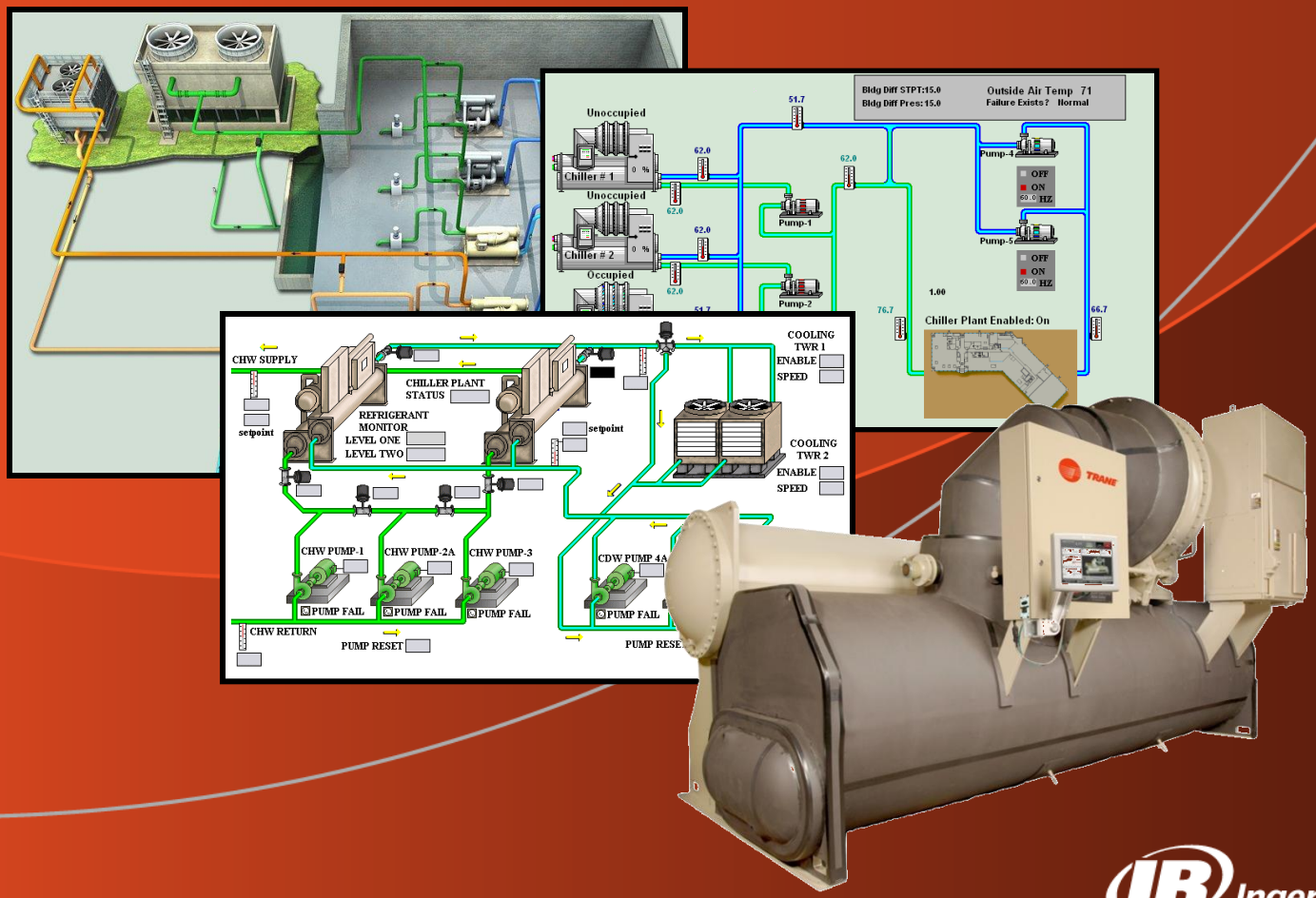
HVAC System Optimization Strategies

Kimberly Hayman

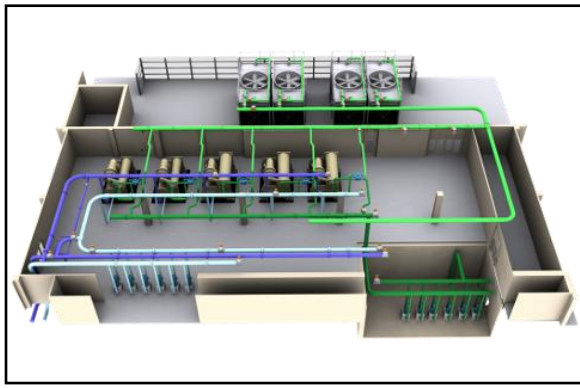
St. Paul, Minnesota, USA

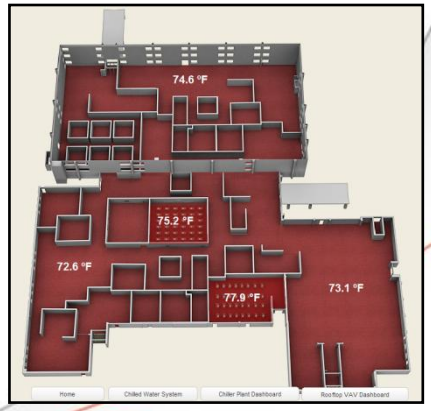
HVAC System Optimization Strategies

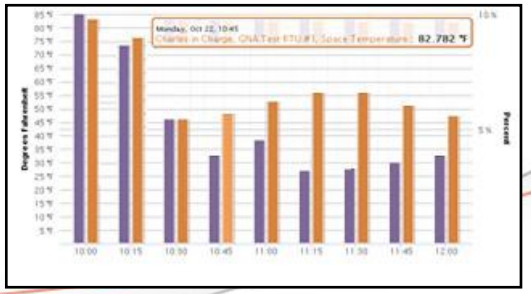


Control Optimization Strategies

- Reliable system control with **Pre-engineered Applications**
- Chilled Water System Optimization Strategies
  - **Chiller-Tower Setpoint Control**
  - **Pump Pressure Optimization**
- Air System Optimization Strategies
  - **Duct Static Pressure Optimization**
  - **Ventilation Reset**
- Document results with **Data Logs and Reports**







Tracer Chiller Plant Control (CPC)

Tracer CPC is a pre-engineered software application that coordinates multiple chillers' operation for optimal efficiency and plant reliability.

- Maintain chilled water flow and temperature
- Minimize manual intervention
- Sequence chillers and match to load

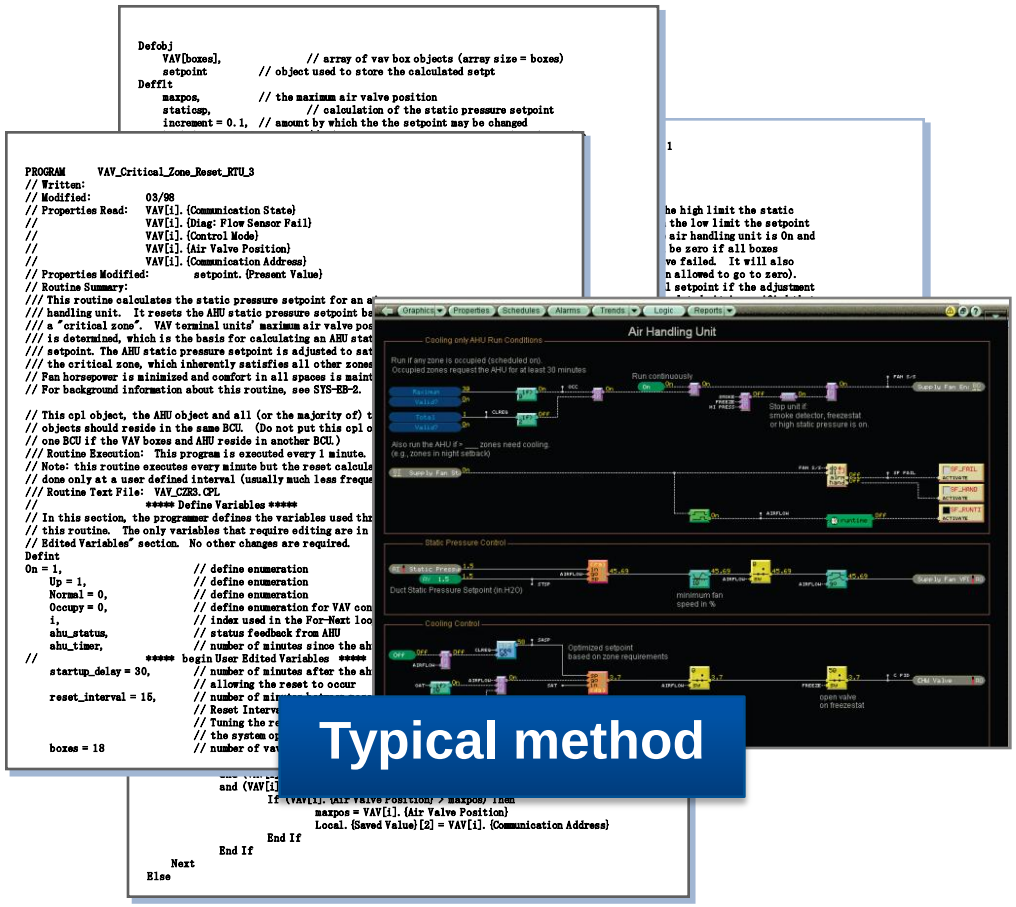


Delivers *flexible*, *repeatable*, plant control that *maximizes* energy savings and *minimizes* operating costs.

