High Performance Buildings:
Achieving Superior Performance for Life

Larry G. Wash
President of Global Services
Climate Solutions Sector
Ingersoll Rand
My Background

• Responsible for the profit and loss of the service, contracting and parts business

• Fully responsible for the management and performance of the services businesses which include after-market service and parts, turnkey and controls contracting, and performance-based energy services for commercial buildings and transportation

• Executive responsibility for the organization’s strategic direction, operating performance and marketplace differentiation

• Extensive service industry expertise
  – Previously served as vice president of service and contracting for Trane within North and South America and in various services leadership roles with Xerox and Eastman Kodak

• Speaker and author on the subjects of growing a profitable global services business and making the business case for energy and operational efficiencies. Presented at many high-level events and published in numerous industry and business journals
Our Agenda

• Today’s operating realities

• What is a high performance building?

• Adopting a high performance buildings approach

• Trane High Performance Buildings offering

• Case studies

• Your questions
Today’s Operating Realities

• Most companies have been affected by severe recession
• Recovery has begun in some sectors
• Organizations focused on doing more with less
  – Productivity, cost reduction are orders of the day
  – Access to cash and credit remains challenging
  – No appetite for capital investments without clear payback
  – Reduced operations staff to deal with comfort calls
• Energy, operating costs rising faster than most other costs
  – Energy accounts for 29% of typical commercial buildings’ operating costs (BOMA 2009)
  – Buildings account for 72% of U.S. total energy consumption (USGBC)
  – Buildings are a major contributor to greenhouse gas emissions
• Continued public policy activity aimed at:
  – Reducing energy consumption and protecting the environment
  – Reducing U.S. dependence on foreign oil
  – Stimulating the economy and creating jobs

Unprecedented challenges in our energy and operating environments
Administration Proposes Better Building Initiative

- New tax incentives for building efficiency
- More financing opportunities for commercial retrofits
- “Race to Green” grants for universities, states and municipalities
- Better Buildings Challenge for universities and the private sector
- Training programs to grow the next generation of building technology workers

The U.S. Green Building Council says high performance buildings are 20-50% more energy efficient than conventional buildings
What is a High Performance Building?

High performance buildings are:
• Cost effective
• Safe and secure
• Sustainable

“The best sustainable designs are not just environmentally responsible. They produce buildings where employees can thrive and productivity can soar. We call these high performance green buildings.”
- U.S. Green Building Council
High performance buildings:

- Are safe, comfortable and efficient
- Help owners and occupants achieve their business mission
- Use design and operating standards that are created, measured and continually validated to deliver established outcomes within specified tolerances
- Are created using a unique methodology – combining financial, operating and energy analysis with specialized service offers and available financing
- Meet specific standards for energy and water use, system reliability and uptime, environmental compliance, occupant comfort and safety and other success factors
- Are designed with LEED and Energy Star principles in mind
- Take lifecycle and asset management to a new level without establishing new industry standards or ratings
- Will meet new green building design standards proposed by ASHRAE, USGBC and IES

High performance buildings deliver optimal efficiency, reliability, value and comfort
A Whole Building, Whole Lifecycle Approach

• Typical buildings have occupied lives of 50-75 years or longer
• Operating costs typically account for 60-85% of building lifecycle costs – compared to 5-10% for design and construction costs
• High performance buildings reduce lifecycle costs so companies can invest in other priorities and make buildings “assets” instead of “expenses”
• Performance standards are created, measured and continually validated to deliver the desired outcomes
• Standards based on desired performance levels and industry benchmarks are typically set for:
  – Energy and water consumption
  – System reliability
  – Environmental compliance
  – Occupant health, safety and comfort

Sizeable opportunities to improve the performance of existing structures

Source: National Institute of Building Sciences
Characteristics of a High Performance Building

