

“Software Solutions For Improving The Bottom Line”

**Building Energy NYC Conference
November 3rd 2016**



Dom Lempereur
Director of East Coast Operations

A Highly-Technical Engineering Team Dedicated To Energy Efficiency



A total of 60 Employees

- 23 licensed Professional Engineers
- 23 engineers with graduate degrees

18 years in business

- Energy engineering and consulting
- Over 500 years of combined industry experience

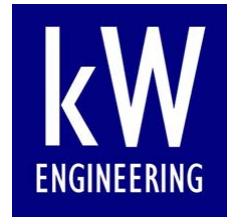
Objective Decision-Making Tools



“Objective decision-making uses reality instead of potentially flawed perception of reality.”

- Confucius.

Keeping Up With The “Softdashians”



Energy Management
Information System
(EMIS)

Energy Dashboard



Building Automation
System (BAS)

Whole Building Approach

Automated Fault Detection
& Diagnostic (AFDD)

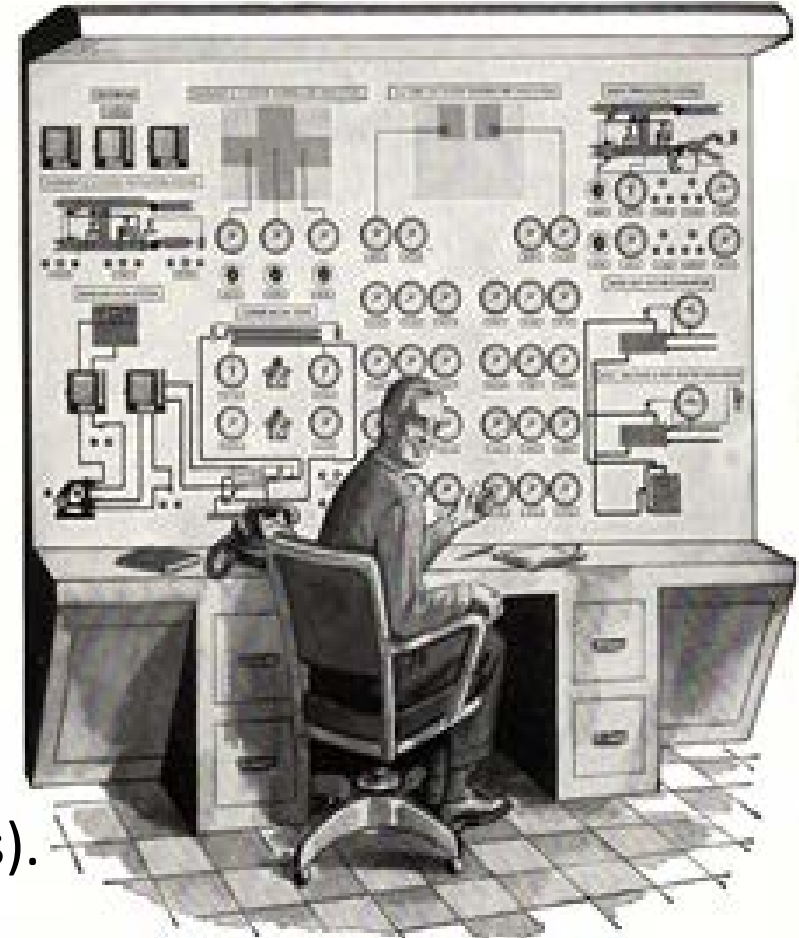
Building Automation Systems (BAS)

What they are:

- A programmed, computerized network of electronic devices that monitor and control systems
- Generally apply to HVAC and lighting systems.

What they do:

- Allow operators to change settings
- Track events, cancellations, overrides
- Send alarms
- Trend data
- Access from mobile or web devices (Cloud-based models).



