



AABC Commissioning Group

AIA Provider Number 50111116

# Ensure Customers are Prepared to Maximize Investments in Data Analytic Tools

Course Number: CXENERGY1611

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# Course Description

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Automated fault detection, data analytic tools and optimization software are being adopted in facilities worldwide. This session provides an understanding of how operational change can maximize the impact of these investments through case studies of customers that successfully integrated technology into their building management operations to realize measurable, sustainable improvement in energy spend, staff optimization and vendor management.

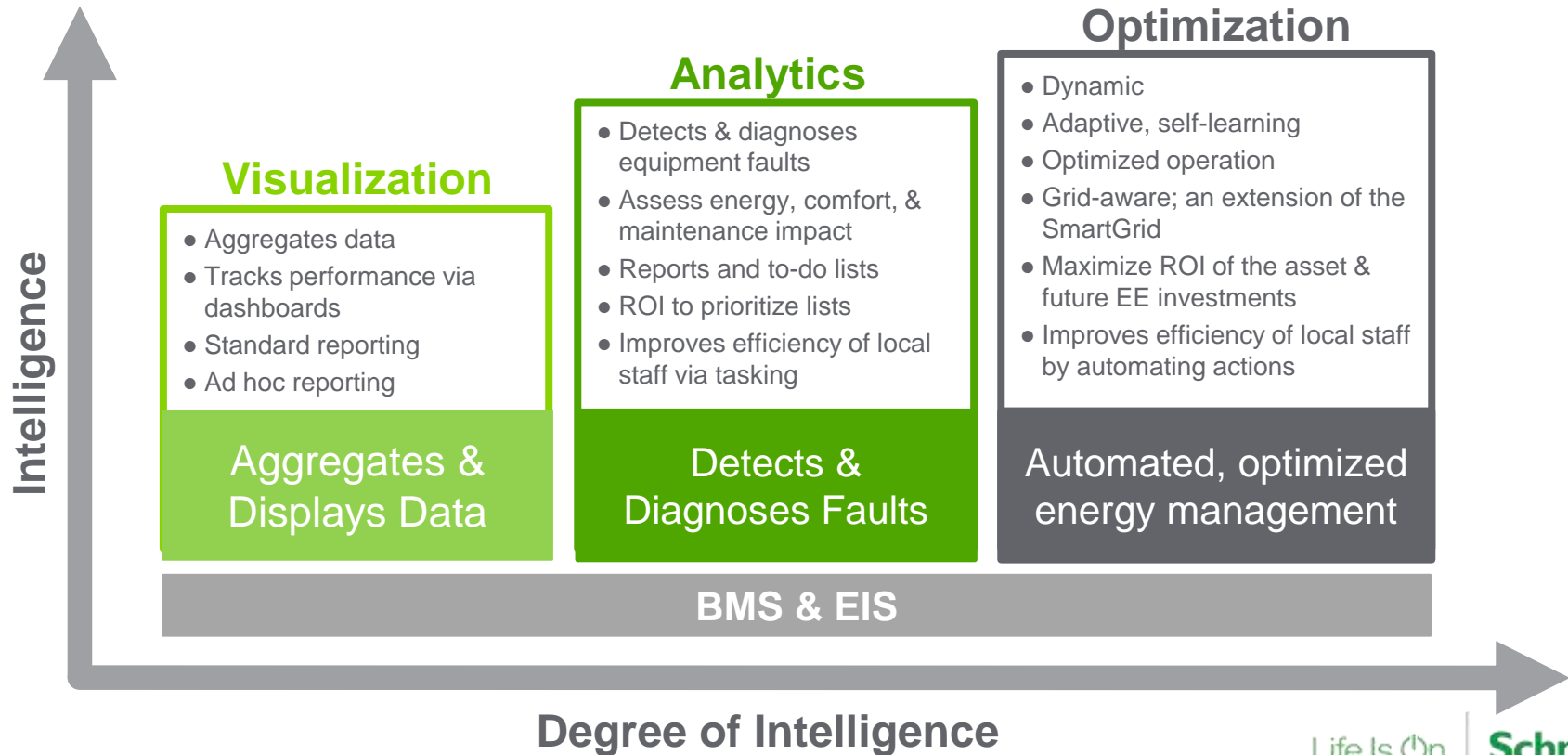
# Learning Objectives

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At the end of the this course, participants will be able to:

1. Learn how fault detection and diagnostics differs from dashboards and other information management systems
2. Learn the definition of fault detection and diagnostics
3. Learn best practices for selection of fault detection and diagnostics solutions
4. Learn operational best practices for leveraging fault detection and diagnostics solutions during and after construction

# Different solutions on the market



# Fault Detection & Diagnostics

## Definition

A technology that employs artificial intelligence, deductive modeling, and statistical methods to automatically detect and diagnose deviations between actual and optimal HVAC system performance.

