

ENERGY EFFICIENCY, DEMAND RESPONSE, AND VOLTTRON

Presented by

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SEEMINGLY SIMPLE STATEMENTS

Utilities need more capacity to handle growth on the grid

Utilities need to balance the load on the grid for stability

Business want lower their operating expenses.

Business want remote control over their facilities

How can bring these different users together to accomplish these goals



AGENDA

About Transformative Wave

Integrated Demand Side Management – Convergence of energy efficiency and demand response

Building Automation Systems

Market Issues

How Volttron helps

Our Approach



TRANSFORMATIVE WAVE

Founded in 2009 to develop innovative HVAC products

Wholly owned subsidiary of the Performance Mechanical Group, 30 year old design build mechanical contracting firm based in Seattle, WA

Flagship products

CATALYST – America's leading Advanced Rooftop Controller (ARC) for packaged rooftop units

eIQ Platform – Energy Intelligence Platform, different approach to building automation. Making Smart Simple...

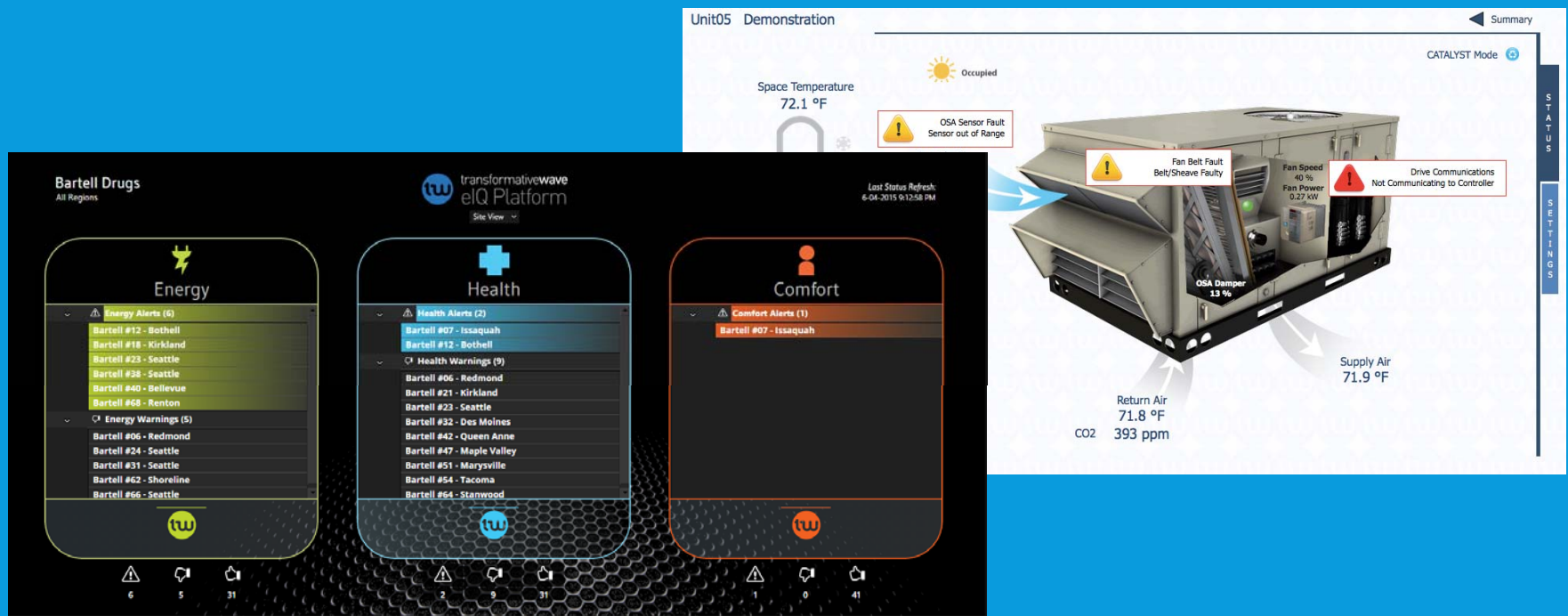


TRANSFORMATIVE WAVE CATALYST

- Add 5 new sensors and a variable frequency drive
- CO₂-based demand-controlled ventilation
- Advanced economization control
- Variable speed supply fan control
- Wireless communication allows for web access



TRANSFORMATIVE WAVE - EIQ





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IDSMM – OVERVIEW

From the utilities view the prime need is better load control – Demand Response

From the customers view the prime need is lower utility spend – Energy Efficiency

Integrated Design Side Management

Utility term for combined energy efficiency and demand response measures on the same project.

