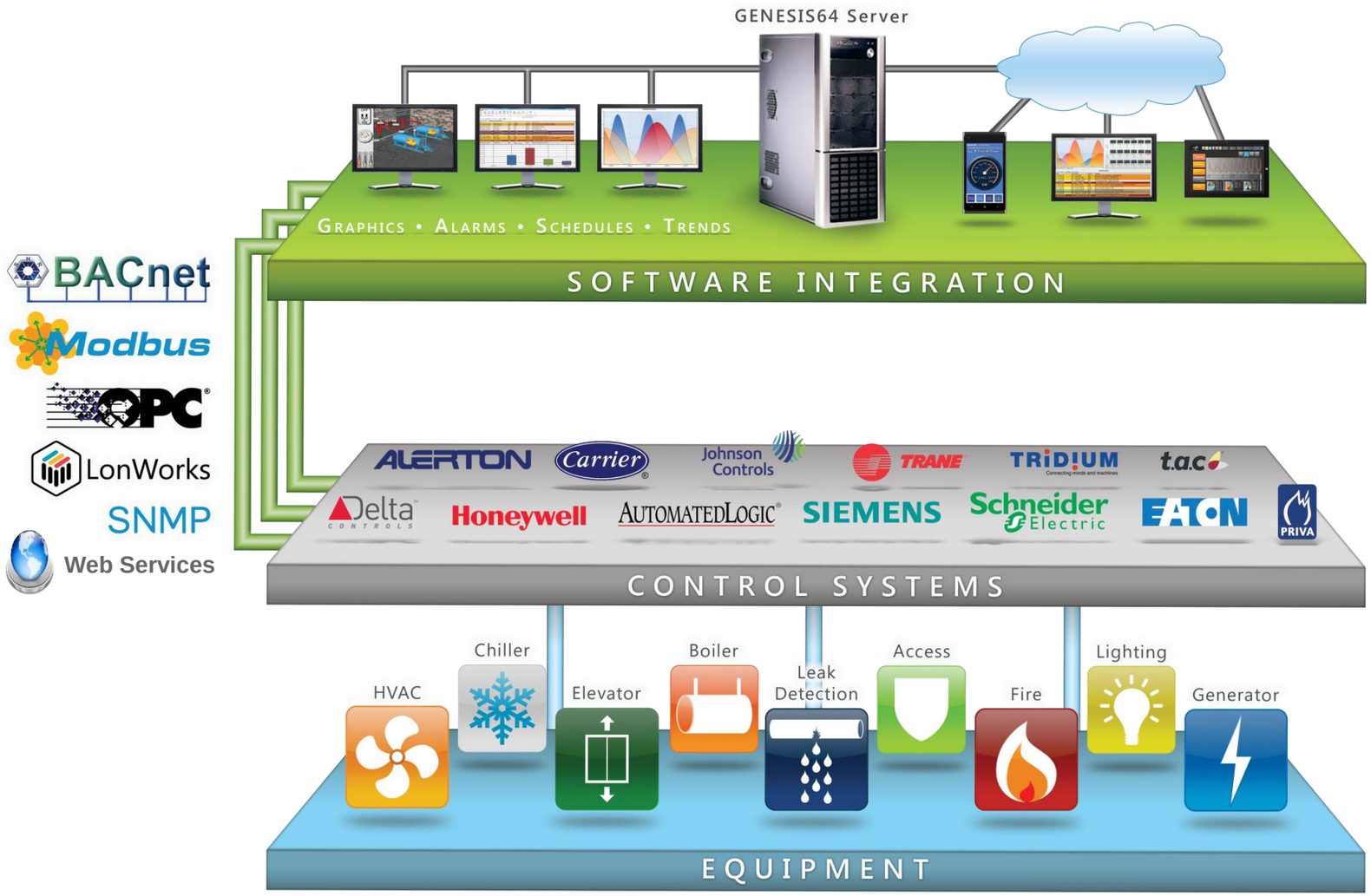
ENERGY-SMART CAMPUS OPERATIONS
MAKING INFORMED DECISIONS

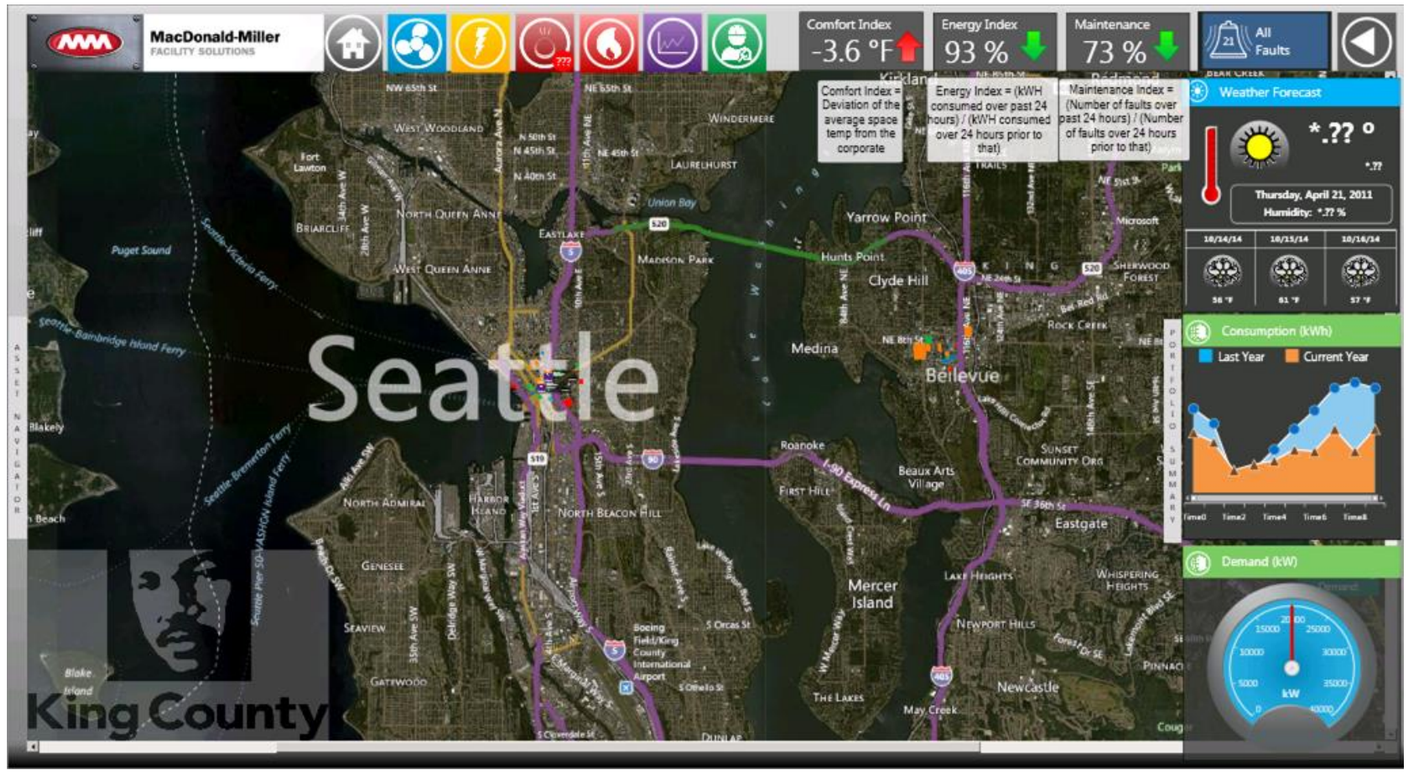
- Building Automation & Network Design Principles
- Information Dashboards & Mobility
- Fault Detection, Diagnostics & Reports
- Utility & Carbon Emissions Management
- System Integrator Qualifications
- Case Studies