-National Institute of Standards and Technology (NIST)

## Uses:

- Startup/Commissioning validation
- Daily maintenance optimization
- ECM identification
- Measurement & verification
- Continual and Monitoring Based Commissioning

# Solutions on the Market

Increasing levels of sophistication

## Types of solutions

1. Alarming
2. Rules
3. Diagnostics



## Technologies

1. Threshold alarms
2. If-then rules
3. Hierarchical (combination)
4. Statistical models



# Alarms, Rules & Diagnostics





# Alarms, Rules & Diagnostics

## Diagnostics

- Utilize rules and models to efficiently detect complex issues and opportunities
- Currently outside the BMS environment
- Ideal for analyzing operations over time to determine and prioritize issues
- Requires HVAC, statistical modeling, AND coding domain expertise
- Best employed by selecting a well developed library that can be mass-customized to each site

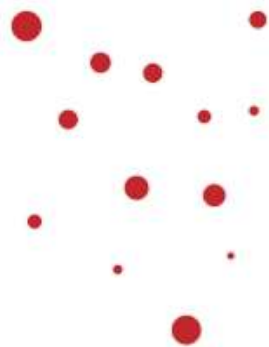
**Notes: PROBLEM: ECONOMIZER IS NOT PROVIDING TOTAL FREE COOLING AVAILABLE**

- The economizer outdoor air fraction or damper is less than one, but additional cooling is available.
- This may result in a loss of \$51 and 392 kBTU of wasted energy.

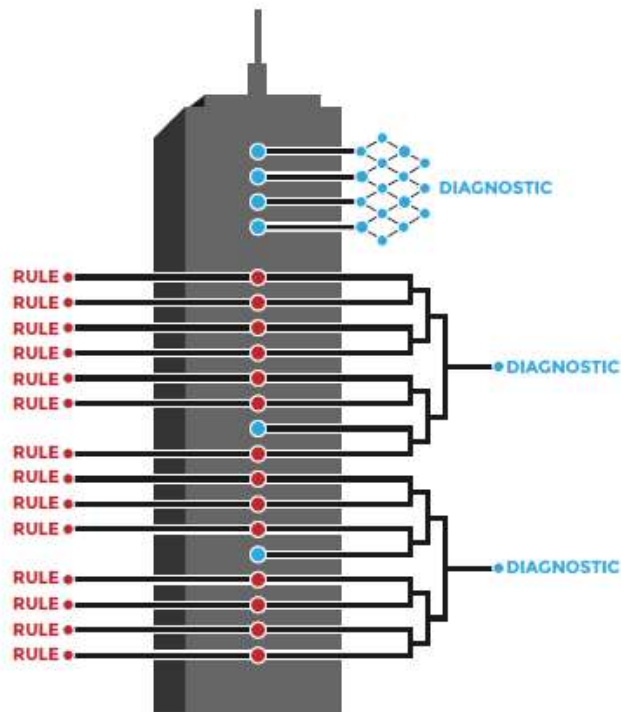
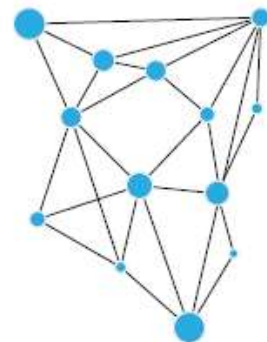
**Possible Causes:**

- Suboptimal economizer control.
- Bad temperature sensor measurement.

# Rules



# Diagnostics



**RULES VS DIAGNOSTICS**

# Different Platform Approaches

Analytics Solution	Pros	Cons
Custom Built Systems	<ul style="list-style-type: none"> <li>• Flexibility</li> <li>• Tailored specifically to exact needs</li> </ul>	<ul style="list-style-type: none"> <li>• Expensive</li> <li>• High technical competency required</li> <li>• Difficult to get multi-site deployment efficiencies</li> <li>• Updates are expensive</li> </ul>
Embedded Analytics	<ul style="list-style-type: none"> <li>• Low cost to deploy</li> <li>• On-site, typically no subscription</li> </ul>	<ul style="list-style-type: none"> <li>• Limited functionality, availability</li> <li>• Difficult in retrofits</li> <li>• Capabilities are quickly outdated</li> </ul>
Software-as-a-Service (SaaS)	<ul style="list-style-type: none"> <li>• Always up to date</li> <li>• Remote access usually built in</li> <li>• Easy to deploy across multiple sites</li> </ul>	<ul style="list-style-type: none"> <li>• High training requirement for staff</li> <li>• Possible cyber security concerns</li> </ul>
Managed-Software-as-a-Service (MSaaS)	<ul style="list-style-type: none"> <li>• Always up to date</li> <li>• Remote access usually built in</li> <li>• Easy to deploy across multiple sites</li> <li>• Expert engineering analysis included</li> </ul>	<ul style="list-style-type: none"> <li>• Possible cyber security concerns</li> </ul>