- **Cost effectiveness.** Lifecycle costs, cost/benefit analysis and ROI over expected lifespan
- **Safety and security.** Safety and security of occupants and impact of building failure on the community
- **Sustainability.** Integrated design, energy performance, water conservation, indoor environmental quality and reduced impact of materials
- **Accessibility.** Recognizing and addressing different accessibility needs
- **Functionality.** Ensuring that the building fulfills its intended purpose and meets occupants’ needs
- **Productivity.** Enabling occupants to do their best work and contribute to achieving the organization’s goals
- **Historic preservation.** Reusing or adopting building shells, materials, etc. to preserve cultural heritage
- **Aesthetics.** Contributing to the productivity of employees, reputation of the owner and operator, and quality of life in the community
Goal is to Enhance Operation Effectiveness

High performance buildings are designed, constructed, operated and maintained to enhance organization and occupant effectiveness

• Providing a safer, healthier, more comfortable environment
• Operating reliably with minimum unscheduled downtime and fast recovery
• Maintaining performance within acceptable tolerances throughout their lifespan
• Enhancing organization and occupant performance, retaining/increasing in value and adding luster to the organization’s brand and reputation
Holistic, technology-enabled, knowledge-based approach is integral to establishing and sustaining standards throughout a building’s occupied lifespan

- Embracing predictive building maintenance strategies
- Establishing and maintaining sound operating metrics
- Adopting performance-based service concepts

A poorly designed building operated and maintained effectively outperforms a well-designed building with poor operating and maintenance practices
Adopting a High Performance Building Approach
What are Your Driving Factors for Change?

- Every organization, building and project is unique
- Modeling begins with understanding:
  - What you’re trying to accomplish
  - Specific goals and objectives
  - Appetite for risk

<table>
<thead>
<tr>
<th>Public</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve infrastructure</td>
<td>Stay competitive (attract tenants, customers, talent)</td>
</tr>
<tr>
<td>Reduce maintenance costs</td>
<td>Reduce maintenance costs</td>
</tr>
<tr>
<td>Reduce operating costs</td>
<td>Reduce operating costs</td>
</tr>
<tr>
<td>Optimize capital budget</td>
<td>Optimize capital budget</td>
</tr>
<tr>
<td>Improve indoor environment (comfort &amp; occupant performance)</td>
<td>Improve indoor environment (comfort &amp; occupant performance)</td>
</tr>
<tr>
<td>Be socially responsible</td>
<td>Add asset value</td>
</tr>
</tbody>
</table>

Building use determines investment strategy
## What Kinds of Changes Make Financial Sense?

<table>
<thead>
<tr>
<th>Quick Return (0-3 yr payback)</th>
<th>Intermediate (3-8 yr payback)</th>
<th>Long-Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrofit lighting</td>
<td>Install new building automation system</td>
<td>Replace high efficiency equipment (major systems chiller/boilers)</td>
</tr>
<tr>
<td>Update existing building automation systems</td>
<td>Improve HVAC systems (CV to VAV)</td>
<td>Building envelope improvements</td>
</tr>
<tr>
<td>Conduct retro/re-commissioning</td>
<td>Implement water conservation</td>
<td>Apply renewable technologies</td>
</tr>
<tr>
<td>Make behavioral changes (turn lights off, program systems)</td>
<td>Use fans and motors (VFDs, high efficiency change outs)</td>
<td>Apply on site/distributive power generation</td>
</tr>
<tr>
<td>Explore utility procurement options</td>
<td>Apply load shifting technology (ice storage)</td>
<td>Implement comprehensive maintenance and repair strategies</td>
</tr>
</tbody>
</table>

