# Controlling the Uncontrollable with Analytics

## Buildings = Patient Care

## Oklahoma Association of Healthcare Engineers

Ingersoll Rand

LET'S GO BEYOND™

# Healthcare Facility Operating Goals

- Healthcare Professionals are looking for:
  - Improved Patient Experience
  - Reduce Infections
  - Reduce Expenses

Regulatory Compliance

# Healthcare Facilities Operating Realities

- Facility Directors are under pressure to do more, with less
  - Reduce Operating Costs
  - Increase Patient Satisfaction
  - Optimize Environment of Care
  - Communicate Priorities

Lower Business Outcomes

# Health Facilities Magazine Survey

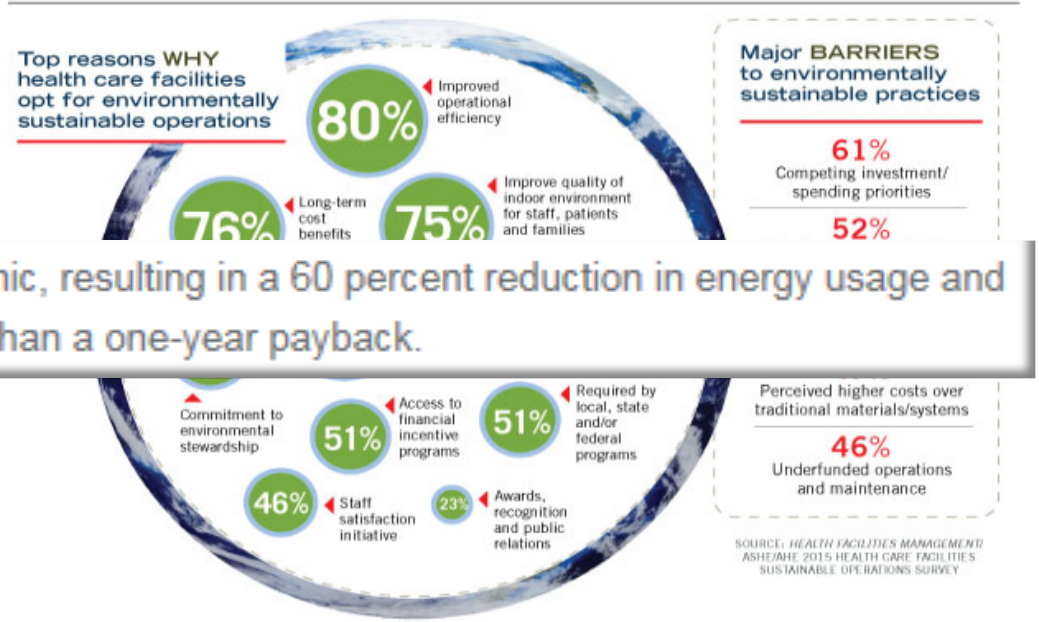
**Most of our peers need:**

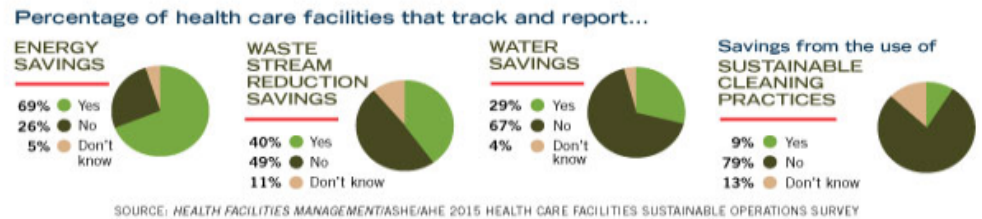
- **Simple**
- **Low investment**

- A facility retrocommissioned a medical clinic, resulting in a 60 percent reduction in energy usage and $55,000 annual savings with slightly more than a one-year payback.

