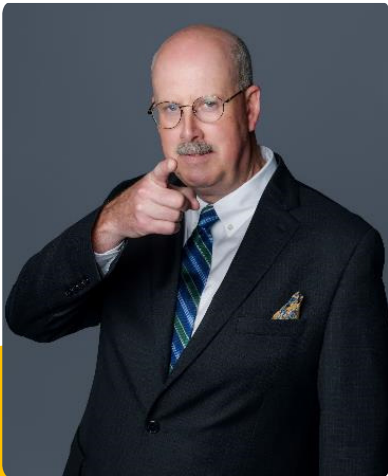
Healthcare Energy Efficiency and Reliability Journey

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**Memorial Hermann Health System,
Houston, Texas**



Presenter

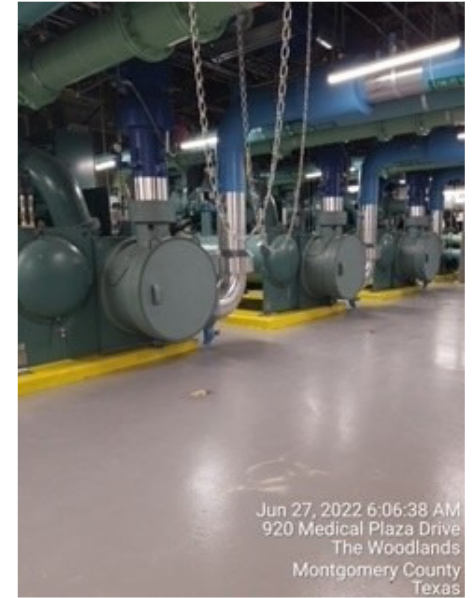


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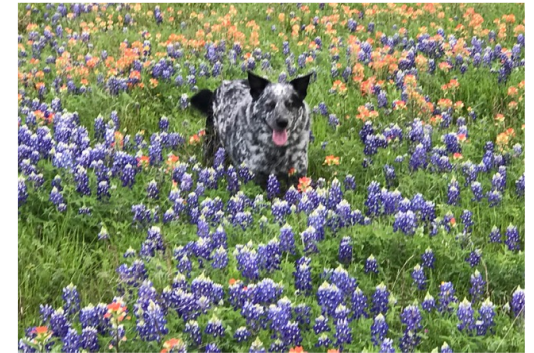
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More about 'Me'.....



Jun 27, 2022 6:06:38 AM
920 Medical Plaza Drive
The Woodlands
Montgomery County
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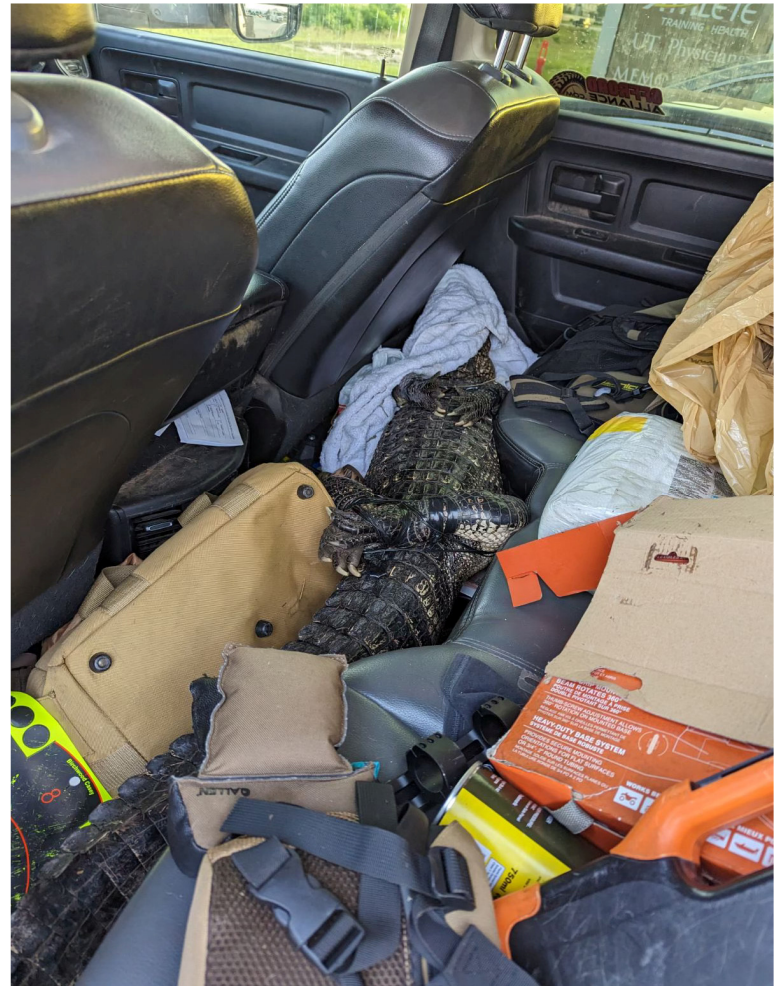