**Taking a lifecycle, whole-building approach offers the best long-term ROI**
For example:

<table>
<thead>
<tr>
<th>Building Type</th>
<th>Category</th>
<th>Cost of Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>Health and welfare</td>
<td>Total costs per day of a winter HVAC failure (teacher salaries, revenue from student attendance, cost of student transportation, etc.)</td>
</tr>
<tr>
<td>Industrial facility</td>
<td>Reliability/uptime</td>
<td>Total costs per hour of shutting down an assembly line (worker salaries, missed deadlines, restart costs, etc.)</td>
</tr>
<tr>
<td>Retail location</td>
<td>Reliability/uptime</td>
<td>Total cost per hour of shutting down a store (lost revenue, employee salaries, lost customer loyalty, etc.)</td>
</tr>
<tr>
<td>Municipal building</td>
<td>Health and welfare</td>
<td>Total cost per hour of employee absenteeism due to poor indoor air quality (employee salaries, lost productivity, risk to reputation, etc.)</td>
</tr>
</tbody>
</table>

Consider the cost of a building failure on operations and stakeholders
### Example: School building

<table>
<thead>
<tr>
<th>Critical Areas Served</th>
<th>Equipment System</th>
<th>Performance Parameters-Acceptable Quality Limits</th>
<th>Validation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry lab</td>
<td>Exhaust fan 1</td>
<td>400 cfm</td>
<td>24/7 monitoring</td>
</tr>
<tr>
<td></td>
<td>Unit ventilator 1</td>
<td>100 cfm OA</td>
<td>quarterly inspection</td>
</tr>
<tr>
<td>Swimming pool</td>
<td>Air handling unit 1</td>
<td>2,500 cfm</td>
<td>24/7 monitoring</td>
</tr>
<tr>
<td></td>
<td>Pool pump 1</td>
<td>82°F; 200 gpm</td>
<td>24/7 monitoring</td>
</tr>
<tr>
<td>Data storage facility</td>
<td>Rooftop unit 1</td>
<td>48°F SA</td>
<td>24/7 monitoring</td>
</tr>
<tr>
<td></td>
<td>In-ceiling unit 1</td>
<td>45% RH</td>
<td>annual inspection</td>
</tr>
<tr>
<td>Cafeteria</td>
<td>H &amp; V unit 1</td>
<td>8,000 cfm</td>
<td>quarterly inspection</td>
</tr>
<tr>
<td></td>
<td>Exhaust fan 1</td>
<td>9,000 cfm</td>
<td>annual inspection</td>
</tr>
<tr>
<td></td>
<td>Freezer</td>
<td>28°F</td>
<td>24/7 monitoring</td>
</tr>
</tbody>
</table>

Every building has unique factors to consider
Conduct a Critical Building Systems Audit

- Assemble a team
- Define program objectives
  - Reduce operating costs
  - Increase operational performance
  - Improve occupant comfort and safety
  - Enhance employee productivity
  - Achieve environmental certification

Build an energy management team with buy-in from key internal stakeholders, including owners, managers and department heads
Gather Relevant Data and Make Comparisons

- Determine the current level of performance of key building systems: HVAC, lighting, water, electrical, etc.
- Gather 3-5 years of actual energy cost data
- Use actual data to estimate annual cost of planned and unplanned maintenance
- Compare actual costs against industry averages and best-in-class performance
Top 25 Energy Conservation Measures

