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Transforming Ordinary Buildings into High Performance Buildings Inexpensively

"It Starts With An Audit. It Performs With Owner Commitment"

Brian J. Lally, P.E., CEM, President, Lally Energy Saving Solutions (LESS)

Audit and Owner Commitment Outline

- Define “High Performance and Sustainable Buildings” (HPSB)
- Strategies, Implementation Plans and Standards to Follow
- Scope of Building Conversion
- It Starts With An Audit and a Plan
- Realities in Meeting the Task
- Cost is an Obstacle
- Where Do You Spend Limited Funds to meet the HPSB Goal?
- Focus on People and Training
- Owner Commitment

Federal Leadership in High Performance and Sustainable Buildings MOU

- **GOALS AND OBJECTIVES OF THIS MOU:** Consistent with and in addition to Federal policy, statutes, executive orders (13423 and 13514) and supplemental agency policies and guidance, the Parties to this MOU collaboratively seek to establish and follow a common set of sustainable Guiding Principles for integrated design, energy performance, water conservation, indoor environmental quality, and materials aimed at helping Federal agencies and organizations:
  - Reduce the total ownership cost of facilities;
  - Improve energy efficiency and water conservation;
  - Provide safe, healthy, and productive built environments; and,
  - Promote sustainable environmental stewardship.

Sustainability

- DoD Defines Sustainability as …
  - "The capacity to continue the mission without compromise. It is the ability to operate into the future without decline – either in the mission or in the natural and manufactured systems that support it."
- Installations provide the warfighter a consistent and stable platform from which to operate
- Sustainable Installations: have the capacity to perform satisfactorily long term and in harmony with nature

New "Sustainable Communities"

- Under funding from the DoD Environmental Security Technology Certification Program (ESTCP) the Air Force Center for Engineering and the Environment (AFCEE) is launching a new effort to demonstrate the ability to apply a standardized sustainability rating system, called "Sustainable Communities" (2012)

- 10 Rating Categories:
  - Community Design & Development
  - Energy & Greenhouse Gases
  - Water Efficiency
  - Built Infrastructure
  - Natural Infrastructure
  - Materials and Waste Mgmt
  - Transportation
  - Mission Readiness
  - Community Engagement
  - Innovation

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Strategies, Standards, Plans and Laws

- DoD: Each Department has an Energy Strategy and Sustainability Approach with funding to initiate and/or complete the objectives in their Implementation Plans
- ASHRAE Std. 189.1 Design of HP Green Buildings
- ISO 50001, Energy Management System (June 2011)
- FLHPSB MOU and Guiding Principles
- Executive Orders 13423 and 13514
- DoD Instruction 4170.11
- ASHRAE Std. 90.1
- EISA 2007 and EPAct 2005