Reliable plant operation

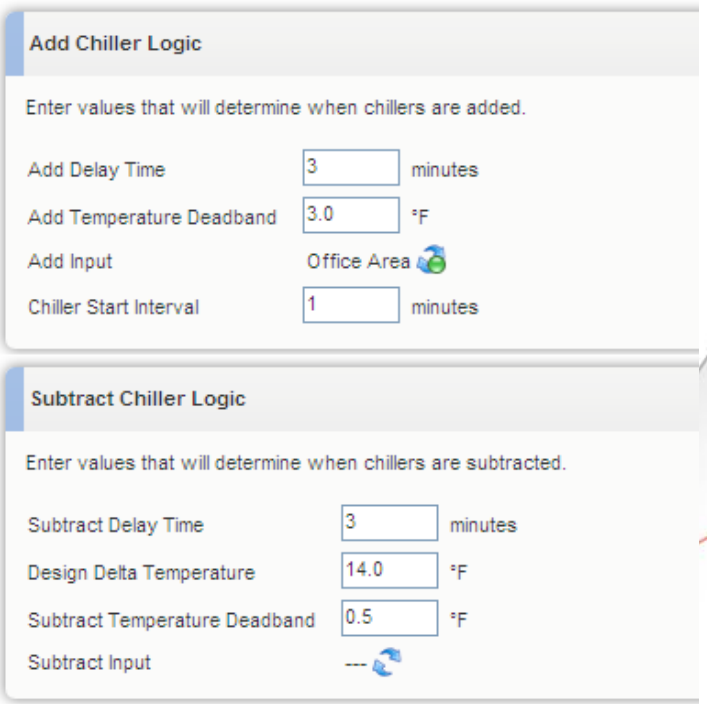
Repeatable Performance From Plant to Plant

with standard, configurable program functions



Typical method

Standard Tracer Application screen



Repeatable – delivers reliable plant operation

HVAC System Optimization Strategies

Helping you achieve energy savings

Select control strategies	Typical savings
Chiller / tower optimization	5-7 % Chiller – tower energy savings
Variable flow pump pressure optimization	20–45% Pumping system energy savings
Duct static pressure optimization	20-45 % Fan system energy savings
Ventilation reset optimization	Up to 25 % HVAC system energy savings

Optimization strategies bring operation cost savings…

Chilled Water Optimization Strategies

Partnership for Energy Efficiency Leadership, 11th April 2013

HVAC System Optimization Strategies

Helping you achieve energy savings

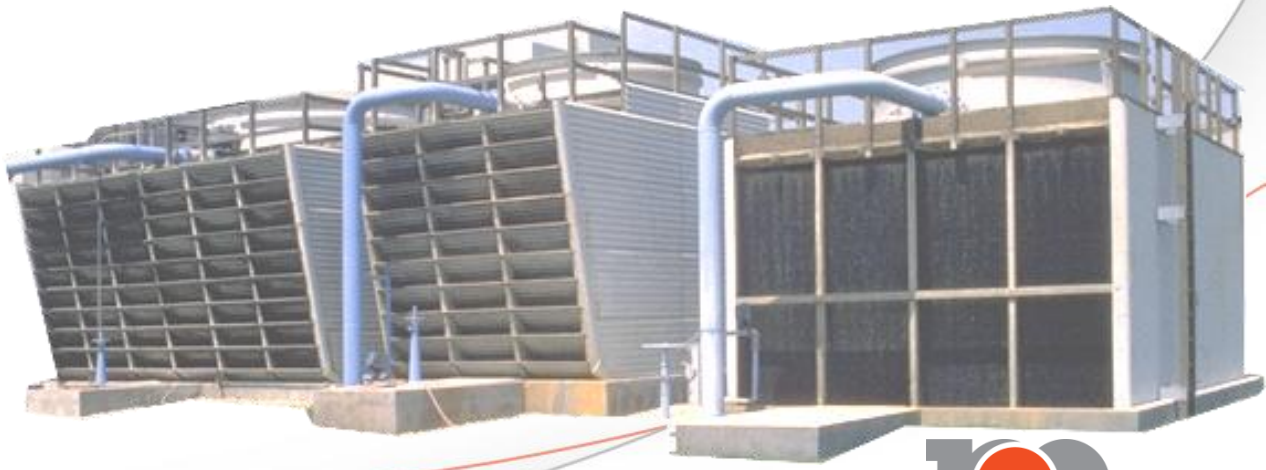
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Optimization strategies bring operation cost savings…

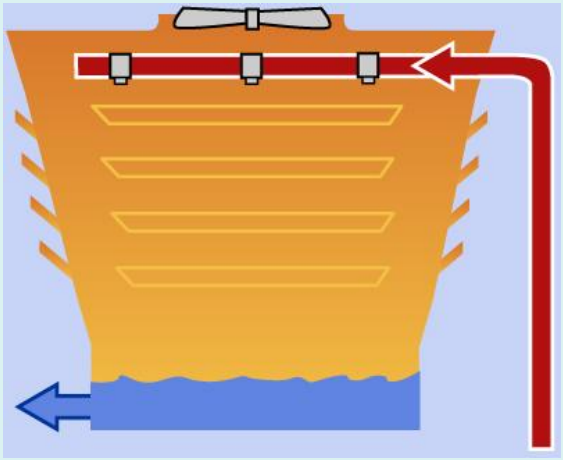
Optimization: Chiller - Tower Control

Traditional Tower Control Methods

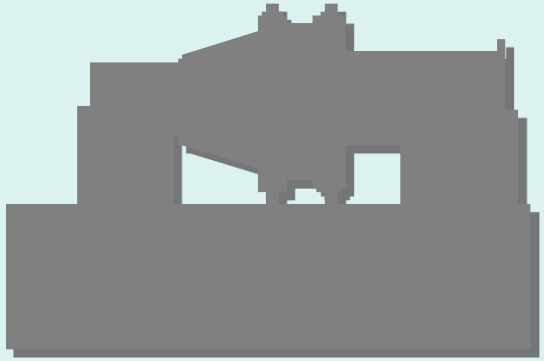
- Minimum tower LWT
- Fixed design tower temperature
- OAT wet bulb plus tower approach
- Satisfy chiller pressure differential