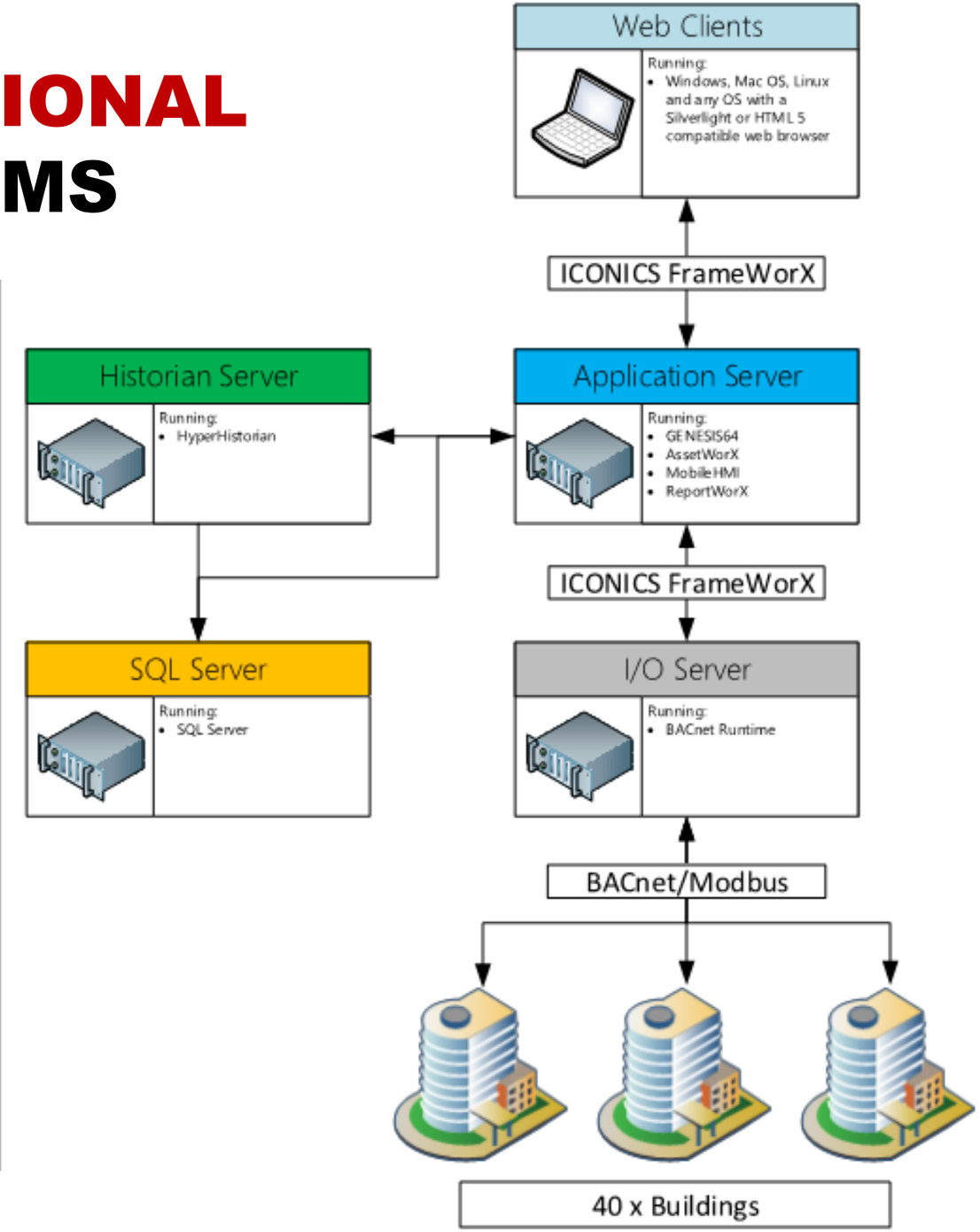
CONNECTING TO ALL OPERATIONAL BUILDING & BUSINESS SYSTEMS



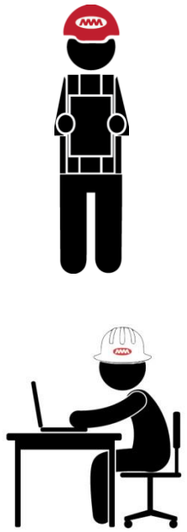
- Unrestricted licensing
- Embedded programming and engineering tools
- Multiple integration pathways via industry recognized protocols and published APIs
- SMNP & Web Services support for IT network integration & custom application development
- Open Database Connectivity (ODBC) compliant
- Access to Corporate & Local Training/Support
- Ownership of data & software