**Continuous Analytics and Commissioning**

- **Scalable**
- **Cost benefit positive**
- **Tech enhanced gets more**



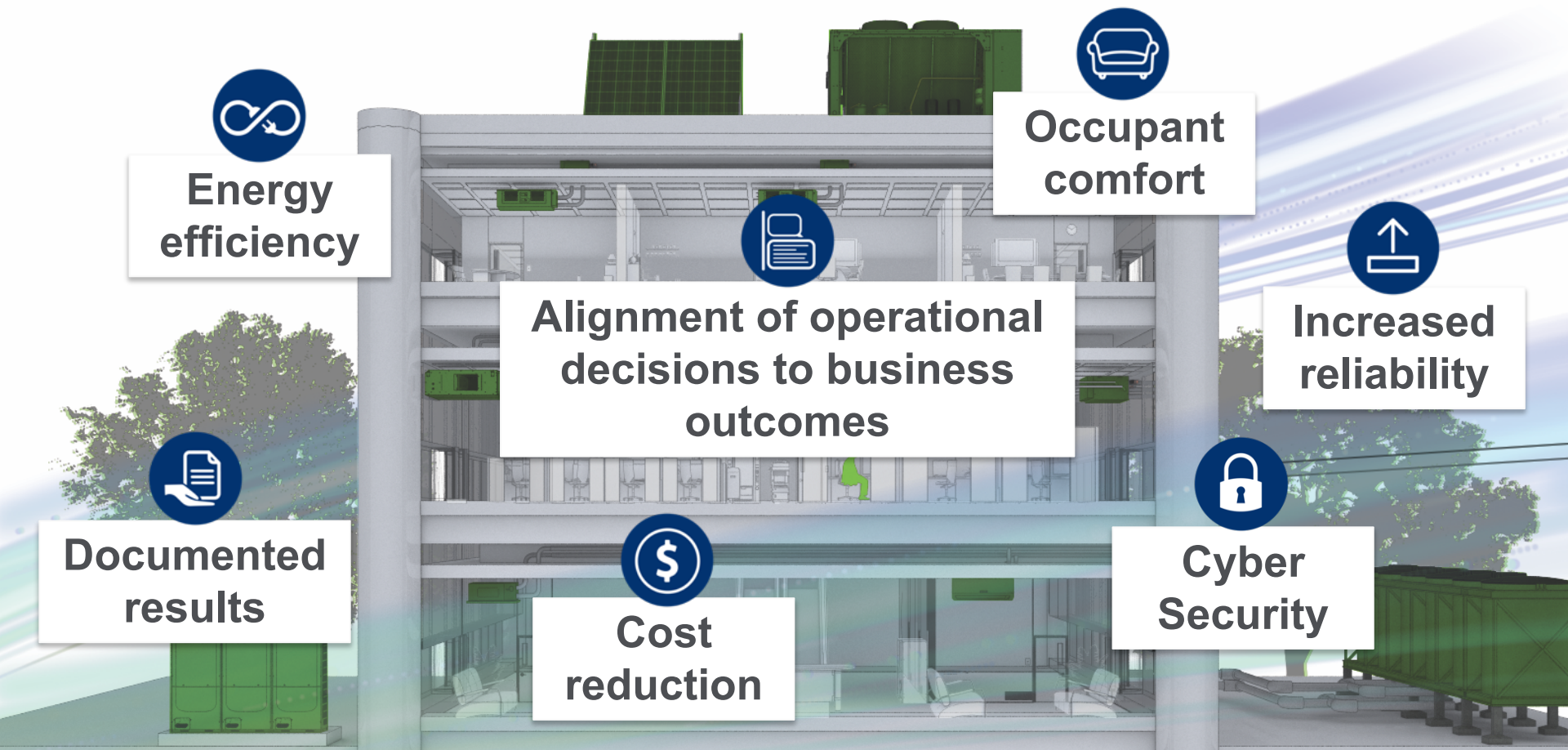



# Healthcare Facilities are at a turning point

- Technology-poor buildings are liabilities
  - High operational costs
- Connected buildings are assets
  - Supporting your mission of healing
  - Aligned to desired outcomes

Data is the great differentiator

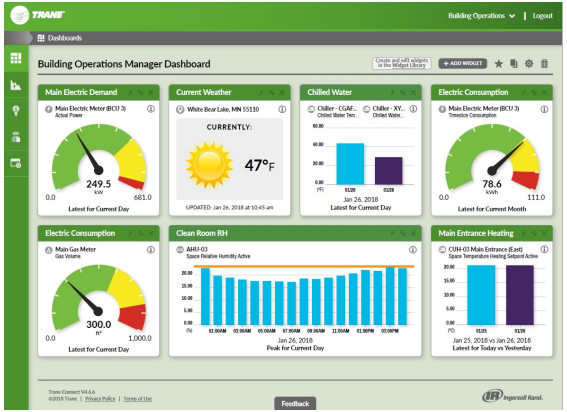
# What a Connected Building can deliver



# BUILDING ENERGY MANAGEMENT SYSTEMS

## Turning building data into an action plan

- Reduce energy use and operating costs
- Identify actionable insights
- Continuously improve building performance




### Energy Assessment

- Identifies how your building uses energy and transforms that data into meaningful, clear information, to help you identify and monetize impactful energy projects for sustained results

### Active Monitoring

- Provides 24/7 support and continuous monitoring, to proactively detect issues, quickly resolve problems or initiate action, and keep critical building systems up and running

### Building Performance

- Analyzes data to see what's happening in your building, providing proactive, data-driven insights and solutions to keep your building running optimally

### Energy Performance

- Uncovers energy waste in every corner of your building and aggregates energy data using powerful visualizations and analytics, to bring clarity and hidden savings opportunities