Chiller - Tower Optimization
Tower Setpoint Optimization

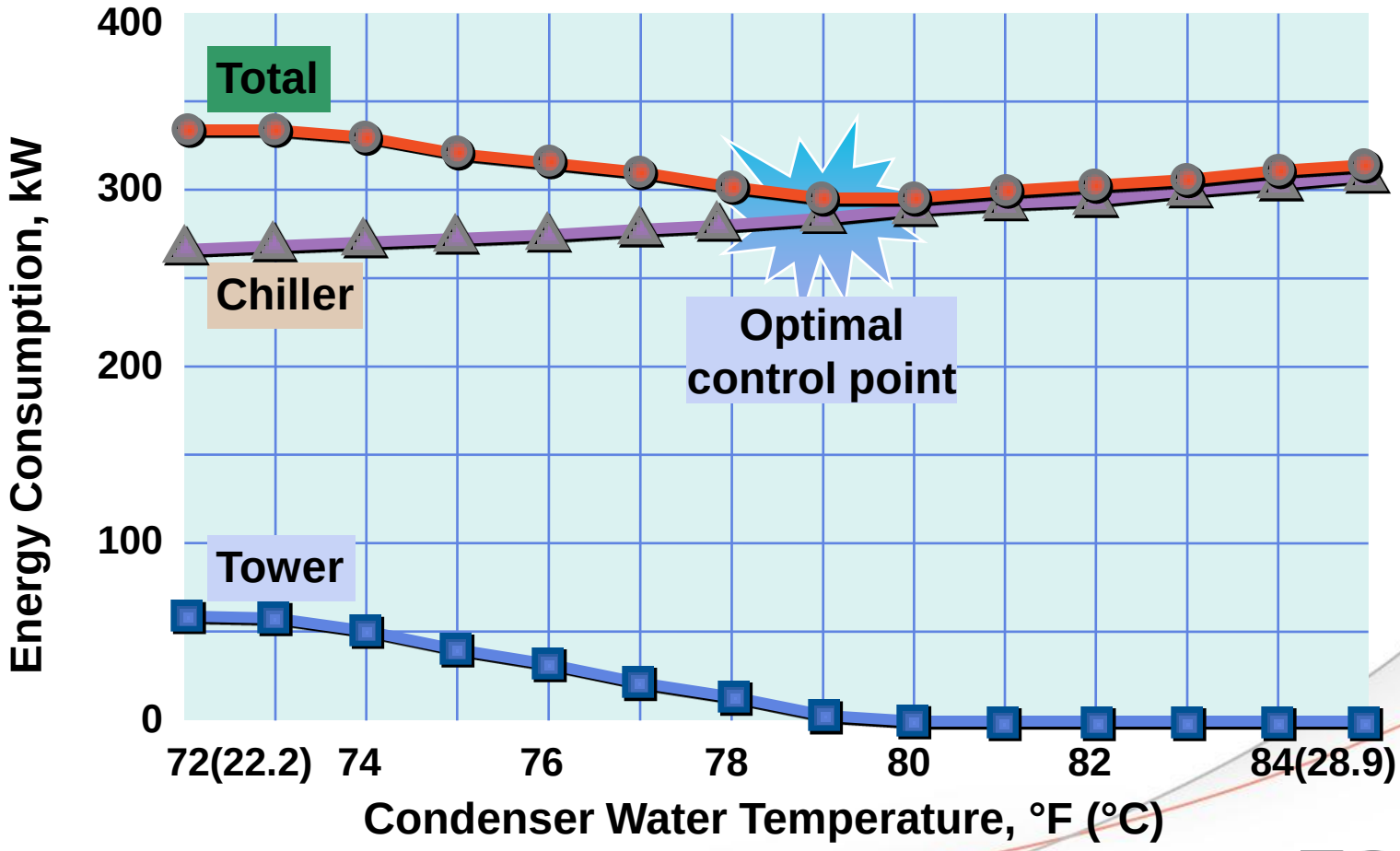


- Load
- Condenser water temperature
- Wet bulb
- Tower design

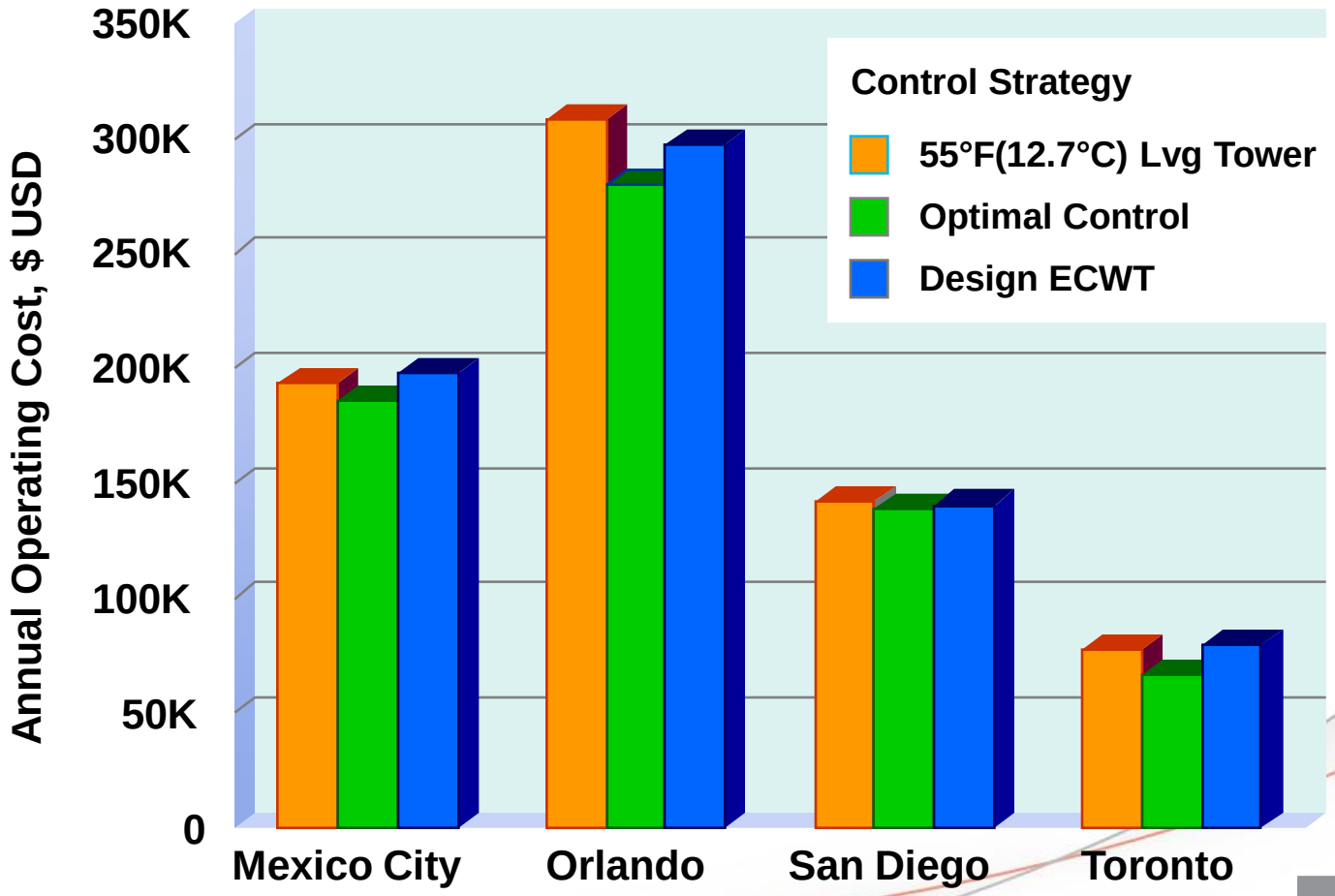


- Load
- Condenser water temperature
- Chiller design

Chiller - Tower Optimization
Chiller–Tower Interaction



Chiller - Tower Optimization
North America



HVAC System Optimization Strategies

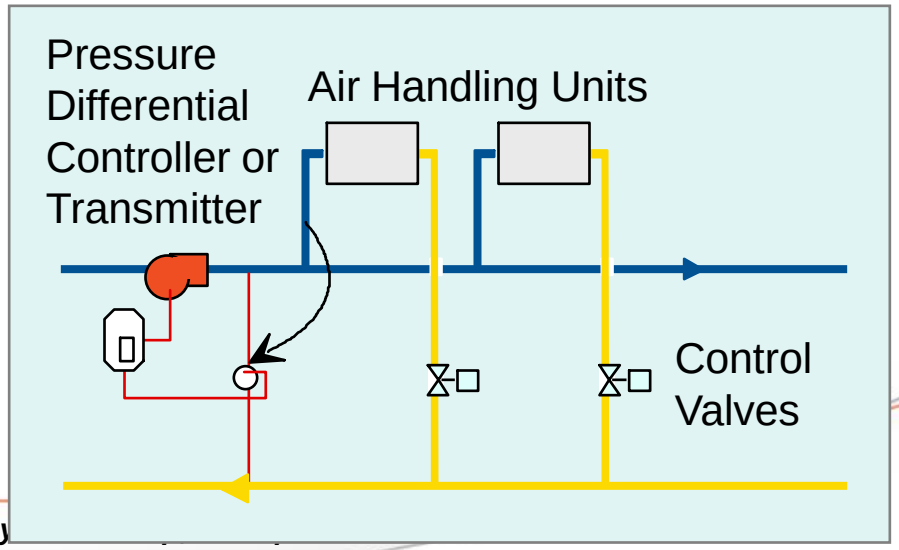
Helping you achieve energy savings

Select control strategies	Typical savings
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Duct static pressure optimization	20-45 % Fan system energy savings
Ventilation reset optimization	Up to 25 % HVAC system energy savings

Optimization strategies bring operation cost savings…

Pump Pressure Optimization
for Distribution Pumping

- Critical valve reset
  - Monitor critical AHU valve position
  - Reset distribution static pressure setpoint
  - Any valve > 90 % open increase setpoint
  - All valves < 80 % open decrease setpoint
- Reduces pump energy, also provides better coil control and extends pump life



HVAC System Optimization Strategies

Helping you achieve energy savings

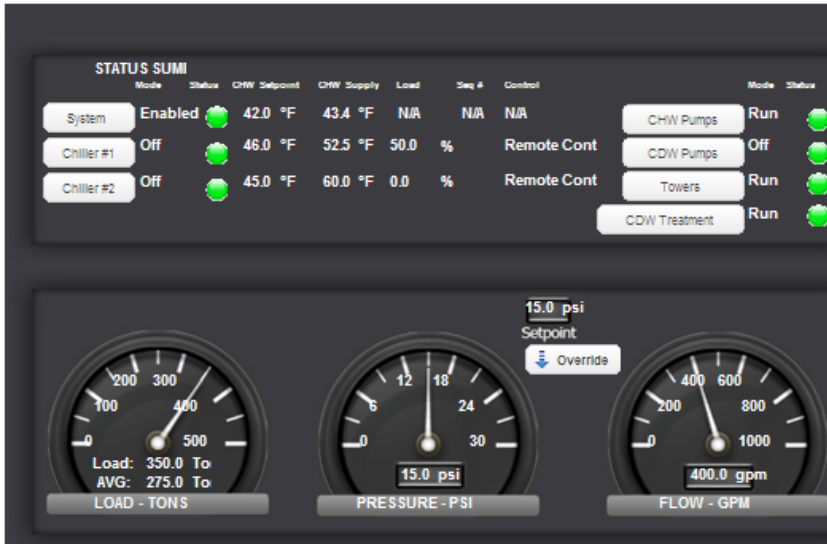
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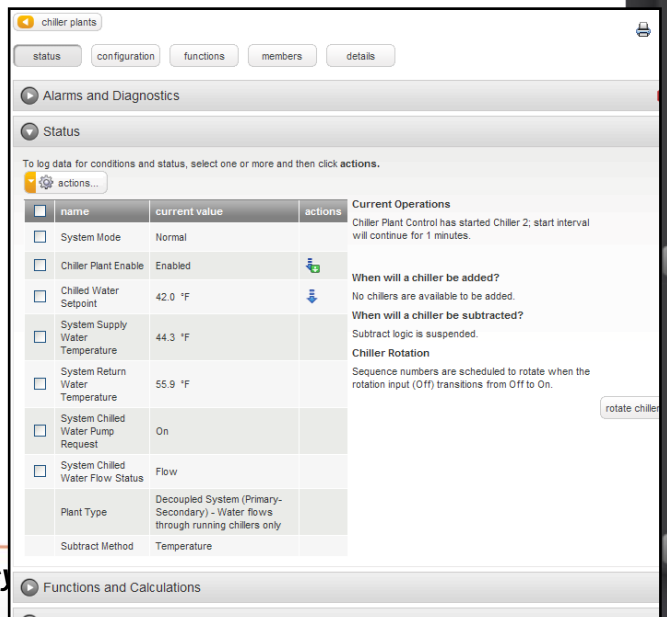
Optimization strategies bring operation cost savings…