<table>
<thead>
<tr>
<th>Major ECM Category</th>
<th>ECM Type</th>
<th>Technology/ECM Name</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls</td>
<td>General/Special</td>
<td>Upgrade to Direct Digital Control</td>
<td>100%</td>
</tr>
<tr>
<td>Industrial</td>
<td>Compressed Air</td>
<td>Implement Compressed Air Utility Management</td>
<td>100%</td>
</tr>
<tr>
<td>Water</td>
<td>Reduce Use</td>
<td>Install Low Flow/Use Fixtures</td>
<td>96%</td>
</tr>
<tr>
<td>Controls</td>
<td>General/Special</td>
<td>Retro/Recommission Controls for Optimizing Savings</td>
<td>94%</td>
</tr>
<tr>
<td>Controls</td>
<td>General/Special</td>
<td>Install Lab Hoods Control - Flow Safe Lab Hoods</td>
<td>94%</td>
</tr>
<tr>
<td>Supply Side Management</td>
<td>Manage Energy Supply</td>
<td>Change Regulated Utility Rate/Tariff</td>
<td>94%</td>
</tr>
<tr>
<td>Water</td>
<td>Smart Metering</td>
<td>Install Smart Meters &amp; software -- for Billing</td>
<td>94%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Install Lighting Controls</td>
<td>92%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Replace T-8s for HiBays with T5s</td>
<td>92%</td>
</tr>
<tr>
<td>Plant</td>
<td>Boilers</td>
<td>Install Tankless/Instantaneous Water Heaters</td>
<td>92%</td>
</tr>
<tr>
<td>Supply Side Management</td>
<td>Manage Energy Supply</td>
<td>Change to Interruptible Rates and Use Electric Generation</td>
<td>92%</td>
</tr>
<tr>
<td>Architectural</td>
<td>Envelope</td>
<td>Install Weather-Stripping</td>
<td>92%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Upgrade Fluorescent Fixtures w/ T8 or T5 Lamps</td>
<td>92%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Retrofit Incandescent Lamps w/ Compact FL</td>
<td>92%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Replace Exit Sign w/new LED Fixture</td>
<td>92%</td>
</tr>
<tr>
<td>Plant</td>
<td>Boilers</td>
<td>Adjust Burner as Regular Maintenance</td>
<td>92%</td>
</tr>
<tr>
<td>HVAC (Building/ Non-Plant)</td>
<td>Unit Upgrade</td>
<td>Convert CV to VAV</td>
<td>88%</td>
</tr>
<tr>
<td>HVAC (Building/ Non-Plant)</td>
<td>Unit Upgrade</td>
<td>Convert Dual Duct to VAV</td>
<td>88%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Replace HID HiBay fixtures with T5s or T8s</td>
<td>86%</td>
</tr>
<tr>
<td>Electrical</td>
<td>Lighting</td>
<td>Add LED night lights in halls</td>
<td>86%</td>
</tr>
<tr>
<td>Architectural</td>
<td>Roof</td>
<td>New Construction with Green Roofs (Plants)</td>
<td>85%</td>
</tr>
<tr>
<td>Plant</td>
<td>Systems</td>
<td>Install Water Source Heat Pump System</td>
<td>83%</td>
</tr>
<tr>
<td>Plant</td>
<td>Motors/Pumping</td>
<td>Install VFD/VSDs for Pumps</td>
<td>81%</td>
</tr>
<tr>
<td>Controls</td>
<td>Resetting</td>
<td>Reduce Outdoor Air To Design Level</td>
<td>78%</td>
</tr>
<tr>
<td>Controls</td>
<td>Resetting</td>
<td>CO2-Based Demand-Controlled Ventilation</td>
<td>78%</td>
</tr>
</tbody>
</table>

- Many, many Energy Conservation Measure (ECM) technologies and applications → need a methodology to assess and rate
- Methodology developed using Six Sigma analysis processes and tools
- Evaluation process based on 5 key customer and Trane “importance factors”
  - Savings potential, Practicality, Commercial viability, Risk management, Business differentiation
- Score of 0-100% with 100% being the best ranking

Use six sigma methodology to select energy measures
Consider All High Performance Building Benefits

- **Human performance** – Studies show high performance buildings enhance occupant productivity, comfort and morale

- **Organizational performance** – High performance buildings enable organizations to apply their resources to other priorities and improve results

- **Property values** – High performance buildings command premium rents, enjoy higher occupancy rates and sell for more on the open market

- **Brand and reputation** – High performance buildings help organizations attract and retain employees, students, customers and community supporters
“Re-commissioning” has become a mainstream concept

- Many buildings fail to live up to standards their designers envisioned – even when new
- Most buildings “drift” from original parameters and perform less efficiently as their functions change, equipment wears and controls strategies deviate from original design intentions