# Best Practice:

Where functions should reside

Function	Best Location	Why
Alarms	<ul style="list-style-type: none"><li>• BMS, EIS</li></ul>	<ul style="list-style-type: none"><li>• Need instantaneous</li><li>• Used by operators</li></ul>
Command & Control	<ul style="list-style-type: none"><li>• BMS, EIS</li><li>• SCADA</li></ul>	<ul style="list-style-type: none"><li>• Need instantaneous</li><li>• Used by operators</li></ul>
Reporting & Metrics	<ul style="list-style-type: none"><li>• BMS</li><li>• Dashboards</li></ul>	<ul style="list-style-type: none"><li>• BMS for Operators</li><li>• Dashboards for Mgmt &amp; Public</li></ul>
Analytics	<ul style="list-style-type: none"><li>• aFDD</li></ul>	<ul style="list-style-type: none"><li>• Requires purpose-built environment</li></ul>

# End User Feedback

## Analytics & Automated Fault Detection & Diagnostics (aFDD)

### Pros:

- ... great technology
- ... helps me run my operations more efficiently
  - Staff know where to focus
- ... helps me manage my service vendors better

### Cons:

- ... didn't find energy savings
- ... told me about problems I already knew about
- ... added cost to my maintenance budget

Conclusion: Some customers find value, others don't. But why?

# Conclusion: Some customers find value, others don't. But why?

## Effective Implementation Requires:

1. Integration into day-to-day operations
2. Buy-in from management & staff
3. Selecting the right application for the goals
4. Sharing information and feedback with vendors

## Ineffective Implementation Often Suffers From:

1. Unrealistic expectations (i.e. energy savings)
2. No budget to address issues found



# Best Practice:

## How to select the right aFDD solution

1. Start with MSaaS
2. Advanced FDD Library
3. Detailed Reports
4. Scalability
5. Open Protocol



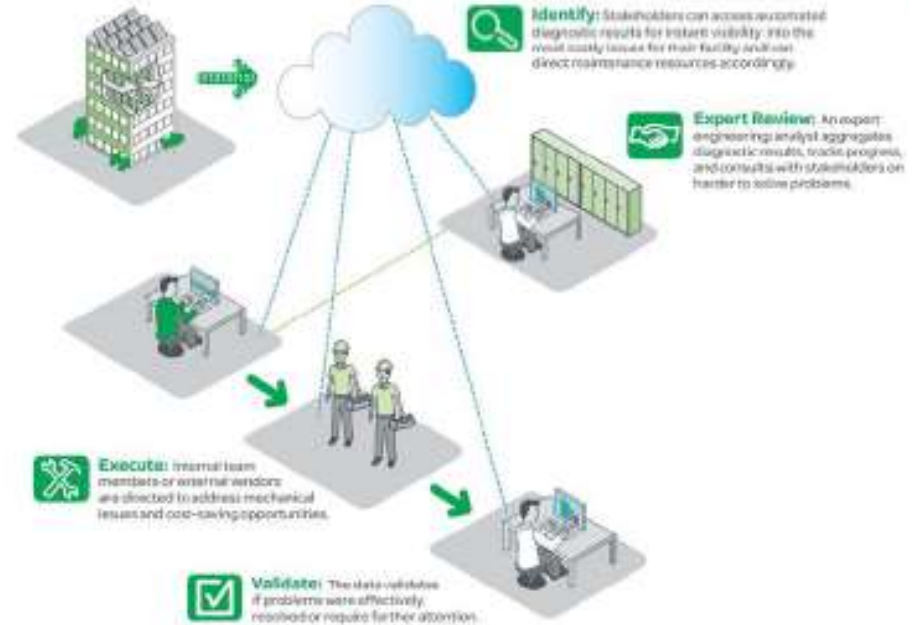
# How to maximize the value of aFDD

## During construction

- Testing
- Commissioning
- Documentation

## After occupancy

- Warranty
- Maintenance & Operations
- Prioritization of Repairs & Improvements



# Summary

## Ensure Customers are Prepared to Maximize Investments in Data Analytic Tools

### Select the right solution

1. Alarming
2. Rules
3. Diagnostics

### Keep functions in the right system:

1. Alarming
2. Reporting
3. Analytics

### Plan to get the most value

1. Set reasonable expectations
2. Get buy-in
3. Establish a plan for:
  - Construction period
  - Occupancy period
4. Budget for issues

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## This concludes The American Institute of Architects Continuing Education Systems Course

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