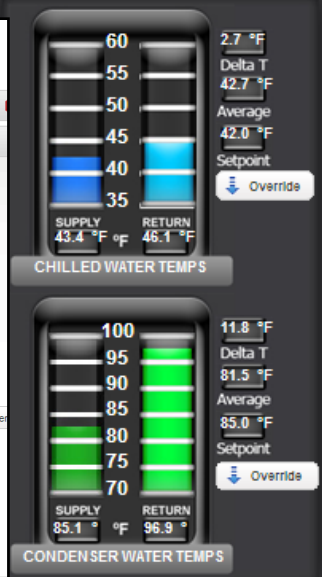
Monitor the system

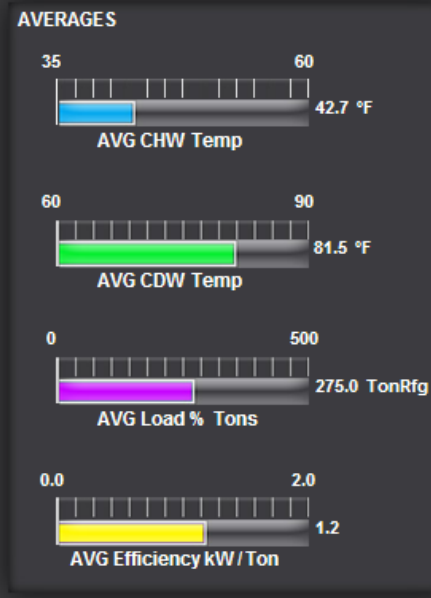
Customized Chiller Plant Dashboard

- At a glance performance assessment
- ASHRAE Guideline 22 conformance
- Intuitive operator information
- State of art presentation









Air System Strategies

Partnership for Energy Efficiency Leadership, 11th April 2013

Tracer Airside System Control

Tracer Airside System Control is another pre-engineered software application that coordinates RTU or AHU with Variable Air Volume units operation for optimal efficiency and system reliability.

Delivers *flexible*, *repeatable*, system control that *maximizes* energy savings and *minimizes* operating costs.



Reliable system operation

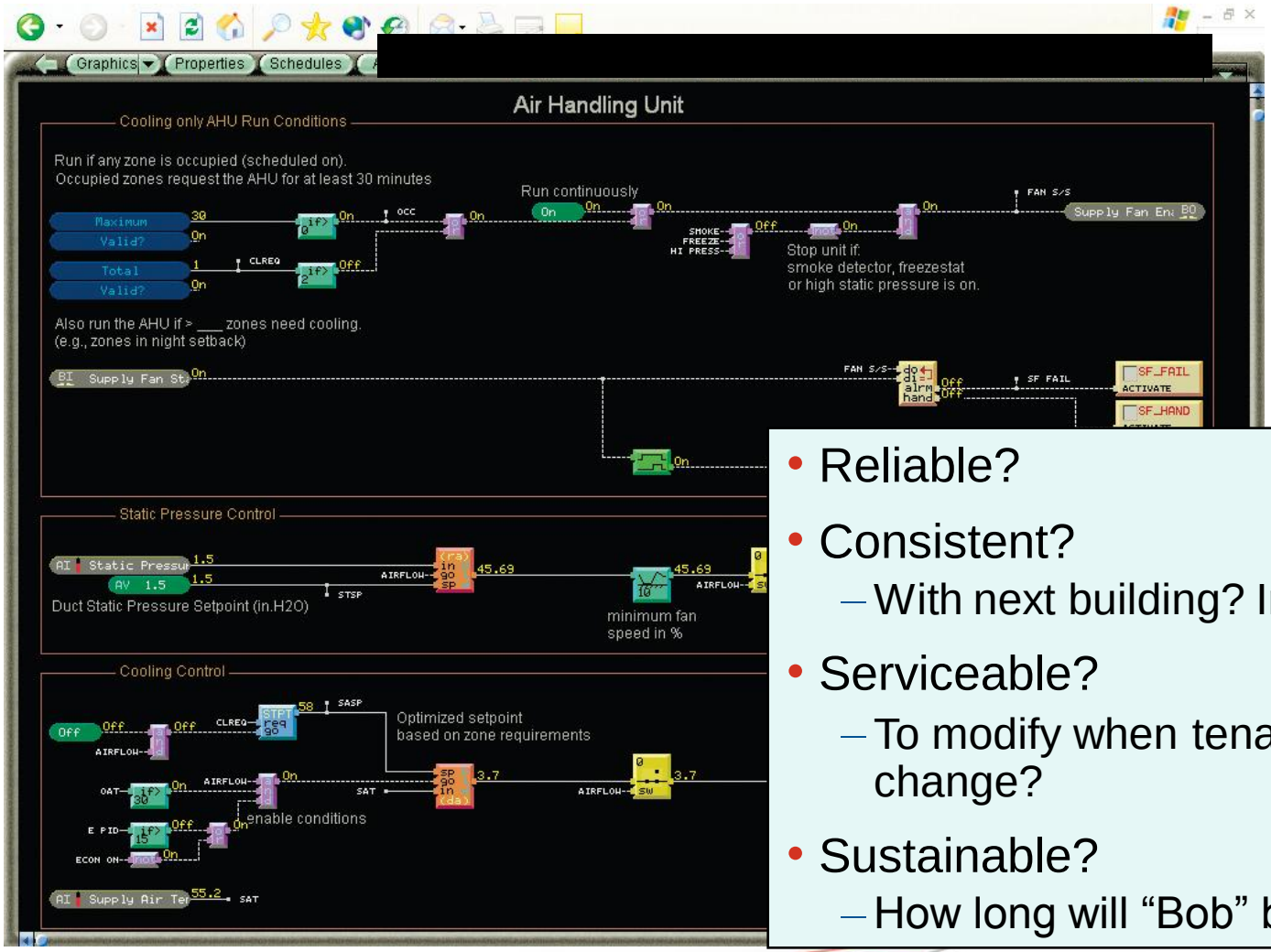
Variable Air System
What does VAS do?

- Coordinates operation of:
  - Air handlers
  - VAV boxes
  - Exhaust fans
- Achieves energy optimization (ASHRAE 90.1)
  - Fan pressure optimization
- Meets IAQ requirements (ASHRAE 62)
  - Ventilation optimization
- Provides summary status of members
- Performs calibration and auto-commissioning of VAV controls

Tracer Airside Control Applications

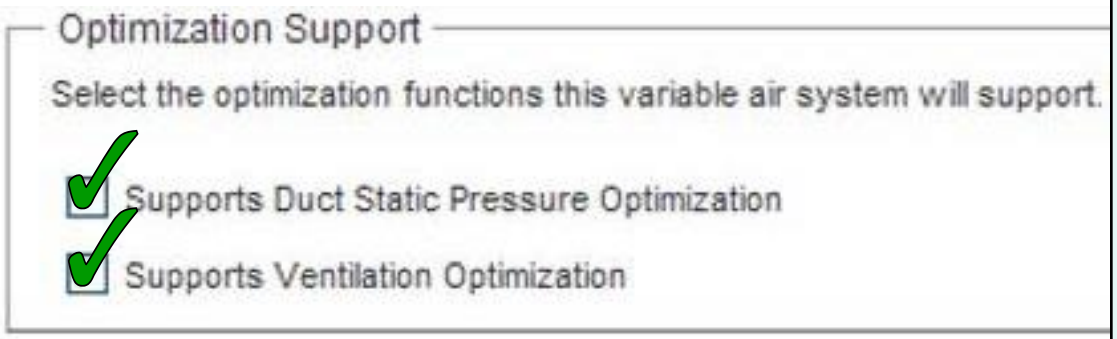
- Comply with ASHRAE 62.1-2004 ventilation requirements
- Comply with ASHRAE 90.1-2010 energy saving requirements
- Achieve LEED-NC v2.2 certification
  - Energy and Atmosphere Prerequisite 2 Must comply with ASHRAE 90.1-2004
  - Indoor Environmental Quality Prerequisite 1 Must comply with ASHRAE 62.1-2004

Conventional “Standard” VAV System Application Programs



- Reliable?
- Consistent?
  - With next building? In next city?
- Serviceable?
  - To modify when tenants/building change?
- Sustainable?
  - How long will “Bob” be there?