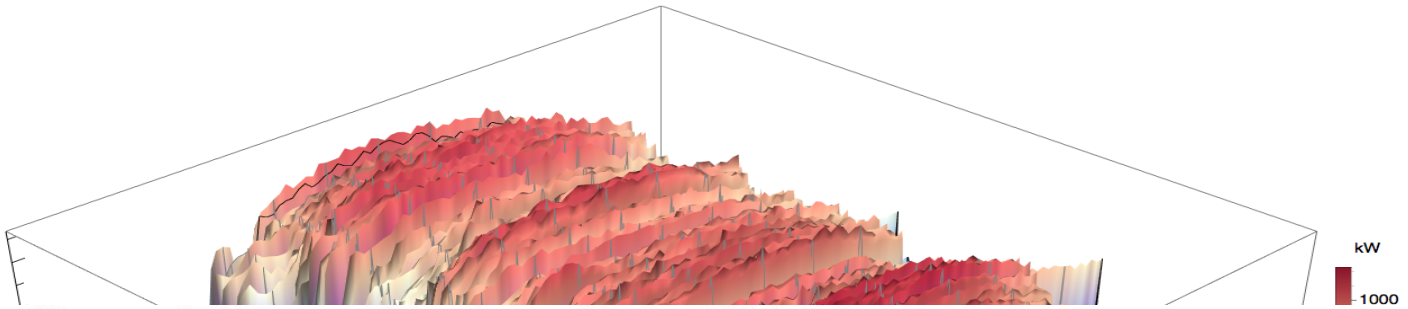
# Energy Operational Expenses

**$2.00**
per Square Foot

Your
Asse
by bu

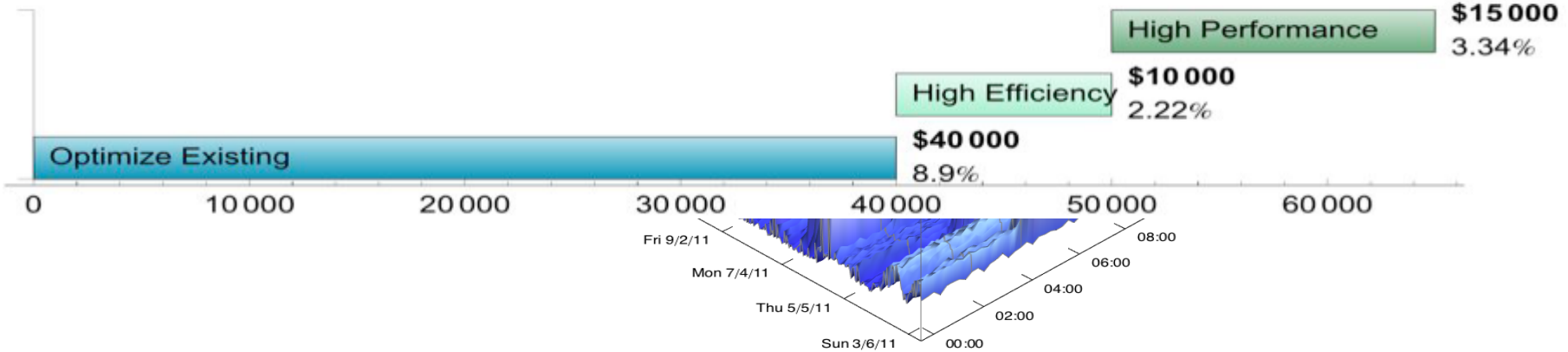
**$1.94**

Aver
Utility
norm




## Annual Energy Savings Potential ($)

Total $65000



# Energy Performance Analytics

- Baselines
- Energy Costs
- Energy Intensity
- Peak Demand

# Building Performance Analytics

Analyzing building performance 24 hrs/day,
yielding insights otherwise hidden from system operators.

# Building Performance Reporting

## The Big Picture

Performance at:

- Year to date operational (energy + other) savings: $3,002 ($2,503 Cost Avoidance + $499 Time Adjusted Energy Savings)
- On site BAS Controls Technician resolved multiple issues found during remote inspections.
- Opportunities were identified during remote inspections that could provide substantial Energy Savings.
- Maintenance items were identified during remote inspections that should be addressed.