CONNECTING TO ALL OPERATIONAL BUILDING & BUSINESS SYSTEMS

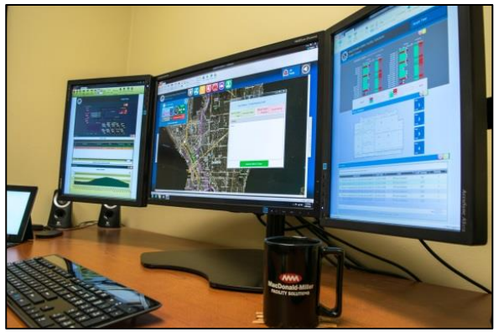




INFORMATIONDASHBOARDS



YOU CAN'T MANAGE



WHAT YOU CAN'T SEE

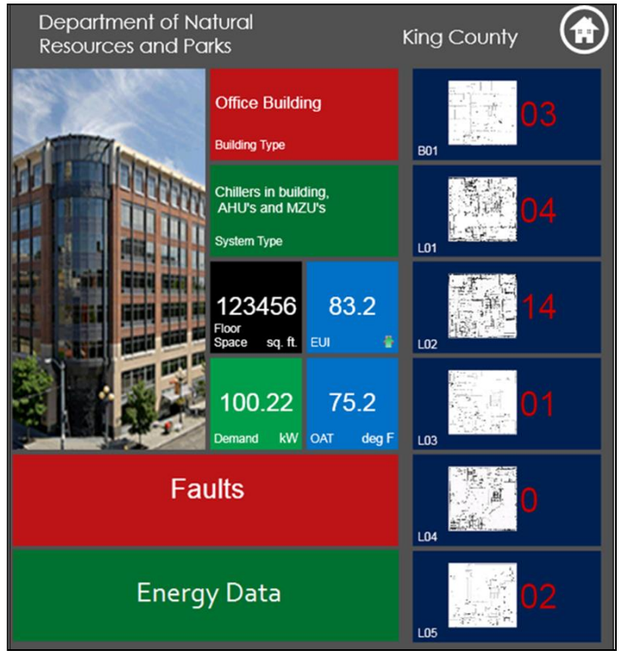
ACCESS YOUR DATA ANYTIME ANYWHERE AT ANY LEVEL

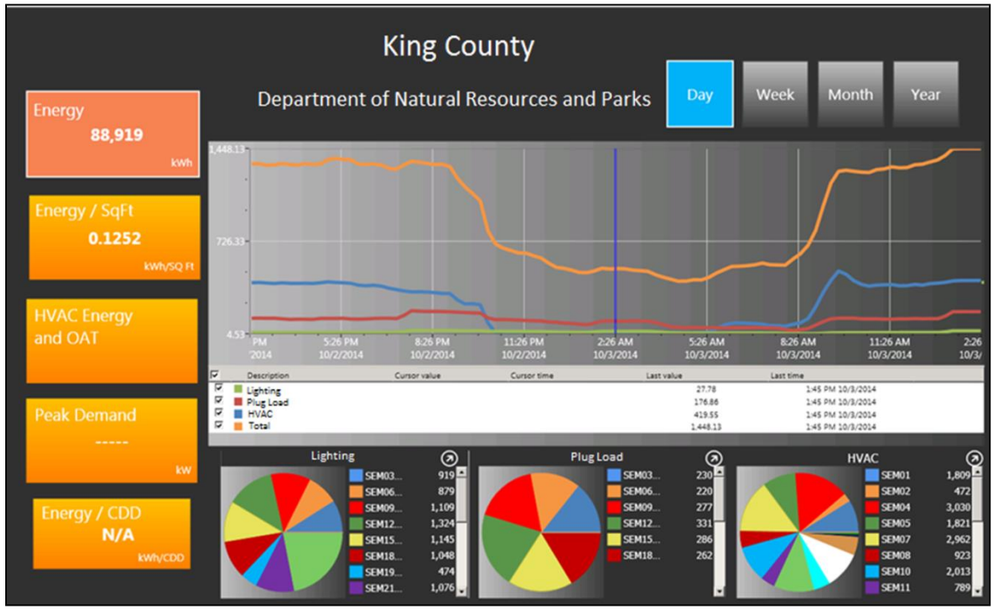
INFORMATIONDASHBOARDS

WHENEVER & WHEREVER YOU NEED IT

Information Dashboards	
Flexible construction of a building specific dashboard	✓
Support the integration of Building Operations, Continuous Monitoring, Historical trending, and Energy data, into any customer defined dashboard	✓
User specific/user group specific information display and/or owner dashboard customization	✓
Allowance for connecting information to a GIS system (ESRI, BING, Google)	✓
Capable of connection or link to operations and maintenance documentation	✓
Determination of key performance indicators (KPIs)	✓

Mobility	
Accessible by mobile and tablet technology (Apple, Microsoft, Google, Amazon)	✓
Accessible via all current Web Browser platforms	✓





FAULTDETECTION

EMPOWERING FACILITY TEAMS WITH KNOWLEDGE BY MAKING THE INVISIBLE VISIBLE

Know what is broken before a technician is deployed

- Effectively utilize and assign staff
- Have the right tools for the job, the first time