Memorial
Hermann
Health
System



Storyed
History of
Excellence in
Energy
Efficiency

You Can't Change Geography!
(some days are like this.....)



“ I’ve never met an electric heat recovery chiller I didn’t like”

“We used to recycle, but it was just too much work”

Investments in high efficiency equipment during R&R and O&M procedures

Transparent Documentation

- EPA Portfolio Manager
- Energy Star
- FCAs

Hospitals are target rich environments for Decarbonization

Investments that reduce dependency of fossil fuels

EPA and DOE Announces Memorial Hermann Health System as the Winner of the 2022 Energy Star Award - May 9, 2022

That makes 8 years, only 1 other health system with 3

The ‘greenest’ kilowatt is never generated!

Reducing KWH supports investment in missions and saves FTEs

“You can’t manage what you can’t measure”

“Would you want to be the first person to test out the new brain suite OR if it wasn’t commissioned”

“Energy management focus has both a financial and environmental bottom line.”

**Healthcare Energy: Reliability, Reliability, Reliability..... Not a Beta Test Site
(affordable)**

- Marketing Overload! (Energy Efficiency, Decarbonization, Electrification, GHG Reduction)
 - Four Primary Goals/Strategies for Energy Management Best Practices
 - To assure a secure (reliable) source of energy for the future
 - To keep utility costs low enough to meet the needs of a growing entity
 - To protect the community while producing and consuming the energy (emissions)
 - To capture true industry best practices (design, implementation, operations) and imbed these into a healthcare facility's focus to continue the journey
 - Document, Recognize, and Celebrate what you've already accomplished
 - Focus on What You Can do, not What outsiders Want You to do
 - Clarify Bandwidth and Resources to Succeed
 - Gain C-Suite Sponsorship and support of the plan
 - Document (Publish) Your Success – Success Breeds Success!
 - Gaining C-Suite Confidence Supports Future Efforts; \$
 - Documentation (done correctly) is utilized for Future “Emissions” Benchmarking

Solutions (and Risks) Are Often Regional.....

Sources/Solutions (No Order of Preference!)

- Hydro Power (Native & Kinetic)....
- Solar
- Wind
- Geo-Thermal
- Nuclear
- Shale Gas
- Tidal
- Coal
- Chemical (Fuel Cells)
- Landfill Methane, et al

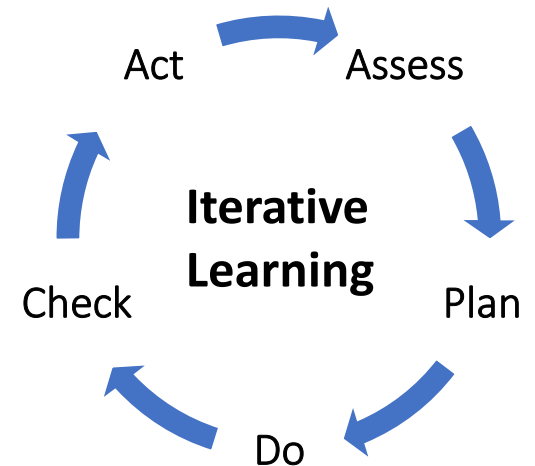
Optimizing the Healthcare Physical Environment (ASHE)

- Why?

- Reduces Operating Expenses (Utilities Focus)
- Improved Maintenance Improves Equipment Life and Energy Efficiency
- Shows Your Value to Organization
- Also “Climate” Benefit; Utility Consumption → Emissions →

- How?