Break down the silos between energy efficiency division and the demand response division in the utility

Each group Energy Efficiency (EE) and Demand Response (DR) have different goals and are looked at independently with regulators

Good Energy Efficiency projects will reduce the opportunity for demand response



IDSMM - INDUSTRY SHIFTS

New rate structures are balancing the financial benefit between EE and DR

How many customer read their bill? Most of them just know their rate is going up.

Utilities haven't fully figured out how to incentivize IDSMM projects (regulatory issues)

To maximize the project payback, we need to balance between demand response and energy efficiency



IDSMM – OPPOSITE ENDS OF THE STICK

Customer View

Demand Response is turning something off that you need
Energy efficiency is using what you have more effectively

Utility View

Can't claim energy efficiency improvements towards a demand response program
Different groups responsible for achieving EE and DR goals

Our View

EE – permanent load shed
DR – temporary load shed



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What we are doing

BAS – BUILDING AUTOMATION SYSTEMS



Problem Statement

U.S. DEPARTMENT OF
ENERGY | Energy Efficiency &
Renewable Energy

- Less than 10% of the buildings have building automation systems (BAS)
- Over 90% of buildings stock either:
 - small (<5,000 sf) or
 - medium-sized (between 5,000 sf and 50,000 sf)
- HVAC, lighting, plug loads in many of these buildings not properly controlled
 - Most of these buildings do not have a cost-effective way to monitor and control their building systems from central location (no BAS)
 - Equipment operates when building not occupied
- Consequence: Uncontrolled building operations lead to unnecessary energy waste of 10% to 25%
- Solution: Scoping study that lays out approach/criteria for realizing better controls in small/medium buildings

2 | Building Technologies Office

eere.energy.gov

Small and Medium Size
Building Automation and
Control System Needs: Scoping
Study

Michael Brambley – April 2,
2013



BAS – WHAT'S PREVENTING THE 90%

Issues preventing Small and Medium Building BAS Adoption

1. Cost
2. Lack of measureable energy savings
3. Technical skill of the operators
4. Technical skill of the service provider
5. Existing building retrofit challenges

BAS – WHAT ABOUT THE 10%



HVAC Assets –

Ventilation



Heating

Economizer



Cooling Assets

Lighting

Zone (not groups) level switching

Zone (not groups) level dimming

Exterior Lights

Other

Plug Loads

Refrigeration equipment



BAS – WHAT ABOUT THE 10%

Many cases a fixed application controller – configurable not programmable

Majority of locations still require a site level controller

Limited local interface or adjustment –

- Good for large portfolios

- Bad for single locations

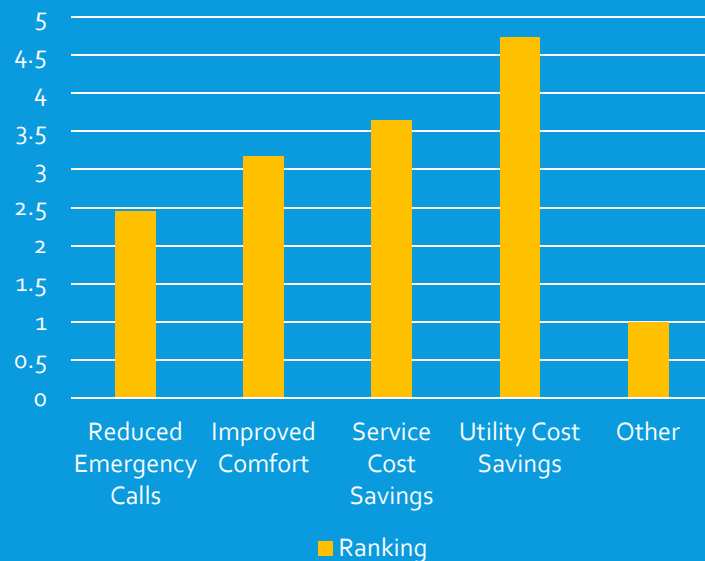
Most BMS don't solve the customers' needs