A disciplined re-commissioning project typically yields 10-20% energy savings
Top Control Strategy Improvements

- **Air handling systems (HVAC)**
  - Temperature setup/setback
  - Sensors that are out of calibration, especially OA sensors
  - Synchronizing the mechanical equipment with building occupancy
  - Economizers that haven’t been maintained
  - Discharge air reset
  - Static pressure reset
  - Demand Control Ventilation
  - Dirty condenser and evaporator coils and filters

- **Chilled water systems**
  - Chilled and condenser water reset
  - Optimal start/stop of major equipment
  - Cooling tower optimization
  - Fan and pump speed drives

- **Heating systems**
  - Boiler hot water reset
Trane High Performance Buildings Offering: Organizations Achieve Financial, Sustainability and Productivity Goals
What Trane Brings to the Table

We make the High Performance Buildings concept tangible and real

Concrete strategies customers can define and implement and Trane can deliver and measure

Supporting four performance pillars:
- Energy, water and operational cost reductions
- Operational sustainability
- Occupant health and welfare
- System reliability and equipment uptime

Helps organizations achieve financial, sustainability and productivity goals
1. Understanding customer’s mission
2. Conducting a critical systems audit and facility assessment
3. Providing performance improvement recommendations
4. Implementing improvements
5. Providing continuous systems monitoring, periodic audits and ongoing assessment
6. Delivering measurement and evaluation

Proven methodology, process and tools for achieving peak performance

Centered on a performance-based Trane High Performance Building Agreement
Building Improvement Survey

Energy Benchmark

- Has the building been energy benchmarked?
  - $/Sq.ft. _____ kbtu/sq. ft. _____ EnergyStar rating _____
- Who performed the benchmark?

Building Occupancy Hours

- Weekday
- Weekend

HVAC Equipment Runtime

- Weekday
- Weekend

HVAC Equipment Data

1. What is the total fan system hp in the building?
2. What is the fan system hp of the unit being controlled?
3. What is the total cfm being supplied to the building?
4. What is the cfm of the system being controlled?
5. What is the total pump hp?
6. What is the individual pump hp being controlled?
7. What is the proposed space setback temperature (degF)?
8. What is the proposed space setup temperature (degF)?
9. What is the current OA cfm? What is the desired OA cfm?
10. What is the current duct static pressure (in. wg)?

Utility Data

1. Annual Electrical Cost
2. Electrical cost per unit
3. Total annual kwh used
4. Heating fuel type
5. Annual heating fuel cost
6. Heating fuel unit cost
7. Total annual fuel used

Analyzes gaps between a building’s current and optimum energy performance
High Performance Building Agreement

Trane customer-centered approach to drive building performance

- Conducting audits and making performance improvements
- Validating system performance within set standards
- Providing periodic energy audits and identifying improvements
- Upgrading control systems with intelligent technology
- Using analytics to improve efficiency and self-sufficiency
- Continuously monitoring and analyzing data against operating benchmarks

Comprehensive solution that helps customers realize their mission
Leverages an existing facility’s investments by using technology to access operational data and optimize building performance

- Benchmarking current building performance
- Using custom analytics to provide performance improvement recommendations
- Performing recommended actions to meet business needs
- Continuously monitoring and analyzing data against operating benchmarks
- Documenting progress toward high performance building status

Providing a new level of technology-enabled service to help building owners and operators achieve and maintain optimum building performance
Adding New Levels of Value for Owners

Intelligent services analyze building data so owners can:

- Perform maintenance when required, around building schedule
- Predict failures before they impact building performance or occupant comfort and welfare
- Reduce energy consumption and reduce ownership costs
- Improve system and equipment performance to help owners achieve their mission
- Create reports and actions to demonstrate building performance and service delivery
Creating New Ways to Think About Service

Leveraging technology to create a whole-building, total-lifecycle, knowledge-based approach to establishing and maintaining performance standards