- Preventive Maintenance (Fix Things)
- Commission EVERY Project (focus on HVAC and Controls)
- Retro-Commission Your Buildings (3-5 Year Cycle?)
- Reliability Centered Maintenance Concept/Practice
- Training and Education on Key Topics
- Benchmark Results



Life Cycle Focus (New Projects or Renovations)

- Best Value on Bid Day (and Design) versus Strictly “Low Bid”
- More Efficient Chiller Plant Across Your Climate Zone (kW/Ton)
- Multiple “Staged” Re-Heat Boiler with Variable Burners
- Lighting Systems that “Dim” to Ambient Conditions and Motion
- Electric Heat for Terminal Boxes vs. Hot Water
- Design/Build more Thermal Efficient “Skin” (Architectural)
- Test (Commission) Skin/Envelope
- “Marry” TAB and CX So You Get Best of Best Team
- Heat Recovery Chillers (Free “Heat”) Pros/Cons

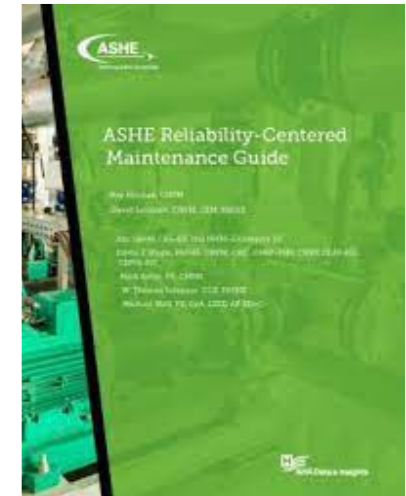
Operations and Maintenance Focus

- Trend Key Parameter via BCS (Free)
 - Overrides
 - Failed Points
 - AHU Discharge Air Temperatures
- Water Treatment and Heat Exchangers
- Planned Maintenance vs. Breakdown Maintenance

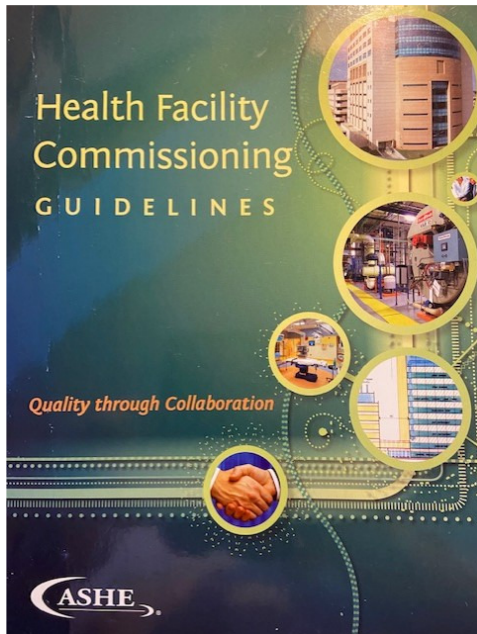


Trends, Benchmarking, Critique Your Operations

- The More Esoteric (Hydrogen Fuel Cells)
VS.
- Resources at Your Fingertips
 - Benchmark
 - Building Controls
 - Improved RCM Focus
 - Life Cycle Replacements
- Small, Incremental Success – For the Long Term!
- ‘Fault Detection’ – Has Technology Matured Enough for Investment?
- Continuous List, “Shovel Ready” Projects – When You Get Funding



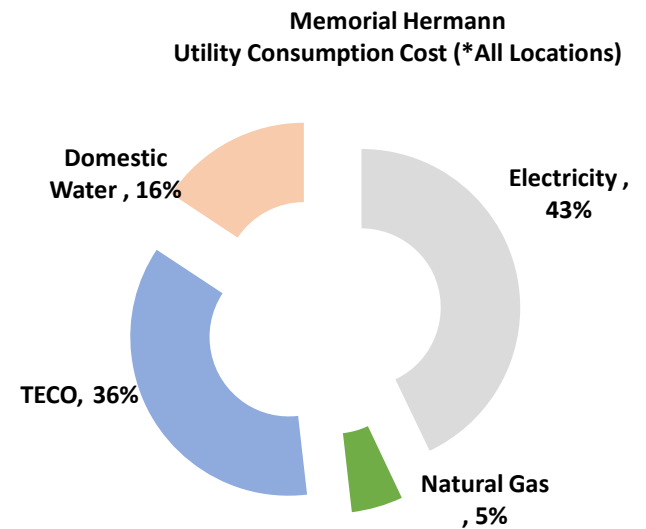
Test/Balance/CX



- Competency of Both
- Alignment with Short/Long Term OPR
- Zero Value if Sequence of Operations Undefined..... (Controls)
- Could Work More Closely Together
- Document the “Pre” and the “Post”
- Great Peer Review Opportunity to Assist MEP Team
- Contractually tie BOTH as Pre-Substantial Completion Milestones