*"Scheduling and Chiller Plant Optimization opportunities are the best energy efficiency measures to implement and will give the greatest savings at your building."*

*As we continue to find ways to reduce energy, we will focus on them.*

*Here's what's going on in your building…*

### Top KPIs

| | KPI | Status | Goal |
|---|---|---|---|
| Energy/ROI | **Annual Energy Savings (kWh/yr)**- Reducing energy usage can be done by remotely implementing improvements and making constructive, data supported recommendations | **Quarter 4 2018:** 120,000 kWh/year potential *savings identified*<br>**YTD:** 6,653 of 30,000 kWh completed (Time Adjusted) | 30,000 kWh/year ✗ |
| Performance | **Operational Efficiency through Avoided Service Calls ($)** - Providing proactive solutions for advantageous equipment operations means less operating costs | **YTD:** $2,503 completed | $2,500 in Cost Avoidance ✓ |
| Reliability | **Longevity of Equipment**- Performing maintenance extends the lifespan of equipment, which directly affects the bottom line of capital budgets | **YTD:** 14 instances completed | 4 Instances (1 per quarter) ✓ |

## Where We've Been

*Highlights of the most impactful changes and activities we've identified in the building.*

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| • Update Scheduling for HVAC equipment to match building Occupancy. | • Optimize the Chiller Plant operation of Pumping and Temperature Control. | • Continue to Optimize AHU Duct Pressure and Supply Air Temperature Control. | • Continue to maintain HVAC Equipment and Controls. |

| | Classification | Summary or number of actions | Date | Impact |
|---|---|---|---|---|
| Energy/ROI | **Annual Energy Savings (kWh/yr)** | Update HVAC Scheduling Optimize Chiller Plant Operations Maintenance | Scheduling identified 2/19/18<br>Chiller Plant identified 1/9/19<br>Maintenance identified 1/9/19 | **120,000 kWh/yr** when complete |
| Performance | **Operational Efficiency through Avoided Service Calls ($)** | Chiller Runtime, Automated Tests & Trends, Duct Pressure Optimization | Completed 6/15/18<br>6/15/18<br>9/6/18 | **$2,503** of cost avoidance |
| Reliability | **Longevity of Equipment** | Chiller Runtime, Outdoor Air Dampers, Exhaust Air Dampers, Failed Sensors | Completed Year to Date | **Up to 20%** Reduced runtime |

# Building Performance Reporting ctd.

## Secondary Opportunity: Chiller Plant Optimization


***What We Learned***

*While the Chiller Plant is functioning normally, it is not operating at its most efficient potential. Fixed Chilled Water and Pumping Flow/Pressure Setpoints are being used.*

***What We Can Do***

*Optimize the Chiller Plant operation for maximum efficiency by utilizing Chilled Water Reset and Pump Flow/Pressure Optimization Strategies. This will dynamically reset the setpoints as outdoor air and building load conditions change.*

***What You Can Gain***

*Substantial Energy Savings as well as Equipment Reliability and Longevity will be gained by dynamically reducing the capacity of the equipment to the minimum required. Occupant comfort will be maintained as the system dynamically increases the capacity of the equipment when required.*

## Other Opportunities: Maintenance


***What We Learned***

*Operator Overrides:*

- *AHU-06 Discharge Air Temperature setpoint is overridden to 55 Deg. F.*
- *AHU-05 Discharge Air Temperature setpoint is overridden to 48 Deg. F.*

*Service Required:*

- *FCU Diagnostic: Filter change required for all units*
- *AHU Diagnostic: Filter maintenance reminder – filters at 50% for all units*
- *VAV 6-08: Air valve at 100% with 52 Deg. F. air entering VAV and 65 Deg. F. air leaving VAV and HW valve closed. Unable to cool space to setpoint*
- *AHU-01: Unable to maintain duct static pressure with VFD demand at 100%*

