Experiences Commercializing FDD in the Northwest

Danny Miller, President – Transformative Wave
Our Background

- Transformative Wave is the manufacturer of the leading HVAC retrofit solution for constant volume HVAC systems, the CATALYST.
- Subsidiary of a 30-year-old HVAC commercial service company in the Pacific Northwest.
- Team has surveyed, serviced, and/or applied our technology to over 5,000 unique RTUs in the U.S. and Canada.
- Have been collecting and analyzing RTU data for the last five years.
- Our approach and views are driven by real-life experience and HVAC expertise.
Our Technology

• The CATALYST is proven to reduce HVAC overall energy use by 25-50% in multiple DOE and utility field trials.  

• The energy savings provides the economic “fuel” to finance our web-enabled advanced features included in the eIQ Platform.  http://transformativewave.com/eiq

• RTU’s are connected wirelessly with 40-points of data collected and stored in a SQL database at 1-minute interval histories.

• Features include fault detection and diagnostic capabilities that focus on RTU efficiency and performance from a whole–unit perspective.  Annunciated via smart phones, tablets, & browsers.

• Automated Demand Response (ADR) capable
Our FDD Features
Our FDD Features

• Controller-level “real-time” faults include:
  • Sensor failures including values out of range and loss of connectivity
  • Drive faults involving numerous fault codes generated by the variable frequency drive and communicated via a ModBus IP interface.
  • Communication faults
  • Inadequate airflow
  • Lack of cooling performance
  • Lack of heating performance
  • Economizer actuator and damper failure
  • Fan belt slippage indicating need for replacement or adjustment.
  • Proper functionality of the CATALYST and its individual components.
Our FDD Features

• Time-based degradation faults using historic data:
  • Improper schedules
  • Excessive use of after-hours override functions
  • Disproportionate runtime between RTUs
  • Changes in the economizer performance
  • Degraded cooling output
  • Comparative RTU energy use analytics for outlier identification
Our FDD Features

• California Title 24 Compliant:
  • Air temperature sensor failure/fault
  • Not economizing when it should
  • Economizing when it should not
  • Damper not modulating
  • Excess outdoor air
Pending FDD Features

- Under contract with PNNL/DOE on refrigerant side rooftop unit embedded diagnostics using Purdue’s virtual sensor method:
  - Fouled condenser coil
  - Fouled evaporator coil
  - Low refrigerant charge
  - Excessive refrigerant charge
  - Liquid line restriction
  - Compressor valve leakage
  - Non-condensable gas present
Our Findings

• Things are worse than we think
• Most of it is preventable
• Reliance on Building Management Control systems is inadequate
• Remarkably, even those paying for a facility monitoring service are subject to much of the same.
• The majority of deployed RTUs lack advanced features and those that do have FDD are not leveraging it.
• Customers are rarely interested in investing in features that cannot be cost justified in the short term.
Our Challenges

• Getting customers to avoid taking low-cost short cuts to the fan energy savings. The trend is that retailers, who control the majority of RTUs, opt for simple drive products or VFD’s. This is shortsighted and misses the larger opportunity.

• Convincing customers to buy into the CATALYST with eIQ offering where higher incentives and savings will pay for FDD.

• Getting multi-site customers to properly consider the value of these robust tools and the positive impact they will have.

• Overcoming customer’s belief that they have inadequate staff to handle information they already receive.

• Consultants, contractors and technicians have not yet bought into advanced FDD tools.
Our Recommendations

1. Promote tools that “make smart – simple” to deal with the information overload that currently exists.
   - We believe customers need a robust tool set that does not prescribe the priority or messaging conditions. When the customer understands that they will not be overwhelmed with emails or alerts, their resistance subsides.
   - FDD can be very complex “under the hood” but customers want simple intuitive tools that are easily customizable.
Our Recommendations

2. Invest more into validating and quantifying the cost of “not knowing”.

• The case must be made using data on a customer-specific basis. General cost justification numbers don’t create the kind of confidence and buy-in necessary for AFDD to gain traction. If we can create cost-avoidance tables or demonstrate an accumulated value for the FDD, the customer will be able to justify it. Everyone answers to someone and those recommending capital investment need to be armed with hard evidence that supports the value of FDD as an enterprise priority.
Our Recommendations

3. Consider radical alternatives:
   • Should the utilities take on the cost and management of FDD for ratepayers if the benefit is so great and the resistance so formidable?
   • Should the major national and regional accounts be required to invest in the deployment and use of FDD by retrofitting existing equipment and in the purchase of new equipment?
Questions??
North America’s Leading Retrofit Solution for Rooftop Packaged HVAC Systems
Web Accessible Control, Visualization, & Fault Detection
Advanced Fault Detection & Remote Diagnostics

Energy Saving Hardware Upgrade

Efficiency & Performance Verification Tools

M&V Data Collection Mechanism

Demand Response Technology

Building Control System

CATALYST with eIQ comprehensive solution
Third-party Validated Savings

- New study by PNNL shows CATALYST saved an average energy savings of 57% on 66 RTUs across four US climate zones.
Three Applications to Choose from

**CATALYST BMS**
Full-featured CATALYST with Tridium BMS for control of HVAC and lighting with portfolio asset management tool.

**CATALYST elQ**
Full-featured CATALYST with web-based live views, fault detection, and energy accountability overlay to existing BMS.

**CATALYST lite**
Smart VFD for those looking for supply fan control. Includes CATALYST ventilation and equipment protection features.
Live Demonstrations Available