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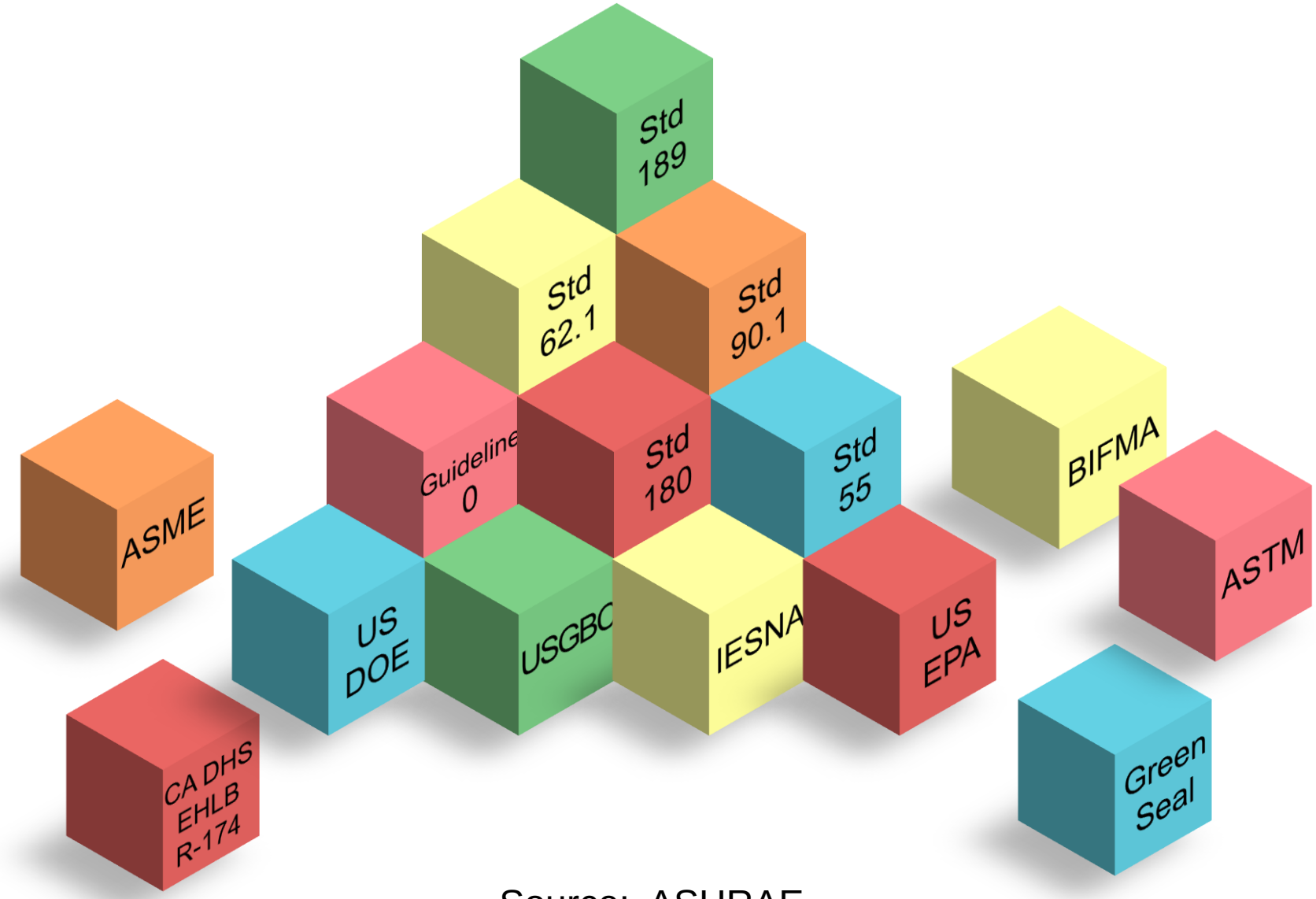
ASHRAE Std. 189.1 Building Blocks



Source: ASHRAE

Scope of the Task

- Federal Government Owns:
  - 445,000 buildings: 3.0 billion SF
- Leases:
  - 57,000 buildings: 374 million SF
- DoD*
  - 316,000 buildings: 5,400 sites, 2.2 billion SF
  - 50 States, 7 US Territories, 39 Foreign Countries
- DOE (Sustainable HPB Database)
  - 61 Federal HPB
  - 9 of 61 are DoD
  - 49 of 189 are DoD LEED "Certifiable"

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*DoD Base Structure Report 2008

It Starts With A Building Audit

- An energy audit is an effective way to identify various energy efficiency (EE) opportunities in residential, commercial, institutional, and industrial facilities. The energy audit determines the most effective energy and water cost-saving measures that can be implemented without adversely affecting the quality of work and the positive environmental aspects of the equipment and processes. **A detailed, investment-grade audit (IGA) is the basis for further engineering analysis and design, and investment in EE improvements.**
- EISA 2007: Section 432: 25% of Covered Facilities Audited Annually

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EISA 2007, Section 432

Requires Federal agencies to report into a Compliance Tracking System

- Designation and location of facilities covered by EISA requirements
- Assignment of energy managers
- Energy and water evaluations completed at covered facilities
- Implementation of energy and water efficiency measures (ECMs), including estimated cost and savings
- Follow-up status on implemented measures, including measured savings and persistence of savings
- Building benchmarking information
- 25% per year … then start over again … Probably RCx and RetroCx

Audits reveal the unknown and provide places to begin your energy and water management.

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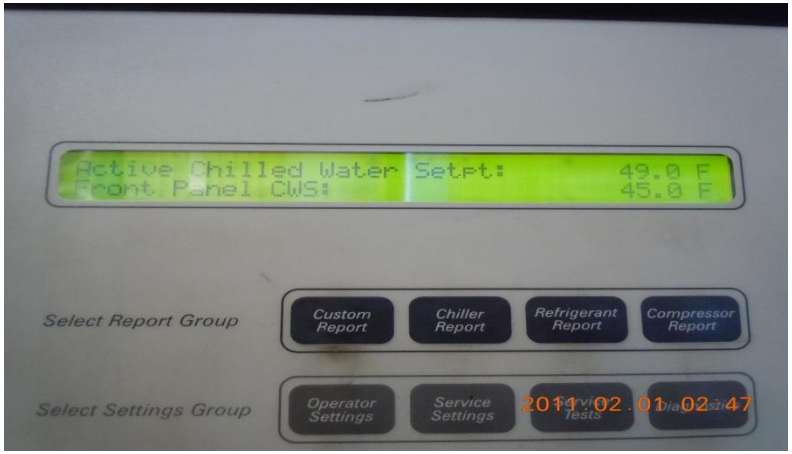
Facility Energy and Water Audits