Check the Box!
For High Performance VAV Systems



Pre-engineered application:

- Reliable, tested
- Consistent
- Serviceable
- Sustainable

HVAC System Optimization Strategies

Helping you achieve energy savings

Select control strategies	Typical savings
Chiller / tower optimization 	5-7 % Chiller – tower energy savings
Variable flow pump pressure optimization 	20–45% Pumping system energy savings
Duct static pressure optimization	**20-45 %** **Fan system energy savings**
Ventilation reset optimization	Up to 25 % HVAC system energy savings

Optimization strategies bring operation cost savings…

VAV Duct Static Pressure Optimization

- Control system duct pressure to the lowest level possible
  - Saves 20% to 45% of the system fan energy
  - Significant acoustical benefits
- Required by ASHRAE 90.1

  *When system design is > 10,000 CFM

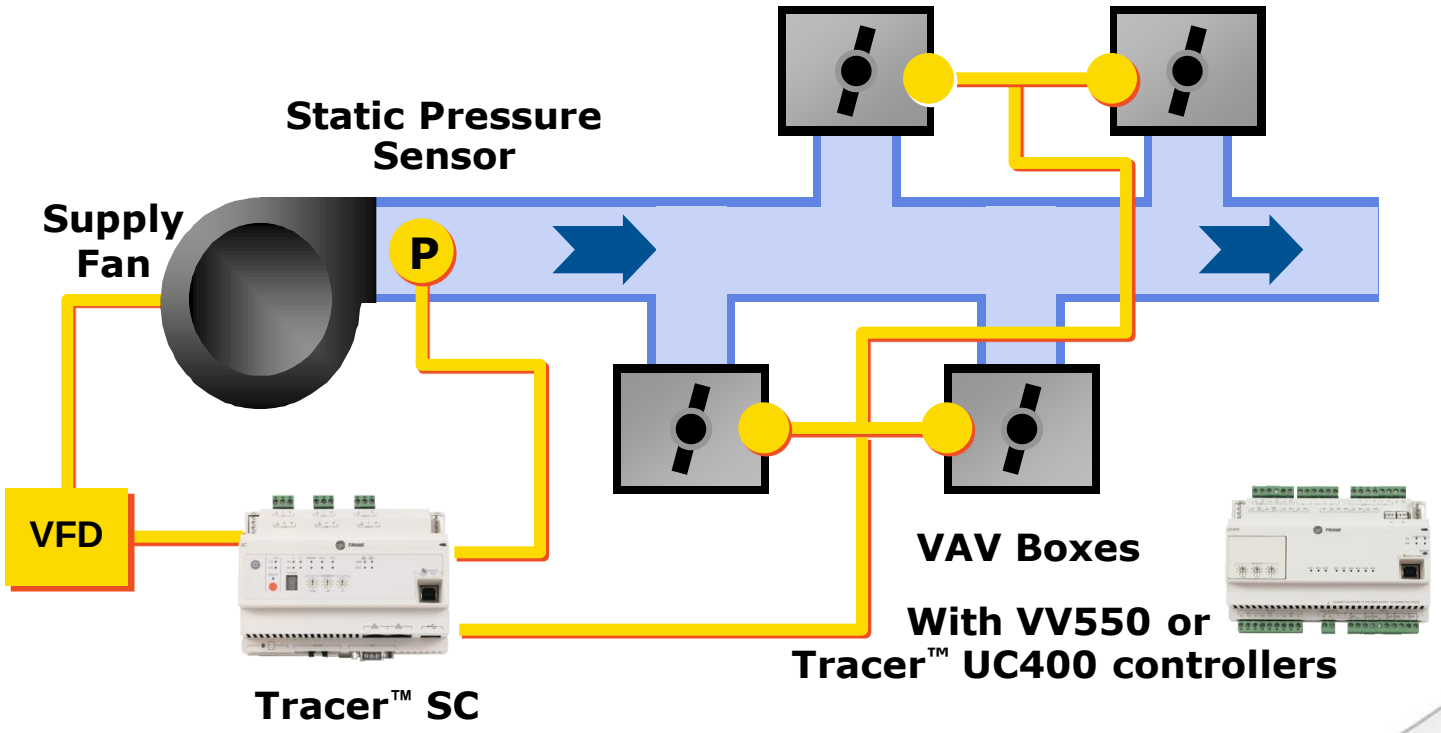
VAV Duct Static Pressure Optimization

Goal
Control system static pressure to the lowest level while maintaining zone airflow requirements

BAS determines “most open” damper in the system

- System static pressure is controlled to keep “most open” zone damper between 65% and 75% open
  - With this strategy, location of sensor is not critical
    - Take advantage of labor savings and mount the sensor at the fan discharge

Duct Static Pressure Optimization



HVAC System Optimization Strategies

Helping you achieve energy savings

Select control strategies	Typical savings
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Ventilation reset optimization	**Up to 25 %** **HVAC system energy savings**

Optimization strategies bring operation cost savings…

Ventilation Optimization

- Use a combination of control strategies to always provide the exact amount of ventilation air
- Properly ventilates *ALL* spaces of a building at *ALL* operating and load conditions, while minimizing operating energy costs!
  - Saves up to 25 % HVAC system energy

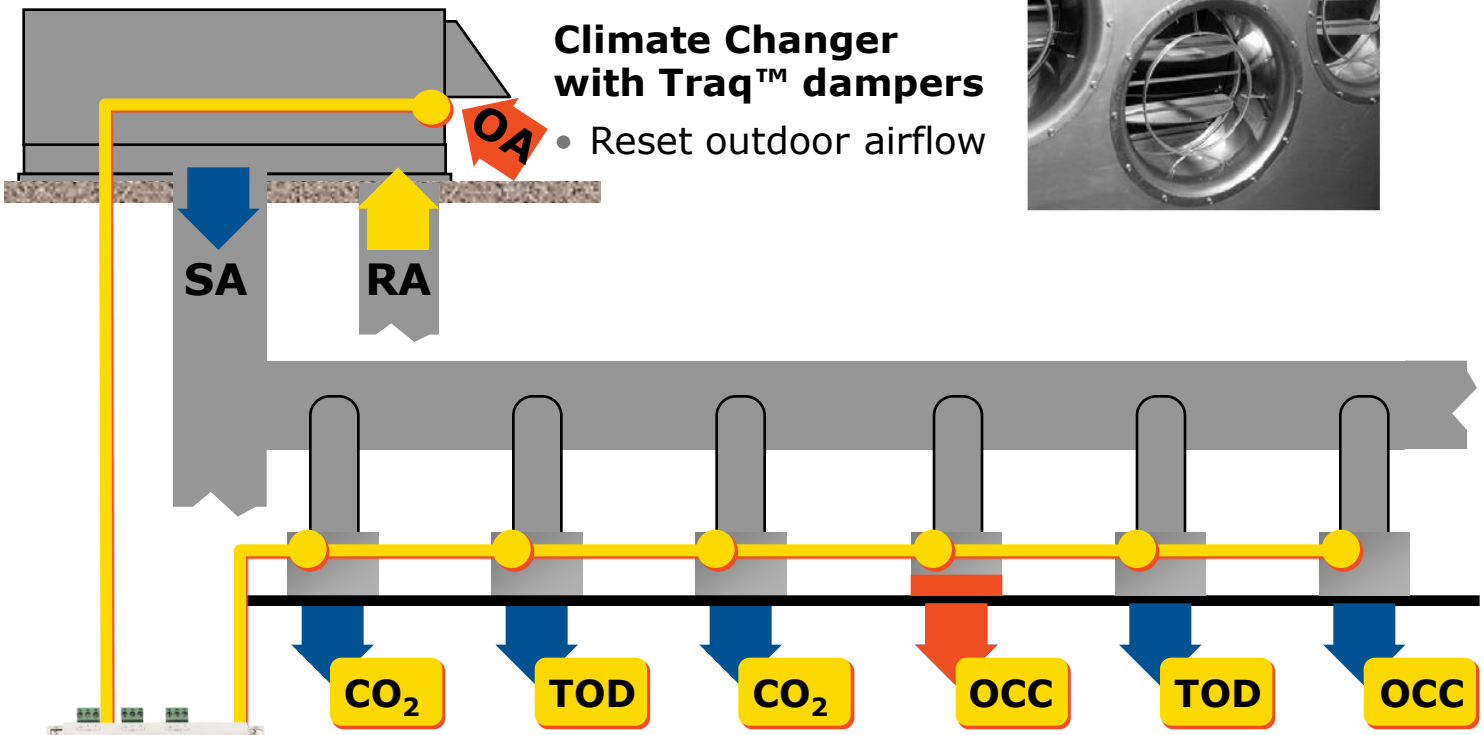
Demand Controlled Ventilation at Zone Level

Four basic methods – determine required ventilation rate

1. Fixed schedule
2. Occupancy sensors
   Detect the presence of people in each monitored space
3. Variable schedules
   Predict current population based on time of day
4. Carbon dioxide (CO_2) sensors
   Monitor concentration of CO_2 that occupants continuously produce