<table>
<thead>
<tr>
<th>Service Today</th>
<th>Service Tomorrow</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Component based</td>
<td>• Component &amp; system based</td>
</tr>
<tr>
<td>• Moment-in-time view</td>
<td>• Continuous (past &amp; present)</td>
</tr>
<tr>
<td>• Human intelligence – best individual</td>
<td>• Collaborative “brain trust” + human intelligence</td>
</tr>
<tr>
<td>• Low tech</td>
<td>• Leverage technology</td>
</tr>
<tr>
<td>• Reactive, corrective</td>
<td>• Proactive, preemptive, predictive</td>
</tr>
<tr>
<td>• Truck based, slow response</td>
<td>• Immediate access, automated</td>
</tr>
<tr>
<td>• Word of mouth benefits</td>
<td>• Performance scorecard</td>
</tr>
</tbody>
</table>

Taking a holistic, technology-enabled approach to high performance
Proving the Model:
Case Examples of Organizations on the High Performance Building Journey
High Performance Building Case Study

TIAA-CREF Headquarters, New York City

SITUATION
• Trane customer looking to save energy, improve reliability, enhance returns and reduce environmental impact

TRANE METHODOLOGY
• Analyze building systems, energy use, rate structure and procurement methods
• Recommend mission-focused ECMs
• Design & install upgrades
  – State-of-the-art chilled water system
  – Rooftop thermal storage system
  – Reprogrammed central automation control system

MEASURE/VALIDATE RESULTS
• Estimated $765,000+ annual energy/operations savings
• 25% internal rate of ROI on incremental spending
• 6.1 million pounds of carbon emission reduction
• No sacrifice of rentable space

Created an improved facility for the company, employees and tenants
High Performance Building Case Study

Mesa County Valley School District 51, Colorado

SITUATION
- Trane customer looking to reduce energy and operating costs spent on aging infrastructure while improving the learning environment at 46 district schools

TRANE METHODOLOGY
- Assess building systems and energy use
- Recommend mission-focused ECMs
- Design & install upgrades district-wide
  - HVAC upgrades & re-commissioning
  - Web-enabled building control system
  - Sky lighting & lighting retrofits
  - Electric-gas oven conversion
  - Water conservation measures

MEASURE/VALIDATE RESULTS
- Estimated annual energy savings of $750,000+ per year
- Maintenance cost savings of $390,000
- $10.7M program funded entirely by energy savings

Created an improved learning environment for students, teachers and staff
High Performance Building Case Study

Jefferson Regional Medical Center, Pittsburgh

SITUATION
• 373-bed hospital needed to improve building monitoring capabilities without increasing labor costs

APPROACH
• Custom solution tailored to hospital needs
• Installed Trane Intelligent Services
  – Added 24/7 monitoring and troubleshooting capabilities
  – Tracer ES™ integrated with existing building automation system

RESULTS
• Added 24/7 systems monitoring capabilities without adding staff
• Reduced workload for existing staff
• Automated record-keeping for regulatory requirements
• Reliability improvements, cost reductions anticipated

Intelligent services deliver improved reliability and performance
High Performance Building Case Study

Trane Manufacturing Facility, Texas

SITUATION
• Trane needed to trim energy and operating costs, improve reliability, add asset value and adjust to reduced production volume

APPROACH
• Comprehensive energy analysis
• Energy conservation measures
  – Building automation system upgrade
  – Lighting system/fixtures retrofit
  – HVAC system improvements – boiler, air compressors, etc.
  – Operations, maintenance and schedule improvements

RESULTS
• $1.4 million annual energy and ops savings – 2 year payback
• Reduced energy consumption by 11.5 million kilowatt hours
• Replaced aging systems – some mid-1960s era
• Improved environmental performance of building

Better comfort, safety and efficiency while right-sizing for reduced volume
High Performance Building Case Study

Trane Manufacturing Facility, Texas

High Performance Buildings Program
Case Study

Energy Improvements at Trane Tyler Facility

Paul Wheeler, National Service Engineer, Texas

Achieving Superior Performance for Life

High Performance Building Case Study

Trane, a brand of Ingersoll Rand, is a leading provider of energy-efficient systems and solutions for business and industry. There is also a strong emphasis on maximizing energy opportunities in our daily operations. In 2005, Trane launched a new energy management program. The company also took a number of measures to improve energy efficiency, including replacing inefficient equipment, improving operations, and implementing new technologies.