- Volttron Tech 2 Market Study – 50% of people were satisfied with their BMS

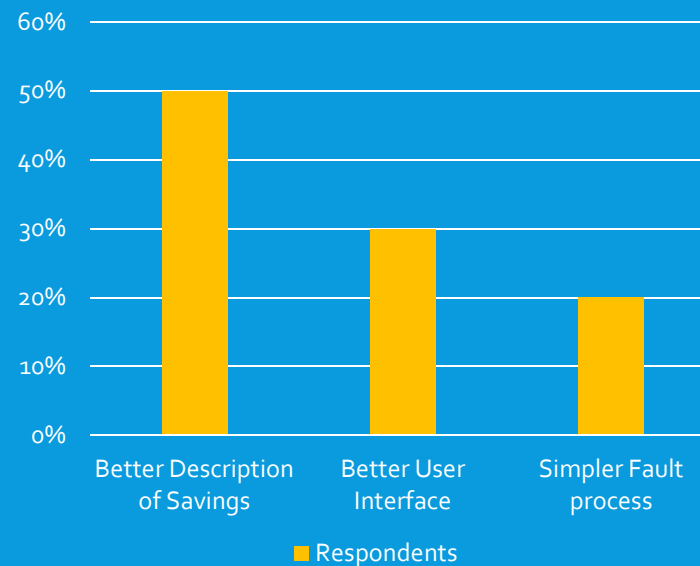


BAS – CUSTOMER VIEW

Question: Rank in order of importance the purchasing reasons for your BMS



Question: What Improvement would you make to your current BMS



Source: Transformative Wave - Volttron Tech 2 Market Demonstration

Transformative Wave | 1012 Central Ave S Kent, WA 98032 | <http://www.transformativewave.com>



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MARKET ISSUES

Best approach

Utility that is willing to recognize the benefit of both and provide incentives that properly recognize the new features

The not-so-best approach

The customer has to choose

EE and DR typically require separate systems

Traditionally has been completed by different contractors

BAS providers and aggregators

To support the best approach a platform is needed that supports both energy efficiency and demand response



MARKET ISSUES

Lack of truly distributed controls

Many buildings require a site level controller

System Cost

Integration cost

New System cost

Commercial lease terms

It is difficult to convince a customer of “soft” savings

MARKET OPPORTUNITY



If you can demonstrate
measureable energy savings or
demand reduction utilities will
provide incentives

- Lower Capital Cost

- Better ROI

- Increase market penetration

“Nothing Happens until
someone writes you a
check.”

Danny Miller
Transformative Wave



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How Volttron helps

Our Approach to the problem



HOW VOLTTRON HELPS - COST

- Can operate on low cost platforms

- Can operate up in the cloud

- Move the intelligence from the site level controller to the zone level controller

- Was not designed for HVAC

 - Open Source

 - Flexible

 - Can do a lot of things

- Can operate both EE and DR on the same platform

HOW VOLTTRON HELPS - FUNCTIONALITY



Open Source Community

Already services customers can leverage

Lab developed services speed product development

Can operate both EE and DR on the same platform



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OUR APPROACH – CURRENT STATE

At the core of our offering we have an energy efficiency retrofit product for rooftop units.

Our current offering is built on a traditional BMS platform.

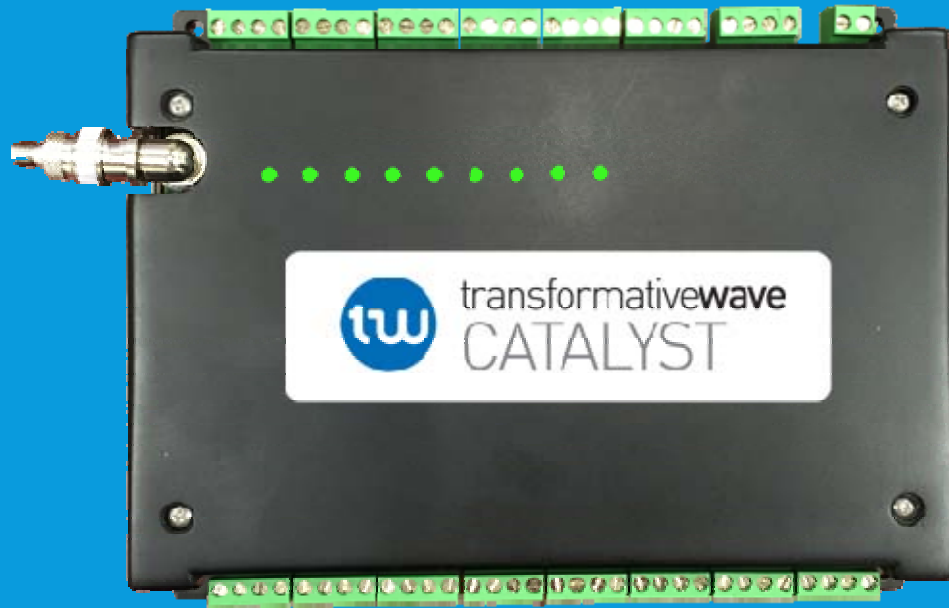
We have shifted to a “cloud” based control system