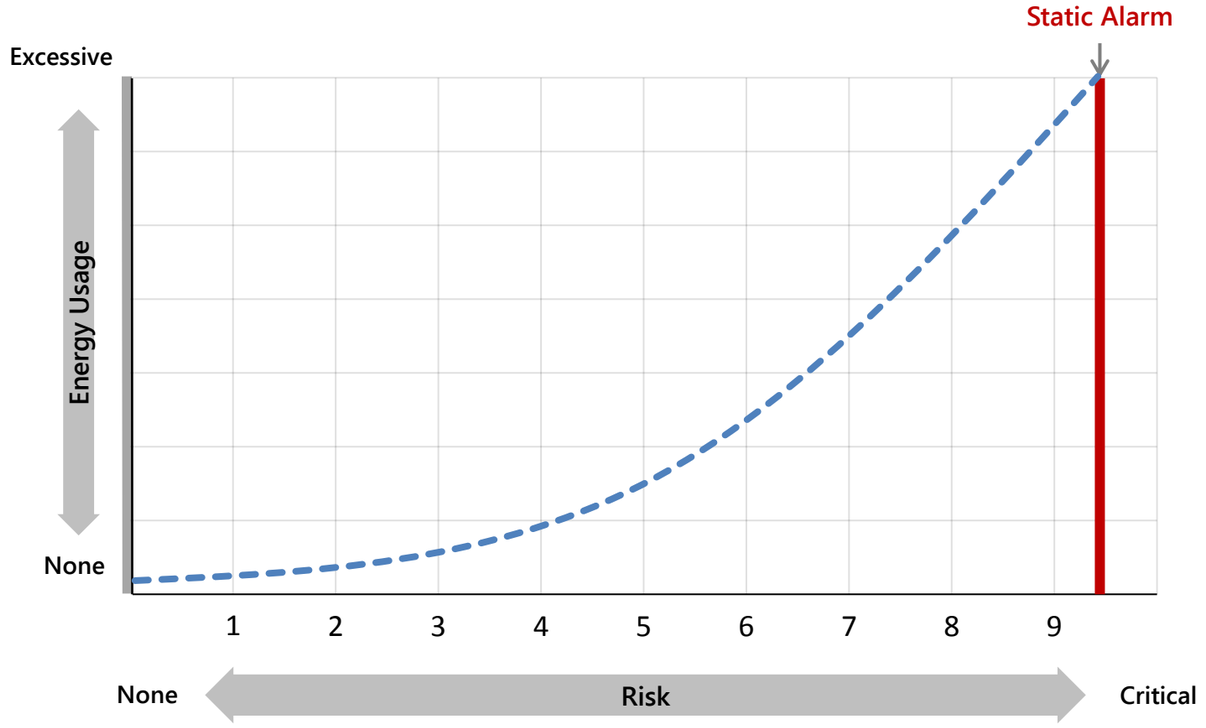
Prioritize repairs by monetary assessment

- Is there is a need to perform maintenance ahead of schedule?
- Is it time to replace the equipment?

ALARMS vs FAULTS

TRADITIONAL BAS ALARMS

ACTIVATE WHEN SYSTEMS REACH CRITICAL STATUS



30,000 CFM Air Handler

Fault Diagnostic:
None

Static BAS Alarm:
Low MA Temperature

Space Temp:
70° F

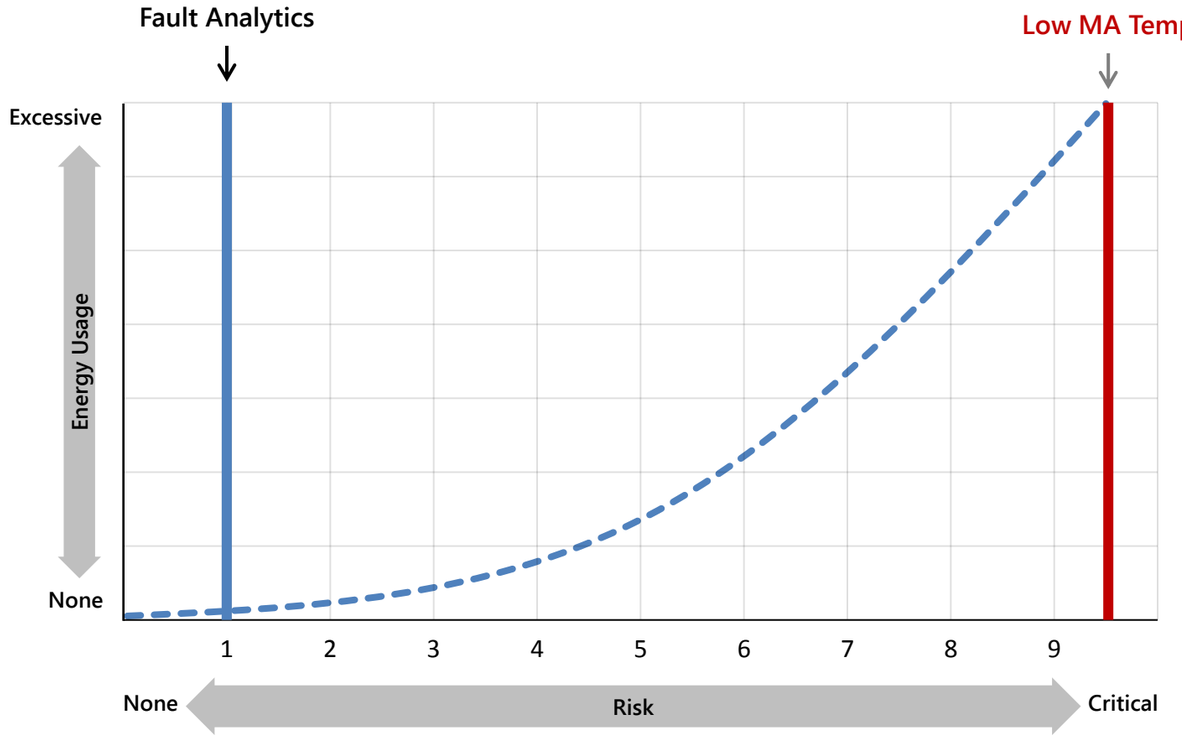
Energy Cost:

Optimal	**13,750 $/year**
Actual	**30,300 $/year**
Variance	**16,550 $/year**
Increase	**120%**