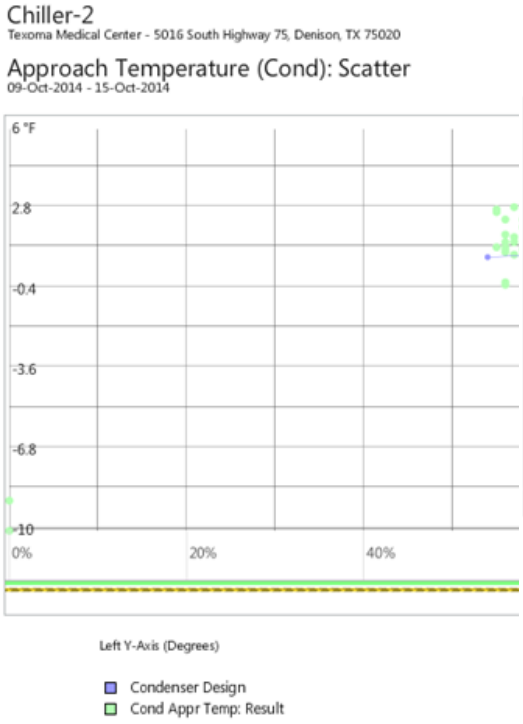
***What We Can Do***

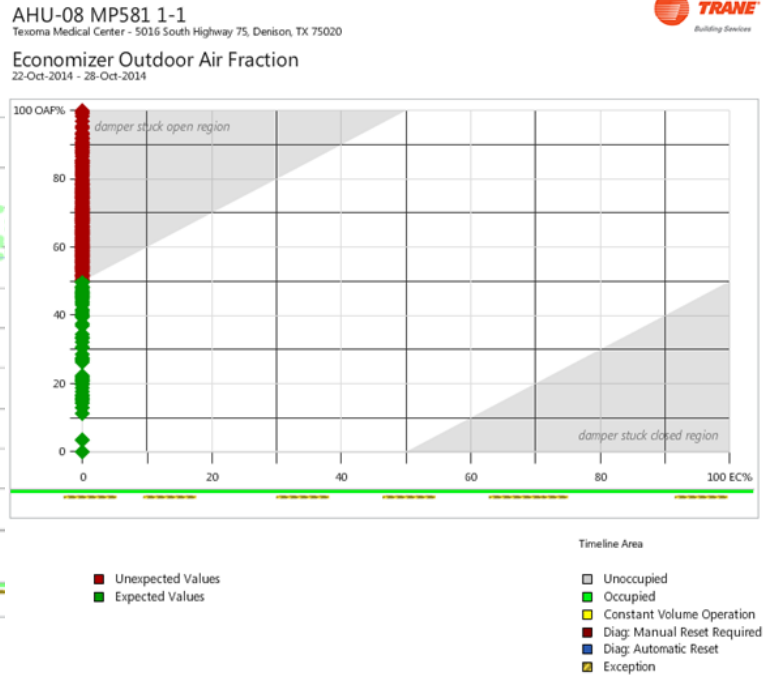
*Release operator overrides to allow AHU Discharge Air Temperature Reset to control temperature setpoint. Check/Change filters for optimal AHU/FCU performance and occupant comfort. Check/Repair VAV 6-08 HW Valve and Air Valve. Check/Repair AHU-01 Supply Fan and VFD.*

***What You Can Gain***

*Allowing AHU Discharge Air Temperature Reset to automatically adjust setpoint will lower cooling load and energy required. Properly replacing filters and maintaining equipment will allow equipment to operate more efficiently as well as insure occupant comfort. This will also increase equipment reliability and longevity.*

# Technical Details: Analytics




## Equipment , System Assessment

**Chart Condition:**

- Calculated outside air damper position is not consistent with commanded outside air damper position.
- Investigation of unit mechanical components and set up parameters related to outside air damper control is recommended.

**Why should I be concerned?**

- Reduction of mechanical equipment life, comfort complaints and increased energy consumption are possible with this condition.

**Energy Conservation Measure:**

- Tune up of the outdoor air damper operation could potentially help improve economizer operation and reduce unit heating and cooling load.

**Condition is typical of :**

| Equipment | Failure Count |
|---|---|
| AHU-08 MP581 1-1 | 202 |
| AHU-09 MP581 7-2 | 196 |
| AHU-07 MP581 3-1 | 54 |
| AHU-10 MP581 7-3 | 37 |
| AHU-03 MP581 5-1 | 36 |
| AHU-12 MP581 8-2 | 34 |
| AHU-11 MP581 8-1 | 27 |
| AHU-06 MP581 6-1 | 27 |
| AHU-01 MP581 2-1 | 16 |
| AHU-05 MP581 7-1 | 9 |

# Operational Analytics

- Chilled Water Supply Water Pressure

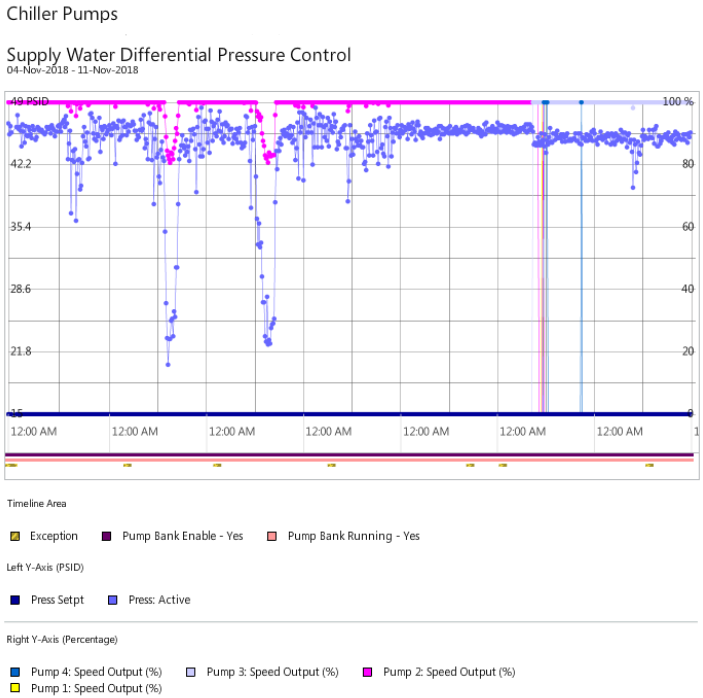



**Chart Condition:** Chart indicates Supply Water Pressure is way above its 15 PSID Set point but yet it keeps 1 Pump running at 100%.