To qualify for DR incentives utilities often require a site supervisor, this undermines any cost benefit from adopting the cloud.

Manual process to remotely update controls.



OUR APPROACH - OPPORTUNITY



Move from the building automation world into the micro PC world.

Provide the flexibility of a PC, but in a package designed for HVAC.



OUR APPROACH - OPPORTUNITY

Designed a field level controller with the intent to run Volttron

Bring supervisor / site level functions down to the field

TI A8 Processor 512MB RAM 4 GB Flash Storage

Built-in Wi-Fi

(2) RS 485 Ports

30 I/O

Linux OS



OUR APPROACH

Cloud Approach

Running Volttron in the Cloud and communicating via Modbus to our controllers

Allows us to develop applications that leverage our existing infrastructure

Integration path for other BMS systems

Can provide add-on services for a nominal fee.

Controller Approach

Running Volttron at the field controller level

Integrates new services that we couldn't perform at the field level

Diagnostics

Measurement and Verification

Demand Response

Bring more value for the same price point



OUR APPROACH

Currently working to deploy Volttron 3.0 as part of our Volttron T2M project

Focused on six services

- Economizer Fault Detection –

- Measurement and Verification – Customer Measure

- Coordinated Control of RTUs in an open space – EE or DR Measure

- Demand Response – DR Measure

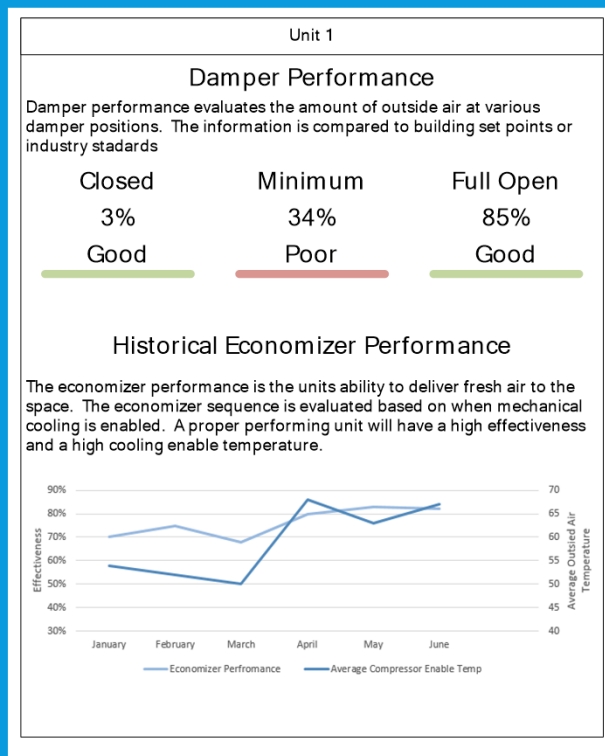
- Equipment Benchmarking – Customer Measure

- Tenant Billing Application – Customer Measure

Deploying a mix of cloud versus hardware sites

These build off of our core CATALYST sequence - EE measure

OUR APPROACH



Provide
information to
the customers in
a simple to
understand
format.



SUMMARY

Projects with measureable energy saving measures and demand response can qualify for utility incentives that bring the customer cost down

If the project is claiming savings, the savings need to be verifiable

Understand that these buildings don't have a full time engineer

Need to have a flexible install to account for existing building systems and types

Volttron is a toolset that helps address many of these issues.

THANK YOU



Questions

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