Each are appropriate for different types of zone

Ventilation Optimization



Climate Changer with Traq™ dampers

- Reset outdoor airflow



Tracer SC

- New OA setpoint …per ASHRAE 62
- Vent Ratio Limit



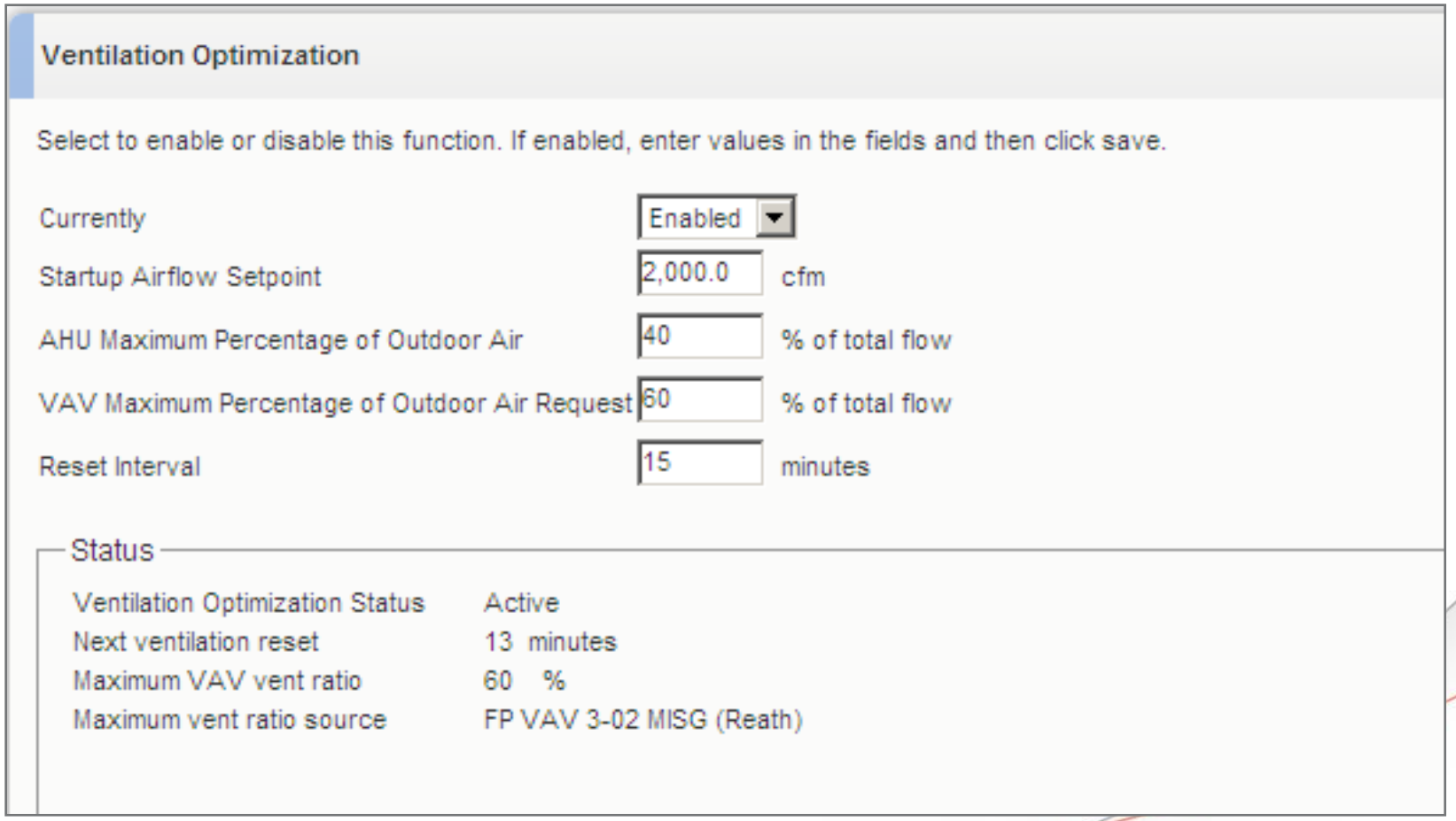
VV550 or UC400 controllers

- Required ventilation (TOD, OCC, CO_2)
- Actual primary airflow (flow ring)
- Calculate Vent Ratio

How Does Trane Perform Ventilation Optimization Better?

- Measure outdoor airflow
  - Validates/documents/proves ventilation
- Measure and control ventilation at a zone level
  - Making sure the air gets where it needs to go
  - Do not over-ventilate non-critical zones
- Patented algorithms to optimize total system energy use
  - Compliant with ASHRAE 62
  - Supports several demand-control ventilation options
    - Schedule, occupancy sensor, CO2
  - Does zone-level action to reduce total system effect
    - Demand control ventilation works at the zone level
    - VAV max OA % - increases flow in critical zone only
- Easy to operate and maintain

Ventilation Optimization in Tracer™ SC

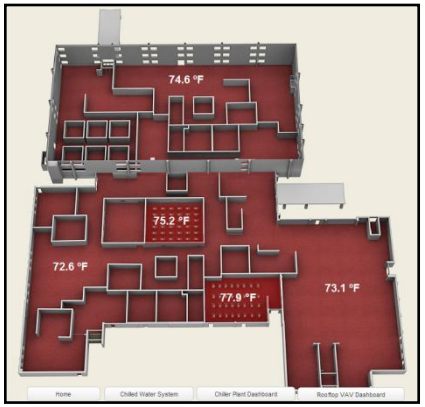


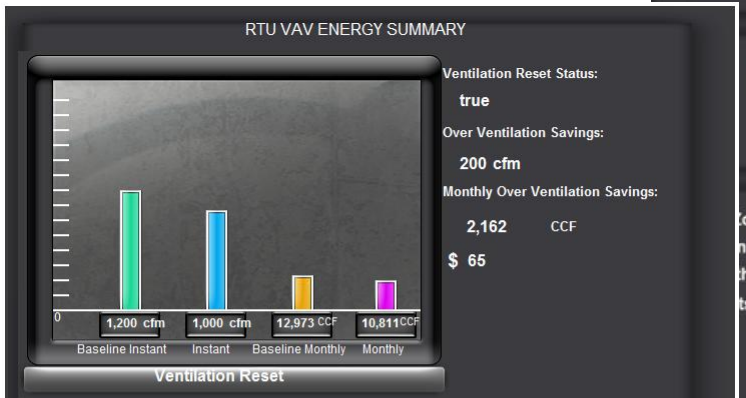
Monitor the system

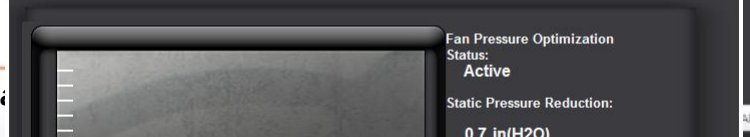
Customized VAV system Dashboard

- At-a-glance performance assessment
- Intuitive operator information
- State of art presentation
- Illustrates savings: energy and $











HVAC System Optimization Strategies

Helping you achieve energy savings

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Optimization strategies bring operation cost savings…