**Space Pressure Control –** The pump bank is unable to maintain the pressure setpoint.

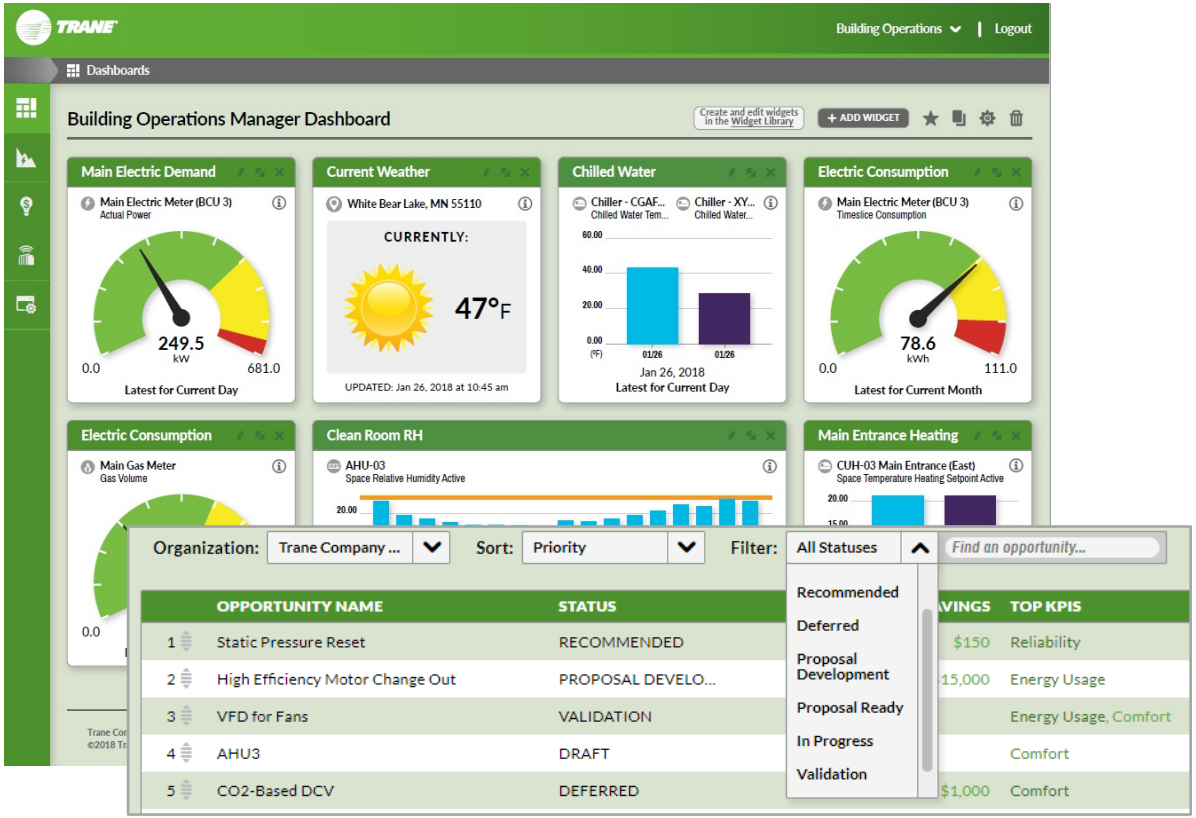
**Cause:**

- Pump bank is currently being controlled on Flow (GPM) for Maximum Flow. While this allows for operation of chillers and pumps, it is not the most energy efficient strategy

# A Comprehensive View

## Dashboards customized to your needs

- Real-time views of building & energy performance
- Measure your Key Performance Indicators
- Track outcomes and opportunities to improve



# Analytics for Continuous Energy Management

4-building medical complex in Greenville Tennessee

"We use the analytics and analysis to clearly see where we are consuming the most energy, and determine ways to improve."
- Chuck Whitfield, Chief Executive Officer

## Results

- First year savings over $778k
- Raised ENERGY STAR score to 90
- Lower maintenance costs, better air quality & patient comfort

## Solution

- Update BMS
- Intelligent Services:
  - Building Performance
  - Active Monitoring

# Optimizing Operations & Energy Use

**Assante's 378-bed referral and trauma center features the latest medical technology and clinical expertise.**

Intelligent Services validated that the actual savings exceeded the chiller plant kWh savings target by 150+ percent, reducing costs more than 9 percent over baseline.