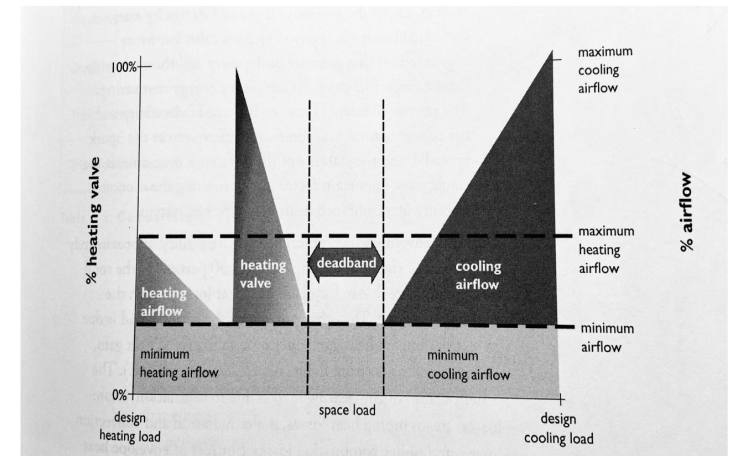
Take Advantage of Physics

- VFD's Work; Match "Flow" to Season/Conditions
 - Proper Shaft Grounding!
 - Huge Horsepower Savings (Wattage) (Dollars)
 - Our Buildings Rarely (never?) Operate at Peak Load
 - Move Less Air, Move Less Water is the Focus
- Ensure Power Factor ≈ 95 (Not Leading!)
- Hartman Loop (chiller plant) Derivations
- Cooling Tower Cannot Cool Below Wet bulb + Approach
- Every Degree Excess Cooling = Extra Degree Reheat
- Is Glycol Really the Way to Control OR "RH"?



Common Building Control Strategies - KIS

- VAV Control of Non ICU/OR Spaces (ASHRAE 170)
- “Off” is Free (Schedule Admin Support Terminal Units)
- “Lock Down” Typical Space Temperatures; 72°F – Minimize Local Control
- AHU Static Pressure Control
- Building Pressurization Control
- Implement Chilled Water and Cold Deck Reset
- OR’s Should be 20+ ACH; NOT 25-30 ACH
- Cooling Towers and Reheat System Should Track Weather (Loads)



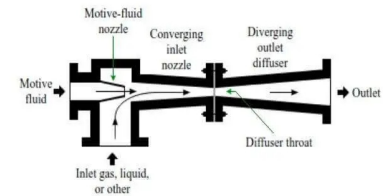
Dead Bands Work!

Building Controls, Fault Detection, Reliability Centered Maintenance

- Systems Viable (Individually) for Generations
- Each a Fabulous Tool
- Why Do I Need 3 Different Providers (Systems, Licenses, Training.....)
- Our Industry Should Push to “Bundle” Into Single Tool Box
- Should be a Mandatory “Specification” Item in YOUR Project
- Why Not Now?

Other Easy Utility “Wins”

- Cooling Tower Process Water “Cycles” (Reuse)
- Municipality Cooling Tower Evaporation Credits
- Steam System Condensate “Return” (Heat, Water, Chemicals)
- Sterilizer Condensate “Recapture”
- Sterilizer Once Through Eductor Vacuum Features
- Eliminate “Once Through” Heat Exchanges
- Find those “Rogue Zones” or Systems Requiring Unique Flow/Temperatures; Eliminate
- LED’s (Why have we NOT Eliminate all Fluorescent/Incandescent Lights?)
- “Stepped” Lighting Control – Garages, Back of House Spaces