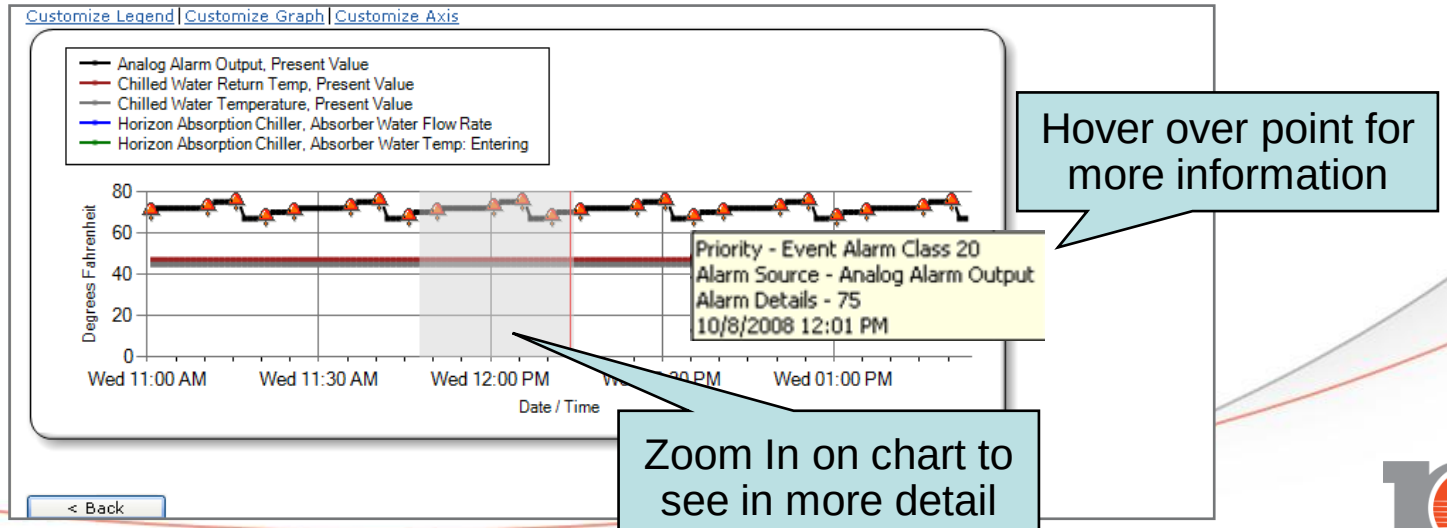
Document Results

with Data Logs and Reports

Partnership for Energy Efficiency Leadership, 11th April 2013

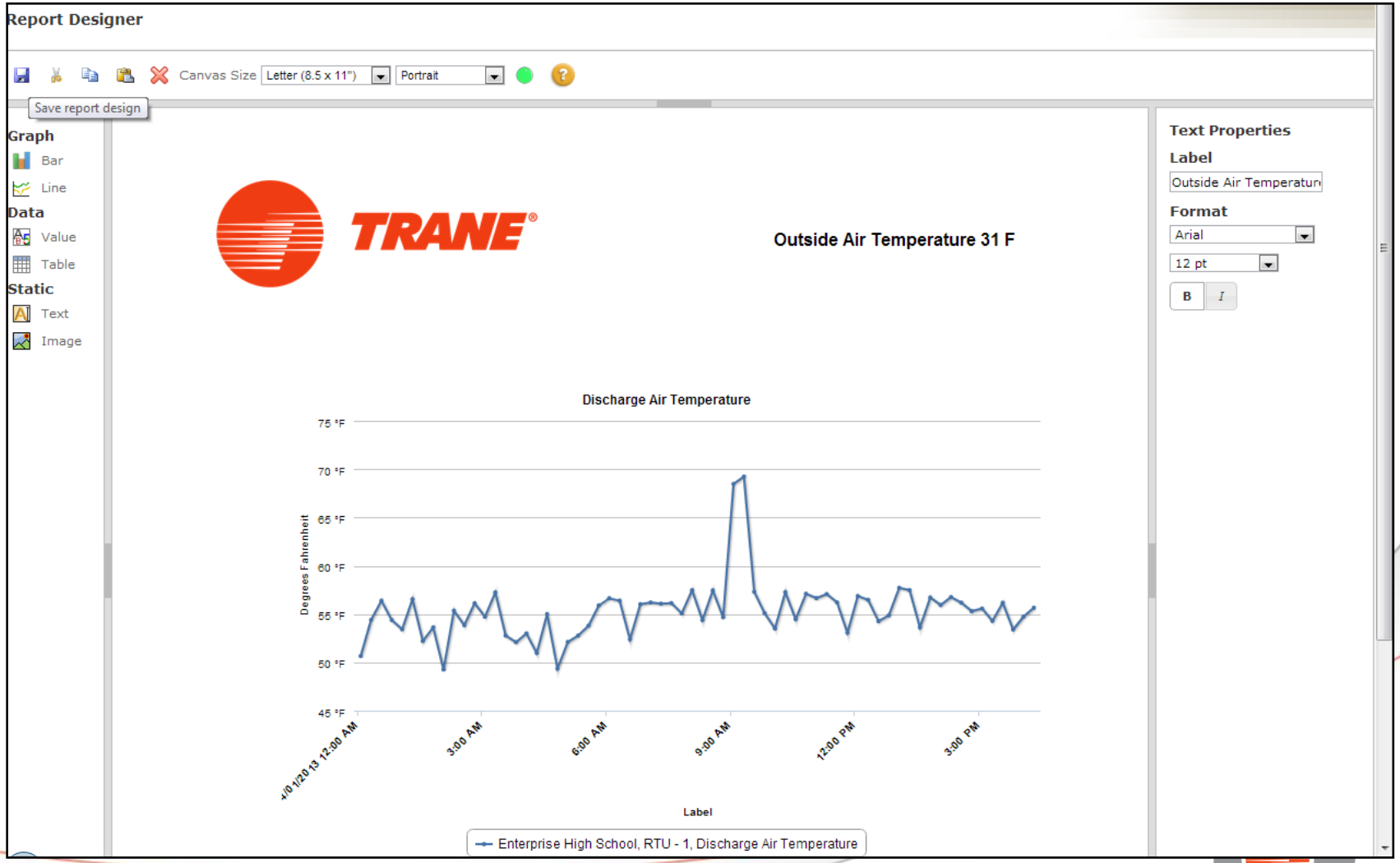
Trane Tracer ES™ Data Logs

- Sample rate selectable from 1 minute to hours
- Various collection options including:
  - Date range (start date / end date)
  - Continuous (start date and then continually log)
  - Pre-set log size with first in / first out