ALARMS vs FAULTS

FAULT DETECTION & DIAGNOSTICS

PRIORITIZES CORRECTIVE ACTION BEFORE A BAS ALARM



30,000 CFM Air Handler

Fault Diagnostic:
Failed OA Damper

Static BAS Alarm:
None

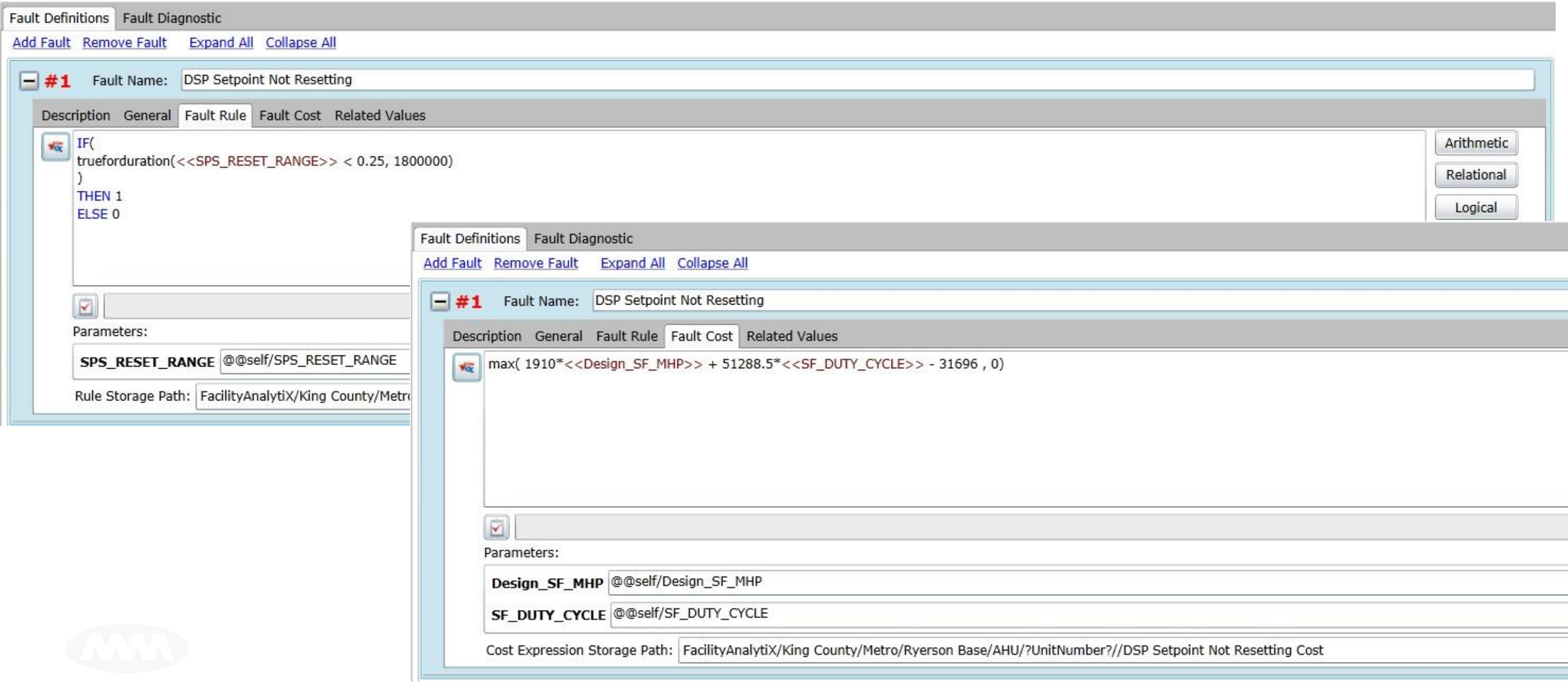
Space Temp:
70° F

Energy Cost:

Optimal	**13,750 $/year**
Actual	**24,620 $/year**
Variance	**10,870 $/year**
Increase	**79%**

FAULTDETECTION

INTUITIVE RULES-BASED DEVELOPMENT TOOLS



FAULTDETECTION

INFORMATIVE REPORTS

Date/ Time	Building	System	Area	Equipment	Fault Name	Fault Savings	Tag
1/5/15 9:23 AM	Chinook	METER-1	Metering	CAM Int	A-Phase Imbalance	$52.00	KingCounty.Region1.Chinook.Meter.METER-1
1/6/15 9:23 AM	Chinook	AHU-1	HVAC	Zone 1	Bad Outside Air Temperature Reference Location	$650.00	KingCounty.Region1.Chinook.HVAC.AHU-1
1/7/15 9:23 AM	Chinook	RTU-1	HVAC	Zone 1	Bad Outside Air Temperature Reference Location	$650.00	KingCounty.Region1.Chinook.HVAC.RTU-1
1/8/15 9:23 AM	Ryerson Base	AHU-1	HVAC	Zone 1	Bad Outside Air Temperature Reference Location	$650.00	KingCounty.Region1.Ryerson.HVAC.AHU-1
1/9/15 9:23 AM	East Base	AC-1	HVAC	Zone 1	Bad Outside Air Temperature Reference Location	$650.00	KingCounty.Region1.East Bas.HVAC.AC-1
1/10/15 9:23 AM	Chinook	METER-1	Metering	CAM Int	B-Phase Imbalance	$352.00	KingCounty.Region1.Chinook.Meter.METER-1
1/11/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Bypass Valve Open	$3,200.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/10/15 9:25 AM	Chinook	CHLR-1	HVAC	Zone 1	Chilled-Water Pump 1 In Hand	$560.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/13/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chilled-Water Pump 2 In Hand	$548.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/14/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 1 Failed Closed Evaporator Isolation Valve	$4,500.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/15/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 1 Failed Open Evaporator Isolation Valve	$4,500.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/16/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 1 Inefficent Operation	$305.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/17/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 1 Low Supply Water Temperature Setpoint	$6,500.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/18/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 2 Failed Closed Evaporator Isolation Valve	$1,565.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/19/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 2 Failed Open Evaporator Isolation Valve	$654.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/20/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 2 Inefficent Operation	$736.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/21/15 9:23 AM	Chinook	CHLR-1	HVAC	Zone 1	Chiller 2 Low Supply Water Temperature Setpoint	$4,863.00	KingCounty.Region1.Chinook.HVAC.CHLR-1
1/22/15 9:23 AM	Chinook	CT-1	HVAC	Zone 1	Condenser Water Pump A Failed	$1,052.00	KingCounty.Region1.Chinook.HVAC.CT-1
1/23/15 9:23 AM	Chinook	CT-1	HVAC	Zone 1	Condenser Water Pump A In Hand	$1,563.00	KingCounty.Region1.Chinook.HVAC.CT-1
1/24/15 9:23 AM	Chinook	CT-1	HVAC	Zone 1	Condenser Water Pump B Failed	$2,344.00	KingCounty.Region1.Chinook.HVAC.CT-1
1/25/15 9:23 AM	Chinook	CT-1	HVAC	Zone 1	Condenser Water Pump B In Hand	$456.00	KingCounty.Region1.Chinook.HVAC.CT-1
1/26/15 9:23 AM	Chinook	METER-1	Metering	Zone 1	C-Phase Imbalance	$2,110.00	KingCounty.Region1.Chinook.Meter.METER-1
1/27/15 9:23 AM	Chinook	AHU-1	HVAC	Zone 1	Dirty Chilled Water Coil	$700.00	KingCounty.Region1.Chinook.HVAC.AHU-1
1/28/15 9:23 AM	Ryerson Base	AHU-1	HVAC	Zone 1	Dirty Chilled Water Coil	$700.00	KingCounty.Region1.Ryerson.HVAC.AHU-1
1/29/15 9:23 AM	Chinook	RTU-1	HVAC	Zone 1	Dirty East Filter Section	$150.00	KingCounty.Region1.Chinook.HVAC.RTU-1
1/30/15 9:23 AM	Ryerson Base	HRU-1	HVAC	Zone 1	Dirty Exhaust Air Filter Section	$150.00	KingCounty.Region1.Ryerson.HVAC.HRU-1
1/31/15 9:23 AM	East Base	AC-2	HVAC	Zone 2	Dirty Exhaust Filter Section	$150.00	KingCounty.Region1.East Bas.HVAC.AC-2
2/1/15 9:23 AM	East Base	AHU-2	HVAC	Zone 2	Dirty Exhaust Filter Section	$150.00	KingCounty.Region1.East Bas.HVAC.AHU-2
2/2/15 9:23 AM	Ryerson Base	AHU-1	HVAC	Zone 1	Dirty Filter Section	$150.00	KingCounty.Region1.Ryerson.HVAC.AHU-1
2/3/15 9:23 AM	Ryerson Base	HP-1	HVAC	Zone 1	Dirty Filter Section	$150.00	KingCounty.Region1.Ryerson.HVAC.HP-1
2/4/15 9:23 AM	East Base	AC-1	HVAC	Zone 1	Dirty Filter Section	$150.00	KingCounty.Region1.East Bas.HVAC.AC-1
2/5/15 9:23 AM	Chinook	CDW-1	HVAC	Zone 1	Dirty Heat Exchanger	$150.00	KingCounty.Region1.Chinook.HVAC.CDW-1