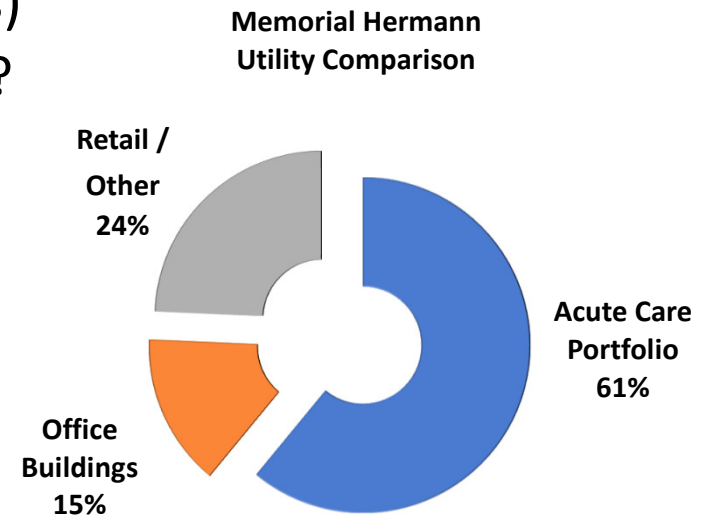


WHAT IS AN EDUCTOR?

How Does It Work, Its Application & Construction Features

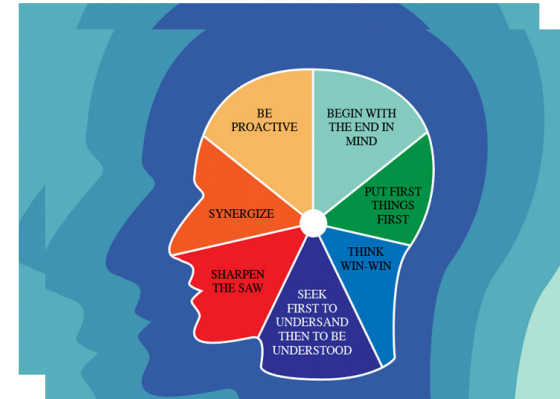
Actions vs. Credits – A Rhetorical Question

- Are “Credits” Really a Sign of Improved “Performance”?
- Does Healthcare have the Margin for Feel-Good \$\$?
- “Rebates” for Energy Efficiency (Utilities)
 - Seem more Logical than Cap and Trade?



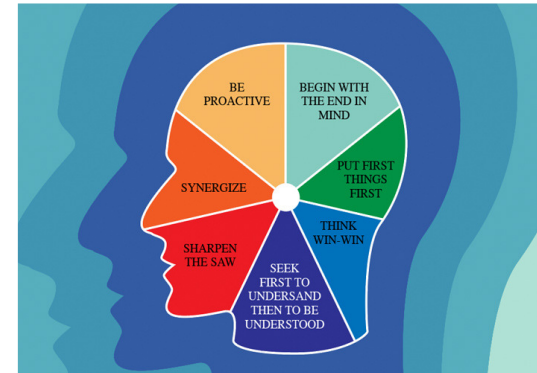
PDC vs. Building Optimization

- Begin with the End in Mind (Covey – Habit #2)
 - Mission Statement for Project
 - Target EUI
 - Goal Setting “Achieve Energy Star 75 Rating”
 - Owner’s Project Requirements
 - Commission and Resolve All Punch Items Prior to Substantial Completion
 - Be Vocal, Present Data, Focus
- Ensure Budgets are “Right” at Beginning (Conceptual State)
- Facility FM Should be Integral Part of Project Team
- Keep a Seat at the Table throughout Project
- Ensure “Optimization” Features Are Part of Any Project at Your Facility



Celebrate Success!

- Energy Star Label
- Energy To Care Award
- ASHE Chapter Challenges
- Recognize YOUR Team
- Internal 'Promotions' to C-Suite
- And.....Sharpen The Saw!



The Plan - What is YOUR Focus Area.....

Our Recipe for Success!