## Results

- Cost Reduction of $87k
- Awarded over $304k in Utility Incentives

## Solution

- Upgrade Building Automation
- Intelligent Services:
  - Building Performance
  - Energy Performance
  - Quarterly Consultations with building & energy experts

# Visibility To Fine-Tune Operations & Save Energy

Project spanned nine facilities with 2.8 million sq ft space

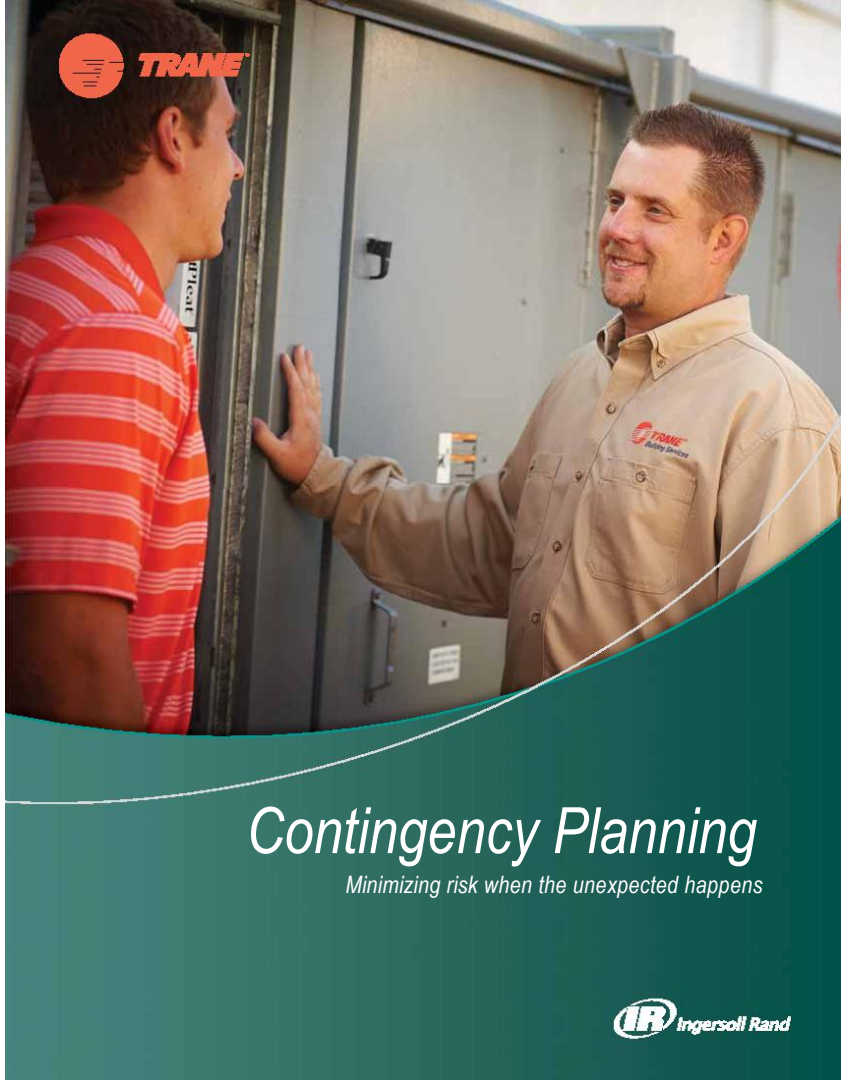

"Maintaining the proper environment for our patients is our goal, and we want to do that as efficiently and cost effectively as possible." - David Bloom, Director

## Results

- Shifted Demand to Off-peak
- Reduced Maintenance Costs

## Solution

- BAS Upgrade
- CALMAC Thermal Storage
- Intelligent Services:
  - Building Performance
  - Energy Performance
  - Quarterly Consultations with building & energy experts


TRANE
Contingency Planning
Minimizing risk when the unexpected happens
Ingersoll Rand

TRANE

# *The right plan can provide peace of mind*

## Know your risk and be prepared

- From natural disasters to everyday mechanical failures, all facilities face some level of risk due to power, HVAC or compressed air failure. A failure could result in anything from minor discomfort due to lack of temperature control to losing hundreds of thousands of dollars due to lost productivity. Knowing what you have at risk can help you decide the level of planning that is warranted.
- Many companies work diligently to make sure their facilities have proper evacuation and safety plans. However, few think about what it will take to get the facility back up and running if something were to happen to their mechanical or electrical systems.
- This is why Trane has developed our Contingency Planning Process. It will walk you through the steps to determine the financial risks associated with losing control of your indoor environment and which types of outages present the highest risk.
- When it comes to emergencies, we all understand the importance of having a plan and practicing it. These practices help us react quickly during stressful times and are designed to help protect your most valuable assets.