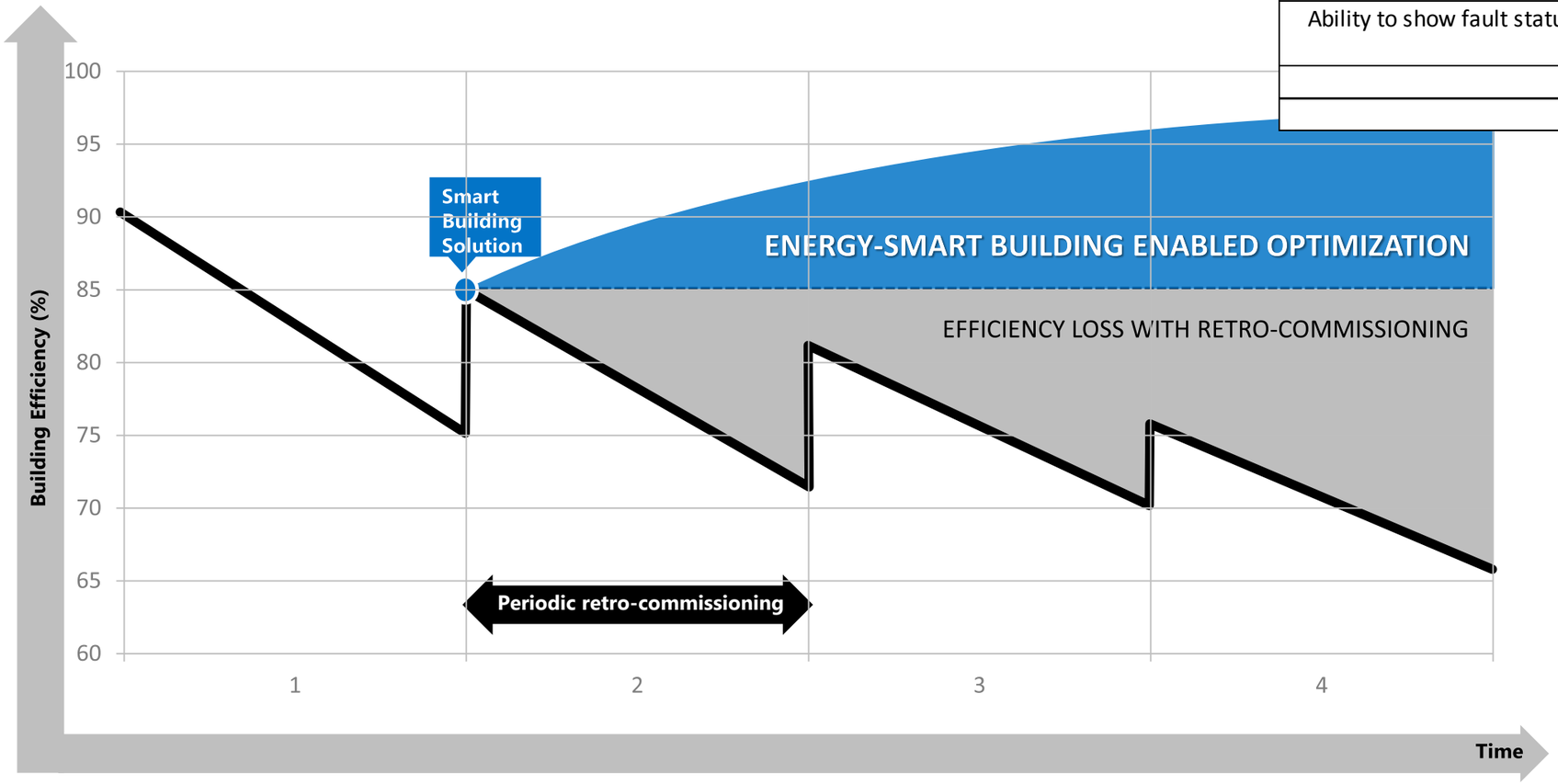
FAULT DETECTION AND DIAGNOSTICS

CONNECTING EQUIPMENT TO ANALYSIS SOFTWARE FOR REAL TIME PERFORMANCE MANAGEMENT

RESULTS IN PRODUCTIVITY GAINS OVER TIME

Fault Reporting	
Fault priority reports by custom priority and/or costs savings potential	✓
Ability to create custom reports	✓
Ad-hoc reporting	✓
Automatic daily, weekly reports	✓