Top Energy Focus Tips to Immediately Improve Your Energy Bottom Line

- “Off” is free; do you continuously evaluate which building HVAC systems and lighting can be shut down during off-peak hours or when not in use?
- Have your building control system (BCS) generate an override point list so you can quickly review all the equipment and see which automatic controls in your building have been “overridden” or taken control of manually.
- Have your BCS generate a failed point list so you can review equipment or points that have failed or are no longer functional.
- Calibrate the air handler cold deck controllers and sensors (pneumatic and electronic).
- Develop an internal guideline or policy about staff overriding or changing BCS set points or equipment statuses; change passwords and enforce your policy.
- Ensure that every air handler and variable air volume (VAV) box has an on/off schedule (i.e., holidays, Sundays, nights, after 6 p.m.).
- Implement cold deck reset to vary the discharge air temperature of the air handler to correspond to outside air temperature conditions.
- Implement Static pressure reset at Air handler units to minimize horsepower (watts).
- Equip VAV boxes with software logic and dead bands in their BCS control loop to ensure that the primary air flow is always reduced to its minimum before any reheat valve or heating contactor is activated.
- Have the minimum primary air flow of most hospital VAV boxes automatically reduced to either four or six room air changes before the reheat valve or heating contactor is activated. Set up common area or office environment hospital VAV boxes such that the primary air flow reduces to two air changes before the reheat is activated.
- Implement chilled water reset to vary the chilled water supply temperature between 42 to 45 degrees to correspond to outside air temperature conditions.
- Implement heating water reset to vary the heating water supply temperature between 85 to 140 degrees to correspond to outside air temperature conditions.
- Implement condenser water reset to vary the condenser water supply temperature between 60 to 85 degrees to correspond to outside air temperature conditions and the operating parameters of your chiller.

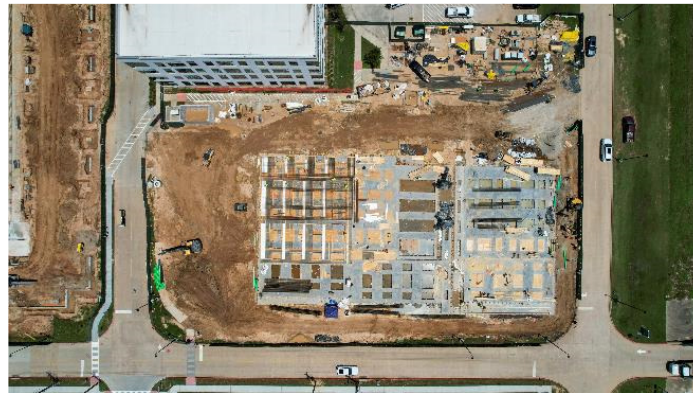
Memorial Hermann PI Journey - *Historical Trend

| Annual Energy Consumption | | | | |
|---------------------------|----------------------|---------------------|--------------------|--|
| Hospitals | | | | |
| | kBtu/ft ² | kWh/ft ² | \$/ft ² | |
| 2008/2009 | 262.1 | 49.9 | \$6.26 | |
| 2022/2023 | 193.9 | 23.7 | \$3.65 | |
| Change | 68.2 | 26.2 | \$2.61 | |
| % Change | -26.0% | -52.5% | -41.7% | |
| *GHG Emissions | -38% | per sq/ft | | |

Summary/Wrap Up

- We Have the Tools:
 - Reliability Centered Maintenance, Quality Circle PI Process
 - Commissioning/Retro-commissioning
 - ASHRAE 90.1/ASHRAE 170/Best Practices/Education
 - Benchmarking; Internal and External (Manual or Automated)
 - Optimization 'Packages' for BCS's
- We know Where Common Defects Occur
 - Building Control System Overrides, Failed Points
 - No 'Seasonality' or 'Occupancy' Consideration with HVAC Systems
 - Over-Ventilation of Healthcare Spaces
 - Improved Central Plant/HVAC Maintenance Practices
- We (Our Industry) Just Requires Focus
 - Direct Correlation Implementing the Above w/ 'Emissions' Reductions
 - Outcomes Support Dual Bottom-Line; Financial \$\$ and Environmental
 - We (Memorial Hermann) Have Just Begun this PI Journey
 - 'We Can' Optimize the Healthcare Physical Environment! (Our Industry)

Current Projects!



Facilities provides critical mission support, and achieves top quartile energy performance



HOUSTON, TX – Memorial Hermann Health System is proud to announce that it has once again received the ENERGY STAR® Partner of the Year – Sustained Excellence Award for continued leadership and superior contributions to ENERGY STAR. This is the ninth time Memorial Hermann has been recognized with this award.

Remember to **Vote** in ASHE's 2023 Election (Late Summer – 2023). **Michael Hatton**, Candidate for **ASHE President-Elect**

Q & A

Credits also to Mark Kenneday, Gordian (ASHE Past-President), for his assistance with an earlier version of this presentation