- Start with your biggest energy and water consumers: Industrial, food prep, gyms, maintenance, network ops, etc.
- Check utility bills & meter readings
- Analyze trend logs
- Review BAS and EMCS data
- Walk through your buildings…OBSERVE
- Check temps against thermostat settings
- Look for water leaks or leaking water
- Install CFLs and LEDs
- Look & feel for infiltration (weather-stripping)
- Check and replace air filters
- Lights left “on” at night or unoccupied
- Reduce Water Heater temp settings
- An engineer/CEM not req’d to document

Audits: What is Involved?

- Level 1 – Walks Throughs
- Level 2 – Detailed/General
- Level 3 – Investment Grade
- Areas Reviewed
  - Utility Bills and Meter Readings
  - BAS and EMCS data
  - Drawings
  - Envelope
  - Lighting
  - HVAC and Controls
  - Water / Plumbing / Waste Sys
  - Equipment Inventories
  - Future facility use

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Audit Levels*

- **Level 0 – Benchmarking**: Preliminary Whole Building Energy Use analysis based on the analysis of the historic utility use and costs and the comparison of the performances of the buildings to those of similar buildings. This benchmarking of the studied installation allows determining if further analysis is required.
  - **Cost: In-house $0**
- **Level I – Walk-through Audit:** Preliminary analysis made to assess building energy efficiency to identify simple and low-cost improvements but also a list of energy conservation measures (ECMs, or energy conservation opportunities, ECOs) to orient the future detailed audit. This inspection is based on visual verifications, study of installed equipment and operating data and detailed analysis of recorded energy consumption collected during the benchmarking phase.
  - **Cost: Trained In-house Staff: $0 OR Contracted: $0.20 to $0.35/SF**
- **Level II – Detailed/General Energy Audit:** Based on the results of the pre-audit, this type of energy audit consists in energy use survey in order to provide a comprehensive analysis of the studied installation, a more detailed analysis of the facility, a breakdown of the energy use and a first quantitative evaluation of the ECOs/ECMs selected to correct the defects or improve the existing installation. This level of analysis can involve advanced on-site measurements and sophisticated computer based simulation tools.
  - **Cost: Contracted: $0.25 to $0.60/SF**
- **Level III – Investment-Grade Audit:** Detailed Analysis of Capital-Intensive Modifications focusing on potential costly ECOs requiring rigorous engineering study.
  - **Cost: Contracted: $0.50 to $0.99/SF**

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Depends upon scope, size, and facility use

Realities in Meeting the Goals

- Few funds to spend
- Sustainability and Energy Efficiency compete for the same few dollars
- Return-on-Investments Differ
- Military deployments create engineering and maintenance staff shortfalls
- Manpower shortages mean "emergencies only get the attention"
- Fix the squeaky wheel only
- Little planning accomplished
- Untrained "energy" workforce
- Complicated work must be contracted-out
- Audits cost money
- Technical Skills Expensive
- Level 3: $0.50 to $0.99/SF
- Level 1: $0.20 to $0.35/SF
- Re-commissioning / Retro-Cx "deemed too costly"
- Training your workforce $1,500 to $2,000/person/course
- Groups of 10 < $1,000/person

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Where Do You Spend Precious Funds?

- Do you have an energy, water and sustainability plan?
- Review your installation energy goals and targets
- Are they realistic?
- Return-on-Investment (ROI)
- Audit / Cx / RCx biggest energy consumers
- Re-set thermostats and fix HVAC controls
- Train your staff ($1,000 to $2,000/person/course)
- Provide tools and equipment for in-house staff
  - Data Loggers: $80 to $500 (Temperature, lighting, voltage, CO2, humidity)
- Team-up smart, passionate, and dedicated staff members
- Hire an audit team that will teach your staff to audit, document, inventory and do-the-math creating energy conservation measures

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Train your staff to audit and keep savings in-house

Focus on People and Training

- Build a Plan to meet installation energy and water goals by focusing on your in-house staff
- Know your people and know your installation
  - What are your biggest energy users?
- Build a culture that desires to establish a repeatable process, measureable goals, and recognition for excellence
- Start with one person at a time. Training costs $2,000/year is a small price to pay to achieve a substantial ROI
- Start with one building at a time