Fault Detection & Diagnostics (FDD)	
Fault detection / diagnostics	✓
Pre-developed (canned) algorithms	✓
Allowance for flexible and customized fault rules by customer or system integrator	✓
Ability to define custom priorities of faults identified	✓
Monetization of faults with respect to utility cost avoidance	✓
Ability to show fault status indication (active, inactive, closed etc.) which can be changed by user	✓
Ability to add user comments per fault	✓
Ability to integrate into a CMMS software	✓



CONTINUOUS COMMISSIOING

CONTINUOUSCOMMISSIOING

DID YOU KNOW

- **ONLY 52% OF THE NEW CONSTRUCTION SPACE IN 2014 WAS COMMISSIONED**

  EQUATES TO 25.8 MILLION SQFT OF THE 49.8 MILLION NEW CONSTRUCTION SQFT PER 2014 COMMERCIAL BUILDING STOCK ASSESSMENT (CBSA)*

- **98.5% OF EXISTING BUILDING SPACE HAS NOT BEEN COMMISSIONED**

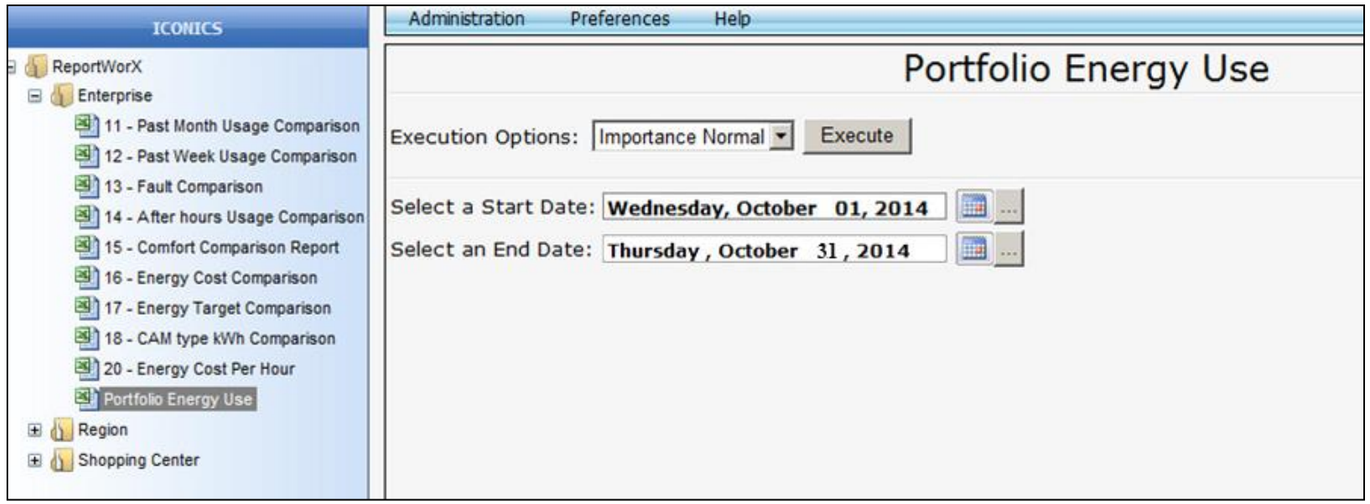
  EQUATES TO 45.7 MILLION SQFT OF THE 2.98 BILLION SQFT OF EXISTING BUILDING FLOOR AREA*

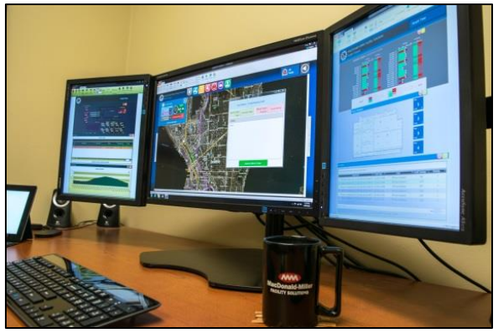
*Data Source: NEEA June 2015 Evaluation Report

UTILITY & CARBON EMISSIONS MANAGEMENT

INSTANTLY ACCESS & NORMALIZE

Utility & Carbon Emissions Management	
Customizable utility analytics and reporting templates, M&V Tracking	✓
Energy (Natural Gas, Electricity, Steam, etc.) and water meter integration for realtime management	✓
Batch import of existing meter data	✓
Direct connectivity with weather station reporting burrows for continuous updating	✓
Direct connectivity with EPA Energy Star Portfolio Manager for automatic updating	✓
Customizable financial reporting on energy and equivalent carbon savings	✓
Standard and fully configurable cost, consumption and carbon reports	✓
Utility reporting normalization for variables such as weather, utility rates and building occupancy	✓





King County

Portfolio Energy Use

						Start Date:	10/1/14 12:00 AM	
						End Date:	10/16/14 6:52 PM	
						Region:	Region 1	
						Sampling Interval:	Monthly	
	Site	Size	Energy (kWh)	Cost ($)	Energy Int. (kWh/sf)	Cost Int. ($/sf)	Norm. Energy Int. (kWh/sf)	Norm. Cost Int. ($/sf)
10	Chinook	292,171	389,708	$31,176.61	1.334	$0.11	129,903	$10,392.20
11	Ryerson	53,442	57,937	$4,635.00	1.084	$0.09	19,312	$1,545.00
12	East Base	57,283	54,122	$4,329.78	0.945	$0.08	18,041	$1,443.26
13	Bow Lake	78,000	85,548	$6,843.87	1.097	$0.09	28,516	$2,281.29
14	Brightwater	15,000	16,439	$1,315.10	1.096	$0.09	5,480	$438.37
15	KCLS	103,655	112,750	$9,020.01	1.088	$0.09	37,583	$3,006.67

SYSTEMINTEGRATOR QUALIFACTIONS

CHOOSING THE RIGHT PROVIDER

Information Technology Certifications

Azure Government Certified

Microsoft Certified Partner

Microsoft Certified Professional

- MCP/MCSE Training
- Adobe FlexBuilder Training
- KMC BACstage & TotalControl
- VB6, C++, J+, J#, .Net VB, .Net C+, ASP, ASP.net, XML
- Microsoft Windows Server 2008, 2012 /R2 Virtual Labs
- SQL Developers, Data Platforms
- MSCE Windows 2000 Professional, Server, Advanced Server and Windows XP
- Microsoft Application Virtualization and User State Virtualization Labs
- .Net C+, ASP, ASP.net, XML