## Program benefits

With a contingency plan, you gain control and peace of mind knowing that your facility can withstand any disaster and be back up and running quickly. Disruptions can occur at any time. Having a plan and being prepared in advance can reduce the risk of financial loss by:

- Shortening the time needed to acquire, install and start up temporary power, HVAC or compressed air systems. In addition, having the paperwork completed in advance further reduces delivery time.
- Ensuring that all parties involved in dealing with the outage are aware of their roles and are trained in the processes and actions needed to deal with the problem.
- Lowering the total cost of the temporary solutions because any necessary building modifications can be scheduled, instead of being performed under emergency conditions.
- Reducing startup delays caused by oversights or problems resulting from improvised designs.
- Improving a facility's operations by identifying and reducing any weaknesses in the system.


*Having a contingency plan in place reduced a hospital's downtime and saved them a substantial amount of money.*

# Building your Plan

Build a plan that is right for you and your facility – and do it quickly and efficiently, so as not to interrupt your daily operation.

**Step 1 – Financial risk analysis** The contingency process begins with a review of the different functional areas of your facility, their dependence on power, HVAC and compressed air equipment, and the impact a loss could potentially have. By understanding the importance of these items to your operations and quantifying their financial impact, we can determine the areas that need to be considered

**Step 2 – Risk assessment** We will identify the potential causes for an interruption and rank them based on cost impact, probability of occurrence and system downtime.

**Step 3 – Equipment identification** Your Trane account manager will work with you to document all equipment in your HVAC and power systems, including their operating conditions. This process may uncover system weaknesses that need to be addressed prior to implementation of the plan

**Step 4 – Prioritization** We will evaluate your most critical facility loads and process needs for essential operations, including those with the highest financial implications for your business. At this point, you may want to consider load prioritization and/or load shedding to reduce the amount of capacity required. For a short period of time, you may be able to operate with higher air temperatures in certain areas and completely shut down others.

**Step 5 – System connection** How and where connections are made helps reduce time and money. Care will be taken to choose a location that is easily accessible and that requires the least amount of temporary installation material to keep additional costs to a minimum.

# Building your Plan ctd…

**Step 6 – Power availability** The need to document the available voltage(s) and amperage is vital because a transformer or generator may be required. Even if your power has not been affected, some temporary units may require more power than your existing units.

**Step 7 – Electrical connection** Whether existing electrical service is adequate or new electrical service will be installed, we will establish the location of the temporary electrical connection(s) and how they will be made.

**Step 8 – Temporary equipment location** Equipment location is important for determining how much electrical cable, chilled water hose and/or flex duct will be required. We will also consider safety of the public and personnel, security, ease of placement, equipment clearances, structural loads, ground firmness and level, noise, emissions (generator), public visibility, auto and pedestrian traffic, permits, and many other things to minimize the impact on normal operations.

**Step 9 – Plan creation** Your Trane account manager will provide your organization with a plan proposal. Included in the proposal are the recommended temporary equipment solutions, the total investment required (both capital and expense), budgetary figures for the temporary solutions (including first and recurring costs), and detailed roles and responsibilities for internal and external resources.

**Step 10 – Implement and review** To help expedite the ordering and delivery of a temporary system, in an emergency situation, it is important to make sure that all documents, such as purchase orders and rental agreements, are completed, and all recommended building modifications are made. We also recommend that the plan be reviewed at least once a year, or when any facility changes are made

# A Fleet of Products at the Ready

Trane is a leading manufacturer of HVAC equipment and offers these same products for temporary applications to better serve our valued customers. Trane has assembled one of the largest and most advanced fleets of rental equipment in the industry. Our fleet is comprised of chillers, package units, air-handlers, cooling towers, diesel generators and air compressors. Essentially, everything you need to create a temporary HVAC or power system to get your facility back up and running.

**Air-cooled chillers 10-500 ton**

- Equipped to provide quick restoration of cooling in emergency and planned shutdown situations

**Water-cooled chillers 250-1,000 ton**

- Ideal for large process and comfort cooling applications where adequate power is a concern
- Restore cooling in an emergency or provide cooling for previously unconditioned spaces
- Perfect for providing air conditioning to very large spaces where high efficiency filtering is required

**Cooling towers 250-750 ton**

- Used to provide cooling for water-cooled chillers or directly for some process cooling applications

**Vertical air conditioning tent units 10-30 ton**

- Designed to cool and heat structures where footprint and noise output are a concern.

**Diesel generators 60-2,000 kW**

- Well-suited for applications that need standby generators when conducting service on existing equipment.

**Portable units 1-5 ton**

- Great for areas such as server rooms, laboratories and small office spaces

**Air compressors 100-1,500 cfm**

- These air compressors are easy to install, ensuring your facility's compressed air system has minimum downtime after an emergency.

**Compressed air dryers**

- Helps protect compressed air users from water impurities, while improving productivity and system efficiency.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# QUESTIONS?

# HOW CAN YOU CONTROL THE UNCONTROLLABLE?