Automated Fault Detection & Diagnostic (AFDD)



What they are:

- Analytic software / mathematical model that works in conjunction with BAS
- Help with day-to-day operation
- An increased interest using them

What they do:

- Address systems performance degradation
- Identify sub-optimal conditions
- Save engineers time addressing issues
- Prioritize faults based on fault frequency or cost

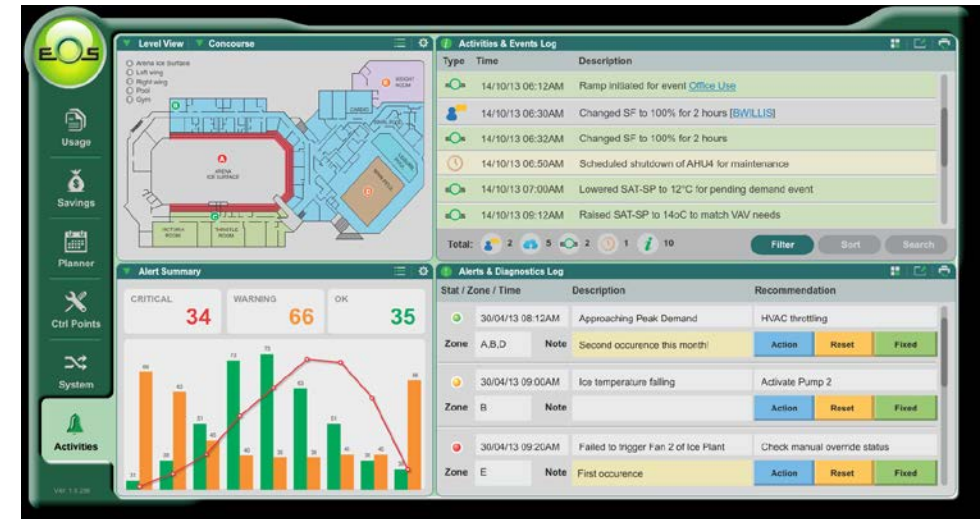


Image Source: Shiftenergy

Automated Fault Detection & Diagnostic (AFDD)



Total Fault Detection: Nes Ziona

Critical: 2, Major: 13, Warning: 30, Information: 51

Rule information
Condenser Fault **Fault name** critical ●

Date: 2016/06/03 11:00
Target: Cooler Compressor 120
Site: Nes Ziona
Duration: 3.65hr
Equip Type: Compressors

Possible Root causes

1. Condenser fan belt torn .
2. Motor fan broken .
3. Severe airflow block on condenser coil .
4. Manual bypass of variable speed drive (VSD / VFD) to pressure-stats

Root cause analysis: causal explanation

Symptoms

- Condenser Fault - Cooler Compressor 120
 - High Compressor Discharge Pressure - Cooler Compressor 120
 - Compressor Is Down - Cap3 Cooler Compressor 120
 - High suction pressure due to compressor down
 - High Suction Pressure - Cooler Compressor 120
 - Compressor Is Down - Cap1 Cooler Compressor 120

Signals

6/3/2016 15:04:45
Pc Cooler Compressor 120 52.91
ReqCap Cooler Compressor 120 100
Po Cooler Compressor 120 -3.35
CompCap Cooler Compressor 120 64

Signals available for technicians and engineers e.g. pressures, Capacities, set points and so forth

Suggestions for Action

1. Check that nothing is blocking the condenser coils (plastic bags etc).
2. Check that fans including fan motor and fan belt are not broken or lose.
3. Verify that the condensing pressure pressure-stat's step-in settings.
4. Verify that the VSD to pressure-stat changeover pressure setting is not too low and matches the