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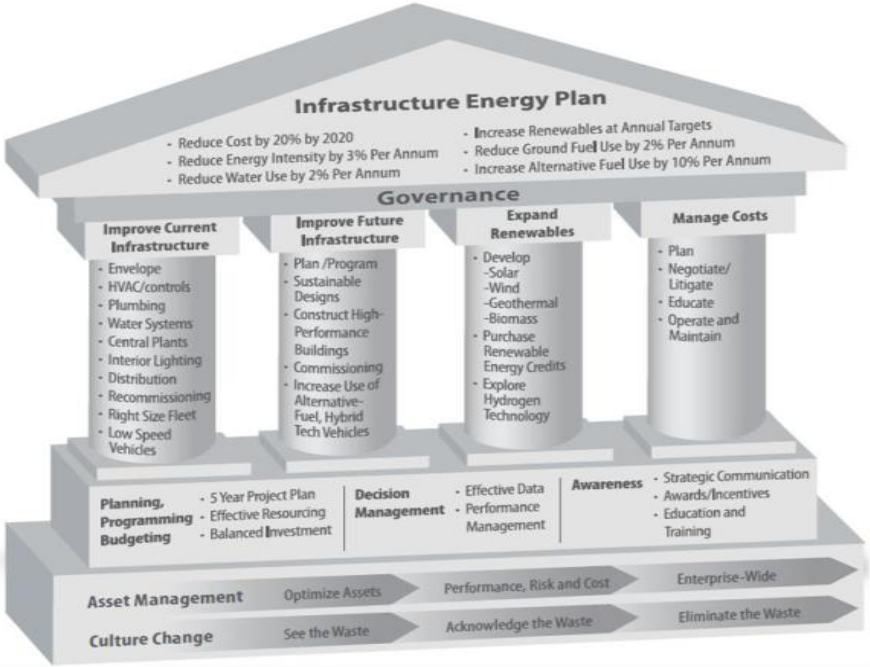
Agency Directors and Installation Commanders Must be Committed

- There are laws that mandate targets but there is zero accountability for not meeting the goals
- ISO 50001 EnMS may create accountability
- Owners must establish the cultural leadership position that states that energy and water conservation will become part of all they do. Set the example.
- Establish public relations plans, recognition programs and rewards for innovation, submit award nominations
- Make at least one major energy or sustainability investment annually



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More on Owners' Commitment

- Plan and commit to creating at least one sustainable building annually
- Press leadership to define a Sustainability ROI to plan investments
- Build one net-zero energy building/yr
- Improve campus E-security by building one renewable E-project every 2 years
- Train at least 2 technicians and 2 engineers annually
- Seek partnerships with local gov'ts and innovative companies
- Empower your staff and reward success
- Explore waste-to-energy opportunities
- Create Real & Measurable sustainable facilities

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Thank You!

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Backup Info

Guiding Principles for FHPSB MOU

Guiding Principles for FHPSB MOU (1)

- I. Integrated Design
  - Performance goals for siting, energy, water, materials, and indoor environmental quality
  - Commissioning: Verify performance of building components and systems
- II. Optimize Energy Performance
  - Energy Efficiency: ASHRAE and IESNA Standard 90.1
  - Measurement and Verification: EPAct 2005, Section 103

Guiding Principles for FHPSB MOU (2)

- III. Protect and Conserve Water
  - Indoor Water: 20% less potable; meet EPAct 1992 fixture performance requirements
  - Outdoor Water: reduce, reuse, recycle
- IV. Enhance Indoor Environmental Quality
  - Ventilation & Thermal Comfort: ASHRAE Std 55 & 62.1
  - Moisture Control: Prevent damage and mold
  - Daylighting: Daylight factor of 2%
  - Low-Emitting Materials: Low pollutant emissions
  - Protect Indoor Air Quality During Construction: 72-Hrs

Guiding Principles for FHPSB MOU (3)

- V. Reduce Environmental Impact of Materials
  - Recycled Content: EPA -- Sum of post-consumer recycled content plus ½ of the pre-consumer content constitutes at least 10% (based on cost) of the total value of all project materials
  - Biobased Content: meet or exceed USDA
  - Construction Waste: Recycle or salvage 50%
  - Ozone Depleting Compounds: Eliminate ODCs consistent with the Montreal Protocol or Title IV of the Clean Water Act Amendments of 1990