Building Automation Certifications

- ICONICS Genesis64 and AnalytiX Systems Integrator and Advanced Graphics
- Tridium Niagara AX, AX Developer and R2 Certification
- Schneider SmartStructure BMS
- Delta Automation Integration
- Licensed Professional Engineers
- LEED AP O+M
- Siemens Apogee Integration
- ICONICS Hyper Historian – Multiple Collector Configurations
- Alerton Certified Engineer – BACtalk, Smoke Control, IBEX Systems
- Trane Building Automation Certified
- Johnson Controls Metasys & FX Certified
- Certified Measurement & Verification Professional (CMVP)
- Certified Energy Manager (CEM)

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CASE STUDY

WASHINGTON ATHLETIC CLUB

Project Details

Number of Buildings: 1

Square Footage: 310,000

Location: Seattle, WA

Project Status: Completed

Start date: July 2011

Completion date: July 2012

7-Year Performance Guarantee

Goals:	Operations	Energy Efficiency	Sustainability	Tenant Experience	Financial Optimization
	✓	✓	✓	✓	✓

Challenges:

- Mitigating any business interruptions to the Club's 24/7 operations
- Retrofitting 30+ year old piping systems with new valves and functional configurations
- Meeting the operating demands of each functional area of the business – lodging, food services, banquets, retail, athletics and office

Successes:

- Cost-effective migration of an obsolete HVAC control system to a web-based, open architecture building automation system
- Achievement of project financial return expectations; second year energy savings were $207,078: 18% above target
- Energy savings per square foot is $0.40; the current energy savings will increase the annual asset value of the property by an estimated $2,387,552
- Saved $459,000 on energy bills thus far
- Intelligent mobility for building operations and overall improvement to occupant comfort

MacDonald-Miller
FACILITY SOLUTIONS®

CASE STUDY

SEATTLE AQUARIUM

Project Details

Number of Buildings: 2

Square Footage: 69,400

Location: Seattle, WA

Project Status: Ongoing

Start date: January 2014

Completion date: July 2015

3-Year Performance Guarantee

Goals:	Operations	Energy Efficiency	Sustainability	Tenant Experience	Financial Optimization
	✓	✓	✓	✓	✓

Challenges:

- Maintaining below average noise levels to avoid disturbing animals
- Ensuring backup systems were running properly while animals were present or relocated during construction
- Confirming lighting improvements to the exhibits would not harm the animals
- Retrofitting newer, more efficient and often larger equipment into confined spaces while maintaining adequate service clearances

Successes:

- Life safety redundancy for the Coral Reef exhibit
- Centralized control of the Aquarium's energy consumption and comfort
- Continuous commissioning and real time reporting of reduced environmental impacts
- The installed project is projected to save 4,703,029 kBtu/year, 25% of their total energy usage

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FACILITY SOLUTIONS®

CASE STUDY

SEATTLE CENTRAL COLLEGE

Project Details

Number of Buildings: 21

Square Footage: 1,122,319

Location: Seattle, WA

Project Status: Ongoing

Start date: July 2013

Completion date: Dec 2015

Goals:	Operations	Energy Efficiency	Sustainability	Tenant Experience	Financial Optimization
	✓	✓	✓	✓	✓

Challenges:

- Creating a common software framework that is customized for the unique needs of distinct businesses within the campus environment, including classrooms, food service, office and performing arts space
- Mitigating any business interruptions and staff/student distractions

Successes:

- Real-time accounting and reporting of energy productivity for College
- Public display of real-time performance based on established goals and normalized to base year
- Facility staff productivity gains based on prioritized tasking and information mobility
- Happier and more productive occupants due to fewer comfort complaints
- The installed project is saved $320,364 in energy the first year. Exceeded engineering estimates by 37%.

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CASE STUDY

HIGHLINE COLLEGE

Project Details

Number of Buildings: 10

Square Footage: 571,356

Location: Des Monies, WA

Project Status: Ongoing

Start date: July 2013

Completion date: July 2016

2-Year Performance Guarantee

Goals:	Operations	Energy Efficiency	Sustainability	Tenant Experience	Financial Optimization
	✓	✓	✓	✓	✓

Challenges:

- Creating a common software framework that is customized for the unique needs of distinct businesses within the campus environment, including classrooms, food service, office and performing arts space
- Mitigating any business interruptions and staff/ student distractions
- Integration with legacy metering and automation systems

Successes:

- Real-time accounting and reporting of energy productivity for College
- Facility staff productivity gains based on prioritized tasking and information mobility
- Happier and more productive occupants due to fewer comfort complaints
- Annual energy savings in excess of $113,197

MacDonald-Miller
FACILITY SOLUTIONS®

CASE STUDY

KING COUNTY ENERGY-SMART BUILDINGS

Goals:	Operations	Energy Efficiency	Sustainability	Tenant Experience	Financial Optimization
	✓	✓	✓	✓	✓

Project Details

Number of Buildings: 5

Square Footage: 547,884

Location: King County, WA

Project Status: Complete

Start date: January 2015

Completion date: July 2016

Challenges:

- Creating a common software framework that is customized for the unique needs of distinct businesses within County operations – Parks & Natural Resources, Facilities, Transit and Executive Office
- Mitigating any business interruptions and employee distractions
- Working with three utility providers (Puget Sound Energy, Seattle City Light and Snohomish PUD) to craft a common approach to implementing a pay-for-performance incentive

Successes:

- Real-time accounting and reporting of energy productivity for King County buildings
- Facility staff productivity gains based on prioritized tasking and information mobility
- Happier and more productive occupants due to fewer comfort complaints

ENERGY-SMART CAMPUS OPERATIONS

MAKING INFORMED DECISIONS

THOUGHTS

- Building Automation & Network Design Principles
- Information Dashboards & Mobility
- Fault Detection, Diagnostics & Reports
- Utility & Carbon Emissions Management
- System Integrator Qualifications
- Case Studies