Action items

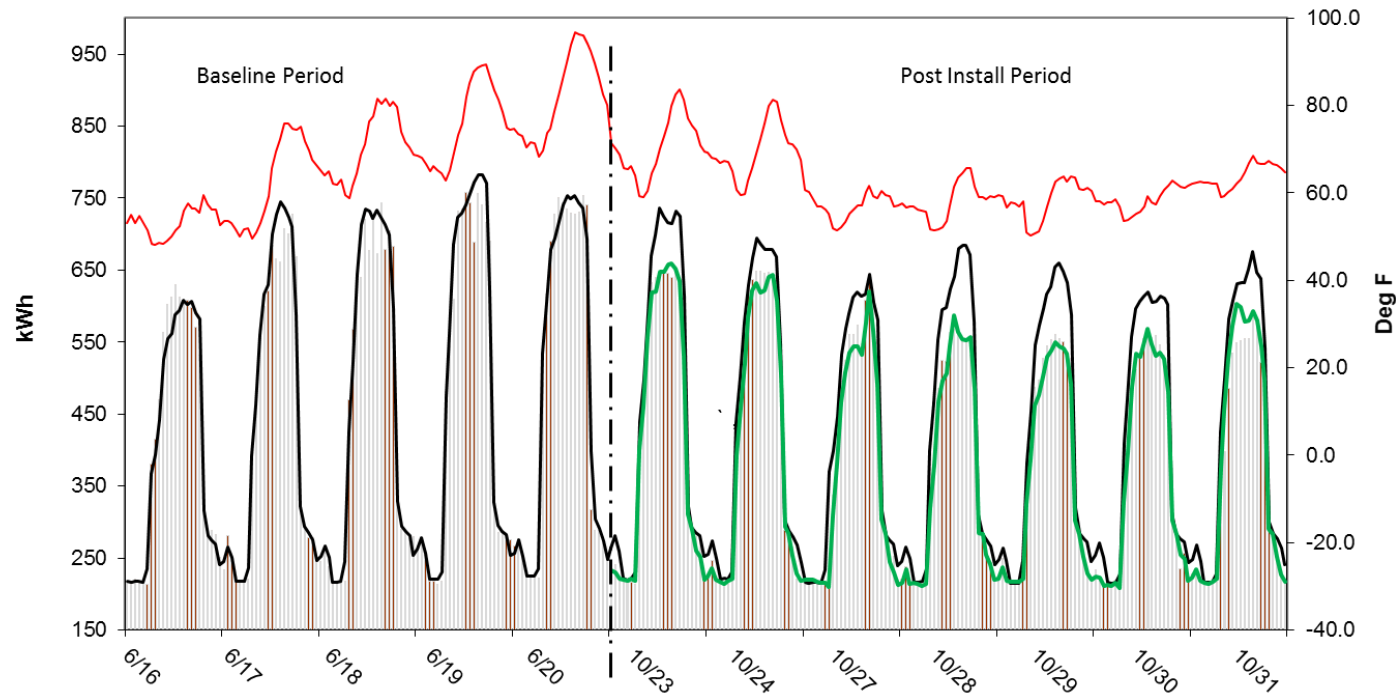
Search for other occurrences of this fault **Search**

Automated System Optimization (ASO)

- The ultimate automation system?
- Dynamically changes BAS settings to fine tune systems
- Technology is still maturing.



Whole-Building Meter-Based Approach



- Interval data is becoming widely available
- Inexpensive – high value, low cost
- Can be combined with onsite investigation and remote trend analysis

Circuit-Level Solutions



Electric loads monitoring: meters, Current Transducers (CTs), communication devices.