This case study discusses the analysis process and implementation of an energy management program with data analysis that includes performance measurement, energy management, replacement projects and improved operations and maintenance practice.

In 2006, the energy management program realized $2.4 million in investment to project implementation. This included a $1.8 million annual cost reduction, versus 2005 energy spent. Annual savings reached $1.5 million in 2008 and $1.3 million in 2010.

Trane is a leader in the delivery of energy management to the top of the list of management priorities. Guiding the way towards continuously re-evaluating and re-engineering core processes is the primary product of this program. The program is designed to examine each business area and develop an action plan for improvement.

Conduct Facility Infrastructure Assessment

- Two automatically scheduled for change (the TCAM and the SCM) consume over $100,000 in annual costs.
- Automation and monitoring equipment also requires monitoring and management.
- Lighting systems are also critical to energy efficiency.
- Focus on improving lighting systems in non-productive areas.
- In addition, energy conservation measures are taken to reduce lighting costs.

Conduct Energy Analysis

- Two primary areas focused on: lighting and HVAC, with a goal of reducing energy consumption by 20%.
- Lighting systems are reviewed for opportunities to improve energy efficiency.
- HVAC systems are reviewed for opportunities to improve energy efficiency.
- Energy Conservation Measures (ECMs) are evaluated for potential savings.

Conduct Energy Management Program:

- Focus on improving lighting systems in non-productive areas.
- In addition, energy conservation measures are taken to reduce lighting costs.
- Lighting systems are reviewed for opportunities to improve energy efficiency.
- HVAC systems are reviewed for opportunities to improve energy efficiency.
- Energy Conservation Measures (ECMs) are evaluated for potential savings.

Conduct Energy Management Program:

- Focus on improving lighting systems in non-productive areas.
- In addition, energy conservation measures are taken to reduce lighting costs.
- Lighting systems are reviewed for opportunities to improve energy efficiency.
- HVAC systems are reviewed for opportunities to improve energy efficiency.
- Energy Conservation Measures (ECMs) are evaluated for potential savings.

Conduct Energy Management Program:

- Focus on improving lighting systems in non-productive areas.
- In addition, energy conservation measures are taken to reduce lighting costs.
- Lighting systems are reviewed for opportunities to improve energy efficiency.
- HVAC systems are reviewed for opportunities to improve energy efficiency.
- Energy Conservation Measures (ECMs) are evaluated for potential savings.

Conduct Energy Management Program:

- Focus on improving lighting systems in non-productive areas.
- In addition, energy conservation measures are taken to reduce lighting costs.
- Lighting systems are reviewed for opportunities to improve energy efficiency.
- HVAC systems are reviewed for opportunities to improve energy efficiency.
- Energy Conservation Measures (ECMs) are evaluated for potential savings.
Energy efficiency makes more sense than ever

Environmental performance is becoming more critical

Organizational performance and employee productivity drive value, ROI

Effective service strategy maintains lifecycle performance

- Link the building to its primary business mission
- Determine the funding strategy
- Understand energy conservation measures and their payback
- Focus on total cost of ownership over occupied life
- Conduct the financial analysis – including cash flow
Larry G. Wash, President of Global Services
Climate Solutions Sector
Ingersoll Rand
732.980.6361
lwash@trane.com
Twitter: @lgwash
LinkedIn: www.linkedin.com/pub/larry-wash/4/33a/64
Your Questions