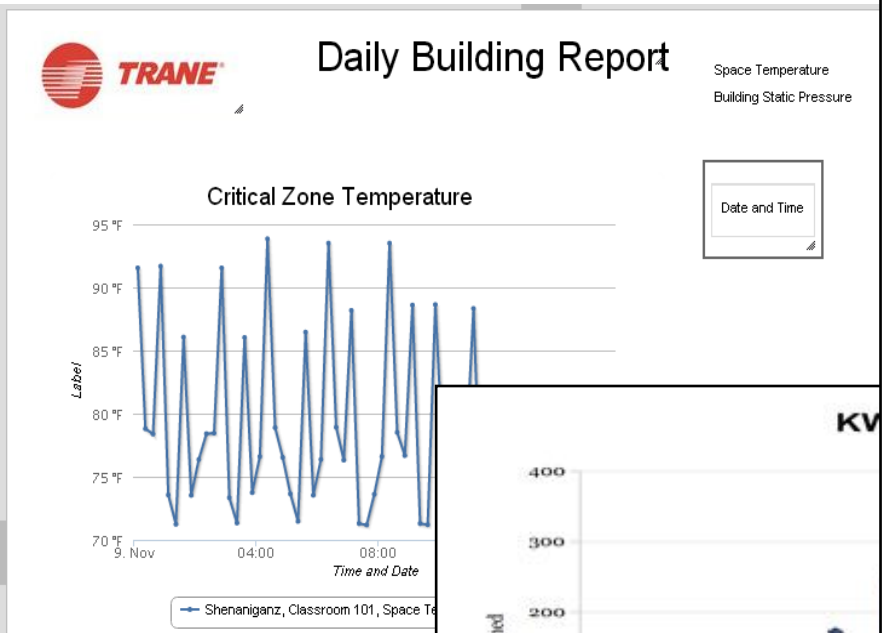


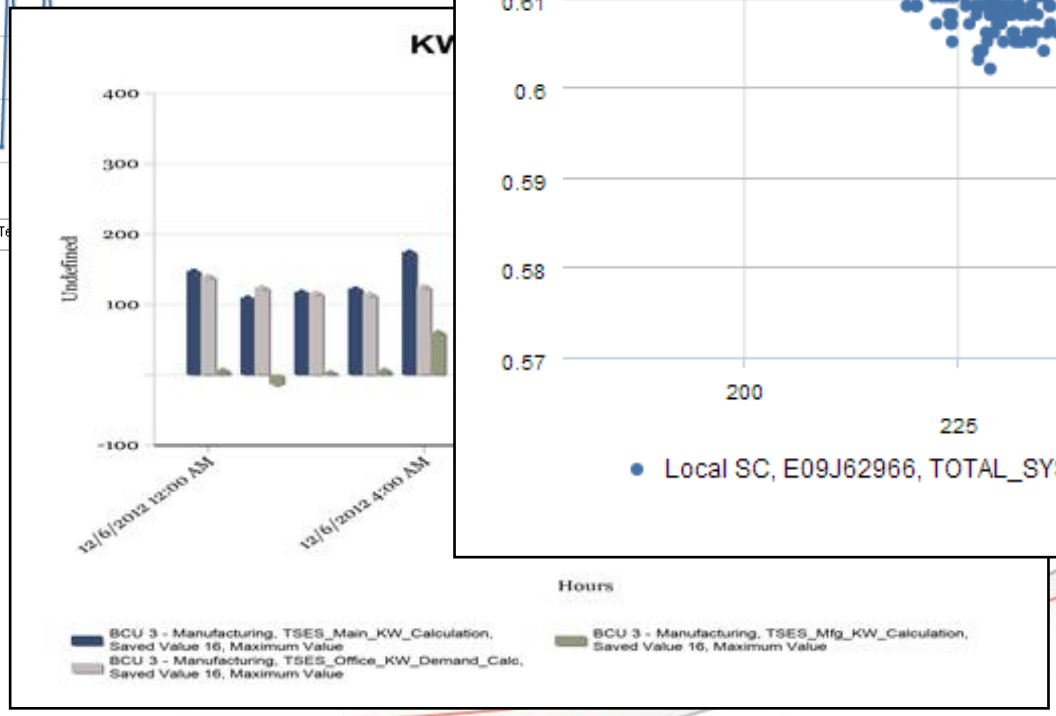
Create Reports

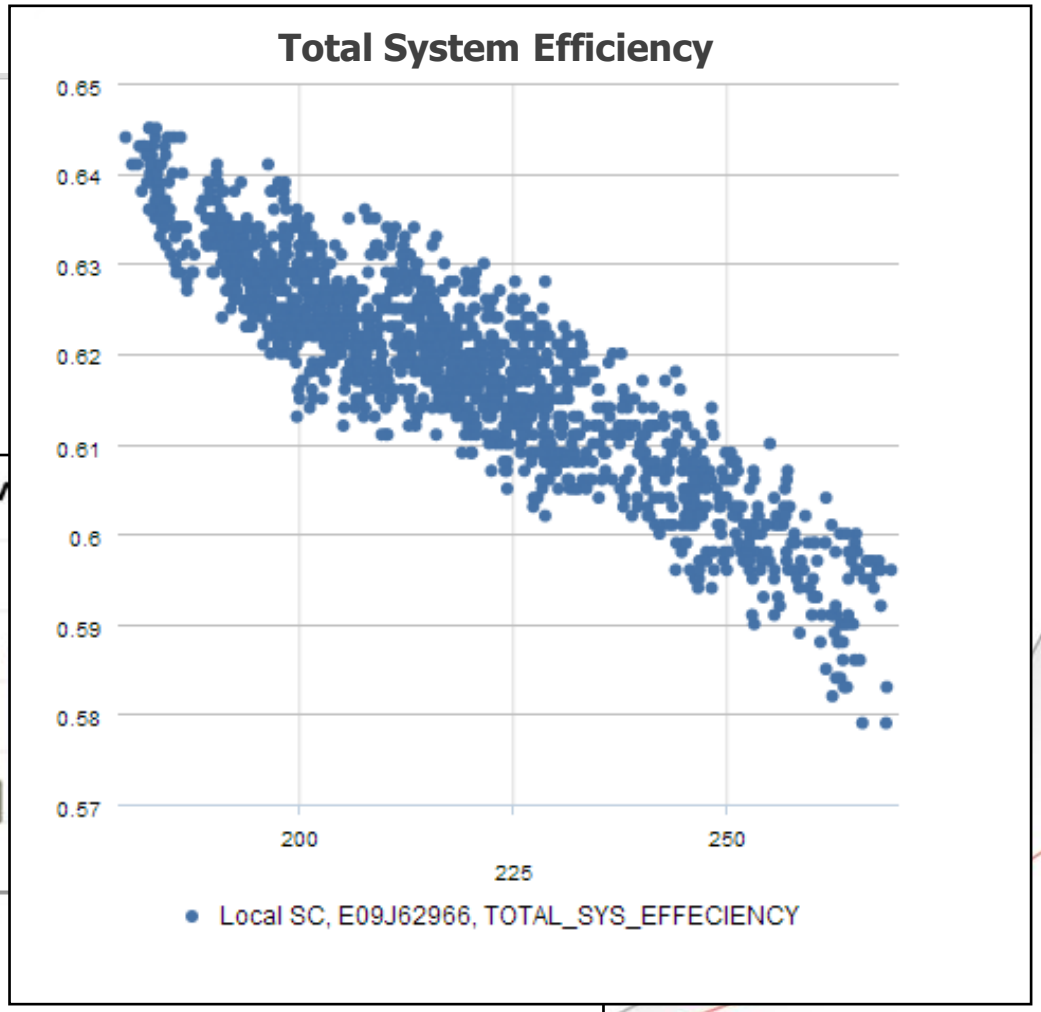
easy to use web-based report editor



Sample Reports



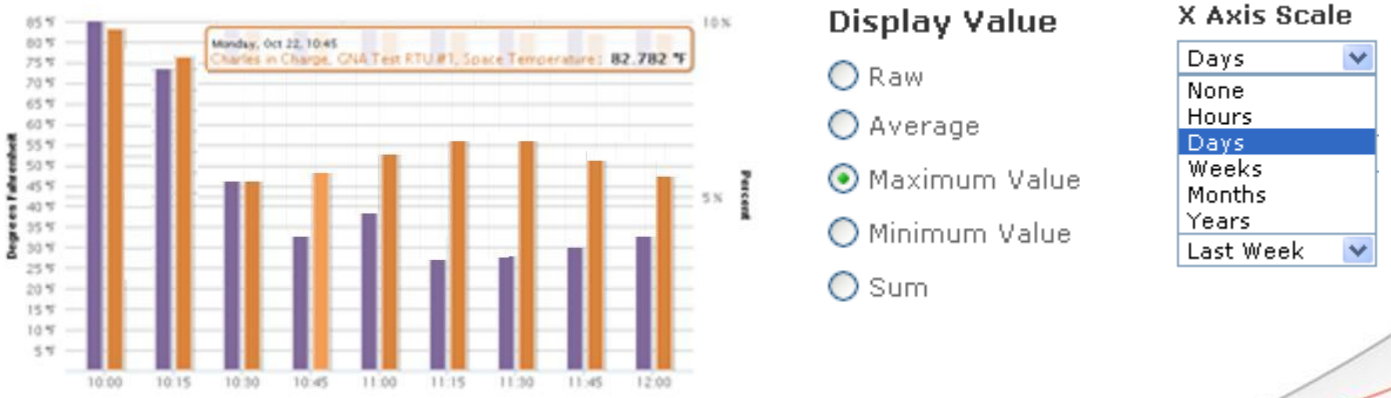




Calculations

Analyze complex data to identify critical values without leaving Tracer ES

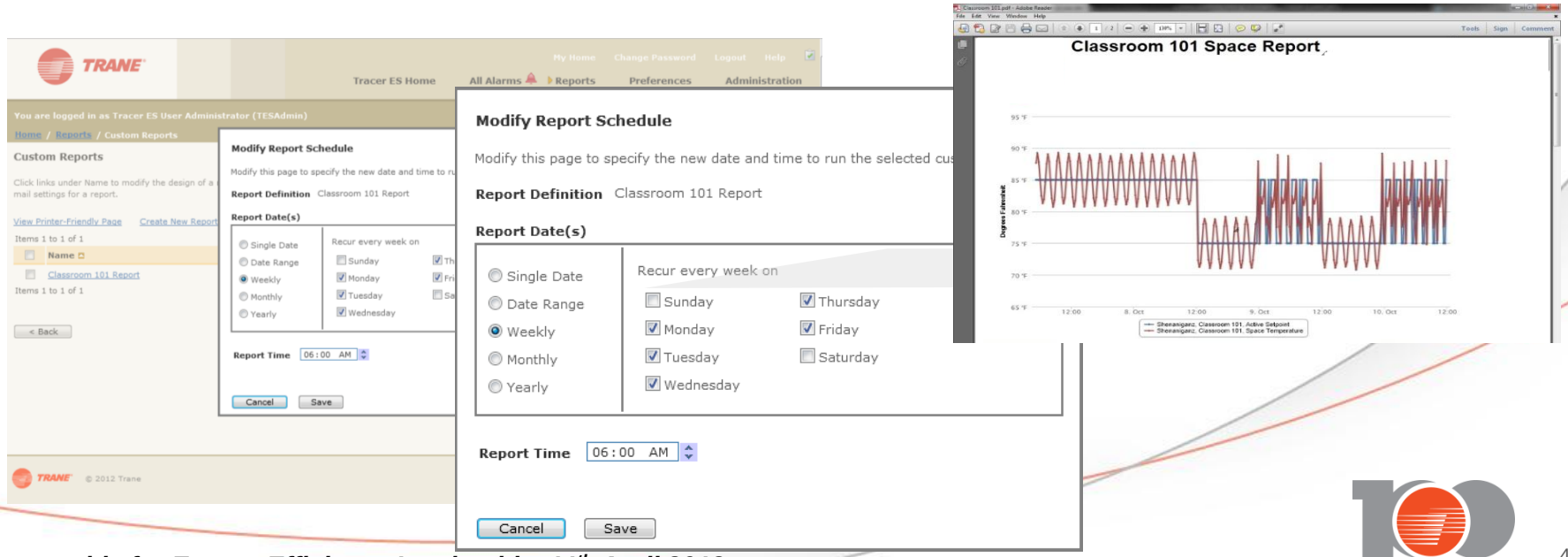
- Mathematical calculations on data logs, such as
  - Daily **maximum** power demand
  - Weekly **sum** of gas usage
  - Monthly **average** outdoor air temperature



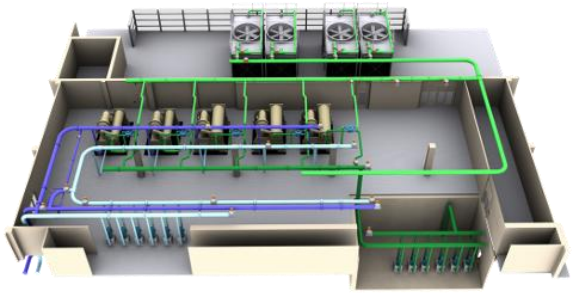
Schedule and Email Reports

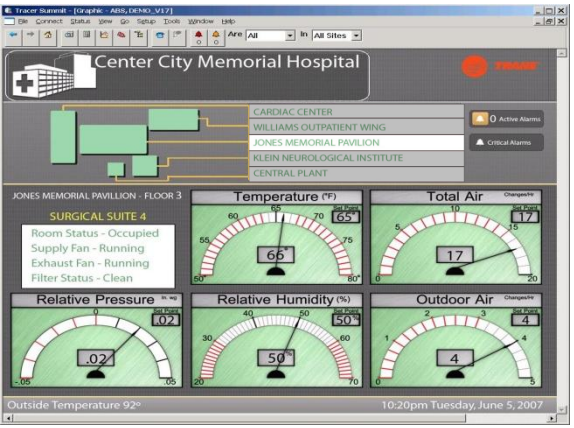
Setup reports to run and email to you, and others, automatically.

- Schedule reports to run at regular intervals
- Report saved with the latest data automatically
- Send reports via email - PDF or Excel format









the Trane advantage

Optimized System Control

- Reliable system control with **Pre-engineered Applications**
- Optimization strategies for chilled water and air systems
  - **Chiller-Tower Setpoint Control**
  - **Pump Pressure Optimization**
  - **Duct Static Pressure Optimization**
  - **Ventilation Reset**
- Document results with **Data Logs and Reports**

...your systems company

Thank you!



Ingersoll Rand