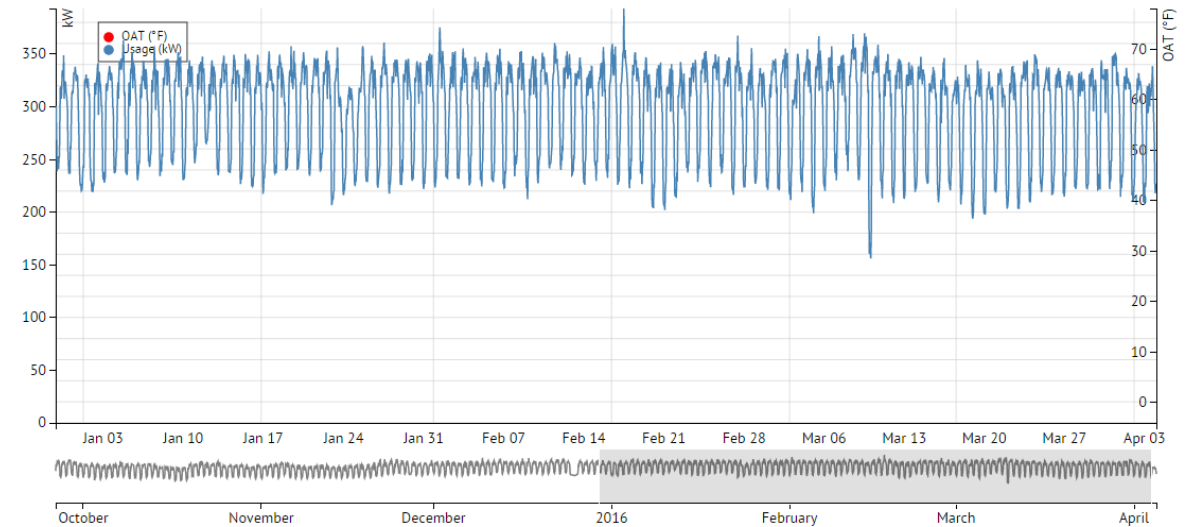
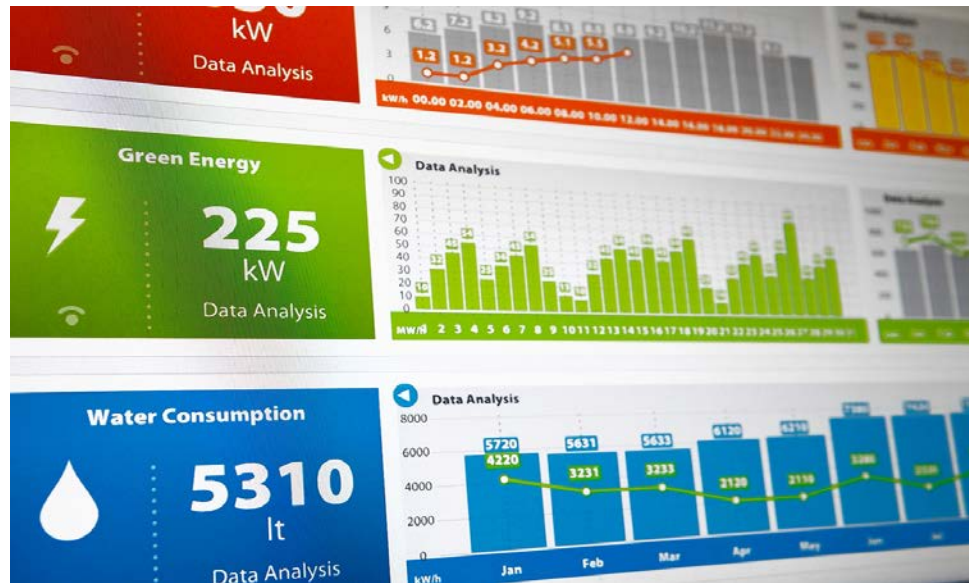


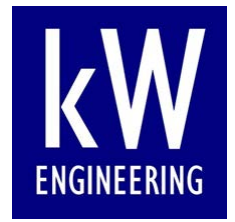
Image Source: Outsmart Inc.

Energy Dashboards



- **Visual representations** of energy use
- They are flooding the market
- Inexpensive

AFDD vs. RCx: A Case Study



- **“Artificial Neural Networks vs. Grey Matter; A RCx case study at matching cloud-based fault detection with traditional human neural networks”**. By Jim Kelsey, P.E. and Arik Cohen, P.E.
- BMS data trend analysis at 2 high tech campus buildings
- Goal = develop sets of recommendations and associated costs savings



The Findings



**Artificial Neural Networks
vs. Grey Matter**

	Auto FDD	RCx Team
Excessive boiler operation	\$6,400	\$6,400
Excessive relief fan operation	\$17,600	
Economizer malfunction	\$43,200	\$43,200
Supply air temp and static pressure reset		\$118,100
Zone level scheduling		\$35,900
AHU scheduling		\$9,800
Lighting controls		\$16,300
Kitchen ventilation		\$20,700
Total	\$67,200	\$250,400

Things AFDD Do Well



- A systematic approach on every connected component
- Prioritize faults and alarms based on frequency or cost
- Store and access fault history

Things That Human Brains Do Well



- Diagnose root cause: understand and correct design flaws at the system-level
- Design optimal control strategies
- Understand interaction between components
- Estimate energy savings and costs impacts accurately
- Clearly communicate the needed corrective action

What Does The Future Hold?

- More connected sensors
- More transfer of engineering knowledge into tools
- More computing to help make better decisions.



Contact info

Dom Lempereur, Director

(646) 214-2096

dlempereur@kw-engineering.com



www.kw-engineering.com



Group photo made with a Solmetric Solar shading tool

